

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



Property Reference	4907-0015-3817-164			Issued on Date	05/12/2019
Assessment Reference	As Built	Prop Type Ref	P508 - Det (Op)		
Property	85, Appleby Drive, Botley, SOUTHAMPTON, SO32 2GE				
SAP Rating	88 B	DER	12.79	TER	15.43
Environmental	88 B	% DER<TER	17.13		
CO ₂ Emissions (t/year)	1.51	DFEE	46.61	TFEE	53.66
General Requirements Compliance	Pass	% DFEE<TFEE	13.13		
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

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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) 15.43 kgCO₂/m²

Dwelling Carbon Dioxide Emission Rate (DER) 12.79 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)53.7 kWh/m²/yr

Dwelling Fabric Energy Efficiency (DFEE)46.6 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:	4.37 (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 m ² , No overhang
Windows facing North East:	0.57 m ² , No overhang
Windows facing South East:	8.16 m ² , No overhang
Windows facing South West:	1.13 m ² , No overhang
Windows facing West:	3.21 m ² , No overhang
Windows facing North West:	10.10 m ² , No overhang
Air change rate:	4.00 ach
Blinds/curtains:	None

10 Key features

Door U-value	0.90 W/m ² K
Thermal bridging y-value	0.038 W/m ² K
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					4.3700
Infiltration rate					0.3333 (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)	=	0.2833 (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	0.3613	0.3542	0.3471	0.3117	0.3046	0.2692	0.2692	0.2621	0.2833	0.3046	0.3188	0.3329 (22b)
Effective ac	0.5653	0.5627	0.5602	0.5486	0.5464	0.5362	0.5362	0.5343	0.5401	0.5464	0.5508	0.5554 (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	64.9748	64.6835	64.3980	63.0571	62.8062	61.6383	61.6383	61.4220	62.0882	62.8062	63.3138	63.8444 (38)
Heat transfer coeff	169.6301	169.3389	169.0534	167.7125	167.4616	166.2937	166.2937	166.0774	166.7436	167.4616	167.9691	168.4997 (39)
Average = Sum(39)m / 12 =												167.7113 (39)
HLP	1.1663	1.1643	1.1624	1.1531	1.1514	1.1434	1.1434	1.1419	1.1465	1.1514	1.1549	1.1586 (40)
HLP (average)												1.1531 (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											
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	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)	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	540.2956	537.9656	519.9807	490.6175	460.0925	431.2441	412.8649	419.5326	434.9350	464.5350	498.5735	524.7860	(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	8.1600	36.7938	0.7100	0.7000	0.7700	103.4082 (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	6.0000	11.2829	0.7100	0.7000	0.7700	23.3165 (81)
Northwest	4.1000	11.2829	0.7100	0.7000	0.7700	15.9329 (81)

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	28.1966	28.2451	28.2928	28.5190	28.5618	28.7624	28.7624	28.7998	28.6848	28.5618	28.4755	28.3858
alpha	2.8798	2.8830	2.8862	2.9013	2.9041	2.9175	2.9175	2.9200	2.9123	2.9041	2.8984	2.8924
util living area	0.9848	0.9731	0.9481	0.8902	0.7859	0.6407	0.5063	0.5653	0.7792	0.9292	0.9758	0.9873 (86)
MIT	18.6770	18.9493	19.4008	19.9810	20.4809	20.8029	20.9279	20.8992	20.6273	19.9647	19.2119	18.6257 (87)
Th 2	19.9470	19.9486	19.9502	19.9577	19.9591	19.9656	19.9656	19.9668	19.9631	19.9591	19.9562	19.9533 (88)
util rest of house	0.9821	0.9683	0.9385	0.8691	0.7436	0.5673	0.4042	0.4627	0.7192	0.9113	0.9707	0.9851 (89)
MIT 2	16.8293	17.2253	17.8781	18.7057	19.3861	19.7913	19.9209	19.8995	19.5960	18.6998	17.6148	16.7582 (90)
Living area fraction									fLA = Living area / (4) =			0.1349 (91)
MIT	17.0786	17.4579	18.0835	18.8777	19.5338	19.9277	20.0568	20.0343	19.7352	18.8704	17.8302	17.0101 (92)
Temperature adjustment												-0.1500
adjusted MIT	16.9286	17.3079	17.9335	18.7277	19.3838	19.7777	19.9068	19.8843	19.5852	18.7204	17.6802	16.8601 (93)

[illegible]

Space heating per m2

$$(98) / (4) = 38.4881 \quad (99)$$

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	6205.8929	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1065.0717	845.1342	722.0068	436.9017	219.8465	0.0000	0.0000	0.0000	0.0000	443.3954	776.1720	1089.1870	(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)	1180.7891	936.9558	800.4511	484.3699	243.7323	0.0000	0.0000	0.0000	0.0000	491.5692	860.5012	1207.5244	(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	88.1969	88.0213	87.6440	86.8093	85.1259	79.5000	79.5000	79.5000	79.5000	86.7590	87.8134	79.5000	(216)
Fuel for water heating, kWh/month	245.1500	216.3667	227.8788	205.7774	205.2994	195.8957	187.6342	206.5859	206.4382	213.5258	223.6488	238.8915	(219)
Water heating fuel used												2573.0925	(219)
Annual totals kWh/year													
Space heating fuel - main system												6205.8929	(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 * 1004 * 1.00) =										-650.5895		-650.5895	(233)
Total delivered energy for all uses												8710.1516	(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	6205.8929	0.2160	1340.4729 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2573.0925	0.2160	555.7880 (264)
Space and water heating			1896.2608 (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	-650.5895	0.5190	-337.6560 (269)
Total CO2, kg/year			1860.5361 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			12.7900 (273)

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

DER		12.7900	ZC1
Total Floor Area			
Assumed number of occupants			
CO2 emission factor in Table 12 for electricity displaced from grid	TFA	145.4400	
CO2 emissions from appliances, equation (L14)	N	2.9268	
CO2 emissions from cooking, equation (L16)	EF	0.5190	
Total CO2 emissions		12.8554	ZC2
Residual CO2 emissions offset from biofuel CHP		1.3012	ZC3
Additional allowable electricity generation, kWh/m ² /year		26.9466	ZC4
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC5
Net CO2 emissions		0.0000	ZC6
		0.0000	ZC7
		26.9466	ZC8

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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 heating	+	secondary heating	+	other	=	total	m3 per hour
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)
	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 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)

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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 m2	Solar flux Table 6a W/m2	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	8.1600	36.7938	0.6300	0.7000	0.7700	91.7565	(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	10.1000	11.2829	0.6300	0.7000	0.7700	34.8270	(81)

Solar gains	170.9544	310.4577	474.3427	668.2005	820.0014	845.0455	801.8612	684.2086	540.9574	356.6388	208.3099	143.9860	(83)
Total gains	716.3182	853.4915	999.3915	1163.8861	1285.1620	1281.3577	1219.7943	1108.8093	980.9605	826.2420	711.9516	673.8401	(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	0.9992	0.9979	0.9929	0.9704	0.8926	0.7268	0.5564	0.6279	0.8817	0.9866	0.9982	0.9994 (86)
MIT	19.7081	19.8628	20.1251	20.4777	20.7822	20.9484	20.9896	20.9812	20.8512	20.4514	20.0149	19.6826 (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	0.9990	0.9971	0.9903	0.9587	0.8512	0.6383	0.4383	0.5061	0.8197	0.9795	0.9974	0.9992 (89)
MIT 2	18.2536	18.4811	18.8649	19.3771	19.7866	19.9778	20.0089	20.0063	19.8836	19.3472	18.7106	18.2218 (90)
Living area fraction	18.4498	18.6675	19.0349	19.5255	19.9209	20.1087	20.1412	20.1378	20.0141	19.4962	18.8866	18.4188 (91)
MIT	18.4498	18.6675	19.0349	19.5255	19.9209	20.1087	20.1412	20.1378	20.0141	19.4962	18.8866	18.4188 (92)
Temperature adjustment	18.4498	18.6675	19.0349	19.5255	19.9209	20.1087	20.1412	20.1378	20.0141	19.4962	18.8866	18.4188 (93)
adjusted MIT	18.4498	18.6675	19.0349	19.5255	19.9209	20.1087	20.1412	20.1378	20.0141	19.4962	18.8866	18.4188 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9983	0.9956	0.9866	0.9513	0.8471	0.6476	0.4542	0.5222	0.8200	0.9742	0.9961	0.9988	(94)
Ext temp.	715.0940	849.7543	986.0161	1107.2024	1088.6701	829.7708	553.9729	579.0235	804.4274	804.9561	709.1695	672.9997	(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	2290.1266	2223.4406	2020.0873	1695.3143	1309.1795	869.5638	558.9850	589.0456	936.7402	1416.7248	1884.1828	2282.0385	(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	1171.8243	923.1172	769.3490	423.4406	164.0590	0.0000	0.0000	0.0000	0.0000	455.1559	846.0096	1197.1248	(98)
Space heating per m2												5950.0804	(98)
												40.9109	(99)

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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													6363.7223	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	1171.8243	923.1172	769.3490	423.4406	164.0590	0.0000	0.0000	0.0000	0.0000	455.1559	846.0096	1197.1248	(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)	1253.2880	987.2911	822.8331	452.8776	175.4642	0.0000	0.0000	0.0000	0.0000	486.7978	904.8231	1280.3474	(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	88.6152	88.4346	88.0222	86.9781	84.5754	79.8000	79.8000	79.8000	79.8000	87.0625	88.2293	88.6853	(216)	
Fuel for water heating, kWh/month	249.3117	220.1696	232.2545	210.6222	212.2088	200.8752	192.8354	211.7158	211.3781	218.1953	227.7643	243.0953	(219)	
Water heating fuel used												2630.4261	(219)	
Annual totals kWh/year														
Space heating fuel - main system												6363.7223	(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												9575.9041	(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	6363.7223	0.2160	1374.5640 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2630.4261	0.2160	568.1720 (264)
Space and water heating			1942.7361 (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			2244.6673 (272)
Emissions per m2 for space and water heating			13.3576 (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) = (13.3576 * 1.00) + 1.8083 + 0.2676, rounded to 2 d.p.			15.4300 (273)

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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					4.3700
Infiltration rate					0.3333 (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)	=	0.2833 (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	0.3613	0.3542	0.3471	0.3117	0.3046	0.2692	0.2692	0.2621	0.2833	0.3046	0.3188	0.3329 (22b)
Effective ac	0.5653	0.5627	0.5602	0.5486	0.5464	0.5362	0.5362	0.5343	0.5401	0.5464	0.5508	0.5554 (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	64.9748	64.6835	64.3980	63.0571	62.8062	61.6383	61.6383	61.4220	62.0882	62.8062	63.3138	63.8444 (38)
Heat transfer coeff	169.6301	169.3389	169.0534	167.7125	167.4616	166.2937	166.2937	166.0774	166.7436	167.4616	167.9691	168.4997 (39)
Average = Sum(39)m / 12 =												167.7113 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1663	1.1643	1.1624	1.1531	1.1514	1.1434	1.1434	1.1419	1.1465	1.1514	1.1549	1.1586 (40)
HLP (average)												1.1531 (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					8.1600	36.7938	0.7100	0.7000				0.7700			103.4082 (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					6.0000	11.2829	0.7100	0.7000				0.7700			23.3165 (81)
Northwest					4.1000	11.2829	0.7100	0.7000				0.7700			15.9329 (81)
Solar gains	192.6629	349.8809	534.5767	753.0513	924.1285	952.3528	903.6848	771.0922	609.6504	401.9263	234.7620	162.2699			(83)
Total gains	652.0979	807.8505	976.3568	1167.9092	1310.0461	1311.6534	1246.5029	1118.1478	971.2450	790.5945	654.6159	607.0562			(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	27.1249	27.1715	27.2174	27.4350	27.4761	27.6691	27.6691	27.7052	27.5945	27.4761	27.3931	27.3069		
alpha	2.8083	2.8114	2.8145	2.8290	2.8317	2.8446	2.8446	2.8470	2.8396	2.8317	2.8262	2.8205		
util living area	0.9875	0.9767	0.9535	0.8989	0.7991	0.6585	0.5258	0.5881	0.7986	0.9387	0.9801	0.9898	(86)	
MIT	18.5314	18.8138	19.2833	19.8907	20.4216	20.7721	20.9134	20.8791	20.5745	19.8674	19.0835	18.4789	(87)	
Th 2	19.9470	19.9486	19.9502	19.9577	19.9591	19.9656	19.9656	19.9668	19.9631	19.9591	19.9562	19.9533	(88)	
util rest of house	0.9853	0.9726	0.9450	0.8794	0.7587	0.5862	0.4224	0.4851	0.7420	0.9230	0.9759	0.9879	(89)	
MIT 2	17.6783	17.9596	18.4245	19.0205	19.5181	19.8254	19.9279	19.9100	19.6714	19.0100	18.2351	17.6303	(90)	
Living area fraction	17.7934	18.0748	18.5403	19.1379	19.6400	19.9531	20.0609	20.0407	19.7932	19.1257	18.3495	17.7448	(92)	
Temperature adjustment	17.7934	18.0748	18.5403	19.1379	19.6400	19.9531	20.0609	20.0407	19.7932	19.1257	18.3495	17.7448	(93)	
adjusted MIT	17.7934	18.0748	18.5403	19.1379	19.6400	19.9531	20.0609	20.0407	19.7932	19.1257	18.3495	17.7448	(93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	638.2646	777.5884	907.9514	1005.1469	975.3093	767.5969	539.2798	551.3987	710.0308	716.7569	632.8518	596.3525	(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	2288.8835	2231.0093	2035.4582	1717.0277	1329.6470	890.1844	575.5188	604.6366	949.3075	1427.7240	1889.5702	2282.2939	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	1228.0605	976.6989	838.8651	512.5542	263.6273	0.0000	0.0000	0.0000	0.0000	528.9595	904.8373	1254.3404	(98)
Space heating												6507.9429	(98)
Space heating per m2												44.7466	(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	1563.1608	1230.5734	1262.1884	0.0000	0.0000	0.0000	0.0000 (100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.7612	0.8238	0.7845	0.0000	0.0000	0.0000	0.0000 (101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1189.8374	1013.7468	990.2389	0.0000	0.0000	0.0000	0.0000 (102)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1657.5332	1578.5054	1430.9644	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	336.7409	420.1804	327.8997	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction									FC = cooled area / (4) =			1084.8211 (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	84.1852	105.0451	81.9749	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling per m2												271.2053 (107)
Energy for space heating												1.8647 (108)
Energy for space cooling												44.7466 (99)
Total												1.8647 (108)
Dwelling Fabric Energy Efficiency (DFEE)												46.6113 (109)
												46.6 (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	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)
	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 content (annual)	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)	
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		1631.7876 (45)	
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (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	8.1600	36.7938	0.6300	0.7000	0.7700	91.7565 (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	10.1000	11.2829	0.6300	0.7000	0.7700	34.8270 (81)

Solar gains	170.9544	310.4577	474.3427	668.2005	820.0014	845.0455	801.8612	684.2086	540.9574	356.6388	208.3099	143.9860	(83)
Total gains	630.3894	768.4273	916.1228	1083.0583	1205.9190	1204.3461	1144.6792	1031.2641	902.5520	745.3070	628.1639	588.7723	(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	0.9996	0.9987	0.9952	0.9779	0.9121	0.7586	0.5888	0.6664	0.9086	0.9915	0.9990	0.9997	(86)
MIT	19.6524	19.8080	20.0727	20.4318	20.7514	20.9368	20.9866	20.9754	20.8218	20.4017	19.9607	19.6274	(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	0.9982	0.9934	0.9688	0.8755	0.6712	0.4659	0.5412	0.8549	0.9868	0.9986	0.9996	(89)
MIT 2	18.7490	18.9059	19.1713	19.5323	19.8310	19.9827	20.0093	20.0068	19.9024	19.5077	19.0661	18.7300	(90)
Living area fraction													(91)
MIT	18.8709	19.0276	19.2929	19.6536	19.9551	20.1114	20.1411	20.1375	20.0265	19.6283	19.1868	18.8511	(92)
Temperature adjustment													(93)
adjusted MIT	18.8709	19.0276	19.2929	19.6536	19.9551	20.1114	20.1411	20.1375	20.0265	19.6283	19.1868	18.8511	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9992	0.9976	0.9916	0.9646	0.8734	0.6808	0.4825	0.5580	0.8560	0.9842	0.9981	0.9994	(94)
Ext temp.	629.8790	766.5882	908.4390	1044.6918	1053.2036	819.8771	552.3301	575.4156	772.6292	733.5447	626.9495	588.4408	(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	2358.2689	2281.5988	2061.6772	1715.7541	1314.6362	869.9855	558.9694	588.9976	938.6929	1437.7646	1932.1826	2351.4118	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating	1285.9221	1018.0871	858.0092	483.1648	194.5058	0.0000	0.0000	0.0000	0.0000	523.9396	939.7679	1311.6504	(98)
Space heating per m2													(98) / (4) = 45.4830 (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	0.8535	0.9179	0.8810	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1266.4978	1072.1419	1055.1676	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1532.1090	1459.4907	1329.4121	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	191.2400	288.1875	204.0379	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												683.4654 (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	47.8100	72.0469	51.0095	0.0000	0.0000	0.0000	0.0000 (107)	
Space cooling												170.8664 (107)
Space cooling per m2												1.1748 (108)
Energy for space heating												45.4830 (99)
Energy for space cooling												1.1748 (108)
Total												46.6578 (109)
Target Fabric Energy Efficiency (TFEE)												53.7 (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		(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					4.3700
Infiltration rate					0.3333 (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) =		0.2833 (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	0.2975	0.2763	0.2833	0.2692	0.2692	0.2621	0.2550	0.2479	0.2408	0.2621	0.2479	0.2621 (22b)
	0.5443	0.5382	0.5401	0.5362	0.5362	0.5343	0.5325	0.5307	0.5290	0.5343	0.5307	0.5343 (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	62.5611	61.8604	62.0882	61.6383	61.6383	61.4220	61.2115	61.0068	60.8078	61.4220	61.0068	61.4220 (38)
Heat transfer coeff	167.2165	166.5157	166.7436	166.2937	166.2937	166.0774	165.8669	165.6622	165.4632	166.0774	165.6622	166.0774 (39)
Average = Sum(39)m / 12 =												166.1625 (39)
HLP	1.1497	1.1449	1.1465	1.1434	1.1434	1.1419	1.1404	1.1390	1.1377	1.1419	1.1390	1.1419 (40)
HLP (average)												1.1425 (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)

AES
Sustainability
Consultants

Water storage loss:												
Store volume											210.0000 (47)	
a) If manufacturer declared loss factor is known (kWh/day):												
Temperature factor from Table 2b											1.4200 (48)	
Enter (49) or (54) in (55)											0.5400 (49)	
Total storage loss											0.7668 (55)	
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	23.0040	23.7708	23.0040	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 (57)	
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)
RHI water heating demand											2186 (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 m ²	Solar flux Table 6a W/m ²	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	8.1600	45.1778	0.7100	0.7000	0.7700	126.9712 (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	6.0000	14.6176	0.7100	0.7000	0.7700	30.2078 (81)
Northwest	4.1000	14.6176	0.7100	0.7000	0.7700	20.6420 (81)

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	28.6036	28.7240	28.6848	28.7624	28.7624	28.7998	28.8364	28.8720	28.9067	28.7998	28.8720	28.7998
alpha	2.9069	2.9149	2.9123	2.9175	2.9175	2.9200	2.9224	2.9248	2.9271	2.9200	2.9248	2.9200
util living area	0.9616	0.9463	0.9059	0.8207	0.6911	0.5078	0.3845	0.4112	0.6493	0.8539	0.9388	0.9664 (86)
MIT	19.1143	19.3140	19.7501	20.2736	20.6771	20.9061	20.9693	20.9634	20.8005	20.3108	19.6527	19.0866 (87)
Th 2	19.9604	19.9643	19.9631	19.9656	19.9656	19.9668	19.9679	19.9691	19.9702	19.9668	19.9691	19.9668 (88)
util rest of house	0.9550	0.9373	0.8899	0.7902	0.6381	0.4302	0.2895	0.3110	0.5750	0.8209	0.9266	0.9605 (89)
MIT 2	17.4693	17.7580	18.3784	19.1051	19.6324	19.8941	19.9524	19.9503	19.7945	19.1750	18.2531	17.4338 (90)
Living area fraction									fLA = Living area / (4) =			0.1349 (91)
MIT	17.6912	17.9679	18.5634	19.2628	19.7733	20.0306	20.0896	20.0870	19.9302	19.3282	18.4419	17.6568 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.5412	17.8179	18.4134	19.1128	19.6233	19.8806	19.9396	19.9370	19.7802	19.1782	18.2919	17.5068 (93)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9330	0.9116	0.8591	0.7604	0.6187	0.4233	0.2868	0.3077	0.5597	0.7896	0.8992	0.9401 (94)
Useful gains	958.0481	1052.2943	1143.3945	1164.7285	1004.5668	718.6391	461.7393	458.8660	743.7125	899.6138	915.8516	906.2739 (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	2113.8161	2084.4226	1903.1125	1598.5430	1184.5577	760.7367	470.9876	469.9772	840.5914	1291.7895	1721.5511	2077.0893 (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	859.8914	693.5902	565.2301	312.3465	133.9132	0.0000	0.0000	0.0000	0.0000	291.7787	580.1036	871.0867 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF HEAT DEMAND 09 Jan 2014

Space heating	4307.9405 (98)
RHI space heating demand	4308 (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		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 348.3288 (5)
Dwelling volume			

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					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					4.3700
Infiltration rate					0.3333 (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) =	0.2833 (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	0.3613	0.3542	0.3471	0.3117	0.3046	0.2692	0.2692	0.2621	0.2833	0.3046	0.3188	0.3329 (22b)
Effective ac	0.5653	0.5627	0.5602	0.5486	0.5464	0.5362	0.5362	0.5343	0.5401	0.5464	0.5508	0.5554 (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	64.9748	64.6835	64.3980	63.0571	62.8062	61.6383	61.6383	61.4220	62.0882	62.8062	63.3138	63.8444 (38)
Heat transfer coeff	169.6301	169.3389	169.0534	167.7125	167.4616	166.2937	166.2937	166.0774	166.7436	167.4616	167.9691	168.4997 (39)
Average = Sum(39)m / 12 =												167.7113 (39)
HLP	1.1663	1.1643	1.1624	1.1531	1.1514	1.1434	1.1434	1.1419	1.1465	1.1514	1.1549	1.1586 (40)
HLP (average)												1.1531 (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	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)

[illegible]

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Space heating per m2 (98) / (4) = 33.8453 (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													5457.2660 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	950.1996	750.1419	634.3840	376.3165	183.5855	0.0000	0.0000	0.0000	0.0000	373.1264	680.1011	974.5989	(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)	1053.4364	831.6429	703.3082	417.2024	203.5316	0.0000	0.0000	0.0000	0.0000	413.6656	753.9923	1080.4866	(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	88.0044	87.8071	87.3839	86.4545	84.6441	79.5000	79.5000	79.5000	79.5000	86.3444	87.5594	79.5000	(216)
Fuel for water heating, kWh/month	245.6862	216.8945	228.5572	206.6219	206.4681	195.8957	187.6342	206.5859	206.4382	214.5509	224.2974	239.3848	(219)
Water heating fuel used												2579.0150	(219)
Annual totals kWh/year													
Space heating fuel - main system												5457.2660	(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 * 1004 * 1.00) =										-650.5895		-650.5895	(233)
Total delivered energy for all uses												7967.4472	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	5457.2660	3.4800	189.9129 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2579.0150	3.4800	89.7497 (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	-650.5895	13.1900	-85.8128 (252)
Total energy cost			390.5834 (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] =	0.8614 (257)
SAP value		87.9835
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	5457.2660	0.2160	1178.7695 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2579.0150	0.2160	557.0672 (264)
Space and water heating			1735.8367 (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	-650.5895	0.5190	-337.6560 (269)
Total kg/year			1700.1119 (272)
CO2 emissions per m2			11.6900 (273)
EI value			88.0374
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	$3.48 \times (1 + 0.29 \times 0.00) / 0.9020 = 3.858$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9020 = 0.2395$, stars = 4
Water heating energy efficiency	$3.48 / 0.8452 = 4.117$, stars = 4
Water heating environmental impact	$0.216 / 0.8452 = 0.2555$, 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					4.3700
Infiltration rate					0.3333 (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) =		0.2833 (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	0.2975	0.2763	0.2833	0.2692	0.2692	0.2621	0.2550	0.2479	0.2408	0.2621	0.2479	0.2621 (22b)
	0.5443	0.5382	0.5401	0.5362	0.5362	0.5343	0.5325	0.5307	0.5290	0.5343	0.5307	0.5343 (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	62.5611	61.8604	62.0882	61.6383	61.6383	61.4220	61.2115	61.0068	60.8078	61.4220	61.0068	61.4220 (38)
Heat transfer coeff	167.2165	166.5157	166.7436	166.2937	166.2937	166.0774	165.8669	165.6622	165.4632	166.0774	165.6622	166.0774 (39)
Average = Sum(39)m / 12 =												166.1625 (39)
HLP	1.1497	1.1449	1.1465	1.1434	1.1434	1.1419	1.1404	1.1390	1.1377	1.1419	1.1390	1.1419 (40)
HLP (average)												1.1425 (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 EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Space heating per m2 (98) / (4) = 29.6201 (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													4775.9872 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	859.8914	693.5902	565.2301	312.3465	133.9132	0.0000	0.0000	0.0000	0.0000	291.7787	580.1036	871.0867	(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)	953.3164	768.9470	626.6409	346.2821	148.4626	0.0000	0.0000	0.0000	0.0000	323.4798	643.1304	965.7280	(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	87.8250	87.6583	87.1379	85.9892	83.8133	79.5000	79.5000	79.5000	79.5000	85.7196	87.2306	79.5000	(216)
Fuel for water heating, kWh/month	246.1881	217.2626	229.2022	207.7398	208.5146	195.8957	187.6342	206.5859	206.4382	216.1148	225.1430	239.9203	(219)
Water heating fuel used												2586.6394	(219)
Annual totals kWh/year													
Space heating fuel - main system												4775.9872	(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 * 1122 * 1.00) =										-727.0046		-727.0046	(233)
Total delivered energy for all uses												7217.3778	(238)

10a. Fuel costs - using BEDF prices (453)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4775.9872	3.9300	187.6963	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	2586.6394	3.9300	101.6549	(247)
Pumps and fans for heating	75.0000	17.5600	13.1700	(249)
Energy for lighting	506.7557	17.5600	88.9863	(250)
Additional standing charges			88.0000	(251)
Energy saving/generation technologies				
PV Unit	-727.0046	17.5600	-127.6620	(252)
Total energy cost			351.8455	(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	4775.9872	0.2160	1031.6132	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2586.6394	0.2160	558.7141	(264)
Space and water heating			1590.3274	(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	-727.0046	0.5190	-377.3154	(269)
Total kg/year			1514.9432	(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	4775.9872	1.2200	5826.7044	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2586.6394	1.2200	3155.7001	(264)
Space and water heating			8982.4045	(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	-727.0046	3.0700	-2231.9040 (269)
Primary energy kWh/year			8536.4904 (272)
Primary energy kWh/m2/year			58.6942 (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 (17.8%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£45 1.85 kg/m²	B 89	B 90
Total Savings	£45 1.85 kg/m²		

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

Fuel prices for cost data on this page from database revision number 453 TEST (27 Nov 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	£102	£111	-£9
Mains gas	£377	£324	£54
Space heating	£289	£290	-£1
Water heating	£102	£55	£46
Lighting	£89	£89	£0
Generated (PV)	-£128	-£128	£0
Total cost of fuels	£351	£307	£45
Total cost of uses	£352	£306	£45
Delivered energy	50 kWh/m²	41 kWh/m²	9 kWh/m²
Carbon dioxide emissions	1.5 tonnes	1.2 tonnes	0.3 tonnes
CO2 emissions per m²	10 kg/m²	9 kg/m²	2 kg/m²
Primary energy	59 kWh/m²	48 kWh/m²	10 kWh/m²

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	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					4.3700
Infiltration rate					0.3333 (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) =	0.2833 (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	0.3613	0.3542	0.3471	0.3117	0.3046	0.2692	0.2692	0.2621	0.2833	0.3046	0.3188	0.3329 (22b)
Effective ac	0.5653	0.5627	0.5602	0.5486	0.5464	0.5362	0.5362	0.5343	0.5401	0.5464	0.5508	0.5554 (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	64.9748	64.6835	64.3980	63.0571	62.8062	61.6383	61.6383	61.4220	62.0882	62.8062	63.3138	63.8444 (38)
Heat transfer coeff	169.6301	169.3389	169.0534	167.7125	167.4616	166.2937	166.2937	166.0774	166.7436	167.4616	167.9691	168.4997 (39)
Average = Sum(39)m / 12 =												167.7113 (39)
HLP	1.1663	1.1643	1.1624	1.1531	1.1514	1.1434	1.1434	1.1419	1.1465	1.1514	1.1549	1.1586 (40)
HLP (average)												1.1531 (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											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											1079.5246 (H5)	
Overshading factor											0.8000 (H6)	
Solar energy available											1813.6014 (H7)	
Adjustment factor for showers											1.0000 (H7a)	
Solar-to-load ratio											1.1114 (H8)	
Utilisation factor											0.5933 (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											-946.1739 (H17)	
Solar input	-27.4372	-45.7847	-77.9766	-104.5041	-129.1060	-126.9317	-125.2543	-109.4353	-85.7098	-58.5297	-32.5444	-22.9602 (63)
											Solar input (sum of months) = Sum(63)m = -946.1739 (63)	
Output from w/h												
180.2879	136.9961	111.8601	59.1605	24.3731	7.9829	2.3984	34.2145	64.7900	116.8378	155.6334	179.4266 (64)	
											Total per year (kWh/year) = Sum(64)m = 1073.9614 (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	28.1966	28.2451	28.2928	28.5190	28.5618	28.7624	28.7624	28.7998	28.6848	28.5618	28.4755	28.3858
alpha	2.8798	2.8830	2.8862	2.9013	2.9041	2.9175	2.9175	2.9200	2.9123	2.9041	2.8984	2.8924
util living area	0.9695	0.9531	0.9210	0.8541	0.7434	0.5946	0.4621	0.5134	0.7211	0.8907	0.9547	0.9737 (86)
MIT	18.9169	19.1745	19.5931	20.1186	20.5598	20.8390	20.9433	20.9220	20.7029	20.1242	19.4244	18.8632 (87)
Th 2	19.9470	19.9486	19.9502	19.9577	19.9591	19.9656	19.9656	19.9668	19.9631	19.9591	19.9562	19.9533 (88)
util rest of house	0.9644	0.9452	0.9075	0.8285	0.6977	0.5217	0.3657	0.4153	0.6561	0.8658	0.9458	0.9692 (89)
MIT 2	17.1759	17.5479	18.1483	18.8900	19.4813	19.8261	19.9313	19.9161	19.6792	18.9155	17.9184	17.1019 (90)
Living area fraction									fLA = Living area / (4) =			0.1349 (91)
MIT	17.4108	17.7673	18.3432	19.0557	19.6268	19.9627	20.0678	20.0518	19.8173	19.0786	18.1216	17.3395 (92)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Temperature adjustment													-0.1500
adjusted MIT	17.2608	17.6173	18.1932	18.9057	19.4768	19.8127	19.9178	19.9018	19.6673	18.9286	17.9716		17.1895 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9448	0.9207	0.8776	0.7971	0.6736	0.5100	0.3610	0.4087	0.6348	0.8339	0.9215	0.9513	(94)
Useful gains	915.9002	1032.1958	1118.9993	1149.3540	1050.4063	788.2442	531.6365	552.2372	776.5220	888.7981	876.4317	873.1640	(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													
	2198.5376	2153.5378	1976.7710	1678.0830	1302.3095	866.8442	551.7350	581.5744	928.3169	1394.7173	1826.0925	2188.7278	(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													
	954.2822	753.5419	638.1822	380.6849	187.4160	0.0000	0.0000	0.0000	0.0000	376.4039	683.7558	978.7795	(98)
Space heating													4953.0464 (98)
Space heating per m2											(98) / (4) =		34.0556 (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													5491.1822 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	954.2822	753.5419	638.1822	380.6849	187.4160	0.0000	0.0000	0.0000	0.0000	376.4039	683.7558	978.7795	(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)	1057.9626	835.4123	707.5191	422.0453	207.7783	0.0000	0.0000	0.0000	0.0000	417.2992	758.0442	1085.1214	(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	180.2879	136.9961	111.8601	59.1605	24.3731	7.9829	2.3984	34.2145	64.7900	116.8378	155.6334	179.4266	(64)
Efficiency of water heater (217)m	88.3113	88.3703	88.4251	88.5962	88.8242	79.5000	79.5000	79.5000	79.5000	87.4131	88.0039	79.5000	(216)
Fuel for water heating, kWh/month	204.1505	155.0250	126.5027	66.7755	27.4397	10.0414	3.0169	43.0371	81.4968	133.6616	176.8483	203.0685	(219)
Water heating fuel used													1231.0641 (219)
Annual totals kWh/year													
Space heating fuel - main system													5491.1822 (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 * 1004 * 1.00) =										-650.5895			-650.5895 (233)
Total delivered energy for all uses													6703.4125 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	5491.1822	3.4800	191.0931	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1231.0641	3.4800	42.8410	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Pump for solar water heating	50.0000	13.1900	6.5950	(249)
Energy for lighting	506.7557	13.1900	66.8411	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-650.5895	13.1900	-85.8128	(252)
Total energy cost			351.4500	(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] =	0.7751 (257)
SAP value			89.1874
SAP rating (Section 12)			89 (258)
SAP band			B

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	5491.1822	0.2160	1186.0954	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1231.0641	0.2160	265.9099	(264)
Space and water heating			1452.0052	(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	-650.5895	0.5190	-337.6560	(269)
Total kg/year			1442.2304	(272)
CO2 emissions per m2			9.9200	(273)
EI value			89.8520	
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	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					4.3700
Infiltration rate					0.3333 (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) =		0.2833 (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	0.2975	0.2763	0.2833	0.2692	0.2692	0.2621	0.2550	0.2479	0.2408	0.2621	0.2479	0.2621 (22b)
	0.5443	0.5382	0.5401	0.5362	0.5362	0.5343	0.5325	0.5307	0.5290	0.5343	0.5307	0.5343 (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	62.5611	61.8604	62.0882	61.6383	61.6383	61.4220	61.2115	61.0068	60.8078	61.4220	61.0068	61.4220 (38)
Heat transfer coeff	167.2165	166.5157	166.7436	166.2937	166.2937	166.0774	165.8669	165.6622	165.4632	166.0774	165.6622	166.0774 (39)
Average = Sum(39)m / 12 =												166.1625 (39)
HLP	1.1497	1.1449	1.1465	1.1434	1.1434	1.1419	1.1404	1.1390	1.1377	1.1419	1.1390	1.1419 (40)
HLP (average)												1.1425 (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	28.6036	28.7240	28.6848	28.7624	28.7624	28.7998	28.8364	28.8720	28.9067	28.7998	28.8720	28.7998
alpha	2.9069	2.9149	2.9123	2.9175	2.9175	2.9200	2.9224	2.9248	2.9271	2.9200	2.9248	2.9200
util living area	0.9624	0.9472	0.9074	0.8240	0.6967	0.5133	0.3895	0.4166	0.6540	0.8564	0.9400	0.9671 (86)
MIT	19.1055	19.3057	19.7417	20.2641	20.6696	20.9034	20.9682	20.9621	20.7965	20.3039	19.6446	19.0776 (87)
Th 2	19.9604	19.9643	19.9631	19.9656	19.9656	19.9668	19.9679	19.9691	19.9702	19.9668	19.9691	19.9668 (88)
util rest of house	0.9559	0.9384	0.8916	0.7938	0.6440	0.4353	0.2935	0.3154	0.5797	0.8238	0.9280	0.9614 (89)
MIT 2	17.4567	17.7461	18.3668	19.0928	19.6239	19.8918	19.9518	19.9496	19.7906	19.1661	18.2417	17.4209 (90)
Living area fraction									fLA = Living area / (4) =			0.1349 (91)
MIT	17.6791	17.9565	18.5523	19.2508	19.7650	20.0283	20.0889	20.0862	19.9263	19.3196	18.4310	17.6444 (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	17.5291	17.8065	18.4023	19.1008	19.6150	19.8783	19.9389	19.9362	19.7763	19.1696	18.2810		17.4944 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9341	0.9129	0.8610	0.7639	0.6241	0.4282	0.2907	0.3120	0.5641	0.7924	0.9008	0.9412	(94)
Useful gains	950.7249	1045.4626	1136.6983	1157.3655	999.0830	716.9839	461.2938	458.3221	741.0663	894.3671	909.2908	898.7850	(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													
	2111.7967	2082.5315	1901.2532	1596.5600	1183.1732	760.3457	470.8803	469.8460	839.9364	1290.3564	1719.7360	2075.0401	(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	863.8374	696.9103	568.8288	316.2200	136.9631	0.0000	0.0000	0.0000	0.0000	294.6160	583.5205	875.1338	(98)
Space heating												4336.0301	(98)
Space heating per m2											(98) / (4) =	29.8132	(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													4807.1287 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	863.8374	696.9103	568.8288	316.2200	136.9631	0.0000	0.0000	0.0000	0.0000	294.6160	583.5205	875.1338	(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)	957.6912	772.6278	630.6307	350.5765	151.8438	0.0000	0.0000	0.0000	0.0000	326.6253	646.9186	970.2149	(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	88.1950	88.2482	88.2572	88.3673	88.1329	79.5000	79.5000	79.5000	79.5000	86.9704	87.7822	79.5000	(216)
Fuel for water heating, kWh/month	199.0601	155.2957	126.0283	65.1876	32.7972	2.3270	0.0000	34.0346	74.4856	129.0750	171.0326	88.2126	(217)
Water heating fuel used												199.4484	(219)
Annual totals kWh/year												1188.7721	(219)
Space heating fuel - main system												4807.1287	(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 * 1122 * 1.00) =										-727.0046		-727.0046	(233)
Total delivered energy for all uses												5900.6520	(238)

10a. Fuel costs - using BEDF prices (453)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4807.1287	3.9300	188.9202	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1188.7721	3.9300	46.7187	(247)
Pumps and fans for heating	75.0000	17.5600	13.1700	(249)
Pump for solar water heating	50.0000	17.5600	8.7800	(249)
Energy for lighting	506.7557	17.5600	88.9863	(250)
Additional standing charges			88.0000	(251)
Energy saving/generation technologies				
PV Unit	-727.0046	17.5600	-127.6620	(252)
Total energy cost			306.9132	(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	4807.1287	0.2160	1038.3398	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1188.7721	0.2160	256.7748	(264)
Space and water heating			1295.1146	(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	-727.0046	0.5190	-377.3154 (269)
Total kg/year			1245.6804 (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	4807.1287	1.2200	5864.6970 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1188.7721	1.2200	1450.3020 (264)
Space and water heating			7314.9990 (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	-727.0046	3.0700	-2231.9040 (269)
Primary energy kWh/year			7022.5850 (272)
Primary energy kWh/m2/year			48.2851 (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	South East
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

Orientation	Ratio	Z_overhangs	Overhang type
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

Orientation	Z blinds	Solar access	Z overhangs	Z summer
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	8.1600	127.3119	0.7100	0.7000	0.9000	418.2158
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	6.0000	106.0502	0.7100	0.7000	0.9000	256.1558
North West	4.1000	106.0502	0.7100	0.7000	0.9000	175.0398
total:						1206.2022

	Jun	Jul	Aug	
Solar gains	1302	1206	1050	(P3)
Internal gains	613	589	599	
Total summer gains	1916	1795	1649	(P5)
Summer gain/loss ratio	3.39	3.18	2.92	(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	19.97	21.65	21.39	(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