

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



Property Reference	4907-0015-3817-153				Issued on Date	15/03/2018
Assessment Reference	As Built		Prop Type Ref	P505 - Det (Op)		
Property	63, Appleby Drive, Botley, SOUTHAMPTON, SO32 2GE					
SAP Rating	89 B	DER	11.91	TER	14.39	
Environmental	88 B	% DER<TER	17.25			
CO ₂ Emissions (t/year)	1.72	DFEE	45.12	TFEE	51.96	
General Requirements Compliance	Pass	% DFEE<TFEE	13.17			
Assessor Details	Mr. Fraser Browning, Fraser Browning, Tel: 01884 242050, Fraser.browning@aessc.co.uk				Assessor ID	T511-0001
Client						

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

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DWELLING AS BUILT

Detached House, total floor area 184 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) 14.39 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 11.91 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)52.0 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)45.1 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: 4.87 (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 18 Heat 18

Efficiency: 89.2% SEDBUK2009
Minimum: 88.0%

OK

Secondary heating system: None

5 Cylinder insulation

Hot water storage Measured cylinder loss: 1.61 kWh/day
Permitted by DBSCG 2.56 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 East: 12.18 m², No overhang
Windows facing South West: 13.31 m², No overhang
Windows facing North West: 0.57 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

10 Key features

Door U-value 0.90 W/m²K
Thermal bridging y-value 0.027 W/m²K
Photovoltaic array 1.08 kW

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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	91.8700 (1b)	x 2.3100 (2b)	= 212.2197 (1b) - (3b)
First floor	91.8700 (1c)	x 2.4800 (2c)	= 227.8376 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	183.7400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 440.0573 (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					6 * 10 = 60.0000 (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)					60.0000 / (5) = 0.1363 (8)
Pressure test					Yes
Measured/design AP50					4.8700
Infiltration rate					0.3798 (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) =	0.3229 (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	0.4117	0.4036	0.3955	0.3552	0.3471	0.3067	0.3067	0.2987	0.3229	0.3471	0.3632	0.3794 (22b)
Effective ac	0.5847	0.5814	0.5782	0.5631	0.5602	0.5470	0.5470	0.5446	0.5521	0.5602	0.5660	0.5720 (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)
Half Glazed Door			1.8900	1.3000	2.4570		(26a)
Window (Uw = 1.40)			20.2600	1.3258	26.8598		(27)
French (Uw = 1.40)			5.8000	1.3258	7.6894		(27)
Heat Loss Floor 1			91.8700	0.1500	13.7805	75.0000	6890.2500 (28a)
100mm Knauf Supafil	194.9500	30.0800	164.8700	0.2500	41.2175	60.0000	9892.2000 (29a)
External Roof 1	91.8700		91.8700	0.1300	11.9431	9.0000	826.8300 (30)
Total net area of external elements Aum(A, m ²)			378.6900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	105.8643		(33)
GF			46.8000			9.0000	421.2000 (32c)
GF			95.1700			39.0000	3711.6300 (32c)
FF			184.1600			9.0000	1657.4400 (32c)
Internal Floor 1			91.8700			18.0000	1653.6600 (32d)
Internal Floor 1			91.8700			18.0000	1653.6600 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	26706.8700 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							145.3514 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.0516 (36)
Total fabric heat loss						(33) + (36) =	115.9160 (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	84.9140	84.4362	83.9679	81.7681	81.3565	79.4406	79.4406	79.0858	80.1786	81.3565	82.1891	83.0596 (38)
Heat transfer coeff	200.8300	200.3522	199.8838	197.6841	197.2725	195.3566	195.3566	195.0018	196.0945	197.2725	198.1051	198.9755 (39)
Average = Sum(39)m / 12 =												197.6821 (39)
HLP	1.0930	1.0904	1.0879	1.0759	1.0737	1.0632	1.0632	1.0613	1.0672	1.0737	1.0782	1.0829 (40)
HLP (average)												1.0759 (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												2.9807 (42)
Average daily hot water use (litres/day)												104.9920 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	115.4912	111.2916	107.0919	102.8922	98.6925	94.4928	94.4928	98.6925	102.8922	107.0919	111.2916	115.4912 (44)

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Energy content (annual)	171.2702	149.7940	154.5740	134.7613	129.3067	111.5819	103.3970	118.6496	120.0666	139.9261	152.7402	165.8660 (45)
Distribution loss (46)m = 0.15 x (45)m	25.6905	22.4691	23.1861	20.2142	19.3960	16.7373	15.5095	17.7974	18.0100	20.9889	22.9110	24.8799 (46)
Water storage loss:												
Store volume												250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.6100 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.8694 (55)
Total storage loss	26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514 (56)
If cylinder contains dedicated solar storage	26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514 (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	221.4840	195.1484	204.7878	183.3553	179.5205	160.1759	153.6108	168.8634	168.6606	190.1399	201.3342	216.0798 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Solar input (sum of months) = Sum(63)m =												0.0000 (63)
Output from w/h	221.4840	195.1484	204.7878	183.3553	179.5205	160.1759	153.6108	168.8634	168.6606	190.1399	201.3342	216.0798 (64)
Heat gains from water heating, kWh/month	97.1184	86.0900	91.5669	83.6833	83.1655	75.9762	74.5505	79.6220	78.7974	86.6965	89.6613	95.3215 (65)
Total per year (kWh/year) = Sum(64)m =												2243.1605 (64)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	149.0359	149.0359	149.0359	149.0359	149.0359	149.0359	149.0359	149.0359	149.0359	149.0359	149.0359	149.0359 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	33.8877	30.0987	24.4779	18.5314	13.8524	11.6948	12.6366	16.4256	22.0464	27.9929	32.6719	34.8295 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	355.3169	359.0040	349.7127	329.9326	304.9637	281.4966	265.8190	262.1320	271.4233	291.2034	316.1722	339.6394 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.9036	37.9036	37.9036	37.9036	37.9036	37.9036	37.9036	37.9036	37.9036	37.9036	37.9036	37.9036 (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)	-119.2287	-119.2287	-119.2287	-119.2287	-119.2287	-119.2287	-119.2287	-119.2287	-119.2287	-119.2287	-119.2287	-119.2287 (71)
Water heating gains (Table 5)	130.5354	128.1101	123.0738	116.2269	111.7816	105.5225	100.2023	107.0188	109.4408	116.5275	124.5296	128.1203 (72)
Total internal gains	590.4508	587.9237	567.9752	535.4016	501.3085	469.4246	449.3688	456.2871	473.6212	506.4346	544.0845	573.3000 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast					12.1800	11.2829		0.7100	0.7000	0.7700	47.3325 (75)	
Southwest					7.5100	36.7938		0.7100	0.7000	0.7700	95.1710 (79)	
Northwest					0.5700	11.2829		0.7100	0.7000	0.7700	2.2151 (81)	
Southwest					5.8000	36.7938		0.7100	0.7000	0.7700	73.5009 (79)	

Solar gains	218.2194	388.1661	574.8204	785.5026	946.7080	969.2800	922.2469	797.4829	647.0718	440.7928	264.3737	184.8110 (83)
Total gains	808.6702	976.0897	1142.7956	1320.9042	1448.0165	1438.7045	1371.6156	1253.7701	1120.6930	947.2274	808.4582	758.1110 (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	36.9396	37.0277	37.1144	37.5274	37.6057	37.9745	37.9745	38.0436	37.8316	37.6057	37.4477	37.2839
alpha	3.4626	3.4685	3.4743	3.5018	3.5070	3.5316	3.5316	3.5362	3.5221	3.5070	3.4965	3.4856
util living area	0.9945	0.9889	0.9757	0.9399	0.8599	0.7217	0.5756	0.6357	0.8458	0.9631	0.9902	0.9956 (86)
MIT	19.0215	19.2447	19.6143	20.1030	20.5401	20.8342	20.9452	20.9217	20.6833	20.1111	19.4782	18.9862 (87)
Th 2	20.0065	20.0087	20.0108	20.0206	20.0224	20.0310	20.0310	20.0326	20.0277	20.0224	20.0187	20.0148 (88)
util rest of house	0.9933	0.9865	0.9703	0.9254	0.8242	0.6492	0.4679	0.5297	0.7929	0.9516	0.9878	0.9947 (89)
MIT 2	17.3345	17.6611	18.1991	18.9061	19.5102	19.8855	19.9984	19.9819	19.7142	18.9284	18.0094	17.2879 (90)
Living area fraction	17.5632	17.8758	18.3910	19.0684	19.6498	20.0141	20.1268	20.1093	19.8456	19.0888	18.2085	17.5181 (92)
MIT	17.5632	17.8758	18.3910	19.0684	19.6498	20.0141	20.1268	20.1093	19.8456	19.0888	18.2085	17.5181 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.4132	17.7258	18.2410	18.9184	19.4998	19.8641	19.9768	19.9593	19.6956	18.9388	18.0585	17.3681 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9883	0.9781	0.9561	0.9038	0.8011	0.6351	0.4614	0.5208	0.7706	0.9332	0.9799	0.9905 (94)
Ext temp.	799.2257	954.7275	1092.6682	1193.8784	1160.0502	913.7399	632.8880	652.9739	863.5686	883.9868	792.2207	750.9370 (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	2633.5244	2569.6749	2346.8353	1980.4683	1538.6851	1028.3797	659.6707	694.0639	1097.2696	1645.0070	2170.9379	2620.1296 (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)
	1364.7182	1085.2447	933.1003	566.3448	281.7043	0.0000	0.0000	0.0000	0.0000	566.1990	992.6764	1390.6793 (98)

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Space heating
Space heating per m2 (98) / (4) = 7180.6671 (98)
39.0806 (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													7960.8282 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1364.7182	1085.2447	933.1003	566.3448	281.7043	0.0000	0.0000	0.0000	0.0000	566.1990	992.6764	1390.6793	(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)	1512.9914	1203.1537	1034.4793	627.8767	312.3108	0.0000	0.0000	0.0000	0.0000	627.7151	1100.5281	1541.7731	(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	221.4840	195.1484	204.7878	183.3553	179.5205	160.1759	153.6108	168.8634	168.6606	190.1399	201.3342	216.0798	(64)
Efficiency of water heater (217)m	88.5361	88.3869	88.0668	87.3255	85.7100	79.5000	79.5000	79.5000	79.5000	87.2479	88.1984	88.5964	(216)
Fuel for water heating, kWh/month	250.1623	220.7889	232.5369	209.9677	209.4511	201.4791	193.2211	212.4067	212.1517	217.9306	228.2744	243.8923	(219)
Water heating fuel used												2632.2628	(219)
Annual totals kWh/year													
Space heating fuel - main system												7960.8282	(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)												598.4667	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.08 * 1004 * 1.00) =										-867.4527		-867.4527	(233)
Total delivered energy for all uses												10399.1050	(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	7960.8282	0.2160	1719.5389	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2632.2628	0.2160	568.5688	(264)
Space and water heating			2288.1077	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	598.4667	0.5190	310.6042	(268)
Energy saving/generation technologies				
PV Unit	-867.4527	0.5190	-450.2080	(269)
Total CO2, kg/year			2187.4289	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			11.9100	(273)

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

DER		11.9100	ZC1
Total Floor Area		183.7400	
Assumed number of occupants		2.9807	
CO2 emission factor in Table 12 for electricity displaced from grid		0.5190	
CO2 emissions from appliances, equation (L14)		11.4593	ZC2
CO2 emissions from cooking, equation (L16)		1.0370	ZC3
Total CO2 emissions		24.4063	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		24.4063	ZC8

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	91.8700 (1b)	x 2.3100 (2b)	= 212.2197 (1b) - (3b)
First floor	91.8700 (1c)	x 2.4800 (2c)	= 227.8376 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	183.7400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 440.0573 (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) =	0.0909 (8)	
Pressure test										Yes							
Measured/design AP50										5.0000							
Infiltration rate										0.3409 (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) =				0.2898 (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	0.3694	0.3622	0.3550	0.3187	0.3115	0.2753	0.2753	0.2680	0.2898	0.3115	0.3260	0.3405 (22b)					
Effective ac	0.5682	0.5656	0.5630	0.5508	0.5485	0.5379	0.5379	0.5359	0.5420	0.5485	0.5531	0.5580 (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 Semi-glazed door			1.8900	1.2000	2.2680			(26a)					
TER Opening Type (Uw = 1.40)			26.0600	1.3258	34.5492			(27)					
Heat Loss Floor 1			91.8700	0.1300	11.9431			(28a)					
100mm Knauf Supafil	194.9500	30.0800	164.8700	0.1800	29.6766			(29a)					
External Roof 1	91.8700		91.8700	0.1300	11.9431			(30)					
Total net area of external elements Aum(A, m2)			378.6900					(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =			92.5100		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)								14.7154 (36)					
Total fabric heat loss						(33) + (36) =	107.2254	(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 82.5200	Feb 82.1352	Mar 81.7580	Apr 79.9862	May 79.6547	Jun 78.1115	Jul 78.1115	Aug 77.8257	Sep 78.7059	Oct 79.6547	Nov 80.3253	Dec 81.0264	(38)
Heat transfer coeff	189.7455	189.3606	188.9834	187.2116	186.8801	185.3370	185.3370	185.0512	185.9314	186.8801	187.5507	188.2518	(39)
Average = Sum(39)m / 12 =												187.2100	(39)
HLP	Jan 1.0327	Feb 1.0306	Mar 1.0285	Apr 1.0189	May 1.0171	Jun 1.0087	Jul 1.0087	Aug 1.0071	Sep 1.0119	Oct 1.0171	Nov 1.0207	Dec 1.0246	(40)
HLP (average)												1.0189	(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												2.9807 (42)
Average daily hot water use (litres/day)												104.9920 (43)
Daily hot water use	Jan 115.4912	Feb 111.2916	Mar 107.0919	Apr 102.8922	May 98.6925	Jun 94.4928	Jul 94.4928	Aug 98.6925	Sep 102.8922	Oct 107.0919	Nov 111.2916	Dec 115.4912 (44)
Energy conte	171.2702	149.7940	154.5740	134.7613	129.3067	111.5819	103.3970	118.6496	120.0666	139.9261	152.7402	165.8660 (45)
Energy content (annual)										Total = Sum(45)m =		1651.9335 (45)
Distribution loss (46)m = 0.15 x (45)m	25.6905	22.4691	23.1861	20.2142	19.3960	16.7373	15.5095	17.7974	18.0100	20.9889	22.9110	24.8799 (46)
Water storage loss:												250.0000 (47)
Store volume												1.8903 (48)
a) If manufacturer declared loss factor is known (kWh/day):												

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Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.0208 (55)
Total storage loss	31.6444	28.5820	31.6444	30.6236	31.6444	30.6236	31.6444	31.6444	30.6236	31.6444	30.6236	31.6444 (56)
If cylinder contains dedicated storage	31.6444	28.5820	31.6444	30.6236	31.6444	30.6236	31.6444	31.6444	30.6236	31.6444	30.6236	31.6444 (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	226.1770	199.3872	209.4808	187.8969	184.2135	164.7175	158.3038	173.5564	173.2022	194.8329	205.8758	220.7728 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Solar input (sum of months) = Sum(63)m =												0.0000 (63)
Output from w/h	226.1770	199.3872	209.4808	187.8969	184.2135	164.7175	158.3038	173.5564	173.2022	194.8329	205.8758	220.7728 (64)
Heat gains from water heating, kWh/month	100.8728	89.4811	95.3213	87.3166	86.9199	79.6095	78.3049	83.3764	82.4306	90.4508	93.2946	99.0759 (65)
Total per year (kWh/year) = Sum(64)m =												2298.4167 (64)

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

Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	149.0359	149.0359	149.0359	149.0359	149.0359	149.0359	149.0359	149.0359	149.0359	149.0359	149.0359	149.0359 (66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	33.8877	30.0987	24.4779	18.5314	13.8524	11.6948	12.6366	16.4256	22.0464	27.9929	32.6719	34.8295 (67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	355.3169	359.0040	349.7127	329.9326	304.9637	281.4966	265.8190	262.1320	271.4233	291.2034	316.1722	339.6394 (68)
Pumps, fans	37.9036	37.9036	37.9036	37.9036	37.9036	37.9036	37.9036	37.9036	37.9036	37.9036	37.9036	37.9036 (69)
Losses e.g. evaporation (negative values) (Table 5)	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)
Water heating gains (Table 5)	-119.2287	-119.2287	-119.2287	-119.2287	-119.2287	-119.2287	-119.2287	-119.2287	-119.2287	-119.2287	-119.2287	-119.2287 (71)
Total internal gains	135.5817	133.1564	128.1200	121.2731	116.8278	110.5687	105.2486	112.0651	114.4870	121.5737	129.5759	133.1665 (72)
	595.4970	592.9699	573.0214	540.4478	506.3548	474.4708	454.4150	461.3334	478.6674	511.4808	549.1307	578.3462 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d			Gains W
Northeast					12.1800	11.2829	0.6300	0.7000			0.7700			41.9992 (75)
Southwest					13.3100	36.7938	0.6300	0.7000			0.7700			149.6666 (79)
Northwest					0.5700	11.2829	0.6300	0.7000			0.7700			1.9655 (81)
Solar gains	193.6313	344.4291	510.0519	696.9953	840.0367	860.0653	818.3317	707.6257	574.1623	391.1260	234.5851			163.9872 (83)
Total gains	789.1284	937.3989	1083.0733	1237.4431	1346.3914	1334.5361	1272.7467	1168.9591	1052.8297	902.6068	783.7158			742.3334 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
alpha	67.2465	67.3832	67.5177	68.1567	68.2776	68.8461	68.8461	68.9524	68.6260	68.2776	68.0334	67.7801
util living area	5.4831	5.4922	5.5012	5.5438	5.5518	5.5897	5.5897	5.5968	5.5751	5.5518	5.5356	5.5187
	0.9996	0.9989	0.9963	0.9838	0.9328	0.7941	0.6205	0.6899	0.9181	0.9924	0.9991	0.9997 (86)
MIT	19.7570	19.8963	20.1317	20.4513	20.7475	20.9337	20.9865	20.9765	20.8341	20.4511	20.0452	19.7339 (87)
Th 2	20.0562	20.0579	20.0596	20.0676	20.0691	20.0761	20.0761	20.0774	20.0734	20.0691	20.0661	20.0629 (88)
util rest of house	0.9995	0.9986	0.9949	0.9770	0.9031	0.7133	0.5006	0.5700	0.8696	0.9882	0.9987	0.9997 (89)
MIT 2	18.3725	18.5777	18.9228	19.3913	19.8021	20.0277	20.0706	20.0665	19.9236	19.3958	18.8018	18.3436 (90)
Living area fraction	0.9995	0.9986	0.9949	0.9770	0.9031	0.7133	0.5006	0.5700	0.8696	0.9882	0.9987	0.9997 (89)
MIT	18.5602	18.7564	19.0867	19.5350	19.9303	20.1505	20.1948	20.1899	20.0470	19.5389	18.9703	18.5321 (92)
Temperature adjustment	18.5602	18.7564	19.0867	19.5350	19.9303	20.1505	20.1948	20.1899	20.0470	19.5389	18.9703	18.5321 (93)
adjusted MIT	18.5602	18.7564	19.0867	19.5350	19.9303	20.1505	20.1948	20.1899	20.0470	19.5389	18.9703	18.5321 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9992	0.9977	0.9928	0.9716	0.8977	0.7206	0.5167	0.5857	0.8679	0.9847	0.9980	0.9994 (94)
Ext temp.	788.4778	935.2835	1075.2429	1202.3443	1208.6740	961.6129	657.6032	684.6725	913.7510	888.7568	782.1446	741.8989 (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	2705.8114	2623.8645	2378.6722	1991.0046	1538.0737	1028.7179	666.2438	701.3214	1105.7413	1670.4952	2226.2905	2698.0398 (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 per m2	1426.4962	1134.7264	969.7514	567.8354	245.0734	0.0000	0.0000	0.0000	0.0000	581.6133	1039.7851	1455.3688 (98)
												7420.6500 (98)
												40.3867 (99)

8c. Space cooling requirement

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Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													7936.5241 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1426.4962	1134.7264	969.7514	567.8354	245.0734	0.0000	0.0000	0.0000	0.0000	581.6133	1039.7851	1455.3688	(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)	1525.6644	1213.6111	1037.1673	607.3106	262.1106	0.0000	0.0000	0.0000	0.0000	622.0463	1112.0696	1556.5442	(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	226.1770	199.3872	209.4808	187.8969	184.2135	164.7175	158.3038	173.5564	173.2022	194.8329	205.8758	220.7728	(64)
Efficiency of water heater (217)m	88.8692	88.7221	88.3945	87.5803	85.5761	79.8000	79.8000	79.8000	79.8000	87.5542	88.5379	88.9294	(216)
Fuel for water heating, kWh/month	254.5054	224.7324	236.9839	214.5425	215.2627	206.4129	198.3757	217.4892	217.0454	222.5284	232.5284	248.2562	(219)
Water heating fuel used												2688.6630	(219)
Annual totals kWh/year													
Space heating fuel - main system												7936.5241	(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)												598.4667	(232)
Total delivered energy for all uses												11298.6538	(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	7936.5241	0.2160	1714.2892 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2688.6630	0.2160	580.7512 (264)
Space and water heating			2295.0404 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	598.4667	0.5190	310.6042 (268)
Total CO2, kg/m2/year			2644.5696 (272)
Emissions per m2 for space and water heating			12.4907 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			1.6905 (272b)
Emissions per m2 for pumps and fans			0.2118 (272c)
Target Carbon Dioxide Emission Rate (TER) = (12.4907 * 1.00) + 1.6905 + 0.2118, rounded to 2 d.p.			14.3900 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	91.8700 (1b)	x 2.3100 (2b)	= 212.2197 (1b) - (3b)
First floor	91.8700 (1c)	x 2.4800 (2c)	= 227.8376 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	183.7400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 440.0573 (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) = 0.0909 (8)
Pressure test					Yes
Measured/design AP50					4.8700
Infiltration rate					0.3344 (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) =	0.2842 (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	0.3624	0.3553	0.3482	0.3127	0.3056	0.2700	0.2700	0.2629	0.2842	0.3056	0.3198	0.3340 (22b)
Effective ac	0.5657	0.5631	0.5606	0.5489	0.5467	0.5365	0.5365	0.5346	0.5404	0.5467	0.5511	0.5558 (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)
Half Glazed Door			1.8900	1.3000	2.4570		(26a)
Window (Uw = 1.40)			20.2600	1.3258	26.8598		(27)
French (Uw = 1.40)			5.8000	1.3258	7.6894		(27)
Heat Loss Floor 1			91.8700	0.1500	13.7805	75.0000	6890.2500 (28a)
100mm Knauf Supafil	194.9500	30.0800	164.8700	0.2500	41.2175	60.0000	9892.2000 (29a)
External Roof 1	91.8700		91.8700	0.1300	11.9431	9.0000	826.8300 (30)
Total net area of external elements Aum(A, m ²)			378.6900				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	105.8643	(33)
GF			46.8000			9.0000	421.2000 (32c)
GF			95.1700			39.0000	3711.6300 (32c)
FF			184.1600			9.0000	1657.4400 (32c)
Internal Floor 1			91.8700			18.0000	1653.6600 (32d)
Internal Floor 1			91.8700			9.0000	826.8300 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 25880.0400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							140.8514 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.0516 (36)
Total fabric heat loss							(33) + (36) = 115.9160 (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	82.1457	81.7754	81.4124	79.7075	79.3886	77.9037	77.9037	77.6287	78.4756	79.3886	80.0339	80.7085 (38)
Heat transfer coeff	198.0616	197.6913	197.3284	195.6235	195.3045	193.8197	193.8197	193.5447	194.3916	195.3045	195.9498	196.6244 (39)
Average = Sum(39)m / 12 =												195.6220 (39)
HLP	1.0779	1.0759	1.0740	1.0647	1.0629	1.0549	1.0549	1.0534	1.0580	1.0629	1.0665	1.0701 (40)
HLP (average)												1.0647 (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												2.9807 (42)
Average daily hot water use (litres/day)												104.9920 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	115.4912	111.2916	107.0919	102.8922	98.6925	94.4928	94.4928	98.6925	102.8922	107.0919	111.2916	115.4912 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Energy conte	171.2702	149.7940	154.5740	134.7613	129.3067	111.5819	103.3970	118.6496	120.0666	139.9261	152.7402	165.8660 (45)
Energy content (annual)	Total = Sum (45)m = 1651.9335 (45)											
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	36.3949	31.8312	32.8470	28.6368	27.4777	23.7111	21.9719	25.2130	25.5142	29.7343	32.4573	35.2465 (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	149.0359	149.0359	149.0359	149.0359	149.0359	149.0359	149.0359	149.0359	149.0359	149.0359	149.0359	149.0359 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	33.8877	30.0987	24.4779	18.5314	13.8524	11.6948	12.6366	16.4256	22.0464	27.9929	32.6719	34.8295 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	355.3169	359.0040	349.7127	329.9326	304.9637	281.4966	265.8190	262.1320	271.4233	291.2034	316.1722	339.6394 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.9036	37.9036	37.9036	37.9036	37.9036	37.9036	37.9036	37.9036	37.9036	37.9036	37.9036	37.9036 (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)	-119.2287	-119.2287	-119.2287	-119.2287	-119.2287	-119.2287	-119.2287	-119.2287	-119.2287	-119.2287	-119.2287	-119.2287 (71)
Water heating gains (Table 5)	48.9179	47.3679	44.1492	39.7733	36.9324	32.9321	29.5321	33.8885	35.4363	39.9654	45.0796	47.3744 (72)
Total internal gains	505.8333	504.1814	486.0505	455.9480	423.4593	393.8343	375.6985	380.1568	396.6167	426.8725	461.6345	489.5541 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b		FF Specific data or Table 6c	Access factor Table 6d		Gains W
Northeast					12.1800	11.2829	0.7100		0.7000	0.7700		47.3325 (75)
Southwest					7.5100	36.7938	0.7100		0.7000	0.7700		95.1710 (79)
Northwest					0.5700	11.2829	0.7100		0.7000	0.7700		2.2151 (81)
Southwest					5.8000	36.7938	0.7100		0.7000	0.7700		73.5009 (79)

Solar gains	218.2194	388.1661	574.8204	785.5026	946.7080	969.2800	922.2469	797.4829	647.0718	440.7928	264.3737	184.8110 (83)
Total gains	724.0527	892.3475	1060.8709	1241.4507	1370.1673	1363.1142	1297.9454	1177.6397	1043.6886	867.6653	726.0081	674.3651 (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	36.2963	36.3643	36.4312	36.7487	36.8087	37.0907	37.0907	37.1434	36.9815	36.8087	36.6875	36.5616
alpha	3.4198	3.4243	3.4287	3.4499	3.4539	3.4727	3.4727	3.4762	3.4654	3.4539	3.4458	3.4374
util living area	0.9957	0.9907	0.9788	0.9456	0.8702	0.7385	0.5952	0.6583	0.8620	0.9689	0.9923	0.9966 (86)
MIT	18.9397	19.1680	19.5464	20.0461	20.5009	20.8126	20.9356	20.9077	20.6462	20.0478	19.3992	18.8996 (87)
Th 2	20.0189	20.0205	20.0222	20.0298	20.0312	20.0379	20.0379	20.0391	20.0353	20.0312	20.0283	20.0253 (88)
util rest of house	0.9948	0.9888	0.9741	0.9326	0.8369	0.6682	0.4874	0.5533	0.8133	0.9593	0.9903	0.9959 (89)
MIT 2	18.1128	18.3415	18.7185	19.2147	19.6470	19.9231	20.0108	19.9968	19.7910	19.2236	18.5785	18.0775 (90)
Living area fraction									fLA = Living area / (4) =			0.1356 (91)
MIT	18.2249	18.4535	18.8307	19.3274	19.7627	20.0437	20.1362	20.1203	19.9069	19.3354	18.6898	18.1890 (92)
Temperature adjustment												0.0000
adjusted MIT	18.2249	18.4535	18.8307	19.3274	19.7627	20.0437	20.1362	20.1203	19.9069	19.3354	18.6898	18.1890 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9924	0.9844	0.9664	0.9207	0.8261	0.6687	0.4993	0.5631	0.8055	0.9500	0.9865	0.9940 (94)
Ext temp.	718.5265	878.4517	1025.2287	1143.0519	1131.8743	911.4594	648.0200	663.1618	840.6419	824.2626	716.2415	670.3012 (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	2757.9951	2679.4140	2433.1986	2039.8465	1574.6893	1055.0925	685.3871	720.0500	1128.8208	1706.0537	2271.0129	2750.5714 (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	1517.3646	1210.2467	1047.5296	645.6921	329.4544	0.0000	0.0000	0.0000	0.0000	656.0526	1119.4354	1547.7211 (98)
Space heating per m2	(98) / (4) = 43.9398 (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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1821.9048	1434.2655	1470.9396	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7561	0.8277	0.7876	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1377.5105	1187.0955	1158.5331	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1730.7172	1651.2987	1513.7964	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	254.3089	345.3672	264.3159	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												863.9920	(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	63.5772	86.3418	66.0790	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												215.9980	(107)
Space cooling per m2												1.1756	(108)
Energy for space heating												43.9398	(99)
Energy for space cooling												1.1756	(108)
Total												45.1154	(109)
Dwelling Fabric Energy Efficiency (DFEE)												45.1	(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	91.8700 (1b)	x 2.3100 (2b)	= 212.2197 (1b) - (3b)
First floor	91.8700 (1c)	x 2.4800 (2c)	= 227.8376 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	183.7400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 440.0573 (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) = 0.0909 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3409 (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) =	0.2898 (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	0.3694	0.3622	0.3550	0.3187	0.3115	0.2753	0.2753	0.2680	0.2898	0.3115	0.3260	0.3405 (22b)
Effective ac	0.5682	0.5656	0.5630	0.5508	0.5485	0.5379	0.5379	0.5359	0.5420	0.5485	0.5531	0.5580 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			2.1300	1.0000	2.1300		(26)
TER Semi-glazed door			1.8900	1.2000	2.2680		(26a)
TER Opening Type (Uw = 1.40)			26.0600	1.3258	34.5492		(27)
Heat Loss Floor 1			91.8700	0.1300	11.9431		(28a)
100mm Knauf Supafil	194.9500	30.0800	164.8700	0.1800	29.6766		(29a)
External Roof 1	91.8700		91.8700	0.1300	11.9431		(30)
Total net area of external elements Aum, m ²			378.6900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	92.5100		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							14.7154 (36)
Total fabric heat loss						(33) + (36) =	107.2254 (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	82.5200	82.1352	81.7580	79.9862	79.6547	78.1115	78.1115	77.8257	78.7059	79.6547	80.3253	81.0264 (38)
Heat transfer coeff	189.7455	189.3606	188.9834	187.2116	186.8801	185.3370	185.3370	185.0512	185.9314	186.8801	187.5507	188.2518 (39)
Average = Sum(39)m / 12 =												187.2100 (39)
HLP	1.0327	1.0306	1.0285	1.0189	1.0171	1.0087	1.0087	1.0071	1.0119	1.0171	1.0207	1.0246 (40)
HLP (average)												1.0189 (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												2.9807 (42)
Average daily hot water use (litres/day)												104.9920 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	115.4912	111.2916	107.0919	102.8922	98.6925	94.4928	94.4928	98.6925	102.8922	107.0919	111.2916	115.4912 (44)
Energy content (annual)	171.2702	149.7940	154.5740	134.7613	129.3067	111.5819	103.3970	118.6496	120.0666	139.9261	152.7402	165.8660 (45)
Distribution loss (46)m = 0.15 x (45)m												1651.9335 (45)
Water storage loss:	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (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	36.3949	31.8312	32.8470	28.6368	27.4777	23.7111	21.9719	25.2130	25.5142	29.7343	32.4573	35.2465 (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	149.0359	149.0359	149.0359	149.0359	149.0359	149.0359	149.0359	149.0359	149.0359	149.0359	149.0359	149.0359	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	33.8877	30.0987	24.4779	18.5314	13.8524	11.6948	12.6366	16.4256	22.0464	27.9929	32.6719	34.8295	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	355.3169	359.0040	349.7127	329.9326	304.9637	281.4966	265.8190	262.1320	271.4233	291.2034	316.1722	339.6394	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.9036	37.9036	37.9036	37.9036	37.9036	37.9036	37.9036	37.9036	37.9036	37.9036	37.9036	37.9036	(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)	-119.2287	-119.2287	-119.2287	-119.2287	-119.2287	-119.2287	-119.2287	-119.2287	-119.2287	-119.2287	-119.2287	-119.2287	(71)
Water heating gains (Table 5)	48.9179	47.3679	44.1492	39.7733	36.9324	32.9321	29.5321	33.8885	35.4363	39.9654	45.0796	47.3744	(72)
Total internal gains	505.8333	504.1814	486.0505	455.9480	423.4593	393.8343	375.6985	380.1568	396.6167	426.8725	461.6345	489.5541	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
Northeast	12.1800	11.2829	0.6300	0.7000	0.7700	41.9992 (75)
Southwest	13.3100	36.7938	0.6300	0.7000	0.7700	149.6666 (79)
Northwest	0.5700	11.2829	0.6300	0.7000	0.7700	1.9655 (81)

Solar gains	193.6313	344.4291	510.0519	696.9953	840.0367	860.0653	818.3317	707.6257	574.1623	391.1260	234.5851	163.9872	(83)
Total gains	699.4646	848.6105	996.1024	1152.9433	1263.4959	1253.8996	1194.0302	1087.7825	970.7790	817.9985	696.2196	653.5413	(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	67.2465	67.3832	67.5177	68.1567	68.2776	68.8461	68.8461	68.9524	68.6260	68.2776	68.0334	67.7801	
alpha	5.4831	5.4922	5.5012	5.5438	5.5518	5.5897	5.5897	5.5968	5.5751	5.5518	5.5356	5.5187	
util living area	0.9998	0.9994	0.9976	0.9882	0.9469	0.8237	0.6550	0.7287	0.9388	0.9952	0.9995	0.9999	(86)
MIT	19.7102	19.8502	20.0871	20.4104	20.7163	20.9196	20.9825	20.9693	20.8052	20.4084	19.9996	19.6875	(87)
Th 2	20.0562	20.0579	20.0596	20.0676	20.0691	20.0761	20.0761	20.0774	20.0734	20.0691	20.0661	20.0629	(88)
util rest of house	0.9997	0.9991	0.9966	0.9831	0.9219	0.7465	0.5315	0.6078	0.8987	0.9925	0.9993	0.9998	(89)
MIT 2	18.8599	19.0012	19.2391	19.5664	19.8600	20.0347	20.0711	20.0672	19.9485	19.5675	19.1573	18.8427	(90)
Living area fraction									fLA = Living area / (4) =			0.1356	(91)
MIT	18.9752	19.1163	19.3540	19.6808	19.9761	20.1547	20.1946	20.1895	20.0647	19.6815	19.2715	18.9572	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9752	19.1163	19.3540	19.6808	19.9761	20.1547	20.1946	20.1895	20.0647	19.6815	19.2715	18.9572	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	699.1958	847.5851	991.7312	1130.1831	1160.9612	945.3535	654.6819	678.6602	872.0168	810.5683	695.5433	653.3713	(94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	2784.5533	2692.0057	2429.2007	2018.2913	1546.6433	1029.4842	666.2173	701.2585	1109.0196	1697.1453	2282.7770	2778.0694	(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	1551.5060	1239.4506	1069.4773	639.4379	286.9475	0.0000	0.0000	0.0000	0.0000	659.6133	1142.8083	1580.7754	(98)
Space heating												8170.0163	(98)
Space heating per m2												(98) / (4) =	44.4651 (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	1742.1674	1371.4935	1406.3890	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8108	0.8905	0.8491	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1412.6158	1221.3252	1194.2045	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1603.0638	1529.8395	1408.7685	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	137.1225	229.5346	159.6356	0.0000	0.0000	0.0000	0.0000	(104)

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Calculation Type: New Build (As Built)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling												526.2928 (104)
Cooled fraction												1.0000 (105)
Intermittency factor (Table 10b)												
	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	34.2806	57.3837	39.9089	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												131.5732 (107)
Space cooling per m2												0.7161 (108)
Energy for space heating												44.4651 (99)
Energy for space cooling												0.7161 (108)
Total												45.1812 (109)
Target Fabric Energy Efficiency (TFEE)												52.0 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	91.8700 (1b)	x 2.3100 (2b)	= 212.2197 (1b) - (3b)
First floor	91.8700 (1c)	x 2.4800 (2c)	= 227.8376 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	183.7400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 440.0573 (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					6 * 10 = 60.0000 (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)					60.0000 / (5) = 0.1363 (8)
Pressure test					Yes
Measured/design AP50					4.8700
Infiltration rate					0.3798 (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) =	0.3229 (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	0.3390	0.3148	0.3229	0.3067	0.3067	0.2987	0.2906	0.2825	0.2744	0.2987	0.2825	0.2987 (22b)
Effective ac	0.5575	0.5495	0.5521	0.5470	0.5470	0.5446	0.5422	0.5399	0.5377	0.5446	0.5399	0.5446 (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)
Half Glazed Door			1.8900	1.3000	2.4570		(26a)
Window (Uw = 1.40)			20.2600	1.3258	26.8598		(27)
French (Uw = 1.40)			5.8000	1.3258	7.6894		(27)
Heat Loss Floor 1			91.8700	0.1500	13.7805	75.0000	6890.2500 (28a)
100mm Knauf Supafil	194.9500	30.0800	164.8700	0.2500	41.2175	60.0000	9892.2000 (29a)
External Roof 1	91.8700		91.8700	0.1300	11.9431	9.0000	826.8300 (30)
Total net area of external elements Aum(A, m ²)			378.6900				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	105.8643	(33)
GF			46.8000			9.0000	421.2000 (32c)
GF			95.1700			39.0000	3711.6300 (32c)
FF			184.1600			9.0000	1657.4400 (32c)
Internal Floor 1			91.8700			18.0000	1653.6600 (32d)
Internal Floor 1			91.8700			18.0000	1653.6600 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 26706.8700 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							145.3514 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.0516 (36)
Total fabric heat loss							(33) + (36) = 115.9160 (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	80.9544	79.8049	80.1786	79.4406	79.4406	79.0858	78.7404	78.4046	78.0781	79.0858	78.4046	79.0858 (38)
Heat transfer coeff	196.8704	195.7208	196.0945	195.3566	195.3566	195.0018	194.6564	194.3205	193.9941	195.0018	194.3205	195.0018 (39)
Average = Sum(39)m / 12 =												195.1413 (39)
HLP	1.0715	1.0652	1.0672	1.0632	1.0632	1.0613	1.0594	1.0576	1.0558	1.0613	1.0576	1.0613 (40)
HLP (average)												1.0621 (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												2.9807 (42)
Average daily hot water use (litres/day)												104.9920 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	115.4912	111.2916	107.0919	102.8922	98.6925	94.4928	94.4928	98.6925	102.8922	107.0919	111.2916	115.4912 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF HEAT DEMAND 09 Jan 2014

Energy conte	171.2702	149.7940	154.5740	134.7613	129.3067	111.5819	103.3970	118.6496	120.0666	139.9261	152.7402	165.8660 (45)
Energy content (annual)										Total =	Sum (45)m =	1651.9335 (45)
Distribution loss (46)m = 0.15 x (45)m												
	25.6905	22.4691	23.1861	20.2142	19.3960	16.7373	15.5095	17.7974	18.0100	20.9889	22.9110	24.8799 (46)
Water storage loss:												
Store volume												250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.6100 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.8694 (55)
Total storage loss												
	26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514 (56)
If cylinder contains dedicated solar storage												
	26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514 (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												
	221.4840	195.1484	204.7878	183.3553	179.5205	160.1759	153.6108	168.8634	168.6606	190.1399	201.3342	216.0798 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
										Solar input (sum of months) =	Sum (63)m =	0.0000 (63)
Output from w/h												
	221.4840	195.1484	204.7878	183.3553	179.5205	160.1759	153.6108	168.8634	168.6606	190.1399	201.3342	216.0798 (64)
RHI water heating demand										Total per year (kWh/year) =	Sum (64)m =	2243.1605 (64)
Heat gains from water heating, kWh/month												2243 (64)
	97.1184	86.0900	91.5669	83.6833	83.1655	75.9762	74.5505	79.6220	78.7974	86.6965	89.6613	95.3215 (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	178.8430	178.8430	178.8430	178.8430	178.8430	178.8430	178.8430	178.8430	178.8430	178.8430	178.8430	178.8430 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	84.7192	75.2468	61.1948	46.3284	34.6310	29.2370	31.5916	41.0639	55.1159	69.9823	81.6797	87.0738 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	530.3238	535.8269	521.9593	492.4367	455.1698	420.1441	396.7448	391.2417	405.1094	434.6319	471.8988	506.9245 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	55.8650	55.8650	55.8650	55.8650	55.8650	55.8650	55.8650	55.8650	55.8650	55.8650	55.8650	55.8650 (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)												
	-119.2287	-119.2287	-119.2287	-119.2287	-119.2287	-119.2287	-119.2287	-119.2287	-119.2287	-119.2287	-119.2287	-119.2287 (71)
Water heating gains (Table 5)												
	130.5354	128.1101	123.0738	116.2269	111.7816	105.5225	100.2023	107.0188	109.4408	116.5275	124.5296	128.1203 (72)
Total internal gains												
	864.0578	857.6632	824.7072	773.4713	720.0618	673.3829	647.0181	657.8039	688.1454	739.6211	796.5876	840.5979 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b		FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast					12.1800	14.6176	0.7100		0.7000	0.7700	61.3217 (75)	
Southwest					7.5100	45.1778	0.7100		0.7000	0.7700	116.8570 (79)	
Northwest					0.5700	14.6176	0.7100		0.7000	0.7700	2.8697 (81)	
Southwest					5.8000	45.1778	0.7100		0.7000	0.7700	90.2491 (79)	
Solar gains	271.2976	412.1053	619.0291	856.9133	985.2978	1096.9804	1035.1461	914.8636	738.0970	505.9907	327.8924	225.6887 (83)
Total gains	1135.3554	1269.7685	1443.7364	1630.3846	1705.3595	1770.3633	1682.1642	1572.6674	1426.2424	1245.6118	1124.4800	1066.2866 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												
Utilisation factor for gains for living area, nil,m (see Table 9a)												21.0000 (85)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	37.6825	37.9039	37.8316	37.9745	37.9745	38.0436	38.1111	38.1770	38.2412	38.0436	38.1770	38.0436
alpha	3.5122	3.5269	3.5221	3.5316	3.5316	3.5362	3.5407	3.5451	3.5494	3.5362	3.5451	3.5362
util living area	0.9824	0.9735	0.9478	0.8846	0.7688	0.5766	0.4361	0.4624	0.7165	0.9060	0.9684	0.9851 (86)
MIT	19.3964	19.5638	19.9239	20.3707	20.7266	20.9290	20.9800	20.9760	20.8430	20.4179	19.8585	19.3798 (87)
Th 2	20.0242	20.0293	20.0277	20.0310	20.0310	20.0326	20.0341	20.0356	20.0371	20.0326	20.0356	20.0326 (88)
util rest of house	0.9788	0.9682	0.9370	0.8599	0.7186	0.4950	0.3346	0.3563	0.6427	0.8797	0.9608	0.9820 (89)
MIT 2	17.8905	18.1356	18.6519	19.2800	19.7494	19.9792	20.0246	20.0241	19.9008	19.3588	18.5690	17.8721 (90)
Living area fraction									fLA = Living area / (4) =			0.1356 (91)
MIT	18.0946	18.3292	18.8243	19.4279	19.8819	20.1080	20.1541	20.1531	20.0285	19.5024	18.7438	18.0765 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.9446	18.1792	18.6743	19.2779	19.7319	19.9580	20.0041	20.0031	19.8785	19.3524	18.5938	17.9265 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9674	0.9537	0.9168	0.8365	0.7010	0.4883	0.3313	0.3526	0.6291	0.8561	0.9446	0.9719 (94)
Useful gains	1098.3935	1211.0125	1323.6670	1363.8512	1195.4978	864.4192	557.3506	554.4936	897.1834	1066.3102	1062.1558	1036.3230 (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												
	2568.1037	2520.7283	2289.2679	1910.1688	1412.7898	908.3095	565.3058	564.1337	1004.6053	1550.7259	2078.0225	2520.6924 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh												

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CALCULATION OF HEAT DEMAND 09 Jan 2014

	1093.4645	880.1290	718.4070	393.3487	161.6652	0.0000	0.0000	0.0000	0.0000	360.4053	731.4240	1104.3708 (98)
Space heating												5443.2146 (98)
RHI space heating demand												5443 (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	91.8700 (1b)	x 2.3100 (2b)	= 212.2197 (1b) - (3b)
First floor	91.8700 (1c)	x 2.4800 (2c)	= 227.8376 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	183.7400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 440.0573 (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					6 * 10 = 60.0000 (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) =					60.0000 / (5) = 0.1363 (8)
Pressure test					Yes
Measured/design AP50					4.8700
Infiltration rate					0.3798 (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) =	0.3229 (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	0.4117	0.4036	0.3955	0.3552	0.3471	0.3067	0.3067	0.2987	0.3229	0.3471	0.3632	0.3794 (22b)
Effective ac	0.5847	0.5814	0.5782	0.5631	0.5602	0.5470	0.5470	0.5446	0.5521	0.5602	0.5660	0.5720 (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)
Half Glazed Door			1.8900	1.3000	2.4570		(26a)
Window (Uw = 1.40)			20.2600	1.3258	26.8598		(27)
French (Uw = 1.40)			5.8000	1.3258	7.6894		(27)
Heat Loss Floor 1			91.8700	0.1500	13.7805	75.0000	6890.2500 (28a)
100mm Knauf Supafil	194.9500	30.0800	164.8700	0.2500	41.2175	60.0000	9892.2000 (29a)
External Roof 1	91.8700		91.8700	0.1300	11.9431	9.0000	826.8300 (30)
Total net area of external elements Aum(A, m ²)			378.6900				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	105.8643	(33)
GF			46.8000			9.0000	421.2000 (32c)
GF			95.1700			39.0000	3711.6300 (32c)
FF			184.1600			9.0000	1657.4400 (32c)
Internal Floor 1			91.8700			18.0000	1653.6600 (32d)
Internal Floor 1			91.8700			18.0000	1653.6600 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 26706.8700 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							145.3514 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.0516 (36)
Total fabric heat loss							(33) + (36) = 115.9160 (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	84.9140	84.4362	83.9679	81.7681	81.3565	79.4406	79.4406	79.0858	80.1786	81.3565	82.1891	83.0596 (38)
Heat transfer coeff	200.8300	200.3522	199.8838	197.6841	197.2725	195.3566	195.3566	195.0018	196.0945	197.2725	198.1051	198.9755 (39)
Average = Sum(39)m / 12 =												197.6821 (39)
HLP	1.0930	1.0904	1.0879	1.0759	1.0737	1.0632	1.0632	1.0613	1.0672	1.0737	1.0782	1.0829 (40)
HLP (average)												1.0759 (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												2.9807 (42)
Average daily hot water use (litres/day)												104.9920 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	115.4912	111.2916	107.0919	102.8922	98.6925	94.4928	94.4928	98.6925	102.8922	107.0919	111.2916	115.4912 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Energy content (annual)	171.2702	149.7940	154.5740	134.7613	129.3067	111.5819	103.3970	118.6496	120.0666	139.9261	152.7402	165.8660 (45)
Distribution loss (46)m = 0.15 x (45)m	25.6905	22.4691	23.1861	20.2142	19.3960	16.7373	15.5095	17.7974	18.0100	20.9889	22.9110	24.8799 (46)
Water storage loss:												
Store volume												250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.6100 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.8694 (55)
Total storage loss	26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514 (56)
If cylinder contains dedicated solar storage	26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514 (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	221.4840	195.1484	204.7878	183.3553	179.5205	160.1759	153.6108	168.8634	168.6606	190.1399	201.3342	216.0798 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Solar input (sum of months) = Sum(63)m =												0.0000 (63)
Output from w/h	221.4840	195.1484	204.7878	183.3553	179.5205	160.1759	153.6108	168.8634	168.6606	190.1399	201.3342	216.0798 (64)
Heat gains from water heating, kWh/month	97.1184	86.0900	91.5669	83.6833	83.1655	75.9762	74.5505	79.6220	78.7974	86.6965	89.6613	95.3215 (65)
Total per year (kWh/year) = Sum(64)m =												2243.1605 (64)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	178.8430	178.8430	178.8430	178.8430	178.8430	178.8430	178.8430	178.8430	178.8430	178.8430	178.8430	178.8430 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	84.7192	75.2468	61.1948	46.3284	34.6310	29.2370	31.5916	41.0639	55.1159	69.9823	81.6797	87.0738 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	530.3238	535.8269	521.9593	492.4367	455.1698	420.1441	396.7448	391.2417	405.1094	434.6319	471.8988	506.9245 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.8650	55.8650	55.8650	55.8650	55.8650	55.8650	55.8650	55.8650	55.8650	55.8650	55.8650	55.8650 (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)	-119.2287	-119.2287	-119.2287	-119.2287	-119.2287	-119.2287	-119.2287	-119.2287	-119.2287	-119.2287	-119.2287	-119.2287 (71)
Water heating gains (Table 5)	130.5354	128.1101	123.0738	116.2269	111.7816	105.5225	100.2023	107.0188	109.4408	116.5275	124.5296	128.1203 (72)
Total internal gains	864.0578	857.6632	824.7072	773.4713	720.0618	673.3829	647.0181	657.8039	688.1454	739.6211	796.5876	840.5979 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
Northeast	12.1800	11.2829	0.7100	0.7000	0.7700	47.3325 (75)
Southwest	7.5100	36.7938	0.7100	0.7000	0.7700	95.1710 (79)
Northwest	0.5700	11.2829	0.7100	0.7000	0.7700	2.2151 (81)
Southwest	5.8000	36.7938	0.7100	0.7000	0.7700	73.5009 (79)

Solar gains	218.2194	388.1661	574.8204	785.5026	946.7080	969.2800	922.2469	797.4829	647.0718	440.7928	264.3737	184.8110 (83)
Total gains	1082.2772	1245.8293	1399.5276	1558.9740	1666.7698	1642.6629	1569.2650	1455.2868	1335.2172	1180.4139	1060.9612	1025.4089 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	36.9396	37.0277	37.1144	37.5274	37.6057	37.9745	37.9745	38.0436	37.8316	37.6057	37.4477	37.2839
alpha	3.4626	3.4685	3.4743	3.5018	3.5070	3.5316	3.5316	3.5362	3.5221	3.5070	3.4965	3.4856
util living area	0.9864	0.9770	0.9571	0.9090	0.8139	0.6634	0.5161	0.5683	0.7840	0.9334	0.9778	0.9887 (86)
MIT	19.2259	19.4404	19.7887	20.2399	20.6270	20.8744	20.9612	20.9452	20.7607	20.2590	19.6628	19.1877 (87)
Th 2	20.0065	20.0087	20.0108	20.0206	20.0224	20.0310	20.0310	20.0326	20.0277	20.0224	20.0187	20.0148 (88)
util rest of house	0.9837	0.9724	0.9482	0.8891	0.7722	0.5892	0.4147	0.4664	0.7221	0.9147	0.9725	0.9864 (89)
MIT 2	17.6315	17.9437	18.4474	19.0930	19.6171	19.9243	20.0087	19.9986	19.8007	19.1323	18.2756	17.5812 (90)
Living area fraction	17.8477	18.1466	18.6293	19.2485	19.7540	20.0531	20.1378	20.1269	19.9309	19.2850	18.4636	17.7990 (92)
MIT	17.8477	18.1466	18.6293	19.2485	19.7540	20.0531	20.1378	20.1269	19.9309	19.2850	18.4636	17.7990 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.6977	17.9966	18.4793	19.0985	19.6040	19.9031	19.9878	19.9769	19.7809	19.1350	18.3136	17.6490 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	1054.1678	1194.5908	1300.5695	1349.4947	1252.5679	950.2616	643.3214	669.5575	939.6008	1053.1948	1017.5629	1002.7677 (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	2690.6565	2623.9385	2394.4599	2016.0813	1559.2509	1036.0000	661.8336	697.5088	1113.9868	1683.7265	2221.4800	2676.0181 (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	1217.5476	960.5216	813.8544	479.9424	228.1721	0.0000	0.0000	0.0000	0.0000	469.1155	866.8203	1244.8983 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Space heating
Space heating per m2 (98) / (4) = 6280.8723 (98)
34.1835 (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													6963.2730 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1217.5476	960.5216	813.8544	479.9424	228.1721	0.0000	0.0000	0.0000	0.0000	469.1155	866.8203	1244.8983	(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)	1349.8310	1064.8799	902.2777	532.0869	252.9624	0.0000	0.0000	0.0000	0.0000	520.0837	960.9981	1380.1533	(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	221.4840	195.1484	204.7878	183.3553	179.5205	160.1759	153.6108	168.8634	168.6606	190.1399	201.3342	216.0798	(64)
Efficiency of water heater (217)m	88.3694	88.1956	87.8236	86.9645	85.1534	79.5000	79.5000	79.5000	79.5000	86.8294	87.9683	88.4395	(216)
Fuel for water heating, kWh/month	250.6342	221.2678	233.1807	210.8393	210.8202	201.4791	193.2211	212.4067	212.1517	218.9809	228.8712	244.3250	(219)
Water heating fuel used												2638.1780	(219)
Annual totals kWh/year													
Space heating fuel - main system												6963.2730	(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)												598.4667	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.08 * 1004 * 1.00) =										-867.4527		-867.4527	(233)
Total delivered energy for all uses												9407.4650	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	6963.2730	3.4800	242.3219 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2638.1780	3.4800	91.8086 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	598.4667	13.1900	78.9378 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-867.4527	13.1900	-114.4170 (252)
Total energy cost			428.5437 (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] =	0.7869 (257)
SAP value		89.0232
SAP rating (Section 12)		89 (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	6963.2730	0.2160	1504.0670 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2638.1780	0.2160	569.8464 (264)
Space and water heating			2073.9134 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	598.4667	0.5190	310.6042 (268)
Energy saving/generation technologies			
PV Unit	-867.4527	0.5190	-450.2080 (269)
Total kg/year			1973.2347 (272)
CO2 emissions per m2			10.7400 (273)
EI value			88.4404
EI rating			88 (274)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

EI band

B

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	$3.48 / 0.8481 = 4.103$, stars = 4
Water heating environmental impact	$0.216 / 0.8481 = 0.2547$, 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	91.8700 (1b)	x 2.3100 (2b)	= 212.2197 (1b) - (3b)
First floor	91.8700 (1c)	x 2.4800 (2c)	= 227.8376 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	183.7400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 440.0573 (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					6 * 10 = 60.0000 (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) =					60.0000 / (5) = 0.1363 (8)
Pressure test					Yes
Measured/design AP50					4.8700
Infiltration rate					0.3798 (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) =		0.3229 (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	0.3390	0.3148	0.3229	0.3067	0.3067	0.2987	0.2906	0.2825	0.2744	0.2987	0.2825	0.2987 (22b)
Effective ac	0.5575	0.5495	0.5521	0.5470	0.5470	0.5446	0.5422	0.5399	0.5377	0.5446	0.5399	0.5446 (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)
Half Glazed Door			1.8900	1.3000	2.4570		(26a)
Window (Uw = 1.40)			20.2600	1.3258	26.8598		(27)
French (Uw = 1.40)			5.8000	1.3258	7.6894		(27)
Heat Loss Floor 1			91.8700	0.1500	13.7805	75.0000	6890.2500 (28a)
100mm Knauf Supafil	194.9500	30.0800	164.8700	0.2500	41.2175	60.0000	9892.2000 (29a)
External Roof 1	91.8700		91.8700	0.1300	11.9431	9.0000	826.8300 (30)
Total net area of external elements Aum(A, m ²)			378.6900				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	105.8643	(33)
GF			46.8000			9.0000	421.2000 (32c)
GF			95.1700			39.0000	3711.6300 (32c)
FF			184.1600			9.0000	1657.4400 (32c)
Internal Floor 1			91.8700			18.0000	1653.6600 (32d)
Internal Floor 1			91.8700			18.0000	1653.6600 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 26706.8700 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							145.3514 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.0516 (36)
Total fabric heat loss							(33) + (36) = 115.9160 (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	80.9544	79.8049	80.1786	79.4406	79.4406	79.0858	78.7404	78.4046	78.0781	79.0858	78.4046	79.0858 (38)
Heat transfer coeff	196.8704	195.7208	196.0945	195.3566	195.3566	195.0018	194.6564	194.3205	193.9941	195.0018	194.3205	195.0018 (39)
Average = Sum(39)m / 12 =												195.1413 (39)
HLP	1.0715	1.0652	1.0672	1.0632	1.0632	1.0613	1.0594	1.0576	1.0558	1.0613	1.0576	1.0613 (40)
HLP (average)												1.0621 (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												2.9807 (42)
Average daily hot water use (litres/day)												104.9920 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	115.4912	111.2916	107.0919	102.8922	98.6925	94.4928	94.4928	98.6925	102.8922	107.0919	111.2916	115.4912 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Energy content (annual)	171.2702	149.7940	154.5740	134.7613	129.3067	111.5819	103.3970	118.6496	120.0666	139.9261	152.7402	165.8660 (45)
Distribution loss (46)m = 0.15 x (45)m	25.6905	22.4691	23.1861	20.2142	19.3960	16.7373	15.5095	17.7974	18.0100	20.9889	22.9110	24.8799 (46)
Water storage loss:												
Store volume												250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.6100 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.8694 (55)
Total storage loss	26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514 (56)
If cylinder contains dedicated solar storage	26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514 (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	221.4840	195.1484	204.7878	183.3553	179.5205	160.1759	153.6108	168.8634	168.6606	190.1399	201.3342	216.0798 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Solar input (sum of months) = Sum(63)m =												0.0000 (63)
Output from w/h	221.4840	195.1484	204.7878	183.3553	179.5205	160.1759	153.6108	168.8634	168.6606	190.1399	201.3342	216.0798 (64)
Heat gains from water heating, kWh/month	97.1184	86.0900	91.5669	83.6833	83.1655	75.9762	74.5505	79.6220	78.7974	86.6965	89.6613	95.3215 (65)
Total per year (kWh/year) = Sum(64)m =												2243.1605 (64)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	178.8430	178.8430	178.8430	178.8430	178.8430	178.8430	178.8430	178.8430	178.8430	178.8430	178.8430	178.8430 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	84.7192	75.2468	61.1948	46.3284	34.6310	29.2370	31.5916	41.0639	55.1159	69.9823	81.6797	87.0738 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	530.3238	535.8269	521.9593	492.4367	455.1698	420.1441	396.7448	391.2417	405.1094	434.6319	471.8988	506.9245 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.8650	55.8650	55.8650	55.8650	55.8650	55.8650	55.8650	55.8650	55.8650	55.8650	55.8650	55.8650 (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)	-119.2287	-119.2287	-119.2287	-119.2287	-119.2287	-119.2287	-119.2287	-119.2287	-119.2287	-119.2287	-119.2287	-119.2287 (71)
Water heating gains (Table 5)	130.5354	128.1101	123.0738	116.2269	111.7816	105.5225	100.2023	107.0188	109.4408	116.5275	124.5296	128.1203 (72)
Total internal gains	864.0578	857.6632	824.7072	773.4713	720.0618	673.3829	647.0181	657.8039	688.1454	739.6211	796.5876	840.5979 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W		
Northeast					12.1800	14.6176		0.7100	0.7000	0.7700	61.3217 (75)		
Southwest					7.5100	45.1778		0.7100	0.7000	0.7700	116.8570 (79)		
Northwest					0.5700	14.6176		0.7100	0.7000	0.7700	2.8697 (81)		
Southwest					5.8000	45.1778		0.7100	0.7000	0.7700	90.2491 (79)		

Solar gains	271.2976	412.1053	619.0291	856.9133	985.2978	1096.9804	1035.1461	914.8636	738.0970	505.9907	327.8924	225.6887 (83)	
Total gains	1135.3554	1269.7685	1443.7364	1630.3846	1705.3595	1770.3633	1682.1642	1572.6674	1426.2424	1245.6118	1124.4800	1066.2866 (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	37.6825	37.9039	37.8316	37.9745	37.9745	38.0436	38.1111	38.1770	38.2412	38.0436	38.1770	38.0436
alpha	3.5122	3.5269	3.5221	3.5316	3.5316	3.5362	3.5407	3.5451	3.5494	3.5362	3.5451	3.5362
util living area	0.9824	0.9735	0.9478	0.8846	0.7688	0.5766	0.4361	0.4624	0.7165	0.9060	0.9684	0.9851 (86)
MIT	19.3964	19.5638	19.9239	20.3707	20.7266	20.9290	20.9800	20.9760	20.8430	20.4179	19.8585	19.3798 (87)
Th 2	20.0242	20.0293	20.0277	20.0310	20.0310	20.0326	20.0341	20.0356	20.0371	20.0326	20.0356	20.0326 (88)
util rest of house	0.9788	0.9682	0.9370	0.8599	0.7186	0.4950	0.3346	0.3563	0.6427	0.8797	0.9608	0.9820 (89)
MIT 2	17.8905	18.1356	18.6519	19.2800	19.7494	19.9792	20.0246	20.0241	19.9008	19.3588	18.5690	17.8721 (90)
Living area fraction	18.0946	18.3292	18.8243	19.4279	19.8819	20.1080	20.1541	20.1531	20.0285	19.5024	18.7438	18.0765 (92)
MIT	17.9446	18.1792	18.6743	19.2779	19.7319	19.9580	20.0041	20.0031	19.8785	19.3524	18.5938	-0.1500
Temperature adjustment												17.9265 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	1098.3935	1211.0125	1323.6670	1363.8512	1195.4978	864.4192	557.3506	554.4936	897.1834	1066.3102	1062.1558	1036.3230 (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	2568.1037	2520.7283	2289.2679	1910.1688	1412.7898	908.3095	565.3058	564.1337	1004.6053	1550.7259	2078.0225	2520.6924 (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	1093.4645	880.1290	718.4070	393.3487	161.6652	0.0000	0.0000	0.0000	0.0000	360.4053	731.4240	1104.3708 (98)

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Space heating 5443.2146 (98)
 Space heating per m2 (98) / (4) = 29.6245 (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													6034.6060 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1093.4645	880.1290	718.4070	393.3487	161.6652	0.0000	0.0000	0.0000	0.0000	360.4053	731.4240	1104.3708	(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)	1212.2666	975.7528	796.4601	436.0850	179.2298	0.0000	0.0000	0.0000	0.0000	399.5624	810.8914	1224.3579	(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	221.4840	195.1484	204.7878	183.3553	179.5205	160.1759	153.6108	168.8634	168.6606	190.1399	201.3342	216.0798	(64)
Efficiency of water heater (217)m	88.2005	88.0493	87.5851	86.4986	84.2347	79.5000	79.5000	79.5000	79.5000	86.1934	87.6536	88.2562	(216)
Fuel for water heating, kWh/month	251.1142	221.6354	233.8158	211.9749	213.1194	201.4791	193.2211	212.4067	212.1517	220.5967	229.6932	244.8325	(217)
Water heating fuel used												2646.0408	(219)
Annual totals kWh/year													
Space heating fuel - main system												6034.6060	(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)												598.4667	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.08 * 1122 * 1.00) =										-969.3394		-969.3394	(233)
Total delivered energy for all uses												8384.7740	(238)

10a. Fuel costs - using BEDF prices (447)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	6034.6060	3.9300	237.1600	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	2646.0408	3.9300	103.9894	(247)
Pumps and fans for heating	75.0000	17.5600	13.1700	(249)
Energy for lighting	598.4667	17.5600	105.0908	(250)
Additional standing charges			88.0000	(251)
Energy saving/generation technologies				
PV Unit	-969.3394	17.5600	-170.2160	(252)
Total energy cost			377.1942	(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	6034.6060	0.2160	1303.4749	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2646.0408	0.2160	571.5448	(264)
Space and water heating			1875.0197	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	598.4667	0.5190	310.6042	(268)
Energy saving/generation technologies				
PV Unit	-969.3394	0.5190	-503.0872	(269)
Total kg/year			1721.4618	(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	6034.6060	1.2200	7362.2193	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2646.0408	1.2200	3228.1697	(264)
Space and water heating			10590.3890	(265)
Pumps and fans	75.0000	3.0700	230.2500	(267)
Energy for lighting	598.4667	3.0700	1837.2929	(268)

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Energy saving/generation technologies
 PV Unit -969.3394 3.0700 -2975.8720 (269)
 Primary energy kWh/year 9682.0599 (272)
 Primary energy kWh/m2/year 52.6943 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 89
 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:
 N Solar water heating SAP change + 1.0 Cost change -£ 45 CO2 change -269 kg (15.6%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£45 1.46 kg/m²	B 90	B 90
Total Savings	£45 1.46 kg/m²		

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

Fuel prices for cost data on this page from database revision number 447 TEST (26 Sep 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	£118	£127	-£9
Mains gas	£429	£376	£54
Space heating	£338	£340	-£1
Water heating	£104	£58	£46
Lighting	£105	£105	£0
Generated (PV)	-£170	-£170	£0
Total cost of fuels	£377	£333	£45
Total cost of uses	£377	£333	£45
Delivered energy	46 kWh/m²	38 kWh/m²	7 kWh/m²
Carbon dioxide emissions	1.7 tonnes	1.5 tonnes	0.3 tonnes
CO2 emissions per m²	9 kg/m²	8 kg/m²	1 kg/m²
Primary energy	53 kWh/m²	44 kWh/m²	8 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	91.8700 (1b)	x 2.3100 (2b)	= 212.2197 (1b) - (3b)
First floor	91.8700 (1c)	x 2.4800 (2c)	= 227.8376 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	183.7400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 440.0573 (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					6 * 10 = 60.0000 (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) =					60.0000 / (5) = 0.1363 (8)
Pressure test					Yes
Measured/design AP50					4.8700
Infiltration rate					0.3798 (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) =	0.3229 (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	0.4117	0.4036	0.3955	0.3552	0.3471	0.3067	0.3067	0.2987	0.3229	0.3471	0.3632	0.3794 (22b)
Effective ac	0.5847	0.5814	0.5782	0.5631	0.5602	0.5470	0.5470	0.5446	0.5521	0.5602	0.5660	0.5720 (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)
Half Glazed Door			1.8900	1.3000	2.4570		(26a)
Window (Uw = 1.40)			20.2600	1.3258	26.8598		(27)
French (Uw = 1.40)			5.8000	1.3258	7.6894		(27)
Heat Loss Floor 1			91.8700	0.1500	13.7805	75.0000	6890.2500 (28a)
100mm Knauf Supafil	194.9500	30.0800	164.8700	0.2500	41.2175	60.0000	9892.2000 (29a)
External Roof 1	91.8700		91.8700	0.1300	11.9431	9.0000	826.8300 (30)
Total net area of external elements Aum(A, m ²)			378.6900				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	105.8643	(33)
GF			46.8000			9.0000	421.2000 (32c)
GF			95.1700			39.0000	3711.6300 (32c)
FF			184.1600			9.0000	1657.4400 (32c)
Internal Floor 1			91.8700			18.0000	1653.6600 (32d)
Internal Floor 1			91.8700			18.0000	1653.6600 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 26706.8700 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							145.3514 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.0516 (36)
Total fabric heat loss							(33) + (36) = 115.9160 (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	84.9140	84.4362	83.9679	81.7681	81.3565	79.4406	79.4406	79.0858	80.1786	81.3565	82.1891	83.0596 (38)
Heat transfer coeff	200.8300	200.3522	199.8838	197.6841	197.2725	195.3566	195.3566	195.0018	196.0945	197.2725	198.1051	198.9755 (39)
Average = Sum(39)m / 12 =												197.6821 (39)
HLP	1.0930	1.0904	1.0879	1.0759	1.0737	1.0632	1.0632	1.0613	1.0672	1.0737	1.0782	1.0829 (40)
HLP (average)												1.0759 (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												2.9807 (42)
Average daily hot water use (litres/day)												104.9920 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	115.4912	111.2916	107.0919	102.8922	98.6925	94.4928	94.4928	98.6925	102.8922	107.0919	111.2916	115.4912 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Energy content (annual)	171.2702	149.7940	154.5740	134.7613	129.3067	111.5819	103.3970	118.6496	120.0666	139.9261	152.7402	165.8660 (45)
Distribution loss (46)m = 0.15 x (45)m	25.6905	22.4691	23.1861	20.2142	19.3960	16.7373	15.5095	17.7974	18.0100	20.9889	22.9110	1651.9335 (45)
Water storage loss:												
Store volume												250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.6100 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.8694 (55)
Total storage loss	26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514 (56)
If cylinder contains dedicated solar storage	18.8660	17.0402	18.8660	18.2574	18.8660	18.2574	18.8660	18.8660	18.2574	18.8660	18.2574	18.8660 (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	213.3986	187.8454	195.3066	168.7771	158.6408	139.7445	132.4984	148.6815	155.4331	180.6587	193.5096	207.9944 (62)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.7000 (H2)
Collector heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0050 (H3a)
Collector effective heat loss coefficient												1.8063 (H3b)
Collector performance ratio												2.5804 (H4)
Annual solar radiation per m2												1079.5246 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												1813.6014 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.0979 (H8)
Utilisation factor												0.5978 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												127.5000 (H13)
Daily hot water demand												104.9920 (H14)
Volume ratio Veff/V												1.2144 (H15)
Solar storage volume factor												1.0000 (H16)
Solar input												-953.3379 (H17)
Solar input	-27.6449	-46.1314	-78.5670	-105.2953	-130.0835	-127.8928	-126.2026	-110.2639	-86.3587	-58.9728	-32.7908	-23.1341 (63)
Solar input (sum of months) = Sum(63)m =												-953.3379 (63)
Output from w/h	185.7536	141.7140	116.7396	63.4818	28.5573	11.8517	6.2958	38.4176	69.0744	121.6859	160.7188	184.8603 (64)
Total per year (kWh/year) = Sum(64)m =												1129.1509 (64)
Heat gains from water heating, kWh/month	90.6500	80.2477	83.9820	72.0208	66.4617	59.6311	57.6607	63.4765	68.2154	79.1115	83.4017	88.8532 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(66)
(66)m	178.8430	178.8430	178.8430	178.8430	178.8430	178.8430	178.8430	178.8430	178.8430	178.8430	178.8430	178.8430	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	84.7192	75.2468	61.1948	46.3284	34.6310	29.2370	31.5916	41.0639	55.1159	69.9823	81.6797	87.0738	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	530.3238	535.8269	521.9593	492.4367	455.1698	420.1441	396.7448	391.2417	405.1094	434.6319	471.8988	506.9245	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.8650	55.8650	55.8650	55.8650	55.8650	55.8650	55.8650	55.8650	55.8650	55.8650	55.8650	55.8650	(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)	-119.2287	-119.2287	-119.2287	-119.2287	-119.2287	-119.2287	-119.2287	-119.2287	-119.2287	-119.2287	-119.2287	-119.2287	(71)
Water heating gains (Table 5)	121.8414	119.4161	112.8790	100.0289	89.3303	82.8210	77.5009	85.3179	94.7436	106.3327	115.8356	119.4263	(72)
Total internal gains	855.3638	848.9692	814.5124	757.2733	697.6105	650.6814	624.3166	636.1029	673.4482	729.4263	787.8936	831.9039	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	12.1800	11.2829	0.7100	0.7000	0.7700	47.3325	(75)
Southwest	7.5100	36.7938	0.7100	0.7000	0.7700	95.1710	(79)
Northwest	0.5700	0.7100	0.7100	0.7000	0.7700	2.2151	(81)
Southwest	5.8000	36.7938	0.7100	0.7000	0.7700	73.5009	(79)

Solar gains	218.2194	388.1661	574.8204	785.5026	946.7080	969.2800	922.2469	797.4829	647.0718	440.7928	264.3737	184.8110	(83)
Total gains	1073.5832	1237.1353	1389.3328	1542.7760	1644.3184	1619.9614	1546.5635	1433.5859	1320.5200	1170.2191	1052.2672	1016.7149	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
tau	36.9396	37.0277	37.1144	37.5274	37.6057	37.9745	37.9745	38.0436	37.8316	37.6057	37.4477	37.2839	
alpha	3.4626	3.4685	3.4743	3.5018	3.5070	3.5316	3.5316	3.5362	3.5221	3.5070	3.4965	3.4856	
util living area	0.9868	0.9775	0.9580	0.9112	0.8186	0.6697	0.5224	0.5751	0.7882	0.9348	0.9783	0.9890	(86)
MIT	19.2195	19.4342	19.7820	20.2311	20.6189	20.8706	20.9596	20.9432	20.7560	20.2529	19.6566	19.1813	(87)
Th 2	20.0065	20.0087	20.0108	20.0206	20.0224	20.0310	20.0310	20.0326	20.0277	20.0224	20.0187	20.0148	(88)
util rest of house													
MIT 2	0.9841	0.9730	0.9492	0.8917	0.7775	0.5955	0.4203	0.4726	0.7268	0.9165	0.9732	0.9867	(89)
MIT 2	17.6223	17.9349	18.4380	19.0812	19.6073	19.9207	20.0077	19.9972	19.7957	19.1240	18.2667	17.5718	(90)
Living area fraction													0.1356 (91)
													fLA = Living area / (4) =

AES
Sustainability
Consultants

MIT	17.8388	18.1381	18.6202	19.2371	19.7444	20.0494	20.1368	20.1254	19.9259	19.2771	18.4551	17.7900 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.6888	17.9881	18.4702	19.0871	19.5944	19.8994	19.9868	19.9754	19.7759	19.1271	18.3051	17.6400 (93)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9746	0.9596	0.9304	0.8683	0.7565	0.5844	0.4153	0.4660	0.7081	0.8941	0.9599	0.9784 (94)
Useful gains	1046.2860	1187.1307	1292.7028	1339.6093	1243.9670	946.7733	642.3470	668.1164	935.1125	1046.3302	1010.1008	994.7757 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	2688.8774	2622.2393	2392.6501	2013.8246	1557.3576	1035.2794	661.6323	697.2112	1113.0133	1682.1539	2219.7936	2674.2321 (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	1222.0880	964.3930	818.3608	485.4350	233.1626	0.0000	0.0000	0.0000	0.0000	473.0529	870.9788	1249.5156 (98)
Space heating												6316.9866 (98)
Space heating per m2												(98) / (4) = 34.3800 (99)

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	0.7155 (257)
SAP value		90.0188
SAP rating (Section 12)		90 (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	7003.3111	0.2160	1512.7152 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1291.6847	0.2160	279.0039 (264)
Space and water heating			1791.7191 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	598.4667	0.5190	310.6042 (268)
Energy saving/generation technologies			
PV Unit	-867.4527	0.5190	-450.2080 (269)
Total kg/year			1716.9904 (272)
CO2 emissions per m2			9.3400 (273)
EI value			89.9416
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	91.8700 (1b)	x 2.3100 (2b)	= 212.2197 (1b) - (3b)
First floor	91.8700 (1c)	x 2.4800 (2c)	= 227.8376 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	183.7400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 440.0573 (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					6 * 10 = 60.0000 (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) =					60.0000 / (5) = 0.1363 (8)
Pressure test					Yes
Measured/design AP50					4.8700
Infiltration rate					0.3798 (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) =		0.3229 (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	0.3390	0.3148	0.3229	0.3067	0.3067	0.2987	0.2906	0.2825	0.2744	0.2987	0.2825	0.2987 (22b)
Effective ac	0.5575	0.5495	0.5521	0.5470	0.5470	0.5446	0.5422	0.5399	0.5377	0.5446	0.5399	0.5446 (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)
Half Glazed Door			1.8900	1.3000	2.4570		(26a)
Window (Uw = 1.40)			20.2600	1.3258	26.8598		(27)
French (Uw = 1.40)			5.8000	1.3258	7.6894		(27)
Heat Loss Floor 1			91.8700	0.1500	13.7805	75.0000	6890.2500 (28a)
100mm Knauf Supafil	194.9500	30.0800	164.8700	0.2500	41.2175	60.0000	9892.2000 (29a)
External Roof 1	91.8700		91.8700	0.1300	11.9431	9.0000	826.8300 (30)
Total net area of external elements Aum(A, m ²)			378.6900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	105.8643		(33)
GF			46.8000			9.0000	421.2000 (32c)
GF			95.1700			39.0000	3711.6300 (32c)
FF			184.1600			9.0000	1657.4400 (32c)
Internal Floor 1			91.8700			18.0000	1653.6600 (32d)
Internal Floor 1			91.8700			18.0000	1653.6600 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	26706.8700 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							145.3514 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.0516 (36)
Total fabric heat loss						(33) + (36) =	115.9160 (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	80.9544	79.8049	80.1786	79.4406	79.4406	79.0858	78.7404	78.4046	78.0781	79.0858	78.4046	79.0858 (38)
Heat transfer coeff	196.8704	195.7208	196.0945	195.3566	195.3566	195.0018	194.6564	194.3205	193.9941	195.0018	194.3205	195.0018 (39)
Average = Sum(39)m / 12 =												195.1413 (39)
HLP	1.0715	1.0652	1.0672	1.0632	1.0632	1.0613	1.0594	1.0576	1.0558	1.0613	1.0576	1.0613 (40)
HLP (average)												1.0621 (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												2.9807 (42)
Average daily hot water use (litres/day)												104.9920 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	115.4912	111.2916	107.0919	102.8922	98.6925	94.4928	94.4928	98.6925	102.8922	107.0919	111.2916	115.4912 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Energy content (annual)	171.2702	149.7940	154.5740	134.7613	129.3067	111.5819	103.3970	118.6496	120.0666	139.9261	152.7402	165.8660 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum (45)m =		1651.9335 (45)
Water storage loss:												
Store volume												250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.6100 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.8694 (55)
Total storage loss												
If cylinder contains dedicated solar storage	26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514 (56)
Primary loss	18.8660	17.0402	18.8660	18.2574	18.8660	18.2574	18.8660	18.8660	18.2574	18.8660	18.2574	18.8660 (57)
Total heat required for water heating calculated for each month	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)
Aperture area of solar collector	213.3986	187.8454	195.3066	168.7771	158.6408	139.7445	132.4984	148.6815	155.4331	180.6587	193.5096	207.9944 (62)
Zero-loss collector efficiency												3.0000 (H1)
Collector heat loss coefficient												0.7000 (H2)
Collector 2nd order heat loss coefficient												1.8000 (H3)
Collector effective heat loss coefficient												0.0050 (H3a)
Collector performance ratio												1.8063 (H3b)
Annual solar radiation per m2												2.5804 (H4)
Overshading factor												1208.1510 (H5)
Solar energy available												0.8000 (H6)
Adjustment factor for showers												2029.6937 (H7)
Solar-to-load ratio												1.0000 (H7a)
Utilisation factor												1.2287 (H8)
Collector performance factor												0.5569 (H9)
Dedicated solar storage volume												0.8793 (H10)
Effective solar volume												75.0000 (H11)
Daily hot water demand												127.5000 (H13)
Volume ratio Veff/V												104.9920 (H14)
Solar storage volume factor												1.2144 (H15)
Solar input												1.0000 (H16)
Solar input	-32.4214	-46.1011	-79.2367	-106.9087	-125.5707	-134.1293	-131.3086	-117.5251	-92.0141	-63.6154	-38.3459	-993.8368 (H17)
Solar input (sum of months) = Sum (63)m =												-26.6598 (63)
Output from w/h	180.9772	141.7443	116.0699	61.8684	33.0701	5.6152	1.1899	31.1564	63.4191	117.0433	155.1637	181.3346 (64)
Total per year (kWh/year) = Sum (64)m =												1088.6520 (64)
Heat gains from water heating, kWh/month	90.6500	80.2477	83.9820	72.0208	66.4617	59.6311	57.6607	63.4765	68.2154	79.1115	83.4017	88.8532 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(66)
(66)m	178.8430	178.8430	178.8430	178.8430	178.8430	178.8430	178.8430	178.8430	178.8430	178.8430	178.8430	178.8430	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	84.7192	75.2468	61.1948	46.3284	34.6310	29.2370	31.5916	41.0639	55.1159	69.9823	81.6797	87.0738	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	530.3238	535.8269	521.9593	492.4367	455.1698	420.1441	396.7448	391.2417	405.1094	434.6319	471.8988	506.9245	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.8650	55.8650	55.8650	55.8650	55.8650	55.8650	55.8650	55.8650	55.8650	55.8650	55.8650	55.8650	(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)	-119.2287	-119.2287	-119.2287	-119.2287	-119.2287	-119.2287	-119.2287	-119.2287	-119.2287	-119.2287	-119.2287	-119.2287	(71)
Water heating gains (Table 5)	121.8414	119.4161	112.8790	100.0289	89.3303	82.8210	77.5009	85.3179	94.7436	106.3327	115.8356	119.4263	(72)
Total internal gains	855.3638	848.9692	814.5124	757.2733	697.6105	650.6814	624.3166	636.1029	673.4482	729.4263	787.8936	831.9039	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
Northeast	12.1800	14.6176	0.7100	0.7000	0.7700	61.3217 (75)
Southwest	7.5100	45.1778	0.7100	0.7000	0.7700	116.8570 (79)
Northwest	0.5700	14.6176	0.7100	0.7000	0.7700	2.8697 (81)
Southwest	5.8000	45.1778	0.7100	0.7000	0.7700	90.2491 (79)

Solar gains	271.2976	412.1053	619.0291	856.9133	985.2978	1096.9804	1035.1461	914.8636	738.0970	505.9907	327.8924	225.6887 (83)
Total gains	1126.6614	1261.0745	1433.5416	1614.1866	1682.9082	1747.6619	1659.4628	1550.9665	1411.5452	1235.4170	1115.7860	1057.5926 (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	37.6825	37.9039	37.8316	37.9745	37.9745	38.0436	38.1111	38.1770	38.2412	38.0436	38.1770	38.0436
alpha	3.5122	3.5269	3.5221	3.5316	3.5316	3.5362	3.5407	3.5451	3.5494	3.5362	3.5451	3.5362
util living area	0.9828	0.9741	0.9488	0.8872	0.7741	0.5824	0.4414	0.4681	0.7209	0.9078	0.9691	0.9855 (86)
MIT	19.3901	19.5577	19.9175	20.3627	20.7200	20.9267	20.9792	20.9751	20.8396	20.4125	19.8525	19.3734 (87)
Th 2	20.0242	20.0293	20.0277	20.0310	20.0310	20.0326	20.0341	20.0356	20.0371	20.0326	20.0356	20.0326 (88)
util rest of house												
	0.9793	0.9688	0.9381	0.8629	0.7243	0.5005	0.3390	0.3610	0.6474	0.8819	0.9616	0.9825 (89)
MIT 2	17.8814	18.1268	18.6428	19.2695	19.7418	19.9773	20.0242	20.0236	19.8976	19.3516	18.5605	17.8628 (90)
Living area fraction												
	fLA = Living area / (4) = 0.1356 (91)											

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MIT	18.0859	18.3208	18.8156	19.4177	19.8744	20.1060	20.1537	20.1526	20.0253	19.4954	18.7356	18.0676 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.9359	18.1708	18.6656	19.2677	19.7244	19.9560	20.0037	20.0026	19.8753	19.3454	18.5856	17.9176 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9681	0.9545	0.9181	0.8395	0.7064	0.4935	0.3356	0.3572	0.6335	0.8583	0.9456	0.9725 (94)	
Useful gains	1090.7060	1203.7023	1316.1661	1355.0480	1188.7388	862.5505	556.9291	553.9795	894.1696	1060.3379	1055.0871	1028.5127 (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	2566.3840	2519.0864	2287.5626	1908.1905	1411.3418	907.9310	565.2171	564.0256	1003.9733	1549.3750	2076.4358	2518.9627 (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	1097.9044	883.9381	722.7190	398.2626	165.6166	0.0000	0.0000	0.0000	0.0000	363.8436	735.3711	1108.8948 (98)	
Space heating												5476.5502 (98)	
Space heating per m2												29.8060 (99)	(98) / (4) =

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													6071.5634 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1097.9044	883.9381	722.7190	398.2626	165.6166	0.0000	0.0000	0.0000	0.0000	363.8436	735.3711	1108.8948 (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)	1217.1889	979.9757	801.2406	441.5329	183.6104	0.0000	0.0000	0.0000	0.0000	403.3742	815.2673	1229.3734 (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	180.9772	141.7443	116.0699	61.8684	33.0701	5.6152	1.1899	31.1564	63.4191	117.0433	155.1637	181.3346 (64)	
Efficiency of water heater (217)m	88.5141	88.5529	88.5508	88.5967	88.2236	79.5000	79.5000	79.5000	79.5000	87.3389	88.1332	88.5254 (217)	
Fuel for water heating, kWh/month	204.4613	160.0673	131.0772	69.8316	37.4844	7.0632	1.4967	39.1904	79.7724	134.0105	176.0559	204.8390 (219)	
Water heating fuel used												1245.3498 (219)	
Annual totals kWh/year													
Space heating fuel - main system												6071.5634 (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)													598.4667 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.08 * 1122 * 1.00) =										-969.3394		-969.3394 (233)	
Total delivered energy for all uses												7071.0405 (238)	

10a. Fuel costs - using BEDF prices (447)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	6071.5634	3.9300	238.6124 (240)	
Space heating - secondary	0.0000	0.0000	0.0000 (242)	
Water heating (other fuel)	1245.3498	3.9300	48.9422 (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	598.4667	17.5600	105.0908 (250)	
Additional standing charges			88.0000 (251)	
Energy saving/generation technologies				
PV Unit	-969.3394	17.5600	-170.2160 (252)	
Total energy cost			332.3794 (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	6071.5634	0.2160	1311.4577 (261)	
Space heating - secondary	0.0000	0.0000	0.0000 (263)	
Water heating (other fuel)	1245.3498	0.2160	268.9955 (264)	

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Space and water heating			1580.4532 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	598.4667	0.5190	310.6042 (268)
Energy saving/generation technologies			
PV Unit	-969.3394	0.5190	-503.0872 (269)
Total kg/year			1452.8453 (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	6071.5634	1.2200	7407.3073 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1245.3498	1.2200	1519.3267 (264)
Space and water heating			8926.6340 (265)
Pumps and fans	125.0000	3.0700	383.7500 (267)
Energy for lighting	598.4667	3.0700	1837.2929 (268)
Energy saving/generation technologies			
PV Unit	-969.3394	3.0700	-2975.8720 (269)
Primary energy kWh/year			8171.8049 (272)
Primary energy kWh/m2/year			44.4748 (273)

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

Overheating Calculation Input Data

Dwelling type	Detached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	North East
Overshading	Average or unknown
Thermal mass parameter	145.4 (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	580.88 (P1)
Transmission heat loss coefficient	115.92 (37)
Summer heat loss coefficient	696.79 (P2)

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

Solar shading	Z blinds	Solar access	Z overhangs	Z summer
Orientation				
North East	1.000	0.90	1.000	0.900 (P8)
South 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 East	12.1800	106.0502	0.7100	0.7000	0.9000	519.9963
South West	7.5100	127.3119	0.7100	0.7000	0.9000	384.9020
North West	0.5700	106.0502	0.7100	0.7000	0.9000	24.3348
South West	5.8000	127.3119	0.7100	0.7000	0.9000	297.2612

total: 1226.4943

	Jun	Jul	Aug	
Solar gains	1321	1226	1080	(P3)
Internal gains	670	644	655	
Total summer gains	1992	1871	1735	(P5)

Summer gain/loss ratio	2.86	2.68	2.49	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 145.4)	0.98	0.98	0.98	
Threshold temperature	19.24	20.97	20.77	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	

Assessment of likelihood of high internal temperature: Slight