

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



Property Reference	4907-0015-3817-157				Issued on Date	12/11/2019
Assessment Reference	As Built	Prop Type Ref	P404 - Det (Op)			
Property	71, Appleby Drive, Botley, SOUTHAMPTON, SO32 2GE					
SAP Rating	88 B	DER	12.60	TER	16.20	
Environmental	89 B	% DER<TER	22.24			
CO ₂ Emissions (t/year)	1.21	DFEE	47.03	TFEE	53.08	
General Requirements Compliance	Pass	% DFEE<TFEE	11.39			
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 123 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) 16.20 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 12.60 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)53.1 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)47.0 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.25 (max. 0.30)	0.25 (max. 0.70)	OK
Floor	0.16 (max. 0.25)	0.16 (max. 0.70)	OK
Roof	0.13 (max. 0.20)	0.13 (max. 0.35)	OK
Openings	1.40 (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: 4.69 (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 Promax Ultra Combi 40 ErP
Combi boiler
Efficiency: 89.1% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

7 Low energy lights

Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Southern England): Slight OK

Based on:

Overshading: Average
Windows facing North East: 2.46 m², No overhang
Windows facing South East: 10.05 m², No overhang
Windows facing South West: 2.84 m², No overhang
Windows facing North West: 11.66 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 0.032 W/m²K
Photovoltaic array 0.81 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	61.4600 (1b)	x 2.3100 (2b)	= 141.9726 (1b) - (3b)
First floor	61.4600 (1c)	x 2.4800 (2c)	= 152.4208 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	122.9200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 294.3934 (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) = 0.1359 (8)
Pressure test					Yes
Measured/design AP50					4.6900
Infiltration rate					0.3704 (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) =	0.3148 (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	0.4014	0.3935	0.3857	0.3463	0.3384	0.2991	0.2991	0.2912	0.3148	0.3384	0.3542	0.3699 (22b)
Effective ac	0.5806	0.5774	0.5744	0.5600	0.5573	0.5447	0.5447	0.5424	0.5496	0.5573	0.5627	0.5684 (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
Window (Uw = 1.40)			21.2100	1.3258	28.1193		(27)
French (Uw = 1.40)			5.8000	1.3258	7.6894		(27)
Heat Loss Floor 1			61.4600	0.1600	9.8336	75.0000	4609.5000 (28a)
100mm Knauf Supafil	155.7700	27.0100	128.7600	0.2500	32.1900	60.0000	7725.6000 (29a)
External Roof 1	61.4600		61.4600	0.1300	7.9898	9.0000	553.1400 (30)
Total net area of external elements Aum(A, m ²)			278.6900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	85.8221		(33)
GF			24.7700			39.0000	966.0300 (32c)
GF			71.1300			9.0000	640.1700 (32c)
FF			131.0000			9.0000	1179.0000 (32c)
Internal Floor 1			61.4600			18.0000	1106.2800 (32d)
Internal Floor 1			61.4600			18.0000	1106.2800 (32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss

(28)...(30) + (32) + (32a)...(32e) =	17886.0000 (34)
145.5093 (35)	
8.9388 (36)	
(33) + (36) =	94.7609 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)	
(38)m	Jan 56.4011 Feb 56.0972 Mar 55.7993 Apr 54.4001 May 54.1384 Jun 52.9198 Jul 52.9198 Aug 52.6941 Sep 53.3891 Oct 54.1384 Nov 54.6679 Dec 55.2216 (38)
Heat transfer coeff	151.1620 150.8581 150.5602 149.1611 148.8993 147.6807 147.6807 147.4550 148.1501 148.8993 149.4289 149.9825 (39)
Average = Sum(39)m / 12 =	149.1598 (39)

HLP	Jan 1.2298 Feb 1.2273 Mar 1.2249 Apr 1.2135 May 1.2114 Jun 1.2014 Jul 1.2014 Aug 1.1996 Sep 1.2053 Oct 1.2114 Nov 1.2157 Dec 1.2202 (40)
HLP (average)	1.2135 (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												2.8739 (42)
Average daily hot water use (litres/day)												102.4557 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	112.7013	108.6031	104.5048	100.4066	96.3084	92.2101	92.2101	96.3084	100.4066	104.5048	108.6031	112.7013 (44)
Energy conte	167.1328	146.1754	150.8399	131.5059	126.1830	108.8863	100.8992	115.7833	117.1661	136.5458	149.0505	161.8591 (45)
Energy content (annual)	Total = Sum(45)m =											1612.0273 (45)

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	25.0699	21.9263	22.6260	19.7259	18.9275	16.3330	15.1349	17.3675	17.5749	20.4819	22.3576	24.2789 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	21.0823	19.0215	21.0122	20.2722	20.8861	20.1384	20.7637	20.8431	20.2105	20.9507	20.3476	21.0596 (61)
Total heat required for water heating calculated for each month	188.2150	165.1968	171.8521	151.7780	147.0692	129.0248	121.6629	136.6264	137.3766	157.4966	169.3981	182.9187 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	188.2150	165.1968	171.8521	151.7780	147.0692	129.0248	121.6629	136.6264	137.3766	157.4966	169.3981	182.9187 (64)
Heat gains from water heating, kWh/month	60.8422	53.3587	55.4073	48.7937	47.1774	41.2393	38.7399	43.7087	44.0104	50.6392	54.6462	59.0831 (65)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)												
Total per year (kWh/year) = Sum(64)m = 1858.6152 (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	143.6962	143.6962	143.6962	143.6962	143.6962	143.6962	143.6962	143.6962	143.6962	143.6962	143.6962	143.6962 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.7715	22.8900	18.6154	14.0931	10.5347	8.8939	9.6101	12.4916	16.7662	21.2886	24.8469	26.4878 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	288.9674	291.9660	284.4097	268.3232	248.0168	228.9317	216.1817	213.1832	220.7395	236.8260	257.1323	276.2174 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.3696	37.3696	37.3696	37.3696	37.3696	37.3696	37.3696	37.3696	37.3696	37.3696	37.3696	37.3696 (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)	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570 (71)
Water heating gains (Table 5)	81.7772	79.4028	74.4722	67.7691	63.4105	57.2768	52.0698	58.7483	61.1255	68.0634	75.8975	79.4127 (72)
Total internal gains	465.6250	463.3677	446.6062	419.2942	391.0709	364.2113	346.9705	353.5319	367.7401	395.2869	426.9856	451.2268 (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	2.4600				11.2829	0.7100	0.7000	0.7700	9.5598 (75)			
Southeast	4.2500				36.7938	0.7100	0.7000	0.7700	53.8584 (77)			
Southwest	2.8400				36.7938	0.7100	0.7000	0.7700	35.9901 (79)			
Northwest	11.6600				11.2829	0.7100	0.7000	0.7700	45.3117 (81)			
Southeast	5.8000				36.7938	0.7100	0.7000	0.7700	73.5009 (77)			
Solar gains	218.2209	389.9370	581.9405	802.1980	972.5945	998.1403	948.7558	816.6517	657.4315	444.0165	264.6975	184.6039 (83)
Total gains	683.8458	853.3046	1028.5467	1221.4922	1363.6654	1362.3516	1295.7263	1170.1836	1025.1716	839.3033	691.6830	635.8306 (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	32.8676	32.9338	32.9990	33.3085	33.3671	33.6424	33.6424	33.6939	33.5358	33.3671	33.2488	33.1261
alpha	3.1912	3.1956	3.1999	3.2206	3.2245	3.2428	3.2428	3.2463	3.2357	3.2245	3.2166	3.2084
util living area	0.9887	0.9768	0.9503	0.8862	0.7691	0.6114	0.4733	0.5336	0.7628	0.9313	0.9804	0.9910 (86)
MIT	18.9357	19.2171	19.6517	20.1897	20.6229	20.8737	20.9589	20.9394	20.7300	20.1392	19.4317	18.8842 (87)
Th 2	19.8963	19.8982	19.9002	19.9092	19.9109	19.9189	19.9189	19.9203	19.9158	19.9109	19.9075	19.9039 (88)
util rest of house	0.9862	0.9719	0.9397	0.8615	0.7201	0.5313	0.3680	0.4254	0.6938	0.9111	0.9755	0.9890 (89)
MIT 2	17.1431	17.5522	18.1787	18.9402	19.5153	19.8171	19.8970	19.8852	19.6683	18.8890	17.8730	17.0726 (90)
Living area fraction									fLA = Living area / (4) =			0.1416 (91)
MIT	17.3968	17.7879	18.3872	19.1171	19.6721	19.9667	20.0473	20.0344	19.8186	19.0660	18.0936	17.3290 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.2468	17.6379	18.2372	18.9671	19.5221	19.8167	19.8973	19.8844	19.6686	18.9160	17.9436	17.1790 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9770	0.9570	0.9175	0.8351	0.7000	0.5230	0.3658	0.4215	0.6754	0.8860	0.9619	0.9812 (94)
Ext temp.	668.1298	816.6487	943.7415	1020.0074	954.5856	712.5400	474.0301	493.2496	692.3944	743.6249	665.3113	623.9064 (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	1957.0677	1921.6121	1767.1523	1501.6199	1164.7047	770.4000	486.9543	513.7919	824.9834	1238.2395	1620.3529	1946.6256 (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	958.9698	742.5354	612.6177	346.7610	156.3286	0.0000	0.0000	0.0000	0.0000	367.9933	687.6300	984.1031 (98)
Space heating per m2												4856.9388 (98)
												(98) / (4) = 39.5130 (99)

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)											
Fraction of space heat from main system(s)	1.0000 (202)											
Efficiency of main space heating system 1 (in %)	90.0000 (206)											
Efficiency of secondary/supplementary heating system, %	0.0000 (208)											
Space heating requirement	5396.5987 (211)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	958.9698	742.5354	612.6177	346.7610	156.3286	0.0000	0.0000	0.0000	0.0000	367.9933	687.6300	984.1031 (98)
Space heating efficiency (main heating system 1)	90.0000	90.0000	90.0000	90.0000	90.0000	0.0000	0.0000	0.0000	0.0000	90.0000	90.0000	90.0000 (210)
Space heating fuel (main heating system)	1065.5220	825.0393	680.6863	385.2900	173.6985	0.0000	0.0000	0.0000	0.0000	408.8814	764.0333	1093.4479 (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	188.2150	165.1968	171.8521	151.7780	147.0692	129.0248	121.6629	136.6264	137.3766	157.4966	169.3981	182.9187 (64)
Efficiency of water heater (217)m	89.4415	89.3809	89.2558	88.9690	88.3696	86.7000	86.7000	86.7000	86.7000	88.9849	89.3280	86.7000 (216)
Fuel for water heating, kWh/month	210.4337	184.8235	192.5389	170.5965	166.4252	148.8175	140.3263	157.5852	158.4506	176.9925	189.6361	204.4556 (219)
Water heating fuel used												2101.0816 (219)
Annual totals kWh/year												
Space heating fuel - main system												5396.5987 (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)												455.1332 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 0.81 * 1029 * 1.00) =												-666.9130 (233)
Total delivered energy for all uses												7360.9005 (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	5396.5987	0.2160	1165.6653 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2101.0816	0.2160	453.8336 (264)
Space and water heating			1619.4989 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	455.1332	0.5190	236.2141 (268)
Energy saving/generation technologies			
PV Unit	-666.9130	0.5190	-346.1278 (269)
Total CO2, kg/year			1548.5102 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			12.6000 (273)

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

DER		12.6000 ZC1
Total Floor Area	TFA	122.9200
Assumed number of occupants	N	2.8739
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190
CO2 emissions from appliances, equation (L14)		13.9307 ZC2
CO2 emissions from cooking, equation (L16)		1.5292 ZC3
Total CO2 emissions		28.0599 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		28.0599 ZC8

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	61.4600 (1b)	x 2.3100 (2b)	= 141.9726 (1b) - (3b)
First floor	61.4600 (1c)	x 2.4800 (2c)	= 152.4208 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	122.9200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 294.3934 (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) = 0.1359 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3859 (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) =	0.3280 (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	0.4182	0.4100	0.4018	0.3608	0.3526	0.3116	0.3116	0.3034	0.3280	0.3526	0.3690	0.3854 (22b)
Effective ac	0.5874	0.5840	0.5807	0.5651	0.5622	0.5485	0.5485	0.5460	0.5538	0.5622	0.5681	0.5743 (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 Opening Type (Uw = 1.40)			27.0100	1.3258	35.8087		(27)
Heat Loss Floor 1			61.4600	0.1300	7.9898		(28a)
100mm Knauf Supafil	155.7700	27.0100	128.7600	0.1800	23.1768		(29a)
External Roof 1	61.4600		61.4600	0.1300	7.9898		(30)
Total net area of external elements Aum (A, m ²)			278.6900				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		74.9651		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							12.3018 (36)
Total fabric heat loss						(33) + (36) =	87.2669 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	57.0698	56.7399	56.4166	54.8979	54.6138	53.2910	53.2910	53.0461	53.8005	54.6138	55.1886	55.7895 (38)
Average = Sum(39)m / 12 =	144.3367	144.0069	143.6835	142.1648	141.8807	140.5579	140.5579	140.3130	141.0674	141.8807	142.4555	143.0564 (39)
												142.1635 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1742	1.1715	1.1689	1.1566	1.1543	1.1435	1.1435	1.1415	1.1476	1.1543	1.1589	1.1638 (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												2.8739 (42)
Average daily hot water use (litres/day)												102.4557 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	112.7013	108.6031	104.5048	100.4066	96.3084	92.2101	92.2101	96.3084	100.4066	104.5048	108.6031	112.7013 (44)
Energy content (annual)	167.1328	146.1754	150.8399	131.5059	126.1830	108.8863	100.8992	115.7833	117.1661	136.5458	149.0505	161.8591 (45)
Distribution loss (46)m = 0.15 x (45)m												
	25.0699	21.9263	22.6260	19.7259	18.9275	16.3330	15.1349	17.3675	17.5749	20.4819	22.3576	24.2789 (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)

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Combi loss	50.9589	46.0274	50.9589	49.3151	49.0777	45.4735	46.9893	49.0777	49.3151	50.9589	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month	218.0917	192.2028	201.7988	180.8209	175.2607	154.3598	147.8885	164.8610	166.4812	187.5047	198.3655	212.8180 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	218.0917	192.2028	201.7988	180.8209	175.2607	154.3598	147.8885	164.8610	166.4812	187.5047	198.3655	212.8180 (64)
Heat gains from water heating, kWh/month	68.3114	60.1102	62.8940	56.0545	54.2253	47.5731	45.2963	50.7674	51.2865	58.1412	61.8880	66.5579 (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	143.6962	143.6962	143.6962	143.6962	143.6962	143.6962	143.6962	143.6962	143.6962	143.6962	143.6962	143.6962 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.7715	22.8900	18.6154	14.0931	10.5347	8.8939	9.6101	12.4916	16.7662	21.2886	24.8469	26.4878 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	288.9674	291.9660	284.4097	268.3232	248.0168	228.9317	216.1817	213.1832	220.7395	236.8260	257.1323	276.2174 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.3696	37.3696	37.3696	37.3696	37.3696	37.3696	37.3696	37.3696	37.3696	37.3696	37.3696	37.3696 (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)	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570 (71)
Water heating gains (Table 5)	91.8164	89.4496	84.5349	77.8534	72.8834	66.0737	60.8821	68.2357	71.2313	78.1468	85.9556	89.4595 (72)
Total internal gains	475.6641	473.4145	456.6689	429.3785	400.5439	373.0082	355.7829	363.0194	377.8458	405.3702	437.0437	461.2736 (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					2.4600	11.2829	0.6300	0.7000	0.7700		8.4826 (75)	
Southeast					10.0500	36.7938	0.6300	0.7000	0.7700		113.0090 (77)	
Southwest					2.8400	36.7938	0.6300	0.7000	0.7700		31.9349 (79)	
Northwest					11.6600	11.2829	0.6300	0.7000	0.7700		40.2062 (81)	
Solar gains	193.6326	346.0004	516.3698	711.8095	863.0064	885.6738	841.8538	724.6346	583.3547	393.9865	234.8724	163.8034 (83)
Total gains	669.2968	819.4149	973.0387	1141.1881	1263.5503	1258.6820	1197.6366	1087.6540	961.2006	799.3567	671.9161	625.0770 (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	59.1403	59.2757	59.4091	60.0438	60.1640	60.7302	60.7302	60.8362	60.5109	60.1640	59.9212	59.6695
alpha	4.9427	4.9517	4.9606	5.0029	5.0109	5.0487	5.0487	5.0557	5.0341	5.0109	4.9947	4.9780
util living area	0.9987	0.9962	0.9877	0.9528	0.8512	0.6716	0.5073	0.5754	0.8395	0.9782	0.9970	0.9991 (86)
MIT	19.6749	19.8568	20.1454	20.5170	20.8137	20.9586	20.9917	20.9850	20.8728	20.4705	20.0006	19.6443 (87)
Th 2	19.9407	19.9428	19.9449	19.9549	19.9568	19.9655	19.9655	19.9671	19.9621	19.9568	19.9530	19.9491 (88)
util rest of house	0.9983	0.9949	0.9832	0.9353	0.8006	0.5802	0.3928	0.4552	0.7659	0.9671	0.9958	0.9988 (89)
MIT 2	18.1699	18.4369	18.8575	19.3913	19.7780	19.9388	19.9625	19.9610	19.8605	19.3368	18.6549	18.1310 (90)
Living area fraction	18.3829	18.6379	19.0398	19.5506	19.9246	20.0831	20.1082	20.1060	20.0038	19.4973	18.8454	0.1416 (91)
MIT	18.3829	18.6379	19.0398	19.5506	19.9246	20.0831	20.1082	20.1060	20.0038	19.4973	18.8454	18.3453 (92)
Temperature adjustment												0.0000
adjusted MIT	18.3829	18.6379	19.0398	19.5506	19.9246	20.0831	20.1082	20.1060	20.0038	19.4973	18.8454	18.3453 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9972	0.9925	0.9778	0.9267	0.7988	0.5913	0.4090	0.4720	0.7693	0.9603	0.9937	0.9980 (94)
Useful gains	667.4426	813.2767	951.4250	1057.5717	1009.3303	744.2238	489.8034	513.4182	739.4707	767.6197	667.6789	623.8291 (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	2032.6835	1978.3499	1801.7594	1514.1443	1166.9111	770.6954	493.1060	519.9992	832.8302	1262.3484	1673.1904	2023.5696 (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	1015.7392	782.9292	632.6488	328.7323	117.2401	0.0000	0.0000	0.0000	0.0000	368.0782	723.9683	1041.4069 (98)
Space heating												5010.7430 (98)
Space heating per m2												(98) / (4) = 40.7643 (99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.4000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													5364.8212 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1015.7392	782.9292	632.6488	328.7323	117.2401	0.0000	0.0000	0.0000	0.0000	368.0782	723.9683	1041.4069	(98)
Space heating efficiency (main heating system 1)	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)	1087.5152	838.2539	677.3542	351.9617	125.5248	0.0000	0.0000	0.0000	0.0000	394.0880	775.1266	1114.9967	(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	218.0917	192.2028	201.7988	180.8209	175.2607	154.3598	147.8885	164.8610	166.4812	187.5047	198.3655	212.8180	(64)
Efficiency of water heater (217)m	88.4339	88.2131	87.7314	86.5375	84.0646	80.3000	80.3000	80.3000	80.3000	86.7189	88.0190	80.3000	(216)
Fuel for water heating, kWh/month	246.6155	217.8847	230.0188	208.9510	208.4834	192.2289	184.1700	205.3064	207.3240	216.2214	225.3667	240.4425	(219)
Water heating fuel used												2583.0134	(219)
Annual totals kWh/year													
Space heating fuel - main system												5364.8212	(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)												455.1332	(232)
Total delivered energy for all uses												8477.9678	(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	5364.8212	0.2160	1158.8014 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2583.0134	0.2160	557.9309 (264)
Space and water heating			1716.7323 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	455.1332	0.5190	236.2141 (268)
Total CO2, kg/m2/year			1991.8714 (272)
Emissions per m2 for space and water heating			13.9663 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			1.9217 (272b)
Emissions per m2 for pumps and fans			0.3167 (272c)
Target Carbon Dioxide Emission Rate (TER) = (13.9663 * 1.00) + 1.9217 + 0.3167, rounded to 2 d.p.			16.2000 (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	61.4600 (1b)	x 2.3100 (2b)	= 141.9726 (1b) - (3b)
First floor	61.4600 (1c)	x 2.4800 (2c)	= 152.4208 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	122.9200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 294.3934 (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) = 0.1359 (8)
Pressure test					Yes
Measured/design AP50					4.6900
Infiltration rate					0.3704 (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) =	0.3148 (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	0.4014	0.3935	0.3857	0.3463	0.3384	0.2991	0.2991	0.2912	0.3148	0.3384	0.3542	0.3699 (22b)
Effective ac	0.5806	0.5774	0.5744	0.5600	0.5573	0.5447	0.5447	0.5424	0.5496	0.5573	0.5627	0.5684 (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
Window (Uw = 1.40)			21.2100	1.3258	28.1193		(27)
French (Uw = 1.40)			5.8000	1.3258	7.6894		(27)
Heat Loss Floor 1			61.4600	0.1600	9.8336	75.0000	4609.5000 (28a)
100mm Knauf Supafil	155.7700	27.0100	128.7600	0.2500	32.1900	60.0000	7725.6000 (29a)
External Roof 1	61.4600		61.4600	0.1300	7.9898	9.0000	553.1400 (30)
Total net area of external elements Aum(A, m ²)			278.6900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	85.8221		(33)
GF			24.7700			39.0000	966.0300 (32c)
GF			71.1300			9.0000	640.1700 (32c)
FF			131.0000			9.0000	1179.0000 (32c)
Internal Floor 1			61.4600			18.0000	1106.2800 (32d)
Internal Floor 1			61.4600			9.0000	553.1400 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 17332.8600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 141.0093 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 8.9388 (36)
Total fabric heat loss (33) + (36) = 94.7609 (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	56.4011	56.0972	55.7993	54.4001	54.1384	52.9198	52.9198	52.6941	53.3891	54.1384	54.6679	55.2216 (38)
Heat transfer coeff	151.1620	150.8581	150.5602	149.1611	148.8993	147.6807	147.6807	147.4550	148.1501	148.8993	149.4289	149.9825 (39)
Average = Sum(39)m / 12 =												149.1598 (39)
HLP	1.2298	1.2273	1.2249	1.2135	1.2114	1.2014	1.2014	1.1996	1.2053	1.2114	1.2157	1.2202 (40)
HLP (average)												1.2135 (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												2.8739 (42)
Average daily hot water use (litres/day)												102.4557 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.7013	108.6031	104.5048	100.4066	96.3084	92.2101	92.2101	96.3084	100.4066	104.5048	108.6031	112.7013 (44)
Energy conte	167.1328	146.1754	150.8399	131.5059	126.1830	108.8863	100.8992	115.7833	117.1661	136.5458	149.0505	161.8591 (45)
Energy content (annual)										Total = Sum(45)m =		1612.0273 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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	35.5157	31.0623	32.0535	27.9450	26.8139	23.1383	21.4411	24.6040	24.8978	29.0160	31.6732	34.3951	(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	143.6962	143.6962	143.6962	143.6962	143.6962	143.6962	143.6962	143.6962	143.6962	143.6962	143.6962	143.6962	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.7715	22.8900	18.6154	14.0931	10.5347	8.8939	9.6101	12.4916	16.7662	21.2886	24.8469	26.4878	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	288.9674	291.9660	284.4097	268.3232	248.0168	228.9317	216.1817	213.1832	220.7395	236.8260	257.1323	276.2174	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.3696	37.3696	37.3696	37.3696	37.3696	37.3696	37.3696	37.3696	37.3696	37.3696	37.3696	37.3696	(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)	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570	(71)
Water heating gains (Table 5)	47.7362	46.2236	43.0826	38.8125	36.0402	32.1366	28.8187	33.0698	34.5803	39.0000	43.9906	46.2299	(72)
Total internal gains	428.5840	427.1885	412.2166	387.3376	360.7006	336.0711	320.7194	324.8535	338.1949	363.2234	392.0787	415.0440	(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					2.4600	11.2829	0.7100	0.7000	0.7700		9.5598 (75)	
Southeast					4.2500	36.7938	0.7100	0.7000	0.7700		53.8584 (77)	
Southwest					2.8400	36.7938	0.7100	0.7000	0.7700		35.9901 (79)	
Northwest					11.6600	11.2829	0.7100	0.7000	0.7700		45.3117 (81)	
Southeast					5.8000	36.7938	0.7100	0.7000	0.7700		73.5009 (77)	
Solar gains	218.2209	389.9370	581.9405	802.1980	972.5945	998.1403	948.7558	816.6517	657.4315	444.0165	264.6975	184.6039 (83)
Total gains	646.8049	817.1255	994.1571	1189.5356	1333.2951	1334.2114	1269.4752	1141.5052	995.6264	807.2399	656.7762	599.6479 (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	31.8512	31.9153	31.9785	32.2784	32.3352	32.6020	32.6020	32.6519	32.4987	32.3352	32.2206	32.1016		
alpha	3.1234	3.1277	3.1319	3.1519	3.1557	3.1735	3.1735	3.1768	3.1666	3.1557	3.1480	3.1401		
util living area	0.9894	0.9778	0.9518	0.8887	0.7735	0.6177	0.4801	0.5421	0.7699	0.9343	0.9816	0.9916	(86)	
MIT	18.8506	19.1398	19.5873	20.1434	20.5949	20.8609	20.9536	20.9317	20.7064	20.0895	19.3600	18.7986	(87)	
Th 2	19.8963	19.8982	19.9002	19.9092	19.9109	19.9189	19.9189	19.9203	19.9158	19.9109	19.9075	19.9039	(88)	
util rest of house	0.9872	0.9732	0.9416	0.8648	0.7255	0.5381	0.3743	0.4337	0.7025	0.9152	0.9771	0.9898	(89)	
MIT 2	17.9356	18.2234	18.6651	19.2065	19.6183	19.8412	19.9017	19.8927	19.7296	19.1686	18.4510	17.8892	(90)	
Living area fraction	18.0651	18.3532	18.7956	19.3391	19.7565	19.9856	20.0506	20.0397	19.8679	19.2990	18.5797	18.0180	(92)	
Temperature adjustment	18.0651	18.3532	18.7956	19.3391	19.7565	19.9856	20.0506	20.0397	19.8679	19.2990	18.5797	18.0180	(93)	
adjusted MIT	18.0651	18.3532	18.7956	19.3391	19.7565	19.9856	20.0506	20.0397	19.8679	19.2990	18.5797	18.0180	(93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	635.1195	788.0814	923.0349	1010.9833	957.1083	725.0208	492.3599	509.6792	696.0399	727.6929	636.6667	590.9202	(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	2080.7608	2029.5185	1851.2295	1557.1038	1199.6117	795.3450	509.5818	536.6977	854.5108	1295.2708	1715.3960	2072.4512	(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	1075.5571	834.2458	690.5767	393.2067	180.4225	0.0000	0.0000	0.0000	0.0000	422.2780	776.6851	1102.2590	(98)
Space heating												5475.2309	(98)
Space heating per m2												44.5430	(99)

8c. Space cooling requirement

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	1388.1985	1092.8371	1120.6582	0.0000	0.0000	0.0000	0.0000 (100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.8264	0.8808	0.8479	0.0000	0.0000	0.0000	0.0000 (101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1147.2283	962.5862	950.2195	0.0000	0.0000	0.0000	0.0000 (102)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1675.3139	1597.0347	1449.6066	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	380.2216	472.0296	371.5440	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction									FC = cooled area / (4) =			1223.7952 (104)
Intermittency factor (Table 10b)												1.0000 (105)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	95.0554	118.0074	92.8860	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling per m2												305.9488 (107)
Energy for space heating												2.4890 (108)
Energy for space cooling												44.5430 (99)
Total												2.4890 (108)
Dwelling Fabric Energy Efficiency (DFEE)												47.0321 (109)
												47.0 (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	61.4600 (1b)	x 2.3100 (2b)	= 141.9726 (1b) - (3b)
First floor	61.4600 (1c)	x 2.4800 (2c)	= 152.4208 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	122.9200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 294.3934 (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) = 0.1359 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3859 (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) =	0.3280 (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	0.4182	0.4100	0.4018	0.3608	0.3526	0.3116	0.3116	0.3034	0.3280	0.3526	0.3690	0.3854 (22b)
Effective ac	0.5874	0.5840	0.5807	0.5651	0.5622	0.5485	0.5485	0.5460	0.5538	0.5622	0.5681	0.5743 (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 Opening Type (Uw = 1.40)			27.0100	1.3258	35.8087		(27)
Heat Loss Floor 1			61.4600	0.1300	7.9898		(28a)
100mm Knauf Supafil	155.7700	27.0100	128.7600	0.1800	23.1768		(29a)
External Roof 1	61.4600		61.4600	0.1300	7.9898		(30)
Total net area of external elements Aum (m ²)			278.6900				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		74.9651		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							12.3018 (36)
Total fabric heat loss						(33) + (36) =	87.2669 (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	57.0698	56.7399	56.4166	54.8979	54.6138	53.2910	53.2910	53.0461	53.8005	54.6138	55.1886	55.7895 (38)
Heat transfer coeff	144.3367	144.0069	143.6835	142.1648	141.8807	140.5579	140.5579	140.3130	141.0674	141.8807	142.4555	143.0564 (39)
Average = Sum(39)m / 12 =												142.1635 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1742	1.1715	1.1689	1.1566	1.1543	1.1435	1.1435	1.1415	1.1476	1.1543	1.1589	1.1638 (40)
HLP (average)												1.1566 (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												2.8739 (42)
Average daily hot water use (litres/day)												102.4557 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	112.7013	108.6031	104.5048	100.4066	96.3084	92.2101	92.2101	96.3084	100.4066	104.5048	108.6031	112.7013 (44)
Energy conte	167.1328	146.1754	150.8399	131.5059	126.1830	108.8863	100.8992	115.7833	117.1661	136.5458	149.0505	161.8591 (45)
Energy content (annual)												Total = Sum(45)m = 1612.0273 (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	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	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	0.0000 (57)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	35.5157	31.0623	32.0535	27.9450	26.8139	23.1383	21.4411	24.6040	24.8978	29.0160	31.6732	34.3951 (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	143.6962	143.6962	143.6962	143.6962	143.6962	143.6962	143.6962	143.6962	143.6962	143.6962	143.6962	143.6962	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.7715	22.8900	18.6154	14.0931	10.5347	8.8939	9.6101	12.4916	16.7662	21.2886	24.8469	26.4878	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	288.9674	291.9660	284.4097	268.3232	248.0168	228.9317	216.1817	213.1832	220.7395	236.8260	257.1323	276.2174	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.3696	37.3696	37.3696	37.3696	37.3696	37.3696	37.3696	37.3696	37.3696	37.3696	37.3696	37.3696	(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)	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570	(71)
Water heating gains (Table 5)	47.7362	46.2236	43.0826	38.8125	36.0402	32.1366	28.8187	33.0698	34.5803	39.0000	43.9906	46.2299	(72)
Total internal gains	428.5840	427.1885	412.2166	387.3376	360.7006	336.0711	320.7194	324.8535	338.1949	363.2234	392.0787	415.0440	(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					2.4600	11.2829	0.6300	0.7000	0.7700		8.4826 (75)	
Southeast					10.0500	36.7938	0.6300	0.7000	0.7700		113.0090 (77)	
Southwest					2.8400	36.7938	0.6300	0.7000	0.7700		31.9349 (79)	
Northwest					11.6600	11.2829	0.6300	0.7000	0.7700		40.2062 (81)	

Solar gains	193.6326	346.0004	516.3698	711.8095	863.0064	885.6738	841.8538	724.6346	583.3547	393.9865	234.8724	163.8034 (83)
Total gains	622.2166	773.1889	928.5864	1099.1471	1223.7070	1221.7449	1162.5732	1049.4881	921.5496	757.2099	626.9511	578.8474 (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	59.1403	59.2757	59.4091	60.0438	60.1640	60.7302	60.7302	60.8362	60.5109	60.1640	59.9212	59.6695	
alpha	4.9427	4.9517	4.9606	5.0029	5.0109	5.0487	5.0487	5.0557	5.0341	5.0109	4.9947	4.9780	
util living area	0.9991	0.9971	0.9899	0.9588	0.8634	0.6872	0.5215	0.5936	0.8562	0.9825	0.9978	0.9994	(86)
MIT	19.6393	19.8222	20.1135	20.4915	20.7993	20.9541	20.9906	20.9828	20.8591	20.4414	19.9667	19.6092	(87)
Th 2	19.9407	19.9428	19.9449	19.9549	19.9568	19.9655	19.9655	19.9671	19.9621	19.9568	19.9530	19.9491	(88)
util rest of house	0.9988	0.9961	0.9861	0.9431	0.8149	0.5954	0.4043	0.4709	0.7861	0.9733	0.9969	0.9991	(89)
MIT 2	18.6961	18.8803	19.1712	19.5466	19.8238	19.9450	19.9632	19.9623	19.8837	19.5059	19.0331	18.6728	(90)
Living area fraction									fLA = Living area / (4) =			0.1416	(91)
MIT	18.8296	19.0136	19.3046	19.6804	19.9618	20.0879	20.1086	20.1068	20.0218	19.6383	19.1652	18.8053	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8296	19.0136	19.3046	19.6804	19.9618	20.0879	20.1086	20.1068	20.0218	19.6383	19.1652	18.8053	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	621.1371	769.1770	912.8446	1030.9529	997.5785	741.6278	489.4019	512.4548	728.7644	734.1047	624.3594	578.1445	(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	2097.1608	2032.4610	1839.8141	1532.5901	1172.1962	771.3651	493.1639	520.1052	835.3727	1282.3671	1718.7595	2089.3857	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	1098.1616	848.9268	689.6653	361.1788	129.9156	0.0000	0.0000	0.0000	0.0000	407.9073	787.9681	1124.3634	(98)
Space heating												5448.0868	(98)
Space heating per m2												44.3222	(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	1321.2447	1040.1288	1066.3788	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8923	0.9421	0.9145	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1178.9729	979.9147	975.2331	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1543.8595	1472.0842	1342.0542	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	262.7184	366.1741	272.9149	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												901.8074	(104)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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	65.6796	91.5435	68.2287	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												225.4519 (107)
Space cooling per m2												1.8341 (108)
Energy for space heating												44.3222 (99)
Energy for space cooling												1.8341 (108)
Total												46.1564 (109)
Target Fabric Energy Efficiency (TFEE)												53.1 (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	61.4600 (1b)	x 2.3100 (2b)	= 141.9726 (1b) - (3b)
First floor	61.4600 (1c)	x 2.4800 (2c)	= 152.4208 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	122.9200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 294.3934 (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) = 0.1359 (8)
Pressure test					Yes
Measured/design AP50					4.6900
Infiltration rate					0.3704 (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)	=	0.3148 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000 (22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250 (22a)
Adj infilt rate												
Effective ac	0.3306	0.3069	0.3148	0.2991	0.2991	0.2912	0.2833	0.2755	0.2676	0.2912	0.2755	0.2912 (22b)
	0.5546	0.5471	0.5496	0.5447	0.5447	0.5424	0.5401	0.5379	0.5358	0.5424	0.5379	0.5424 (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
Window (Uw = 1.40)			21.2100	1.3258	28.1193		(27)
French (Uw = 1.40)			5.8000	1.3258	7.6894		(27)
Heat Loss Floor 1			61.4600	0.1600	9.8336	75.0000	4609.5000 (28a)
100mm Knauf Supafil	155.7700	27.0100	128.7600	0.2500	32.1900	60.0000	7725.6000 (29a)
External Roof 1	61.4600		61.4600	0.1300	7.9898	9.0000	553.1400 (30)
Total net area of external elements Aum(A, m ²)			278.6900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	85.8221		(33)
GF			24.7700			39.0000	966.0300 (32c)
GF			71.1300			9.0000	640.1700 (32c)
FF			131.0000			9.0000	1179.0000 (32c)
Internal Floor 1			61.4600			18.0000	1106.2800 (32d)
Internal Floor 1			61.4600			18.0000	1106.2800 (32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss
(28)...(30) + (32) + (32a)...(32e) = 17886.0000 (34)
145.5093 (35)
8.9388 (36)
(33) + (36) = 94.7609 (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	53.8826	53.1514	53.3891	52.9198	52.9198	52.6941	52.4744	52.2608	52.0532	52.6941	52.2608	52.6941 (38)
Heat transfer coeff	148.6435	147.9124	148.1501	147.6807	147.6807	147.4550	147.2354	147.0217	146.8141	147.4550	147.0217	147.4550 (39)
Average = Sum(39)m / 12 =												147.5438 (39)
HLP	1.2093	1.2033	1.2053	1.2014	1.2014	1.1996	1.1978	1.1961	1.1944	1.1996	1.1961	1.1996 (40)
HLP (average)												1.2003 (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												2.8739 (42)
Average daily hot water use (litres/day)												102.4557 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	112.7013	108.6031	104.5048	100.4066	96.3084	92.2101	92.2101	96.3084	100.4066	104.5048	108.6031	112.7013 (44)
Energy conte	167.1328	146.1754	150.8399	131.5059	126.1830	108.8863	100.8992	115.7833	117.1661	136.5458	149.0505	161.8591 (45)
Energy content (annual)										Total = Sum(45)m =		1612.0273 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	25.0699	21.9263	22.6260	19.7259	18.9275	16.3330	15.1349	17.3675	17.5749	20.4819	22.3576	24.2789 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	21.0823	19.0215	21.0122	20.2722	20.8861	20.1384	20.7637	20.8431	20.2105	20.9507	20.3476	21.0596 (61)
Total heat required for water heating calculated for each month	188.2150	165.1968	171.8521	151.7780	147.0692	129.0248	121.6629	136.6264	137.3766	157.4966	169.3981	182.9187 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	188.2150	165.1968	171.8521	151.7780	147.0692	129.0248	121.6629	136.6264	137.3766	157.4966	169.3981	182.9187 (64)
RHI water heating demand												
Heat gains from water heating, kWh/month	60.8422	53.3587	55.4073	48.7937	47.1774	41.2393	38.7399	43.7087	44.0104	50.6392	54.6462	59.0831 (65)
												1859 (64)
												1858.6152 (64)
												1859 (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	172.4355	172.4355	172.4355	172.4355	172.4355	172.4355	172.4355	172.4355	172.4355	172.4355	172.4355	172.4355 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	64.4288	57.2251	46.5386	35.2327	26.3369	22.2347	24.0254	31.2291	41.9156	53.2215	62.1173	66.2195 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	431.2946	435.7701	424.4920	400.4823	370.1744	341.6892	322.6593	318.1838	329.4619	353.4716	383.7796	412.2648 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.1175	55.1175	55.1175	55.1175	55.1175	55.1175	55.1175	55.1175	55.1175	55.1175	55.1175	55.1175 (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)	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570 (71)
Water heating gains (Table 5)	81.7772	79.4028	74.4722	67.7691	63.4105	57.2768	52.0698	58.7483	61.1255	68.0634	75.8975	79.4127 (72)
Total internal gains	693.0966	687.9940	661.0988	619.0801	575.5177	536.7967	514.3504	523.7571	548.0990	590.3525	637.3903	673.4929 (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						2.4600	14.6176	0.7100	0.7000			0.7700			12.3852 (75)		
Southeast						4.2500	45.1778	0.7100	0.7000			0.7700			66.1308 (77)		
Southwest						2.8400	45.1778	0.7100	0.7000			0.7700			44.1909 (79)		
Northwest						11.6600	14.6176	0.7100	0.7000			0.7700			58.7037 (81)		
Southeast						5.8000	45.1778	0.7100	0.7000			0.7700			90.2491 (77)		
Solar gains						271.6598	414.6651	627.8861	876.6733	1013.6742	1131.0133	1066.2896	938.3852	751.3373	510.5944	328.7616	225.7133 (83)
Total gains						964.7563	1102.6591	1288.9849	1495.7533	1589.1919	1667.8100	1580.6400	1462.1424	1299.4363	1100.9468	966.1519	899.2062 (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	33.4245	33.5897	33.5358	33.6424	33.6424	33.6939	33.7442	33.7932	33.8410	33.6939	33.7932	33.6939
alpha	3.2283	3.2393	3.2357	3.2428	3.2428	3.2463	3.2496	3.2529	3.2561	3.2463	3.2529	3.2463
util living area	0.9675	0.9509	0.9063	0.8103	0.6677	0.4754	0.3546	0.3806	0.6231	0.8502	0.9442	0.9725 (86)
MIT	19.3608	19.5674	19.9816	20.4528	20.7816	20.9463	20.9845	20.9810	20.8701	20.4601	19.8576	19.3283 (87)
Th 2	19.9126	19.9173	19.9158	19.9189	19.9189	19.9203	19.9217	19.9231	19.9245	19.9203	19.9231	19.9203 (88)
util rest of house	0.9610	0.9413	0.8881	0.7750	0.6086	0.3950	0.2603	0.2805	0.5417	0.8123	0.9312	0.9669 (89)
MIT 2	17.7672	18.0654	18.6501	19.2934	19.7073	19.8832	19.9152	19.9149	19.8202	19.3232	18.4904	17.7260 (90)
Living area fraction									fLA = Living area / (4) =			0.1416 (91)
MIT	17.9928	18.2780	18.8386	19.4576	19.8593	20.0337	20.0665	20.0658	19.9688	19.4841	18.6840	17.9529 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.8428	18.1280	18.6886	19.3076	19.7093	19.8837	19.9165	19.9158	19.8188	19.3341	18.5340	17.8029 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	909.9884	1014.1948	1111.3520	1124.6059	947.3675	653.9919	410.7223	409.0705	692.4947	866.6408	877.5930	854.9147 (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	1923.8589	1897.4264	1731.6651	1448.3859	1064.6808	675.8825	414.6912	413.9895	751.5108	1169.9280	1563.4236	1887.8452 (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	754.3197	593.5316	461.5130	233.1216	87.2811	0.0000	0.0000	0.0000	0.0000	225.6457	493.7980	768.5003 (98)
Space heating												3617.7110 (98)
RHI space heating demand												3618 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF HEAT DEMAND 09 Jan 2014

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	61.4600 (1b)	x 2.3100 (2b)	= 141.9726 (1b) - (3b)
First floor	61.4600 (1c)	x 2.4800 (2c)	= 152.4208 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	122.9200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 294.3934 (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) =	0.1359 (8)
Pressure test					Yes
Measured/design AP50					4.6900
Infiltration rate					0.3704 (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) =		0.3148 (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	0.4014	0.3935	0.3857	0.3463	0.3384	0.2991	0.2991	0.2912	0.3148	0.3384	0.3542	0.3699 (22b)
Effective ac	0.5806	0.5774	0.5744	0.5600	0.5573	0.5447	0.5447	0.5424	0.5496	0.5573	0.5627	0.5684 (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
Window (Uw = 1.40)			21.2100	1.3258	28.1193		(27)
French (Uw = 1.40)			5.8000	1.3258	7.6894		(27)
Heat Loss Floor 1			61.4600	0.1600	9.8336	75.0000	4609.5000 (28a)
100mm Knauf Supafil	155.7700	27.0100	128.7600	0.2500	32.1900	60.0000	7725.6000 (29a)
External Roof 1	61.4600		61.4600	0.1300	7.9898	9.0000	553.1400 (30)
Total net area of external elements Aum(A, m ²)			278.6900				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		85.8221		(33)
GF			24.7700			39.0000	966.0300 (32c)
GF			71.1300			9.0000	640.1700 (32c)
FF			131.0000			9.0000	1179.0000 (32c)
Internal Floor 1			61.4600			18.0000	1106.2800 (32d)
Internal Floor 1			61.4600			18.0000	1106.2800 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 17886.0000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 145.5093 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 8.9388 (36)
Total fabric heat loss (33) + (36) = 94.7609 (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	56.4011	56.0972	55.7993	54.4001	54.1384	52.9198	52.9198	52.6941	53.3891	54.1384	54.6679	55.2216 (38)
Heat transfer coeff	151.1620	150.8581	150.5602	149.1611	148.8993	147.6807	147.6807	147.4550	148.1501	148.8993	149.4289	149.9825 (39)
Average = Sum(39)m / 12 =												149.1598 (39)
HLP	1.2298	1.2273	1.2249	1.2135	1.2114	1.2014	1.2014	1.1996	1.2053	1.2114	1.2157	1.2202 (40)
HLP (average)												1.2135 (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												2.8739 (42)
Average daily hot water use (litres/day)												102.4557 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	112.7013	108.6031	104.5048	100.4066	96.3084	92.2101	92.2101	96.3084	100.4066	104.5048	108.6031	112.7013 (44)
Energy conte	167.1328	146.1754	150.8399	131.5059	126.1830	108.8863	100.8992	115.7833	117.1661	136.5458	149.0505	161.8591 (45)
Energy content (annual)										Total = Sum(45)m =		1612.0273 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	25.0699	21.9263	22.6260	19.7259	18.9275	16.3330	15.1349	17.3675	17.5749	20.4819	22.3576	24.2789 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	21.0823	19.0215	21.0122	20.2722	20.8861	20.1384	20.7637	20.8431	20.2105	20.9507	20.3476	21.0596 (61)
Total heat required for water heating calculated for each month	188.2150	165.1968	171.8521	151.7780	147.0692	129.0248	121.6629	136.6264	137.3766	157.4966	169.3981	182.9187 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	188.2150	165.1968	171.8521	151.7780	147.0692	129.0248	121.6629	136.6264	137.3766	157.4966	169.3981	182.9187 (64)
Heat gains from water heating, kWh/month	60.8422	53.3587	55.4073	48.7937	47.1774	41.2393	38.7399	43.7087	44.0104	50.6392	54.6462	59.0831 (65)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)												
Total per year (kWh/year) = Sum(64)m = 1858.6152 (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	172.4355	172.4355	172.4355	172.4355	172.4355	172.4355	172.4355	172.4355	172.4355	172.4355	172.4355	172.4355 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	64.4288	57.2251	46.5386	35.2327	26.3369	22.2347	24.0254	31.2291	41.9156	53.2215	62.1173	66.2195 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	431.2946	435.7701	424.4920	400.4823	370.1744	341.6892	322.6593	318.1838	329.4619	353.4716	383.7796	412.2648 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.1175	55.1175	55.1175	55.1175	55.1175	55.1175	55.1175	55.1175	55.1175	55.1175	55.1175	55.1175 (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)	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570 (71)
Water heating gains (Table 5)	81.7772	79.4028	74.4722	67.7691	63.4105	57.2768	52.0698	58.7483	61.1255	68.0634	75.8975	79.4127 (72)
Total internal gains	693.0966	687.9940	661.0988	619.0801	575.5177	536.7967	514.3504	523.7571	548.0990	590.3525	637.3903	673.4929 (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	2.4600				11.2829	0.7100	0.7000	0.7700		9.5598 (75)		
Southeast	4.2500				36.7938	0.7100	0.7000	0.7700		53.8584 (77)		
Southwest	2.8400				36.7938	0.7100	0.7000	0.7700		35.9901 (79)		
Northwest	11.6600				11.2829	0.7100	0.7000	0.7700		45.3117 (81)		
Southeast	5.8000				36.7938	0.7100	0.7000	0.7700		73.5009 (77)		
Solar gains	218.2209	389.9370	581.9405	802.1980	972.5945	998.1403	948.7558	816.6517	657.4315	444.0165	264.6975	184.6039 (83)
Total gains	911.3175	1077.9309	1243.0393	1421.2781	1548.1122	1534.9369	1463.1062	1340.4088	1205.5305	1034.3690	902.0878	858.0968 (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	32.8676	32.9338	32.9990	33.3085	33.3671	33.6424	33.6424	33.6939	33.5358	33.3671	33.2488	33.1261
alpha	3.1912	3.1956	3.1999	3.2206	3.2245	3.2428	3.2428	3.2463	3.2357	3.2245	3.2166	3.2084
util living area	0.9749	0.9571	0.9216	0.8450	0.7191	0.5595	0.4258	0.4770	0.6976	0.8895	0.9601	0.9790 (86)
MIT	19.1729	19.4386	19.8397	20.3226	20.6953	20.9028	20.9698	20.9562	20.7962	20.2947	19.6425	19.1193 (87)
Th 2	19.8963	19.8982	19.9002	19.9092	19.9109	19.9189	19.9189	19.9203	19.9158	19.9109	19.9075	19.9039 (88)
util rest of house	0.9699	0.9487	0.9062	0.8150	0.6668	0.4815	0.3285	0.3762	0.6241	0.8609	0.9509	0.9747 (89)
MIT 2	17.4857	17.8687	18.4407	19.1143	19.5981	19.8424	19.9032	19.8958	19.7359	19.0958	18.1736	17.4130 (90)
Living area fraction									fLA = Living area / (4) =			0.1416 (91)
MIT	17.7245	18.0909	18.6388	19.2853	19.7535	19.9925	20.0542	20.0459	19.8860	19.2655	18.3815	17.6545 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.5745	17.9409	18.4888	19.1353	19.6035	19.8425	19.9042	19.8959	19.7360	19.1155	18.2315	17.5045 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	869.7249	1000.4634	1094.7791	1122.2536	1006.8874	730.0973	478.6363	500.9743	735.8493	863.0584	839.6786	824.5124 (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	2006.5995	1967.3246	1805.0303	1526.7124	1176.8186	774.2158	487.9658	515.4854	834.9748	1267.9466	1663.3699	1995.4436 (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	845.8347	649.7307	528.4268	291.2103	126.4288	0.0000	0.0000	0.0000	0.0000	301.2369	593.0577	871.1728 (98)
Space heating												4207.0988 (98)
Space heating per m2												(98) / (4) = 34.2263 (99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.0000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													4674.5542 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	845.8347	649.7307	528.4268	291.2103	126.4288	0.0000	0.0000	0.0000	0.0000	301.2369	593.0577	871.1728	(98)
Space heating efficiency (main heating system 1)	90.0000	90.0000	90.0000	90.0000	90.0000	0.0000	0.0000	0.0000	0.0000	90.0000	90.0000	90.0000	(210)
Space heating fuel (main heating system)	939.8163	721.9230	587.1409	323.5670	140.4764	0.0000	0.0000	0.0000	0.0000	334.7076	658.9530	967.9698	(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	188.2150	165.1968	171.8521	151.7780	147.0692	129.0248	121.6629	136.6264	137.3766	157.4966	169.3981	182.9187	(64)
Efficiency of water heater (217)m	89.3808	89.3109	89.1671	88.8414	88.1949	86.7000	86.7000	86.7000	86.7000	88.8391	89.2453	86.7000	(216)
Fuel for water heating, kWh/month	210.5766	184.9683	192.7303	170.8415	166.7548	148.8175	140.3263	157.5852	158.4506	177.2830	189.8118	89.4094	(217)
Water heating fuel used												204.5855	(219)
Annual totals kWh/year												2102.7314	(219)
Space heating fuel - main system												4674.5542	(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)												455.1332	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 1029 * 1.00) =										-666.9130		-666.9130	(233)
Total delivered energy for all uses												6640.5058	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4674.5542	3.4800	162.6745	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	2102.7314	3.4800	73.1751	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	455.1332	13.1900	60.0321	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-666.9130	13.1900	-87.9658	(252)
Total energy cost			337.8083	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.4200	(256)
Energy cost factor (ECF)	0.8449	(257)
SAP value	88.2133	
SAP rating (Section 12)	88	(258)
SAP band	B	

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4674.5542	0.2160	1009.7037	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2102.7314	0.2160	454.1900	(264)
Space and water heating			1463.8937	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	455.1332	0.5190	236.2141	(268)
Energy saving/generation technologies				
PV Unit	-666.9130	0.5190	-346.1278	(269)
Total kg/year			1392.9050	(272)
CO2 emissions per m2			11.3300	(273)
EI value			88.8846	
EI rating			89	(274)
EI band			B	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

Calculation of stars for heating and DHW

Main heating energy efficiency $3.48 \times (1 + 0.29 \times 0.00) / 0.9000 = 3.867$, stars = 4
Main heating environmental impact $0.216 \times (1 + 0.29 \times 0.00) / 0.9000 = 0.2400$, stars = 4
Water heating energy efficiency $3.48 / 0.8827 = 3.943$, stars = 4
Water heating environmental impact $0.216 / 0.8827 = 0.2447$, 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	61.4600 (1b)	x 2.3100 (2b)	= 141.9726 (1b) - (3b)
First floor	61.4600 (1c)	x 2.4800 (2c)	= 152.4208 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	122.9200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 294.3934 (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) = 0.1359 (8)
Pressure test					Yes
Measured/design AP50					4.6900
Infiltration rate					0.3704 (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) =	0.3148 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000 (22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250 (22a)
Adj infilt rate												
Effective ac	0.3306	0.3069	0.3148	0.2991	0.2991	0.2912	0.2833	0.2755	0.2676	0.2912	0.2755	0.2912 (22b)
	0.5546	0.5471	0.5496	0.5447	0.5447	0.5424	0.5401	0.5379	0.5358	0.5424	0.5379	0.5424 (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
Window (Uw = 1.40)			21.2100	1.3258	28.1193		(27)
French (Uw = 1.40)			5.8000	1.3258	7.6894		(27)
Heat Loss Floor 1			61.4600	0.1600	9.8336	75.0000	4609.5000 (28a)
100mm Knauf Supafil	155.7700	27.0100	128.7600	0.2500	32.1900	60.0000	7725.6000 (29a)
External Roof 1	61.4600		61.4600	0.1300	7.9898	9.0000	553.1400 (30)
Total net area of external elements Aum(A, m ²)			278.6900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	85.8221		(33)
GF			24.7700			39.0000	966.0300 (32c)
GF			71.1300			9.0000	640.1700 (32c)
FF			131.0000			9.0000	1179.0000 (32c)
Internal Floor 1			61.4600			18.0000	1106.2800 (32d)
Internal Floor 1			61.4600			18.0000	1106.2800 (32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss
(28)...(30) + (32) + (32a)...(32e) = 17886.0000 (34)
145.5093 (35)
8.9388 (36)
(33) + (36) = 94.7609 (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	53.8826	53.1514	53.3891	52.9198	52.9198	52.6941	52.4744	52.2608	52.0532	52.6941	52.2608	52.6941 (38)
Heat transfer coeff	148.6435	147.9124	148.1501	147.6807	147.6807	147.4550	147.2354	147.0217	146.8141	147.4550	147.0217	147.4550 (39)
Average = Sum(39)m / 12 =												147.5438 (39)
HLP	1.2093	1.2033	1.2053	1.2014	1.2014	1.1996	1.1978	1.1961	1.1944	1.1996	1.1961	1.1996 (40)
HLP (average)												1.2003 (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												2.8739 (42)
Average daily hot water use (litres/day)												102.4557 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	112.7013	108.6031	104.5048	100.4066	96.3084	92.2101	92.2101	96.3084	100.4066	104.5048	108.6031	112.7013 (44)
Energy content	167.1328	146.1754	150.8399	131.5059	126.1830	108.8863	100.8992	115.7833	117.1661	136.5458	149.0505	161.8591 (45)
Energy content (annual)	Total = Sum(45)m =											1612.0273 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Distribution loss (46)m = 0.15 x (45)m	25.0699	21.9263	22.6260	19.7259	18.9275	16.3330	15.1349	17.3675	17.5749	20.4819	22.3576	24.2789 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	21.0823	19.0215	21.0122	20.2722	20.8861	20.1384	20.7637	20.8431	20.2105	20.9507	20.3476	21.0596 (61)
Total heat required for water heating calculated for each month	188.2150	165.1968	171.8521	151.7780	147.0692	129.0248	121.6629	136.6264	137.3766	157.4966	169.3981	182.9187 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	188.2150	165.1968	171.8521	151.7780	147.0692	129.0248	121.6629	136.6264	137.3766	157.4966	169.3981	182.9187 (64)
Heat gains from water heating, kWh/month	60.8422	53.3587	55.4073	48.7937	47.1774	41.2393	38.7399	43.7087	44.0104	50.6392	54.6462	59.0831 (65)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)												
Total per year (kWh/year) = Sum(64)m = 1858.6152 (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	172.4355	172.4355	172.4355	172.4355	172.4355	172.4355	172.4355	172.4355	172.4355	172.4355	172.4355	172.4355 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	64.4288	57.2251	46.5386	35.2327	26.3369	22.2347	24.0254	31.2291	41.9156	53.2215	62.1173	66.2195 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	431.2946	435.7701	424.4920	400.4823	370.1744	341.6892	322.6593	318.1838	329.4619	353.4716	383.7796	412.2648 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.1175	55.1175	55.1175	55.1175	55.1175	55.1175	55.1175	55.1175	55.1175	55.1175	55.1175	55.1175 (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)	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570 (71)
Water heating gains (Table 5)	81.7772	79.4028	74.4722	67.7691	63.4105	57.2768	52.0698	58.7483	61.1255	68.0634	75.8975	79.4127 (72)
Total internal gains	693.0966	687.9940	661.0988	619.0801	575.5177	536.7967	514.3504	523.7571	548.0990	590.3525	637.3903	673.4929 (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					2.4600	14.6176	0.7100	0.7000			0.7700	12.3852 (75)
Southeast					4.2500	45.1778	0.7100	0.7000			0.7700	66.1308 (77)
Southwest					2.8400	45.1778	0.7100	0.7000			0.7700	44.1909 (79)
Northwest					11.6600	14.6176	0.7100	0.7000			0.7700	58.7037 (81)
Southeast					5.8000	45.1778	0.7100	0.7000			0.7700	90.2491 (77)
Solar gains	271.6598	414.6651	627.8861	876.6733	1013.6742	1131.0133	1066.2896	938.3852	751.3373	510.5944	328.7616	225.7133 (83)
Total gains	964.7563	1102.6591	1288.9849	1495.7533	1589.1919	1667.8100	1580.6400	1462.1424	1299.4363	1100.9468	966.1519	899.2062 (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	33.4245	33.5897	33.5358	33.6424	33.6424	33.6939	33.7442	33.7932	33.8410	33.6939	33.7932	33.6939
alpha	3.2283	3.2393	3.2357	3.2428	3.2428	3.2463	3.2496	3.2529	3.2561	3.2463	3.2529	3.2463
util living area	0.9675	0.9509	0.9063	0.8103	0.6677	0.4754	0.3546	0.3806	0.6231	0.8502	0.9442	0.9725 (86)
MIT	19.3608	19.5674	19.9816	20.4528	20.7816	20.9463	20.9845	20.9810	20.8701	20.4601	19.8576	19.3283 (87)
Th 2	19.9126	19.9173	19.9158	19.9189	19.9189	19.9203	19.9217	19.9231	19.9245	19.9203	19.9231	19.9203 (88)
util rest of house	0.9610	0.9413	0.8881	0.7750	0.6086	0.3950	0.2603	0.2805	0.5417	0.8123	0.9312	0.9669 (89)
MIT 2	17.7672	18.0654	18.6501	19.2934	19.7073	19.8832	19.9152	19.9149	19.8202	19.3232	18.4904	17.7260 (90)
Living area fraction	17.9928	18.2780	18.8386	19.4576	19.8593	20.0337	20.0665	20.0658	19.9688	19.4841	18.6840	17.9529 (91)
MIT	17.9928	18.2780	18.8386	19.4576	19.8593	20.0337	20.0665	20.0658	19.9688	19.4841	18.6840	17.9529 (92)
Temperature adjustment	17.8428	18.1280	18.6886	19.3076	19.7093	19.8837	19.9165	19.9158	19.8188	19.3341	18.5340	17.8029 (93)
adjusted MIT	17.8428	18.1280	18.6886	19.3076	19.7093	19.8837	19.9165	19.9158	19.8188	19.3341	18.5340	17.8029 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9432	0.9198	0.8622	0.7519	0.5961	0.3921	0.2598	0.2798	0.5329	0.7872	0.9083	0.9507 (94)
Ext temp.	909.9884	1014.1948	1111.3520	1124.6059	947.3675	653.9919	410.7223	409.0705	692.4947	866.6408	877.5930	854.9147 (95)
Heat loss rate W	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)
Month fracti	1923.8589	1897.4264	1731.6651	1448.3859	1064.6808	675.8825	414.6912	413.9895	751.5108	1169.9280	1563.4236	1887.8452 (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	754.3197	593.5316	461.5130	233.1216	87.2811	0.0000	0.0000	0.0000	0.0000	225.6457	493.7980	768.5003 (98)
Space heating per m2												3617.7110 (98)
												(98) / (4) = 29.4314 (99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.0000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													4019.6789 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	754.3197	593.5316	461.5130	233.1216	87.2811	0.0000	0.0000	0.0000	0.0000	225.6457	493.7980	768.5003	(98)
Space heating efficiency (main heating system 1)	90.0000	90.0000	90.0000	90.0000	90.0000	0.0000	0.0000	0.0000	0.0000	90.0000	90.0000	90.0000	(210)
Space heating fuel (main heating system)	838.1330	659.4796	512.7922	259.0240	96.9790	0.0000	0.0000	0.0000	0.0000	250.7174	548.6644	853.8893	(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	188.2150	165.1968	171.8521	151.7780	147.0692	129.0248	121.6629	136.6264	137.3766	157.4966	169.3981	182.9187	(64)
Efficiency of water heater (217)m	89.3211	89.2603	89.0800	88.6692	87.9004	86.7000	86.7000	86.7000	86.7000	88.6135	89.1334	86.7000	(216)
Fuel for water heating, kWh/month	210.7173	185.0732	192.9188	171.1735	167.3135	148.8175	140.3263	157.5852	158.4506	177.7342	190.0500	204.7303	(219)
Water heating fuel used												2104.8903	(219)
Annual totals kWh/year													
Space heating fuel - main system												4019.6789	(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)												455.1332	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 1156 * 1.00) =										-749.2375		-749.2375	(233)
Total delivered energy for all uses												5905.4649	(238)

10a. Fuel costs - using BEDF prices (450)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4019.6789	3.9300	157.9734	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	2104.8903	3.9300	82.7222	(247)
Pumps and fans for heating	75.0000	17.5600	13.1700	(249)
Energy for lighting	455.1332	17.5600	79.9214	(250)
Additional standing charges			88.0000	(251)
Energy saving/generation technologies				
PV Unit	-749.2375	17.5600	-131.5661	(252)
Total energy cost			290.2209	(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	4019.6789	0.2160	868.2506	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2104.8903	0.2160	454.6563	(264)
Space and water heating			1322.9069	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	455.1332	0.5190	236.2141	(268)
Energy saving/generation technologies				
PV Unit	-749.2375	0.5190	-388.8543	(269)
Total kg/year			1209.1918	(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	4019.6789	1.2200	4904.0082	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2104.8903	1.2200	2567.9661	(264)
Space and water heating			7471.9744	(265)
Pumps and fans	75.0000	3.0700	230.2500	(267)
Energy for lighting	455.1332	3.0700	1397.2590	(268)
Energy saving/generation technologies				
PV Unit	-749.2375	3.0700	-2300.1591	(269)
Primary energy kWh/year			6799.3243	(272)
Primary energy kWh/m2/year			55.3150	(273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 88
Current environmental impact rating: B 89

(For testing purposes):

A	Not considered
B	Not considered
C	Not considered
D	Not considered
E Low energy lighting	Already installed
F	Not considered
G	Not considered
H	Not considered
I	Not considered
J	Not considered
K	Not considered
M	Not considered
N Solar water heating	Recommended
O	Not considered
P	Not considered
R	Not considered
S	Not considered
T	Not considered
U Solar photovoltaic panels	Already installed
A2	Not considered
A3	Not considered
T2	Not considered
W	Not considered
X	Not considered
Y	Not considered
J2	Not considered
Q2	Not considered
Z1	Not considered
Z2	Not considered
Z3	Not considered
Z4	Not considered
Z5	Not considered
V2 Wind turbine	Not applicable
L2	Not considered
Q3	Not considered
O3	Not considered

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.0	-£ 32	-200 kg (16.6%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£32 1.63 kg/m²	B 89	B 90
Total Savings	£32 1.63 kg/m²		

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

Fuel prices for cost data on this page from database revision number 450 TEST (30 Oct 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	£93	£102	-£9
Mains gas	£329	£288	£41
Space heating	£259	£259	£0
Water heating	£83	£50	£32
Lighting	£80	£80	£0
Generated (PV)	-£132	-£132	£0
Total cost of fuels	£290	£258	£32
Total cost of uses	£290	£257	£32
Delivered energy	48 kWh/m²	40 kWh/m²	8 kWh/m²
Carbon dioxide emissions	1.2 tonnes	1.0 tonnes	0.2 tonnes
CO2 emissions per m²	10 kg/m²	8 kg/m²	2 kg/m²
Primary energy	55 kWh/m²	46 kWh/m²	9 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	61.4600 (1b)	x 2.3100 (2b)	= 141.9726 (1b) - (3b)
First floor	61.4600 (1c)	x 2.4800 (2c)	= 152.4208 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	122.9200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 294.3934 (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) = 0.1359 (8)
Pressure test					Yes
Measured/design AP50					4.6900
Infiltration rate					0.3704 (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) =	0.3148 (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	0.4014	0.3935	0.3857	0.3463	0.3384	0.2991	0.2991	0.2912	0.3148	0.3384	0.3542	0.3699 (22b)
Effective ac	0.5806	0.5774	0.5744	0.5600	0.5573	0.5447	0.5447	0.5424	0.5496	0.5573	0.5627	0.5684 (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
Window (Uw = 1.40)			21.2100	1.3258	28.1193		(27)
French (Uw = 1.40)			5.8000	1.3258	7.6894		(27)
Heat Loss Floor 1			61.4600	0.1600	9.8336	75.0000	4609.5000 (28a)
100mm Knauf Supafil	155.7700	27.0100	128.7600	0.2500	32.1900	60.0000	7725.6000 (29a)
External Roof 1	61.4600		61.4600	0.1300	7.9898	9.0000	553.1400 (30)
Total net area of external elements Aum(A, m ²)			278.6900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	85.8221		(33)
GF			24.7700			39.0000	966.0300 (32c)
GF			71.1300			9.0000	640.1700 (32c)
FF			131.0000			9.0000	1179.0000 (32c)
Internal Floor 1			61.4600			18.0000	1106.2800 (32d)
Internal Floor 1			61.4600			18.0000	1106.2800 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 17886.0000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 145.5093 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 8.9388 (36)
Total fabric heat loss (33) + (36) = 94.7609 (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	56.4011	56.0972	55.7993	54.4001	54.1384	52.9198	52.9198	52.6941	53.3891	54.1384	54.6679	55.2216 (38)
Heat transfer coeff	151.1620	150.8581	150.5602	149.1611	148.8993	147.6807	147.6807	147.4550	148.1501	148.8993	149.4289	149.9825 (39)
Average = Sum(39)m / 12 =												149.1598 (39)
HLP	1.2298	1.2273	1.2249	1.2135	1.2114	1.2014	1.2014	1.1996	1.2053	1.2114	1.2157	1.2202 (40)
HLP (average)												1.2135 (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												2.8739 (42)
Average daily hot water use (litres/day)												102.4557 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	112.7013	108.6031	104.5048	100.4066	96.3084	92.2101	92.2101	96.3084	100.4066	104.5048	108.6031	112.7013 (44)
Energy conte	167.1328	146.1754	150.8399	131.5059	126.1830	108.8863	100.8992	115.7833	117.1661	136.5458	149.0505	161.8591 (45)
Energy content (annual)										Total = Sum(45)m =		1612.0273 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	25.0699	21.9263	22.6260	19.7259	18.9275	16.3330	15.1349	17.3675	17.5749	20.4819	22.3576	24.2789 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	21.0823	19.0215	21.0122	20.2722	20.8861	20.1384	20.7637	20.8431	20.2105	20.9507	20.3476	21.0596 (61)
Total heat required for water heating calculated for each month	188.2150	165.1968	171.8521	151.7780	147.0692	129.0248	121.6629	136.6264	137.3766	157.4966	169.3981	182.9187 (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												1.1250 (H8)
Utilisation factor												0.5889 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												102.4557 (H14)
Volume ratio Veff/V												0.7320 (H15)
Solar storage volume factor												0.9376 (H16)
Solar input	-25.5322	-42.6060	-72.5628	-97.2485	-120.1423	-118.1190	-116.5580	-101.8373	-79.7590	-54.4660	-30.2849	-880.4822 (H17)
Solar input (sum of months) = Sum (63)m =												-880.4822 (63)
Output from w/h	162.6828	122.5909	99.2893	54.5296	26.9269	10.9058	5.1048	34.7891	57.6176	103.0305	139.1132	161.5526 (64)
Total per year (kWh/year) = Sum (64)m =												978.1330 (64)
Heat gains from water heating, kWh/month	60.8422	53.3587	55.4073	48.7937	47.1774	41.2393	38.7399	43.7087	44.0104	50.6392	54.6462	59.0831 (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	172.4355	172.4355	172.4355	172.4355	172.4355	172.4355	172.4355	172.4355	172.4355	172.4355	172.4355	172.4355	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	64.4288	57.2251	46.5386	35.2327	26.3369	22.2347	24.0254	31.2291	41.9156	53.2215	62.1173	66.2195	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	431.2946	435.7701	424.4920	400.4823	370.1744	341.6892	322.6593	318.1838	329.4619	353.4716	383.7796	412.2648	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.1175	55.1175	55.1175	55.1175	55.1175	55.1175	55.1175	55.1175	55.1175	55.1175	55.1175	55.1175	(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)	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570	(71)
Water heating gains (Table 5)	81.7772	79.4028	74.4722	67.7691	63.4105	57.2768	52.0698	58.7483	61.1255	68.0634	75.8975	79.4127	(72)
Total internal gains	693.0966	687.9940	661.0988	619.0801	575.5177	536.7967	514.3504	523.7571	548.0990	590.3525	637.3903	673.4929	(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					2.4600	11.2829	0.7100	0.7000			0.7700	9.5598 (75)
Southeast					4.2500	36.7938	0.7100	0.7000			0.7700	53.8584 (77)
Southwest					2.8400	36.7938	0.7100	0.7000			0.7700	35.9901 (79)
Northwest					11.6600	11.2829	0.7100	0.7000			0.7700	45.3117 (81)
Southeast					5.8000	36.7938	0.7100	0.7000			0.7700	73.5009 (77)
Solar gains	218.2209	389.9370	581.9405	802.1980	972.5945	998.1403	948.7558	816.6517	657.4315	444.0165	264.6975	184.6039 (83)
Total gains	911.3175	1077.9309	1243.0393	1421.2781	1548.1122	1534.9369	1463.1062	1340.4088	1205.5305	1034.3690	902.0878	858.0968 (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	32.8676	32.9338	32.9990	33.3085	33.3671	33.6424	33.6424	33.6939	33.5358	33.3671	33.2488	33.1261
alpha	3.1912	3.1956	3.1999	3.2206	3.2245	3.2428	3.2428	3.2463	3.2357	3.2245	3.2166	3.2084
util living area	0.9749	0.9571	0.9216	0.8450	0.7191	0.5595	0.4258	0.4770	0.6976	0.8895	0.9601	0.9790 (86)
MIT	19.1729	19.4386	19.8397	20.3226	20.6953	20.9028	20.9698	20.9562	20.7962	20.2947	19.6425	19.1193 (87)
Th 2	19.8963	19.8982	19.9002	19.9092	19.9109	19.9189	19.9189	19.9203	19.9158	19.9109	19.9075	19.9039 (88)
util rest of house	0.9699	0.9487	0.9062	0.8150	0.6668	0.4815	0.3285	0.3762	0.6241	0.8609	0.9509	0.9747 (89)
MIT 2	17.4857	17.8687	18.4407	19.1143	19.5981	19.8424	19.9032	19.8958	19.7359	19.0958	18.1736	17.4130 (90)
Living area fraction												
MIT	17.7245	18.0909	18.6388	19.2853	19.7535	19.9925	20.0542	20.0459	19.8860	19.2655	18.3815	17.6545 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.5745	17.9409	18.4888	19.1353	19.6035	19.8425	19.9042	19.8959	19.7360	19.1155	18.2315	17.5045 (93)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9544	0.9281	0.8807	0.7896	0.6504	0.4757	0.3271	0.3737	0.6104	0.8344	0.9308	0.9609	(94)
Useful gains	869.7249	1000.4634	1094.7791	1122.2536	1006.8874	730.0973	478.6363	500.9743	735.8493	863.0584	839.6786	824.5124	(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	2006.5995	1967.3246	1805.0303	1526.7124	1176.8186	774.2158	487.9658	515.4854	834.9748	1267.9466	1663.3699	1995.4436	(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	845.8347	649.7307	528.4268	291.2103	126.4288	0.0000	0.0000	0.0000	0.0000	301.2369	593.0577	871.1728	(98)
Space heating												4207.0988	(98)
Space heating per m2											(98) / (4) =	34.2263	(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 %)													90.0000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													4674.5542 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	845.8347	649.7307	528.4268	291.2103	126.4288	0.0000	0.0000	0.0000	0.0000	301.2369	593.0577	871.1728	(98)
Space heating efficiency (main heating system 1)	90.0000	90.0000	90.0000	90.0000	90.0000	0.0000	0.0000	0.0000	0.0000	90.0000	90.0000	90.0000	(210)
Space heating fuel (main heating system)	939.8163	721.9230	587.1409	323.5670	140.4764	0.0000	0.0000	0.0000	0.0000	334.7076	658.9530	967.9698	(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	162.6828	122.5909	99.2893	54.5296	26.9269	10.9058	5.1048	34.7891	57.6176	103.0305	139.1132	161.5526	(64)
Efficiency of water heater	89.4508	89.4595	89.4614	89.4629	89.4025	86.7000	86.7000	86.7000	86.7000	89.1353	89.3538	89.4673	(216)
Fuel for water heating, kWh/month	181.8685	137.0351	110.9856	60.9521	30.1187	12.5788	5.8879	40.1258	66.4563	115.5889	155.6880	180.5717	(219)
Water heating fuel used												1097.8573	(219)
Annual totals kWh/year													
Space heating fuel - main system												4674.5542	(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)												455.1332	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 1029 * 1.00) =										-666.9130		-666.9130	(233)
Total delivered energy for all uses												5685.6318	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4674.5542	3.4800	162.6745	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1097.8573	3.4800	38.2054	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Pump for solar water heating	50.0000	13.1900	6.5950	(249)
Energy for lighting	455.1332	13.1900	60.0321	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-666.9130	13.1900	-87.9658	(252)
Total energy cost			309.4337	(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] =	0.7740 (257)
SAP value		89.2034
SAP rating (Section 12)		89 (258)
SAP band		B

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	4674.5542	0.2160	1009.7037 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1097.8573	0.2160	237.1372 (264)
Space and water heating			1246.8409 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	455.1332	0.5190	236.2141 (268)
Energy saving/generation technologies			
PV Unit	-666.9130	0.5190	-346.1278 (269)
Total kg/year			1201.8022 (272)
CO2 emissions per m2			9.7800 (273)
EI value			90.4096
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	61.4600 (1b)	x 2.3100 (2b)	= 141.9726 (1b) - (3b)
First floor	61.4600 (1c)	x 2.4800 (2c)	= 152.4208 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	122.9200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 294.3934 (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) = 0.1359 (8)
Pressure test					Yes
Measured/design AP50					4.6900
Infiltration rate					0.3704 (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) =	0.3148 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000 (22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250 (22a)
Adj infilt rate												
Effective ac	0.3306	0.3069	0.3148	0.2991	0.2991	0.2912	0.2833	0.2755	0.2676	0.2912	0.2755	0.2912 (22b)
	0.5546	0.5471	0.5496	0.5447	0.5447	0.5424	0.5401	0.5379	0.5358	0.5424	0.5379	0.5424 (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
Window (Uw = 1.40)			21.2100	1.3258	28.1193		(27)
French (Uw = 1.40)			5.8000	1.3258	7.6894		(27)
Heat Loss Floor 1			61.4600	0.1600	9.8336	75.0000	4609.5000 (28a)
100mm Knauf Supafil	155.7700	27.0100	128.7600	0.2500	32.1900	60.0000	7725.6000 (29a)
External Roof 1	61.4600		61.4600	0.1300	7.9898	9.0000	553.1400 (30)
Total net area of external elements Aum(A, m ²)			278.6900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	85.8221		(33)
GF			24.7700			39.0000	966.0300 (32c)
GF			71.1300			9.0000	640.1700 (32c)
FF			131.0000			9.0000	1179.0000 (32c)
Internal Floor 1			61.4600			18.0000	1106.2800 (32d)
Internal Floor 1			61.4600			18.0000	1106.2800 (32e)

Heat capacity Cm = Sum(A x k)
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
 Thermal bridges (Sum(L x Psi) calculated using Appendix K)
 Total fabric heat loss
 (28)...(30) + (32) + (32a)...(32e) = 17886.0000 (34)
 145.5093 (35)
 8.9388 (36)
 (33) + (36) = 94.7609 (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	53.8826	53.1514	53.3891	52.9198	52.9198	52.6941	52.4744	52.2608	52.0532	52.6941	52.2608	52.6941 (38)
Heat transfer coeff	148.6435	147.9124	148.1501	147.6807	147.6807	147.4550	147.2354	147.0217	146.8141	147.4550	147.0217	147.4550 (39)
Average = Sum(39)m / 12 =												147.5438 (39)
HLP	1.2093	1.2033	1.2053	1.2014	1.2014	1.1996	1.1978	1.1961	1.1944	1.1996	1.1961	1.1996 (40)
HLP (average)												1.2003 (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												2.8739 (42)
Average daily hot water use (litres/day)												102.4557 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.7013	108.6031	104.5048	100.4066	96.3084	92.2101	92.2101	96.3084	100.4066	104.5048	108.6031	112.7013 (44)
Energy conte	167.1328	146.1754	150.8399	131.5059	126.1830	108.8863	100.8992	115.7833	117.1661	136.5458	149.0505	161.8591 (45)
Energy content (annual)										Total = Sum(45)m =		1612.0273 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Distribution loss (46)m = 0.15 x (45)m	25.0699	21.9263	22.6260	19.7259	18.9275	16.3330	15.1349	17.3675	17.5749	20.4819	22.3576	24.2789 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	21.0823	19.0215	21.0122	20.2722	20.8861	20.1384	20.7637	20.8431	20.2105	20.9507	20.3476	21.0596 (61)
Total heat required for water heating calculated for each month	188.2150	165.1968	171.8521	151.7780	147.0692	129.0248	121.6629	136.6264	137.3766	157.4966	169.3981	182.9187 (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												1208.1510 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												2029.6937 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.2591 (H8)
Utilisation factor												0.5481 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												102.4557 (H14)
Volume ratio Veff/V												0.7320 (H15)
Solar storage volume factor												0.9376 (H16)
Solar input												-917.1094 (H17)
Solar input	-29.9183	-42.5420	-73.1194	-98.6550	-115.8762	-123.7741	-121.1711	-108.4518	-84.9103	-58.7041	-35.3855	-24.6016 (63)
Solar input (sum of months) = Sum (63)m =												-917.1094 (63)
Output from w/h	158.2967	122.6549	98.7327	53.1230	31.1929	5.2507	0.4918	28.1746	52.4664	98.7925	134.0126	158.3172 (64)
Total per year (kWh/year) = Sum (64)m =												941.5058 (64)
Heat gains from water heating, kWh/month	60.8422	53.3587	55.4073	48.7937	47.1774	41.2393	38.7399	43.7087	44.0104	50.6392	54.6462	59.0831 (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	172.4355	172.4355	172.4355	172.4355	172.4355	172.4355	172.4355	172.4355	172.4355	172.4355	172.4355	172.4355	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	64.4288	57.2251	46.5386	35.2327	26.3369	22.2347	24.0254	31.2291	41.9156	53.2215	62.1173	66.2195	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	431.2946	435.7701	424.4920	400.4823	370.1744	341.6892	322.6593	318.1838	329.4619	353.4716	383.7796	412.2648	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.1175	55.1175	55.1175	55.1175	55.1175	55.1175	55.1175	55.1175	55.1175	55.1175	55.1175	55.1175	(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)	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570	(71)
Water heating gains (Table 5)	81.7772	79.4028	74.4722	67.7691	63.4105	57.2768	52.0698	58.7483	61.1255	68.0634	75.8975	79.4127	(72)
Total internal gains	693.0966	687.9940	661.0988	619.0801	575.5177	536.7967	514.3504	523.7571	548.0990	590.3525	637.3903	673.4929	(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					2.4600	14.6176		0.7100	0.7000	0.7700		12.3852 (75)				
Southeast					4.2500	45.1778		0.7100	0.7000	0.7700		66.1308 (77)				
Southwest					2.8400	45.1778		0.7100	0.7000	0.7700		44.1909 (79)				
Northwest					11.6600	14.6176		0.7100	0.7000	0.7700		58.7037 (81)				
Southeast					5.8000	45.1778		0.7100	0.7000	0.7700		90.2491 (77)				
Solar gains					271.6598	414.6651	627.8861	876.6733	1013.6742	1131.0133	1066.2896	938.3852	751.3373	510.5944	328.7616	225.7133 (83)
Total gains					964.7563	1102.6591	1288.9849	1495.7533	1589.1919	1667.8100	1580.6400	1462.1424	1299.4363	1100.9468	966.1519	899.2062 (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	33.4245	33.5897	33.5358	33.6424	33.6424	33.6939	33.7442	33.7932	33.8410	33.6939	33.7932	33.6939
alpha	3.2283	3.2393	3.2357	3.2428	3.2428	3.2463	3.2496	3.2529	3.2561	3.2463	3.2529	3.2463
util living area	0.9675	0.9509	0.9063	0.8103	0.6677	0.4754	0.3546	0.3806	0.6231	0.8502	0.9442	0.9725 (86)
MIT	19.3608	19.5674	19.9816	20.4528	20.7816	20.9463	20.9845	20.9810	20.8701	20.4601	19.8576	19.3283 (87)
Th 2	19.9126	19.9173	19.9158	19.9189	19.9189	19.9203	19.9217	19.9231	19.9245	19.9203	19.9231	19.9203 (88)
util rest of house	0.9610	0.9413	0.8881	0.7750	0.6086	0.3950	0.2603	0.2805	0.5417	0.8123	0.9312	0.9669 (89)
MIT 2	17.7672	18.0654	18.6501	19.2934	19.7073	19.8832	19.9152	19.9149	19.8202	19.3232	18.4904	17.7260 (90)
Living area fraction									fLA = Living area / (4) =			0.1416 (91)
MIT	17.9928	18.2780	18.8386	19.4576	19.8593	20.0337	20.0665	20.0658	19.9688	19.4841	18.6840	17.9529 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.8428	18.1280	18.6886	19.3076	19.7093	19.8837	19.9165	19.9158	19.8188	19.3341	18.5340	17.8029 (93)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9432	0.9198	0.8622	0.7519	0.5961	0.3921	0.2598	0.2798	0.5329	0.7872	0.9083	0.9507	(94)
Useful gains	909.9884	1014.1948	1111.3520	1124.6059	947.3675	653.9919	410.7223	409.0705	692.4947	866.6408	877.5930	854.9147	(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	1923.8589	1897.4264	1731.6651	1448.3859	1064.6808	675.8825	414.6912	413.9895	751.5108	1169.9280	1563.4236	1887.8452	(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	754.3197	593.5316	461.5130	233.1216	87.2811	0.0000	0.0000	0.0000	0.0000	225.6457	493.7980	768.5003	(98)
Space heating												3617.7110	(98)
Space heating per m2											(98) / (4) =	29.4314	(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 %)													90.0000	(206)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement													4019.6789	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	754.3197	593.5316	461.5130	233.1216	87.2811	0.0000	0.0000	0.0000	0.0000	225.6457	493.7980	768.5003	(98)	
Space heating efficiency (main heating system 1)	90.0000	90.0000	90.0000	90.0000	90.0000	0.0000	0.0000	0.0000	0.0000	90.0000	90.0000	90.0000	(210)	
Space heating fuel (main heating system)	838.1330	659.4796	512.7922	259.0240	96.9790	0.0000	0.0000	0.0000	0.0000	250.7174	548.6644	853.8893	(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	158.2967	122.6549	98.7327	53.1230	31.1929	5.2507	0.4918	28.1746	52.4664	98.7925	134.0126	158.3172	(64)	
Efficiency of water heater	89.4097	89.4171	89.4003	89.3687	89.1070	86.7000	86.7000	86.7000	86.7000	88.9688	89.2747	86.7000	(216)	
Fuel for water heating, kWh/month	177.0464	137.1716	110.4389	59.4426	35.0061	6.0561	0.5672	32.4966	60.5148	111.0417	150.1127	177.0517	(219)	
Water heating fuel used												1056.9463	(219)	
Annual totals kWh/year														
Space heating fuel - main system													4019.6789	(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)													455.1332	(232)
Energy saving/generation technologies (Appendices M, N and Q)														
PV Unit 0 (0.80 * 0.81 * 1156 * 1.00) =										-749.2375			-749.2375	(233)
Total delivered energy for all uses													4907.5209	(238)

10a. Fuel costs - using BEDF prices (450)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4019.6789	3.9300	157.9734	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1056.9463	3.9300	41.5380	(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	455.1332	17.5600	79.9214	(250)
Additional standing charges			88.0000	(251)
Energy saving/generation technologies				
PV Unit	-749.2375	17.5600	-131.5661	(252)
Total energy cost			257.8167	(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	4019.6789	0.2160	868.2506	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1056.9463	0.2160	228.3004	(264)
Space and water heating			1096.5510	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	455.1332	0.5190	236.2141	(268)
Energy saving/generation technologies				

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PV Unit	-749.2375	0.5190	-388.8543 (269)
Total kg/year			1008.7859 (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	4019.6789	1.2200	4904.0082 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1056.9463	1.2200	1289.4745 (264)
Space and water heating			6193.4828 (265)
Pumps and fans	125.0000	3.0700	383.7500 (267)
Energy for lighting	455.1332	3.0700	1397.2590 (268)
Energy saving/generation technologies			
PV Unit	-749.2375	3.0700	-2300.1591 (269)
Primary energy kWh/year			5674.3327 (272)
Primary energy kWh/m2/year			46.1628 (273)

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

Overheating Calculation Input Data

Dwelling type	Detached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	North West
Overshading	Average or unknown
Thermal mass parameter	145.5 (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	388.60 (P1)
Transmission heat loss coefficient	94.76 (37)
Summer heat loss coefficient	483.36 (P2)

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

Solar shading Orientation	Z blinds	Solar access	Z overhangs	Z summer
North East	1.000	0.90	1.000	0.900 (P8)
South East	1.000	0.90	1.000	0.900 (P8)
South West	1.000	0.90	1.000	0.900 (P8)
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	2.4600	106.0502	0.7100	0.7000	0.9000	105.0239
South East	4.2500	127.3119	0.7100	0.7000	0.9000	217.8207
South West	2.8400	127.3119	0.7100	0.7000	0.9000	145.5555
North West	11.6600	106.0502	0.7100	0.7000	0.9000	497.7961
South East	5.8000	127.3119	0.7100	0.7000	0.9000	297.2612

total: 1263.4574

	Jun	Jul	Aug	
Solar gains	1362	1263	1108	(P3)
Internal gains	534	511	521	
Total summer gains	1896	1775	1629	(P5)

Summer gain/loss ratio	3.92	3.67	3.37	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 145.5)	0.98	0.98	0.98	
Threshold temperature	20.30	21.95	21.65	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	

Assessment of likelihood of high internal temperature: Slight