

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



Property Reference	4907-0015-3817-142				Issued on Date	15/03/2018
Assessment Reference	As Built	Prop Type Ref	P404 - Det (As)			
Property	33, Appleby Drive, Botley, SOUTHAMPTON, SO32 2GE					
SAP Rating	88 B	DER	12.94	TER	16.20	
Environmental	89 B	% DER<TER	20.15			
CO ₂ Emissions (t/year)	1.25	DFEE	48.17	TFEE	53.08	
General Requirements Compliance	Pass	% DFEE<TFEE	9.25			
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) 12.94 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)53.1 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)48.2 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: 11.66 m², No overhang
Windows facing South East: 2.84 m², No overhang
Windows facing South West: 10.05 m², No overhang
Windows facing North West: 2.46 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) (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)

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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					11.6600	11.2829	0.6200	0.7000	0.7700			39.5680 (75)
Southeast					2.8400	36.7938	0.6200	0.7000	0.7700			31.4280 (77)
Southwest					4.2500	36.7938	0.6200	0.7000	0.7700			47.0313 (79)
Northwest					2.4600	11.2829	0.6200	0.7000	0.7700			8.3480 (81)
Southwest					5.8000	36.7938	0.6200	0.7000	0.7700			64.1839 (79)
Solar gains	190.5591	340.5083	508.1734	700.5110	849.3079	871.6155	828.4910	713.1324	574.0951	387.7327	231.1443	161.2034 (83)
Total gains	656.1840	803.8760	954.7796	1119.8052	1240.3788	1235.8268	1175.4615	1066.6644	941.8352	783.0196	658.1298	612.4302 (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	0.9899	0.9803	0.9588	0.9058	0.8035	0.6538	0.5135	0.5735	0.7942	0.9419	0.9829	0.9919 (86)
MIT	18.9061	19.1663	19.5824	20.1133	20.5644	20.8457	20.9480	20.9251	20.6917	20.0898	19.3967	18.8589 (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	0.9878	0.9761	0.9498	0.8843	0.7577	0.5732	0.4024	0.4613	0.7289	0.9242	0.9786	0.9901 (89)
MIT 2	17.1001	17.4790	18.0809	18.8382	19.4462	19.7918	19.8905	19.8758	19.6274	18.8216	17.8226	17.0357 (90)
Living area fraction	17.3557	17.7179	18.2934	19.0187	19.6045	19.9409	20.0402	20.0243	19.7781	19.0011	18.0454	17.2938 (91)
MIT	17.3557	17.7179	18.2934	19.0187	19.6045	19.9409	20.0402	20.0243	19.7781	19.0011	18.0454	17.2938 (92)
Temperature adjustment	17.2057	17.5679	18.1434	18.8687	19.4545	19.7909	19.8902	19.8743	19.6281	18.8511	17.8954	17.1438 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9793	0.9626	0.9293	0.8580	0.7353	0.5626	0.3992	0.4561	0.7081	0.9003	0.9661	0.9830 (94)
Ext temp.	642.5872	773.8181	887.3167	960.8421	912.0009	695.3367	469.2643	486.5401	666.8682	704.9281	635.8325	602.0001 (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	1950.8532	1911.0504	1753.0394	1486.9482	1154.6370	766.6020	485.9034	512.3097	818.9842	1228.5835	1613.1491	1941.3457 (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	973.3499	764.2201	644.0977	378.7964	180.5213	0.0000	0.0000	0.0000	0.0000	389.5996	703.6679	996.4731 (98)
Space heating per m2												5030.7260 (98)
												(98) / (4) = 40.9268 (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	5589.6956 (211)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	973.3499	764.2201	644.0977	378.7964	180.5213	0.0000	0.0000	0.0000	0.0000	389.5996	703.6679	996.4731 (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)	1081.4999	849.1335	715.6641	420.8849	200.5792	0.0000	0.0000	0.0000	0.0000	432.8884	781.8533	1107.1923 (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	89.4483	89.3952	89.2843	89.0306	88.4879	86.7000	86.7000	86.7000	86.7000	89.0245	89.3402	86.7000 (216)
Fuel for water heating, kWh/month	210.4176	184.7938	192.4775	170.4785	166.2025	148.8175	140.3263	157.5852	158.4506	176.9137	189.6101	204.4428 (219)
Water heating fuel used	2100.5161 (219)											
Annual totals kWh/year	2100.5161 (219)											
Space heating fuel - main system	5589.6956 (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												7553.4319 (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	5589.6956	0.2160	1207.3742 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2100.5161	0.2160	453.7115 (264)
Space and water heating			1661.0857 (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			1590.0970 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			12.9400 (273)

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

DER		12.9400 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		28.3999 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		28.3999 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 (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	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)

FULL SAP CALCULATION PRINTOUT

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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					11.6600	11.2829	0.6300	0.7000	0.7700		40.2062 (75)	
Southeast					2.8400	36.7938	0.6300	0.7000	0.7700		31.9349 (77)	
Southwest					10.0500	36.7938	0.6300	0.7000	0.7700		113.0090 (79)	
Northwest					2.4600	11.2829	0.6300	0.7000	0.7700		8.4826 (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					11.6600	11.2829	0.6200	0.7000	0.7700		39.5680 (75)					
Southeast					2.8400	36.7938	0.6200	0.7000	0.7700		31.4280 (77)					
Southwest					4.2500	36.7938	0.6200	0.7000	0.7700		47.0313 (79)					
Northwest					2.4600	11.2829	0.6200	0.7000	0.7700		8.3480 (81)					
Southwest					5.8000	36.7938	0.6200	0.7000	0.7700		64.1839 (79)					
Solar gains					190.5591	340.5083	508.1734	700.5110	849.3079	871.6155	828.4910	713.1324	574.0951	387.7327	231.1443	161.2034 (83)
Total gains					619.1430	767.6968	920.3900	1087.8486	1210.0085	1207.6866	1149.2104	1037.9859	912.2900	750.9561	623.2230	576.2474 (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	0.9906	0.9812	0.9602	0.9082	0.8079	0.6606	0.5211	0.5829	0.8013	0.9448	0.9841	0.9925	(86)
MIT	18.8203	19.0876	19.5160	20.0642	20.5332	20.8306	20.9414	20.9158	20.6656	20.0382	19.3241	18.7726	(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	0.9886	0.9773	0.9516	0.8875	0.7633	0.5808	0.4096	0.4708	0.7378	0.9282	0.9801	0.9909	(89)
MIT 2	17.9055	18.1721	18.5962	19.1340	19.5682	19.8222	19.8966	19.8854	19.6994	19.1207	18.4156	17.8635	(90)
Living area fraction	18.0350	18.3017	18.7264	19.2656	19.7048	19.9649	20.0445	20.0312	19.8362	19.2506	18.5442	17.9922	(92)
Temperature adjustment	18.0350	18.3017	18.7264	19.2656	19.7048	19.9649	20.0445	20.0312	19.8362	19.2506	18.5442	17.9922	(93)
adjusted MIT	18.0350	18.3017	18.7264	19.2656	19.7048	19.9649	20.0445	20.0312	19.8362	19.2506	18.5442	17.9922	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	609.1504	744.2267	864.7182	949.1591	911.8755	705.9011	486.6026	501.6604	668.1466	687.1205	606.4573	568.6959	(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	2076.2041	2021.7578	1840.8119	1546.1494	1191.9040	792.2986	508.6856	535.4428	849.8129	1288.0645	1710.0966	2068.5821	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	1091.4880	858.5009	726.2137	429.8330	208.3412	0.0000	0.0000	0.0000	0.0000	447.1023	794.6203	1115.9153	(98)
Space heating												5672.0147	(98)
Space heating per m2												46.1440	(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	0.7954	0.8563	0.8209	0.0000	0.0000	0.0000	0.0000 (101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1104.1577	935.8318	919.9224	0.0000	0.0000	0.0000	0.0000 (102)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1527.4277	1456.4654	1328.6101	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	304.7544	387.3514	304.0637	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction									FC = cooled area / (4) =			996.1695 (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	76.1886	96.8378	76.0159	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling per m2												249.0424 (107)
Energy for space heating												2.0261 (108)
Energy for space cooling												46.1440 (99)
Total												2.0261 (108)
Dwelling Fabric Energy Efficiency (DFEE)												48.1700 (109)
												48.2 (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	=	0 * 40 =	0.0000 (6a)				
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000 (6b)				
Number of intermittent fans							4 * 10 =	40.0000 (7a)				
Number of passive vents							0 * 10 =	0.0000 (7b)				
Number of flueless gas fires							0 * 40 =	0.0000 (7c)				
Air changes per hour												
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =						40.0000 / (5) =	0.1359 (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)				
Wind speed	Jan 5.1000	Feb 5.0000	Mar 4.9000	Apr 4.4000	May 4.3000	Jun 3.8000	Jul 3.8000	Aug 3.7000	Sep 4.0000	Oct 4.3000	Nov 4.5000	Dec 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 m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	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, m2)			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/m2K							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 57.0698	Feb 56.7399	Mar 56.4166	Apr 54.8979	May 54.6138	Jun 53.2910	Jul 53.2910	Aug 53.0461	Sep 53.8005	Oct 54.6138	Nov 55.1886	Dec 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)
HLP	Jan 1.1742	Feb 1.1715	Mar 1.1689	Apr 1.1566	May 1.1543	Jun 1.1435	Jul 1.1435	Aug 1.1415	Sep 1.1476	Oct 1.1543	Nov 1.1589	Dec 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)
Daily hot water use	Jan 112.7013	Feb 108.6031	Mar 104.5048	Apr 100.4066	May 96.3084	Jun 92.2101	Jul 92.2101	Aug 96.3084	Sep 100.4066	Oct 104.5048	Nov 108.6031	Dec 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 (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)

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					11.6600	11.2829	0.6300	0.7000	0.7700		40.2062 (75)	
Southeast					2.8400	36.7938	0.6300	0.7000	0.7700		31.9349 (77)	
Southwest					10.0500	36.7938	0.6300	0.7000	0.7700		113.0090 (79)	
Northwest					2.4600	11.2829	0.6300	0.7000	0.7700		8.4826 (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, Thl (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	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

	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)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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)

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	Solar input (sum of months) = Sum(63)m =					0.0000 (63)
								136.6264	137.3766	157.4966	169.3981	182.9187 (64)	
								Total per year (kWh/year) = Sum(64)m =					1858.6152 (64)
RHI water heating demand												1859 (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)	

[illegible]

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)

												2.8739 (42)
Assumed occupancy												
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	11.6600				11.2829	0.6200	0.7000	0.7700	39.5680 (75)			
Southeast	2.8400				36.7938	0.6200	0.7000	0.7700	31.4280 (77)			
Southwest	4.2500				36.7938	0.6200	0.7000	0.7700	47.0313 (79)			
Northwest	2.4600				11.2829	0.6200	0.7000	0.7700	8.3480 (81)			
Southwest	5.8000				36.7938	0.6200	0.7000	0.7700	64.1839 (79)			
Solar gains	190.5591	340.5083	508.1734	700.5110	849.3079	871.6155	828.4910	713.1324	574.0951	387.7327	231.1443	161.2034 (83)
Total gains	883.6557	1028.5023	1169.2722	1319.5910	1424.8255	1408.4121	1342.8414	1236.8896	1122.1941	978.0852	868.5346	834.6963 (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	0.9769	0.9620	0.9321	0.8663	0.7523	0.5969	0.4590	0.5102	0.7271	0.9022	0.9639	0.9805 (86)
MIT	19.1448	19.3913	19.7774	20.2577	20.6488	20.8824	20.9624	20.9468	20.7681	20.2524	19.6100	19.0951 (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	0.9723	0.9544	0.9184	0.8388	0.7020	0.5172	0.3560	0.4048	0.6552	0.8760	0.9554	0.9766 (89)
MIT 2	17.4452	17.8015	18.3544	19.0299	19.5453	19.8247	19.8990	19.8899	19.7078	19.0403	18.1276	17.3781 (90)
Living area fraction									fLA = Living area / (4) =			0.1416 (91)
MIT	17.6858	18.0265	18.5559	19.2037	19.7015	19.9745	20.0496	20.0395	19.8579	19.2119	18.3374	17.6211 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.5358	17.8765	18.4059	19.0537	19.5515	19.8245	19.8996	19.8895	19.7079	19.0619	18.1874	17.4711 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	846.0742	961.5890	1045.0185	1072.4485	973.3337	717.8115	475.5261	496.6849	717.5646	830.8787	813.1360	804.0852 (95)
Ext temp.	4.3000	4.9000	6.5000	8.0000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	2000.7455	1957.6122	1792.5478	1514.5403	1169.0807	771.5521	487.2832	514.5467	830.8067	1259.9711	1656.7828	1990.4343 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	859.0755	669.3276	556.1618	318.3061	145.6358	0.0000	0.0000	0.0000	0.0000	319.2448	607.4257	882.6437 (98)
Space heating												4357.8210 (98)
Space heating per m2										(98) / (4) =		35.4525 (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													4842.0233 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	859.0755	669.3276	556.1618	318.3061	145.6358	0.0000	0.0000	0.0000	0.0000	319.2448	607.4257	882.6437	(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)	954.5283	743.6974	617.9575	353.6734	161.8176	0.0000	0.0000	0.0000	0.0000	354.7164	674.9174	980.7153	(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	89.3885	89.3270	89.1986	88.9074	88.3111	86.7000	86.7000	86.7000	86.7000	88.8824	89.2591	86.7000	(216)
Fuel for water heating, kWh/month	210.5583	184.9350	192.6624	170.7148	166.5353	148.8175	140.3263	157.5852	158.4506	177.1966	189.7823	204.5710	(219)
Water heating fuel used												2102.1353	(219)
Annual totals kWh/year													
Space heating fuel - main system												4842.0233	(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												6807.3789	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	4842.0233	3.4800	168.5024 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2102.1353	3.4800	73.1543 (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			343.6155 (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] =	0.8594 (257)
SAP value		88.0107
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	4842.0233	0.2160	1045.8770 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2102.1353	0.2160	454.0612 (264)
Space and water heating			1499.9383 (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			1428.9496 (272)
CO2 emissions per m2			11.6300 (273)
EI value			88.5970
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	$3.48 / 0.8829 = 3.942$, stars = 4
Water heating environmental impact	$0.216 / 0.8829 = 0.2446$, 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	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)
Effective ac	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)					(28)...(30) + (32) + (32a)...(32e) =		17886.0000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							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	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)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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 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					11.6600	14.6176	0.6200	0.7000	0.7700			51.2624 (75)
Southeast					2.8400	45.1778	0.6200	0.7000	0.7700			38.5893 (77)
Southwest					4.2500	45.1778	0.6200	0.7000	0.7700			57.7480 (79)
Northwest					2.4600	14.6176	0.6200	0.7000	0.7700			10.8152 (81)
Southwest					5.8000	45.1778	0.6200	0.7000	0.7700			78.8091 (79)
Solar gains	237.2240	362.1019	548.2949	765.5457	885.1803	987.6454	931.1261	819.4350	656.0973	445.8711	287.0876	197.1017 (83)
Total gains	930.3206	1050.0959	1209.3937	1384.6257	1460.6980	1524.4421	1445.4765	1343.1921	1204.1963	1036.2236	924.4779	870.5947 (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	0.9705	0.9566	0.9190	0.8356	0.7035	0.5124	0.3851	0.4111	0.6563	0.8674	0.9500	0.9748 (86)
MIT	19.3265	19.5179	19.9178	20.3909	20.7438	20.9332	20.9802	20.9761	20.8482	20.4182	19.8193	19.2993 (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	0.9645	0.9480	0.9027	0.8029	0.6454	0.4282	0.2838	0.3043	0.5746	0.8322	0.9382	0.9696 (89)
MIT 2	17.7182	17.9955	18.5627	19.2152	19.6669	19.8733	19.9132	19.9127	19.8004	19.2706	18.4370	17.6844 (90)
Living area fraction									fLA = Living area / (4) =			0.1416 (91)
MIT	17.9458	18.2110	18.7545	19.3816	19.8193	20.0233	20.0642	20.0632	19.9487	19.4330	18.6327	17.9129 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.7958	18.0610	18.6045	19.2316	19.6693	19.8733	19.9142	19.9132	19.7987	19.2830	18.4827	17.7629 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9477	0.9276	0.8773	0.7783	0.6305	0.4243	0.2831	0.3033	0.5640	0.8064	0.9162	0.9543 (94)
Ext temp.	881.6214	974.0448	1061.0468	1077.7083	920.9888	646.8706	409.2346	407.3590	679.1509	835.5935	847.0196	830.7791 (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	1916.8806	1887.5134	1719.2131	1437.1724	1058.7681	674.3609	414.3569	413.6054	748.5673	1162.3892	1555.8860	1881.9611 (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	770.2329	613.8509	489.6757	258.8142	102.5078	0.0000	0.0000	0.0000	0.0000	243.1360	510.3839	782.0794 (98)
Space heating per m2												3770.6807 (98)
										(98) / (4) =		30.6759 (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													4189.6452 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	770.2329	613.8509	489.6757	258.8142	102.5078	0.0000	0.0000	0.0000	0.0000	243.1360	510.3839	782.0794	(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)	855.8143	682.0565	544.0841	287.5713	113.8976	0.0000	0.0000	0.0000	0.0000	270.1511	567.0932	868.9771	(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	89.3323	89.2794	89.1188	88.7513	88.0257	86.7000	86.7000	86.7000	86.7000	88.6732	89.1544	86.7000	(216)
Fuel for water heating, kWh/month	210.6909	185.0335	192.8348	171.0151	167.0753	148.8175	140.3263	157.5852	158.4506	177.6147	190.0053	204.7094	(219)
Water heating fuel used												2104.1586	(219)
Annual totals kWh/year													
Space heating fuel - main system												4189.6452	(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												6074.6996	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	4189.6452	3.9200	164.2341 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2104.1586	3.9200	82.4830 (247)
Pumps and fans for heating	75.0000	16.9600	12.7200 (249)
Energy for lighting	455.1332	16.9600	77.1906 (250)
Additional standing charges			88.0000 (251)
Energy saving/generation technologies			
PV Unit	-749.2375	16.9600	-127.0707 (252)
Total energy cost			297.5570 (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	4189.6452	0.2160	904.9634 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2104.1586	0.2160	454.4983 (264)
Space and water heating			1359.4616 (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			1245.7465 (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	4189.6452	1.2200	5111.3672 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2104.1586	1.2200	2567.0735 (264)
Space and water heating			7678.4407 (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			7005.7906 (272)
Primary energy kWh/m2/year			56.9947 (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	-£ 33	-200 kg (16.1%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£33 1.63 kg/m²	B 89	B 90
Total Savings	£33 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 443 TEST (28 May 2019)
Recommendation texts revision number 4.9c (22 Feb 2014)

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

	Current	Potential	Saving
Electricity	£90	£98	-£8
Mains gas	£335	£294	£41
Space heating	£265	£265	£0
Water heating	£82	£50	£33
Lighting	£77	£77	£0
Generated (PV)	-£127	-£127	£0
Total cost of fuels	£298	£265	£33
Total cost of uses	£297	£265	£33
Delivered energy	49 kWh/m²	41 kWh/m²	8 kWh/m²
Carbon dioxide emissions	1.2 tonnes	1.0 tonnes	0.2 tonnes
CO2 emissions per m²	10 kg/m²	9 kg/m²	2 kg/m²
Primary energy	57 kWh/m²	48 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)

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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					11.6600	11.2829		0.6200	0.7000	0.7700		39.5680 (75)				
Southeast					2.8400	36.7938		0.6200	0.7000	0.7700		31.4280 (77)				
Southwest					4.2500	36.7938		0.6200	0.7000	0.7700		47.0313 (79)				
Northwest					2.4600	11.2829		0.6200	0.7000	0.7700		8.3480 (81)				
Southwest					5.8000	36.7938		0.6200	0.7000	0.7700		64.1839 (79)				
Solar gains					190.5591	340.5083	508.1734	700.5110	849.3079	871.6155	828.4910	713.1324	574.0951	387.7327	231.1443	161.2034 (83)
Total gains					883.6557	1028.5023	1169.2722	1319.5910	1424.8255	1408.4121	1342.8414	1236.8896	1122.1941	978.0852	868.5346	834.6963 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	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	0.9769	0.9620	0.9321	0.8663	0.7523	0.5969	0.4590	0.5102	0.7271	0.9022	0.9639	0.9805	(86)
MIT	19.1448	19.3913	19.7774	20.2577	20.6488	20.8824	20.9624	20.9468	20.7681	20.2524	19.6100	19.0951	(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	0.9723	0.9544	0.9184	0.8388	0.7020	0.5172	0.3560	0.4048	0.6552	0.8760	0.9554	0.9766	(89)
MIT 2	17.4452	17.8015	18.3544	19.0299	19.5453	19.8247	19.8990	19.8899	19.7078	19.0403	18.1276	17.3781	(90)
Living area fraction									fLA = Living area / (4) =			0.1416	(91)
MIT	17.6858	18.0265	18.5559	19.2037	19.7015	19.9745	20.0496	20.0395	19.8579	19.2119	18.3374	17.6211	(92)
Temperature adjustment												-0.1500	
adjusted MIT	17.5358	17.8765	18.4059	19.0537	19.5515	19.8245	19.8996	19.8895	19.7079	19.0619	18.1874	17.4711	(93)

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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	0.9575	0.9349	0.8937	0.8127	0.6831	0.5097	0.3541	0.4016	0.6394	0.8495	0.9362	0.9633	(94)
Useful gains	846.0742	961.5890	1045.0185	1072.4485	973.3337	717.8115	475.5261	496.6849	717.5646	830.8787	813.1360	804.0852	(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	2000.7455	1957.6122	1792.5478	1514.5403	1169.0807	771.5521	487.2832	514.5467	830.8067	1259.9711	1656.7828	1990.4343	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	859.0755	669.3276	556.1618	318.3061	145.6358	0.0000	0.0000	0.0000	0.0000	319.2448	607.4257	882.6437	(98)
Space heating												4357.8210	(98)
Space heating per m2											(98) / (4) =	35.4525	(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													4842.0233	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	859.0755	669.3276	556.1618	318.3061	145.6358	0.0000	0.0000	0.0000	0.0000	319.2448	607.4257	882.6437	(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)	954.5283	743.6974	617.9575	353.6734	161.8176	0.0000	0.0000	0.0000	0.0000	354.7164	674.9174	980.7153	(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	89.4579	89.4728	89.4841	89.5018	89.4686	86.7000	86.7000	86.7000	86.7000	89.1719	89.3662	86.7000	(216)	
Fuel for water heating, kWh/month	181.8541	137.0147	110.9575	60.9257	30.0964	12.5788	5.8879	40.1258	66.4563	115.5415	155.6665	180.5600	(219)	
Water heating fuel used												1097.6652	(219)	
Annual totals kWh/year														
Space heating fuel - main system												4842.0233	(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												5852.9087	(238)	

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4842.0233	3.4800	168.5024	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1097.6652	3.4800	38.1987	(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			315.2549	(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] =	0.7885	(257)
SAP value			89.0002	
SAP rating (Section 12)			89	(258)
SAP band			B	

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

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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	4842.0233	0.2160	1045.8770 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1097.6652	0.2160	237.0957 (264)
Space and water heating			1282.9727 (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			1237.9340 (272)
CO2 emissions per m2			10.0700 (273)
EI value			90.1213
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)

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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					11.6600	14.6176	0.6200	0.7000			0.7700			51.2624 (75)
Southeast					2.8400	45.1778	0.6200	0.7000			0.7700			38.5893 (77)
Southwest					4.2500	45.1778	0.6200	0.7000			0.7700			57.7480 (79)
Northwest					2.4600	14.6176	0.6200	0.7000			0.7700			10.8152 (81)
Southwest					5.8000	45.1778	0.6200	0.7000			0.7700			78.8091 (79)
Solar gains	237.2240	362.1019	548.2949	765.5457	885.1803	987.6454	931.1261	819.4350	656.0973	445.8711	287.0876	197.1017 (83)		
Total gains	930.3206	1050.0959	1209.3937	1384.6257	1460.6980	1524.4421	1445.4765	1343.1921	1204.1963	1036.2236	924.4779	870.5947 (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	0.9705	0.9566	0.9190	0.8356	0.7035	0.5124	0.3851	0.4111	0.6563	0.8674	0.9500	0.9748 (86)
MIT	19.3265	19.5179	19.9178	20.3909	20.7438	20.9332	20.9802	20.9761	20.8482	20.4182	19.8193	19.2993 (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	0.9645	0.9480	0.9027	0.8029	0.6454	0.4282	0.2838	0.3043	0.5746	0.8322	0.9382	0.9696 (89)
MIT 2	17.7182	17.9955	18.5627	19.2152	19.6669	19.8733	19.9132	19.9127	19.8004	19.2706	18.4370	17.6844 (90)
Living area fraction									fLA = Living area / (4) =			0.1416 (91)
MIT	17.9458	18.2110	18.7545	19.3816	19.8193	20.0233	20.0642	20.0632	19.9487	19.4330	18.6327	17.9129 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.7958	18.0610	18.6045	19.2316	19.6693	19.8733	19.9142	19.9132	19.7987	19.2830	18.4827	17.7629 (93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9477	0.9276	0.8773	0.7783	0.6305	0.4243	0.2831	0.3033	0.5640	0.8064	0.9162	0.9543	(94)
Useful gains	881.6214	974.0448	1061.0468	1077.7083	920.9888	646.8706	409.2346	407.3590	679.1509	835.5935	847.0196	830.7791	(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	1916.8806	1887.5134	1719.2131	1437.1724	1058.7681	674.3609	414.3569	413.6054	748.5673	1162.3892	1555.8860	1881.9611	(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	770.2329	613.8509	489.6757	258.8142	102.5078	0.0000	0.0000	0.0000	0.0000	243.1360	510.3839	782.0794	(98)
Space heating												3770.6807	(98)
Space heating per m2											(98) / (4) =	30.6759	(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													4189.6452	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	770.2329	613.8509	489.6757	258.8142	102.5078	0.0000	0.0000	0.0000	0.0000	243.1360	510.3839	782.0794	(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)	855.8143	682.0565	544.0841	287.5713	113.8976	0.0000	0.0000	0.0000	0.0000	270.1511	567.0932	868.9771	(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	89.4198	89.4331	89.4288	89.4204	89.2078	86.7000	86.7000	86.7000	86.7000	89.0210	89.2932	86.7000	(216)	
(217)m	89.4198	89.4331	89.4288	89.4204	89.2078	86.7000	86.7000	86.7000	86.7000	89.0210	89.2932	89.4270	(217)	
Fuel for water heating, kWh/month	177.0265	137.1471	110.4036	59.4082	34.9666	6.0561	0.5672	32.4966	60.5148	110.9766	150.0815	177.0351	(219)	
Water heating fuel used												1056.6801	(219)	
Annual totals kWh/year														
Space heating fuel - main system												4189.6452	(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												5077.2210	(238)	

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4189.6452	3.9200	164.2341	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1056.6801	3.9200	41.4219	(247)
Pumps and fans for heating	75.0000	16.9600	12.7200	(249)
Pump for solar water heating	50.0000	16.9600	8.4800	(249)
Energy for lighting	455.1332	16.9600	77.1906	(250)
Additional standing charges			88.0000	(251)
Energy saving/generation technologies				
PV Unit	-749.2375	16.9600	-127.0707	(252)
Total energy cost			264.9759	(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	4189.6452	0.2160	904.9634	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1056.6801	0.2160	228.2429	(264)
Space and water heating			1133.2063	(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			1045.4411 (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	4189.6452	1.2200	5111.3672 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1056.6801	1.2200	1289.1497 (264)
Space and water heating			6400.5168 (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			5881.3667 (272)
Primary energy kWh/m2/year			47.8471 (273)

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

Overheating Calculation Input Data

Dwelling type	Detached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	North East
Overshading	Average or unknown
Thermal mass parameter	145.5 (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	11.6600	106.0502	0.6200	0.7000	0.9000	434.6952
South East	2.8400	127.3119	0.6200	0.7000	0.9000	127.1048
South West	4.2500	127.3119	0.6200	0.7000	0.9000	190.2096
North West	2.4600	106.0502	0.6200	0.7000	0.9000	91.7110
South West	5.8000	127.3119	0.6200	0.7000	0.9000	259.5802

total: 1103.3009

	Jun	Jul	Aug	
Solar gains	1190	1103	968	(P3)
Internal gains	534	511	521	
Total summer gains	1723	1615	1489	(P5)

Summer gain/loss ratio	3.57	3.34	3.08	(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	19.95	21.62	21.36	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	

Assessment of likelihood of high internal temperature: Slight