

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property Reference	X309 Semi				Issued on Date	15/12/2022
Assessment Reference	X309 Semi	Prop Type Ref	Beech			
Property	3 Bed, K, WC, B, En					
SAP Rating	87 B	DER	12.83	TER	16.46	
Environmental	89 B	% DER<TER	22.04			
CO ₂ Emissions (t/year)	1.13	DFEE	39.12	TFEE	48.90	
General Requirements Compliance	Pass	% DFEE<TFEE	20.01			
Assessor Details	Mr. Christopher MacDougall, Chris MacDougall, Tel: 02032 902 902, chris.macdougall@aessc.co.uk				Assessor ID	Q920-0001
Client						

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

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DWELLING AS DESIGNED

Semi-Detached House, total floor area 105 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) 16.46 kgCO₂/m²

Dwelling Carbon Dioxide Emission Rate (DER) 12.83 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)48.9 kWh/m²/yr

Dwelling Fabric Energy Efficiency (DFEE)39.1 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.24 (max. 0.30)	0.44 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.11 (max. 0.25)	0.11 (max. 0.70)	OK
Roof	0.12 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.22 (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:	4.01 (design value)	
Maximum	10.0	OK

4 Heating efficiency

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

Data from database

Ideal LOGIC COMBI ESPl 35

Combi boiler

Efficiency: 89.6% 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

Continuous extract system (decentralised)

Specific fan power: 0.1700 0.1800
Maximum 0.7 OK

9 Summertime temperature

Overheating risk (Thames Valley): Medium OK

Based on:

Overshading: Average

Windows facing North East: 7.09 m², No overhang

Windows facing South East: 1.44 m², No overhang

Windows facing South West: 7.42 m², No overhang

Air change rate: 4.00 ach

Blinds/curtains: None

10 Key features

External wall U-value	0.12 W/m ² K
Party wall U-value	0.00 W/m ² K
Roof U-value	0.09 W/m ² K
Floor U-value	0.12 W/m ² K
Door U-value	0.11 W/m ² K
Thermal bridging y-value	1.00 W/m ² K
	0.034 W/m ² K

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (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	39.5300 (1b)	x 2.3100 (2b)	= 91.3143 (1b) - (3b)
First floor	39.5300 (1c)	x 2.5300 (2c)	= 100.0109 (1c) - (3c)
Second floor	26.3000 (1d)	x 2.3600 (2d)	= 62.0680 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	105.3600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 253.3932 (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							0 * 10 =	0.0000 (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) =						0.0000 / (5) =	0.0000 (8)				
Pressure test							Yes					
Measured/design AP50							4.0100					
Infiltration rate							0.2005 (18)					
Number of sides sheltered							1 (19)					
Shelter factor							(20) = 1 - [0.075 x (19)] =	0.9250 (20)				
Infiltration rate adjusted to include shelter factor							(21) = (18) x (20) =	0.1855 (21)				
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind factor	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												
	0.2365	0.2318	0.2272	0.2040	0.1994	0.1762	0.1762	0.1716	0.1855	0.1994	0.2086	0.2179 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (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 = 1.20)			12.1500	1.1450	13.9122		(27)
French Door (Uw = 1.40)			3.8000	1.3258	5.0379		(27)
Front Door			2.1500	1.0000	2.1500		(26)
FP McCann System			39.5300	0.1100	4.3483	75.0000	2964.7500 (28a)
100mm Knauf Supafil 34	98.5000	15.7900	82.7100	0.2500	20.6775	52.8000	4367.0880 (29a)
WTV	15.3600		15.3600	0.1200	1.8432	9.0000	138.2400 (29a)
Dormer Cheek	6.1900	2.3100	3.8800	0.4400	1.7072	9.0000	34.9200 (29a)
Plane Ceiling-500mm Loft Roll	12.8600		12.8600	0.0900	1.1574	9.0000	115.7400 (30)
Sloping Ceiling	9.9300		9.9300	0.1600	1.5888	9.0000	89.3700 (30)
Dormer Roof	3.5100		3.5100	0.1400	0.4914	9.0000	31.5900 (30)
CTV	13.2300		13.2300	0.1200	1.5876	9.0000	119.0700 (30)
Total net area of external elements Aum(A, m ²)			199.1100				(31)
Fabric heat loss, W/K = Sum (A x U)	(26)...(30) + (32) =				54.5015		(33)
E-WM-30			52.6200	0.0000	0.0000	45.0000	2367.9000 (32)
1F Timber			76.0000			9.0000	684.0000 (32c)
GF Timber			64.5000			9.0000	580.5000 (32c)
SF Timber			35.1800			9.0000	316.6200 (32c)
Internal Floor			65.8300			12.6000	829.4580 (32d)
Internal Ceiling			65.8300			9.0000	592.4700 (32e)
Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =						13231.7160 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							125.5858 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.8336 (36)
Total fabric heat loss	(33) + (36) =						61.3351 (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	41.8099	41.8099	41.8099	41.8099	41.8099	41.8099	41.8099	41.8099	41.8099	41.8099	41.8099	41.8099 (38)
Heat transfer coeff	103.1449	103.1449	103.1449	103.1449	103.1449	103.1449	103.1449	103.1449	103.1449	103.1449	103.1449	103.1449 (39)
Average = Sum(39)m / 12 =												103.1449 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.9790	0.9790	0.9790	0.9790	0.9790	0.9790	0.9790	0.9790	0.9790	0.9790	0.9790	0.9790 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

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4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.7839	(42)	
Average daily hot water use (litres/day)												100.3180	(43)	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Daily hot water use	110.3498	106.3370	102.3243	98.3116	94.2989	90.2862	90.2862	94.2989	98.3116	102.3243	106.3370	110.3498	(44)	
Energy content	163.6455	143.1254	147.6926	128.7620	123.5502	106.6144	98.7939	113.3675	114.7214	133.6968	145.9405	158.4819	(45)	
Energy content (annual)												Total = Sum(45)m =	1578.3921	(45)
Distribution loss	(46)m = 0.15 x (45)m													
	24.5468	21.4688	22.1539	19.3143	18.5325	15.9922	14.8191	17.0051	17.2082	20.0545	21.8911	23.7723	(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	14.1493	12.7688	14.1110	13.6166	14.0362	13.5438	13.9706	14.0131	13.5835	14.0774	13.6631	14.1369	(61)	
Total heat required for water heating calculated for each month	177.7948	155.8942	161.8036	142.3786	137.5864	120.1582	112.7646	127.3806	128.3049	147.7742	159.6036	172.6188	(62)	
WWHRS	-58.0955	-51.1175	-52.1716	-42.9189	-39.8478	-32.8702	-27.8149	-33.6788	-34.6632	-42.8551	-49.6480	-56.1533	eq. (G10)	
Total of WWHRS savings													-521.8348	
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)	
								Solar input (sum of months) =	Sum(63)m =					
	119.6993	104.7766	109.6320	99.4597	97.7386	87.2881	84.9497	93.7018	93.6417	104.9191	109.9555	116.4655	(64)	
								Total per year (kWh/year) =	Sum(64)m =					
Heat gains from water heating, kWh/month	57.9495	50.7814	52.6355	46.2175	44.5895	38.8352	36.3416	41.1980	41.5408	47.9735	51.9410	56.2295	(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	139.1957	139.1957	139.1957	139.1957	139.1957	139.1957	139.1957	139.1957	139.1957	139.1957	139.1957	139.1957 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	24.8989	22.1150	17.9851	13.6159	10.1781	8.5927	9.2848	12.0687	16.1986	20.5678	24.0057	25.5910 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	264.7132	267.4601	260.5380	245.8017	227.1998	209.7166	198.0367	195.2898	202.2119	216.9482	235.5501	253.0333 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.9196	36.9196	36.9196	36.9196	36.9196	36.9196	36.9196	36.9196	36.9196	36.9196	36.9196	36.9196 (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)	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566 (71)
Water heating gains (Table 5)	77.8891	75.5675	70.7467	64.1910	59.9321	53.9378	48.8463	55.3736	57.6955	64.4806	72.1402	75.5772 (72)
Total internal gains	435.2599	432.9014	417.0286	391.3673	365.0686	340.0059	323.9265	330.4908	343.8647	369.7553	399.4548	421.9603 (73)

6. Solar gains

[Jan]												Gains					
			Area			Solar flux			g			FF			Access	factor	Gains
			m2			Table 6a			Specific data			Specific data			factor	Table 6d	W
						W/m2			or Table 6b			or Table 6c					
Northeast			7.0900			11.2829			0.4600			0.0000			0.7700		28.3346 (75)
Southeast			1.4400			36.7938			0.4600			0.0000			0.7700		18.7666 (77)
Southwest			3.6200			36.7938			0.4600			0.0000			0.7700		47.1772 (79)
Southwest			3.8000			36.7938			0.4300			0.0000			0.7700		46.2933 (79)
Solar gains	140.5717	248.8572	365.4962	494.7695	592.4293	604.9684	576.2530	500.8225	409.8590	281.7806	170.0864					119.1910	(83)
Total gains	575.8316	681.7585	782.5247	886.1368	957.4979	944.9743	900.1795	831.3133	753.7237	651.5358	569.5412					541.1513	(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	35.6341	35.6341	35.6341	35.6341	35.6341	35.6341	35.6341	35.6341	35.6341	35.6341	35.6341	35.6341
alpha	3.3756	3.3756	3.3756	3.3756	3.3756	3.3756	3.3756	3.3756	3.3756	3.3756	3.3756	3.3756
util living area	0.9834	0.9702	0.9431	0.8825	0.7722	0.6193	0.4781	0.5304	0.7488	0.9178	0.9728	0.9864 (86)
MIT	19.2089	19.4522	19.8264	20.2780	20.6594	20.8840	20.9636	20.9480	20.7719	20.2646	19.6373	19.1426 (87)
Th 2	20.1009	20.1009	20.1009	20.1009	20.1009	20.1009	20.1009	20.1009	20.1009	20.1009	20.1009	20.1009 (88)
util rest of house	0.9805	0.9651	0.9332	0.8614	0.7315	0.5524	0.3899	0.4406	0.6905	0.8985	0.9673	0.9840 (89)
MIT 2	17.6842	18.0364	18.5748	19.2116	19.7241	19.9979	20.0780	20.0659	19.8773	19.2057	18.3083	17.5879 (90)
Living area fraction	17.8824	18.2205	18.7375	19.3502	19.8457	20.1131	20.1932	20.1806	19.9937	19.3434	18.4812	17.7901 (91)
MIT	17.8824	18.2205	18.7375	19.3502	19.8457	20.1131	20.1932	20.1806	19.9937	19.3434	18.4812	17.7901 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.7324	18.0705	18.5875	19.2002	19.6957	19.9631	20.0432	20.0306	19.8437	19.1934	18.3312	17.6401 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9692	0.9489	0.9111	0.8359	0.7109	0.5413	0.3840	0.4332	0.6714	0.8733	0.9516	0.9741 (94)

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Useful gains	558.0787	646.9198	712.9850	740.6835	680.6554	511.5560	345.6712	360.0955	506.0837	568.9968	541.9535	527.1396 (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	1385.4875	1358.4715	1246.7688	1062.4171	824.7188	553.1801	355.1444	374.4758	592.4287	886.3624	1158.4371	1386.2765 (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	615.5922	478.1628	397.1352	231.6482	107.1832	0.0000	0.0000	0.0000	0.0000	236.1200	443.8682	639.1979 (98)
Space heating												3148.9076 (98)
Space heating per m2											(98) / (4) =	29.8871 (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 %)												90.5000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												3479.4560 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	615.5922	478.1628	397.1352	231.6482	107.1832	0.0000	0.0000	0.0000	0.0000	236.1200	443.8682	639.1979 (98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000 (210)
Space heating fuel (main heating system)	680.2124	528.3566	438.8234	255.9649	118.4345	0.0000	0.0000	0.0000	0.0000	260.9061	490.4621	706.2960 (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	119.6993	104.7766	109.6320	99.4597	97.7386	87.2881	84.9497	93.7018	93.6417	104.9191	109.9555	116.4655 (64)
Efficiency of water heater	89.9632	89.9077	89.7880	89.5144	88.9450	87.3000	87.3000	87.3000	87.3000	89.4908	89.8461	87.3000 (216)
(217)m	89.9632	89.9077	89.7880	89.5144	88.9450	87.3000	87.3000	87.3000	87.3000	89.4908	89.8461	89.9916 (217)
Fuel for water heating, kWh/month	133.0537	116.5381	122.1010	111.1103	109.8865	99.9863	97.3077	107.3331	107.2643	117.2401	122.3820	129.4182 (219)
Water heating fuel used												1373.6213 (219)
Annual totals kWh/year												
Space heating fuel - main system												3479.4560 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
(MEV)Decentralised, Database: total watage = 6.6170, total flow = 29.0000, SFP = 0.2282)												
mechanical ventilation fans (SFP = 0.2282)												70.5372 (230a)
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												145.5372 (231)
Electricity for lighting (calculated in Appendix L)												439.7232 (232)
Total delivered energy for all uses												5438.3377 (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	3479.4560	0.2160	751.5625 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1373.6213	0.2160	296.7022 (264)
Space and water heating			1048.2647 (265)
Pumps and fans	145.5372	0.5190	75.5338 (267)
Energy for lighting	439.7232	0.5190	228.2164 (268)
Total CO2, kg/year			1352.0148 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			12.8300 (273)

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

DER			12.8300 ZC1
Total Floor Area		TFA	105.3600
Assumed number of occupants		N	2.7839
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190
CO2 emissions from appliances, equation (L14)			14.8883 ZC2
CO2 emissions from cooking, equation (L16)			1.7636 ZC3
Total CO2 emissions			29.4819 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			29.4819 ZC8

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
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First floor	39.5300 (1c)	x 2.5300 (2c)	= 100.0109 (1c) - (3c)
Second floor	26.3000 (1d)	x 2.3600 (2d)	= 62.0680 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	105.3600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 253.3932 (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) =	0.1579 (8)	
Pressure test												
Measured/design AP50												
Infiltration rate												
Number of sides sheltered												
Shelter factor										(20) = 1 - [0.075 x (19)] =	0.9250 (20)	
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =	0.3773 (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	0.4810	0.4716	0.4622	0.4150	0.4056	0.3584	0.3584	0.3490	0.3773	0.4056	0.4244	0.4433 (22b)
Effective ac	0.6157	0.6112	0.6068	0.5861	0.5822	0.5642	0.5642	0.5609	0.5712	0.5822	0.5901	0.5983 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K					
TER Opaque door			2.1500	1.0000	2.1500		(26)					
TER Opening Type (Uw = 1.40)			15.9500	1.3258	21.1458		(27)					
FP McCann System			39.5300	0.1300	5.1389		(28a)					
100mm Knauf Supafil 34	98.5000	15.7900	82.7100	0.1800	14.8878		(29a)					
WTV	15.3600		15.3600	0.1800	2.7648		(29a)					
Dormer Cheek	6.1900	2.3100	3.8800	0.1800	0.6984		(29a)					
Plane Ceiling-500mm Loft Roll	12.8600		12.8600	0.1300	1.6718		(30)					
Sloping Ceiling	9.9300		9.9300	0.1300	1.2909		(30)					
Dormer Roof	3.5100		3.5100	0.1300	0.4563		(30)					
CTV	13.2300		13.2300	0.1300	1.7199		(30)					
Total net area of external elements Aum(A, m ²)			199.1100				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		51.9246		(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)							10.5731 (36)					
Total fabric heat loss						(33) + (36) =	62.4977 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 51.4837	Feb 51.1081	Mar 50.7399	Apr 49.0104	May 48.6868	Jun 47.1805	Jul 47.1805	Aug 46.9016	Sep 47.7607	Oct 48.6868	Nov 49.3414	Dec 50.0258 (38)
Heat transfer coeff	113.9815	113.6058	113.2376	111.5081	111.1846	109.6783	109.6783	109.3993	110.2585	111.1846	111.8392	112.5235 (39)
Average = Sum(39)m / 12 =												111.5066 (39)
HLP	Jan 1.0818	Feb 1.0783	Mar 1.0748	Apr 1.0584	May 1.0553	Jun 1.0410	Jul 1.0410	Aug 1.0383	Sep 1.0465	Oct 1.0553	Nov 1.0615	Dec 1.0680 (40)
HLP (average)												1.0583 (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													2.7839 (42)
Average daily hot water use (litres/day)													100.3180 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
Energy content	110.3498	106.3370	102.3243	98.3116	94.2989	90.2862	90.2862	94.2989	98.3116	102.3243	106.3370	110.3498 (44)	
Energy content (annual)	163.6455	143.1254	147.6926	128.7620	123.5502	106.6144	98.7939	113.3675	114.7214	133.6968	145.9405	158.4819 (45)	
	Total = Sum(45)m =											1578.3921 (45)	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	24.5468	21.4688	22.1539	19.3143	18.5325	15.9922	14.8191	17.0051	17.2082	20.0545	21.8911	23.7723 (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	50.9589	46.0274	50.9589	48.4824	48.0537	44.5247	46.0088	48.0537	48.4824	50.9589	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month	214.6044	189.1528	198.6515	177.2444	171.6039	151.1391	144.8028	161.4212	163.2039	184.6557	195.2556	209.4408 (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	214.6044	189.1528	198.6515	177.2444	171.6039	151.1391	144.8028	161.4212	163.2039	184.6557	195.2556	209.4408 (64)
Heat gains from water heating, kWh/month	67.1519	59.0960	61.8475	54.9340	53.0939	46.5805	44.3512	49.7081	50.2655	57.1939	60.8540	65.4350 (65)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)												
Total per year (kWh/year) = Sum(64)m = 2161.1759 (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	139.1957	139.1957	139.1957	139.1957	139.1957	139.1957	139.1957	139.1957	139.1957	139.1957	139.1957	139.1957 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	24.8989	22.1150	17.9851	13.6159	10.1781	8.5927	9.2848	12.0687	16.1986	20.5678	24.0057	25.5910 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	264.7132	267.4601	260.5380	245.8017	227.1998	209.7166	198.0367	195.2898	202.2119	216.9482	235.5501	253.0333 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.9196	36.9196	36.9196	36.9196	36.9196	36.9196	36.9196	36.9196	36.9196	36.9196	36.9196	36.9196 (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)	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566 (71)
Water heating gains (Table 5)	90.2579	87.9405	83.1284	76.2972	71.3627	64.6951	59.6118	66.8120	69.8132	76.8735	84.5194	87.9502 (72)
Total internal gains	447.6287	445.2744	429.4102	403.4735	376.4992	350.7631	334.6920	341.9292	355.9824	382.1483	411.8339	434.3332 (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				7.0900	11.2829	0.6300	0.7000	0.7700	24.4478 (75)			
Southeast				1.4400	36.7938	0.6300	0.7000	0.7700	16.1923 (77)			
Southwest				7.4200	36.7938	0.6300	0.7000	0.7700	83.4355 (79)			
Solar gains	124.0756	219.4673	321.8545	434.9474	520.1772	530.9311	505.8335	440.0291	360.6695	248.3739	150.0929	105.2260 (83)
Total gains	571.7044	664.7417	751.2647	838.4209	896.6764	881.6942	840.5255	781.9583	716.6519	630.5221	561.9268	539.5592 (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	64.1917	64.4040	64.6134	65.6155	65.8065	66.7103	66.7103	66.8804	66.3592	65.8065	65.4213	65.0235
alpha	5.2794	5.2936	5.3076	5.3744	5.3871	5.4474	5.4474	5.4587	5.4239	5.3871	5.3614	5.3349
util living area	0.9988	0.9970	0.9914	0.9692	0.8969	0.7353	0.5619	0.6216	0.8684	0.9823	0.9973	0.9991 (86)
MIT	19.7973	19.9466	20.1892	20.5135	20.7915	20.9512	20.9906	20.9844	20.8742	20.5130	20.0993	19.7772 (87)
Th 2	20.0157	20.0186	20.0215	20.0350	20.0375	20.0493	20.0493	20.0515	20.0448	20.0375	20.0324	20.0271 (88)
util rest of house	0.9984	0.9960	0.9882	0.9571	0.8571	0.6493	0.4469	0.5044	0.8043	0.9733	0.9961	0.9988 (89)
MIT 2	18.4022	18.6224	18.9775	19.4519	19.8270	20.0157	20.0457	20.0448	19.9396	19.4588	18.8559	18.3810 (90)
Living area fraction									fLA = Living area / (4) =			0.1300 (91)
MIT	18.5836	18.7945	19.1350	19.5899	19.9524	20.1374	20.1686	20.1669	20.0611	19.5959	19.0176	18.5625 (92)
Temperature adjustment												0.0000
adjusted MIT	18.5836	18.7945	19.1350	19.5899	19.9524	20.1374	20.1686	20.1669	20.0611	19.5959	19.0176	18.5625 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9974	0.9940	0.9842	0.9499	0.8530	0.6579	0.4618	0.5193	0.8056	0.9675	0.9943	0.9981 (94)
Ext temp.	570.2239	660.7707	739.3789	796.4349	764.8387	580.0586	388.1195	406.0979	577.3519	610.0413	558.7454	538.5258 (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	1628.0654	1578.5014	1430.7604	1192.0157	917.5438	607.3293	391.3962	412.1005	657.2649	1000.2028	1332.8562	1616.1209 (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	787.0341	616.7150	514.3878	284.8182	113.6126	0.0000	0.0000	0.0000	0.0000	290.2802	557.3597	801.7307 (98)
Space heating per m2												3965.9383 (98)
										(98) / (4) =		37.6418 (99)

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.4000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													4246.1866 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	787.0341	616.7150	514.3878	284.8182	113.6126	0.0000	0.0000	0.0000	0.0000	290.2802	557.3597	801.7307	(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)	842.6489	660.2944	550.7364	304.9445	121.6409	0.0000	0.0000	0.0000	0.0000	310.7925	596.7449	858.3841	(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	214.6044	189.1528	198.6515	177.2444	171.6039	151.1391	144.8028	161.4212	163.2039	184.6557	195.2556	209.4408	(64)
Efficiency of water heater (217)m	88.0278	87.8077	87.3395	86.2392	84.0402	80.3000	80.3000	80.3000	80.3000	86.1853	87.5433	88.1047	(216)
Fuel for water heating, kWh/month	243.7917	215.4171	227.4475	205.5266	204.1927	188.2181	180.3272	201.0226	203.2427	214.2543	223.0388	237.7181	(219)
Water heating fuel used												2544.1973	(219)
Annual totals kWh/year													
Space heating fuel - main system												4246.1866	(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)												439.7232	(232)
Total delivered energy for all uses												7305.1072	(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	4246.1866	0.2160	917.1763 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2544.1973	0.2160	549.5466 (264)
Space and water heating			1466.7229 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	439.7232	0.5190	228.2164 (268)
Total CO2, kg/m2/year			1733.8643 (272)
Emissions per m2 for space and water heating			13.9211 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.1661 (272b)
Emissions per m2 for pumps and fans			0.3694 (272c)
Target Carbon Dioxide Emission Rate (TER) = (13.9211 * 1.00) + 2.1661 + 0.3694, rounded to 2 d.p.			16.4600 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (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	39.5300 (1b)	x 2.3100 (2b)	= 91.3143 (1b) - (3b)
First floor	39.5300 (1c)	x 2.5300 (2c)	= 100.0109 (1c) - (3c)
Second floor	26.3000 (1d)	x 2.3600 (2d)	= 62.0680 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	105.3600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 253.3932 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				40.0000 / (5) = 0.1579 (8)
Pressure test					Yes
Measured/design AP50					4.0100
Infiltration rate					0.3584 (18)
Number of sides sheltered					1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3315 (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	0.4226	0.4144	0.4061	0.3646	0.3563	0.3149	0.3149	0.3066	0.3315	0.3563	0.3729	0.3895 (22b)
Effective ac	0.5893	0.5858	0.5824	0.5665	0.5635	0.5496	0.5496	0.5470	0.5549	0.5635	0.5695	0.5759 (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 = 1.20)			12.1500	1.1450	13.9122		(27)
French Door (Uw = 1.40)			3.8000	1.3258	5.0379		(27)
Front Door			2.1500	1.0000	2.1500		(26)
FP McCann System			39.5300	0.1100	4.3483	75.0000	2964.7500 (28a)
100mm Knauf Supafil 34	98.5000	15.7900	82.7100	0.2500	20.6775	52.8000	4367.0880 (29a)
WTV	15.3600		15.3600	0.1200	1.8432	9.0000	138.2400 (29a)
Dormer Cheek	6.1900	2.3100	3.8800	0.4400	1.7072	9.0000	34.9200 (29a)
Plane Ceiling-500mm Loft Roll	12.8600		12.8600	0.0900	1.1574	9.0000	115.7400 (30)
Sloping Ceiling	9.9300		9.9300	0.1600	1.5888	9.0000	89.3700 (30)
Dormer Roof	3.5100		3.5100	0.1400	0.4914	9.0000	31.5900 (30)
CTV	13.2300		13.2300	0.1200	1.5876	9.0000	119.0700 (30)
Total net area of external elements Aum(A, m ²)			199.1100				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		54.5015		(33)
E-WM-30			52.6200	0.0000	0.0000	45.0000	2367.9000 (32)
1F Timber			76.0000			9.0000	684.0000 (32c)
GF Timber			64.5000			9.0000	580.5000 (32c)
SF Timber			35.1800			9.0000	316.6200 (32c)
Internal Floor			65.8300			12.6000	829.4580 (32d)
Internal Ceiling			65.8300			9.0000	592.4700 (32e)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		13231.7160 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							125.5858 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.8336 (36)
Total fabric heat loss					(33) + (36) =		61.3351 (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	49.2781	48.9881	48.7038	47.3687	47.1189	45.9560	45.9560	45.7407	46.4039	47.1189	47.6242	48.1525 (38)
Heat transfer coeff	110.6131	110.3231	110.0389	108.7037	108.4539	107.2911	107.2911	107.0757	107.7390	108.4539	108.9593	109.4876 (39)
Average = Sum(39)m / 12 =												108.7025 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0499	1.0471	1.0444	1.0317	1.0294	1.0183	1.0183	1.0163	1.0226	1.0294	1.0342	1.0392 (40)
HLP (average)												1.0317 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Assumed occupancy	2.7839 (42)											
Average daily hot water use (litres/day)	100.3180 (43)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	110.3498	106.3370	102.3243	98.3116	94.2989	90.2862	90.2862	94.2989	98.3116	102.3243	106.3370	110.3498 (44)
Energy content (annual)	163.6455	143.1254	147.6926	128.7620	123.5502	106.6144	98.7939	113.3675	114.7214	133.6968	145.9405	158.4819 (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	1578.3921 (45)
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	34.7747	30.4141	31.3847	27.3619	26.2544	22.6556	20.9937	24.0906	24.3783	28.4106	31.0124	33.6774 (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	139.1957	139.1957	139.1957	139.1957	139.1957	139.1957	139.1957	139.1957	139.1957	139.1957	139.1957	139.1957 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	24.8989	22.1150	17.9851	13.6159	10.1781	8.5927	9.2848	12.0687	16.1986	20.5678	24.0057	25.5910 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	264.7132	267.4601	260.5380	245.8017	227.1998	209.7166	198.0367	195.2898	202.2119	216.9482	235.5501	253.0333 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.9196	36.9196	36.9196	36.9196	36.9196	36.9196	36.9196	36.9196	36.9196	36.9196	36.9196	36.9196 (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)	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566 (71)
Water heating gains (Table 5)	46.7401	45.2591	42.1837	38.0027	35.2882	31.4661	28.2174	32.3798	33.8588	38.1862	43.0727	45.2653 (72)
Total internal gains	401.1110	399.5930	385.4656	362.1790	337.4247	314.5341	300.2975	304.4970	317.0279	340.4610	367.3872	388.6484 (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					7.0900	11.2829	0.4600	0.0000	0.7700		28.3346 (75)	
Southeast					1.4400	36.7938	0.4600	0.0000	0.7700		18.7666 (77)	
Southwest					3.6200	36.7938	0.4600	0.0000	0.7700		47.1772 (79)	
Southwest					3.8000	36.7938	0.4300	0.0000	0.7700		46.2933 (79)	
Solar gains	140.5717	248.8572	365.4962	494.7695	592.4293	604.9684	576.2530	500.8225	409.8590	281.7806	170.0864	119.1910 (83)
Total gains	541.6827	648.4502	750.9618	856.9485	929.8540	919.5025	876.5506	805.3195	726.8869	622.2415	537.4737	507.8394 (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	33.2282	33.3156	33.4016	33.8119	33.8898	34.2571	34.2571	34.3260	34.1146	33.8898	33.7326	33.5698
alpha	3.2152	3.2210	3.2268	3.2541	3.2593	3.2838	3.2838	3.2884	3.2743	3.2593	3.2488	3.2380
util living area	0.9862	0.9749	0.9515	0.8969	0.7953	0.6452	0.5035	0.5579	0.7746	0.9299	0.9774	0.9887 (86)
MIT	19.0107	19.2653	19.6629	20.1670	20.5897	20.8571	20.9530	20.9338	20.7244	20.1625	19.4940	18.9672 (87)
Th 2	20.0420	20.0443	20.0465	20.0570	20.0589	20.0681	20.0681	20.0698	20.0646	20.0589	20.0550	20.0508 (88)
util rest of house	0.9838	0.9704	0.9425	0.8772	0.7554	0.5762	0.4095	0.4632	0.7169	0.9125	0.9727	0.9867 (89)
MIT 2	18.2112	18.4650	18.8584	19.3545	19.7477	19.9811	20.0479	20.0393	19.8788	19.3605	18.7018	18.1744 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	18.3152	18.5691	18.9630	19.4601	19.8572	20.0950	20.1656	20.1556	19.9888	19.4648	18.8048	18.2775 (92)
Temperature adjustment	0.0000											
adjusted MIT	18.3152	18.5691	18.9630	19.4601	19.8572	20.0950	20.1656	20.1556	19.9888	19.4648	18.8048	18.2775 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9776	0.9613	0.9297	0.8624	0.7458	0.5784	0.4198	0.4725	0.7115	0.8987	0.9642	0.9814 (94)
Ext temp.	529.5492	623.3517	698.1584	739.0562	693.5048	531.8059	367.9752	380.5154	517.2149	559.1960	518.2115	498.4022 (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	1550.2598	1508.0127	1371.4175	1147.9248	884.6783	589.5665	382.5581	402.1334	634.4521	961.4180	1275.3493	1541.3131 (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	759.4087	594.4922	500.9048	294.3854	142.2331	0.0000	0.0000	0.0000	0.0000	299.2531	545.1392	775.9257 (98)
Space heating per m2	(98) / (4) = 37.1274 (99)											

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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	1008.5359	793.9538	813.7754	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8237	0.8804	0.8535	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	830.7199	699.0356	694.5558	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1183.2293	1130.7146	1049.5715	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	253.8068	321.1692	264.1317	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling													
Cooled fraction													839.1076 (104)
Intermittency factor (Table 10b)													1.0000 (105)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	63.4517	80.2923	66.0329	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling													
Space cooling per m2													209.7769 (107)
Energy for space heating													1.9910 (108)
Energy for space cooling													37.1274 (99)
Total													1.9910 (108)
Dwelling Fabric Energy Efficiency (DFEE)													39.1184 (109)
													39.1 (109)

FC = cooled area / (4) =

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (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	39.5300 (1b)	x 2.3100 (2b)	= 91.3143 (1b) - (3b)
First floor	39.5300 (1c)	x 2.5300 (2c)	= 100.0109 (1c) - (3c)
Second floor	26.3000 (1d)	x 2.3600 (2d)	= 62.0680 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	105.3600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 253.3932 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				40.0000 / (5) = 0.1579 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4079 (18)
Number of sides sheltered					1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3773 (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	0.4810	0.4716	0.4622	0.4150	0.4056	0.3584	0.3584	0.3490	0.3773	0.4056	0.4244	0.4433 (22b)
Effective ac	0.6157	0.6112	0.6068	0.5861	0.5822	0.5642	0.5642	0.5609	0.5712	0.5822	0.5901	0.5983 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			2.1500	1.0000	2.1500		(26)
TER Opening Type (Uw = 1.40)			15.9500	1.3258	21.1458		(27)
FP McCann System			39.5300	0.1300	5.1389		(28a)
100mm Knauf Supafil 34	98.5000	15.7900	82.7100	0.1800	14.8878		(29a)
WTV	15.3600		15.3600	0.1800	2.7648		(29a)
Dormer Cheek	6.1900	2.3100	3.8800	0.1800	0.6984		(29a)
Plane Ceiling-500mm Loft Roll	12.8600		12.8600	0.1300	1.6718		(30)
Sloping Ceiling	9.9300		9.9300	0.1300	1.2909		(30)
Dormer Roof	3.5100		3.5100	0.1300	0.4563		(30)
CTV	13.2300		13.2300	0.1300	1.7199		(30)
Total net area of external elements Aum(A, m ²)			199.1100				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		51.9246		(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)							10.5731 (36)
Total fabric heat loss						(33) + (36) =	62.4977 (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	51.4837	51.1081	50.7399	49.0104	48.6868	47.1805	47.1805	46.9016	47.7607	48.6868	49.3414	50.0258 (38)
Heat transfer coeff	113.9815	113.6058	113.2376	111.5081	111.1846	109.6783	109.6783	109.3993	110.2585	111.1846	111.8392	112.5235 (39)
Average = Sum(39)m / 12 =												111.5066 (39)
HLP	1.0818	1.0783	1.0748	1.0584	1.0553	1.0410	1.0410	1.0383	1.0465	1.0553	1.0615	1.0680 (40)
HLP (average)												1.0583 (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												2.7839 (42)
Average daily hot water use (litres/day)												100.3180 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	110.3498	106.3370	102.3243	98.3116	94.2989	90.2862	90.2862	94.2989	98.3116	102.3243	106.3370	110.3498 (44)
Energy conte	163.6455	143.1254	147.6926	128.7620	123.5502	106.6144	98.7939	113.3675	114.7214	133.6968	145.9405	158.4819 (45)
Energy content (annual)										Total = Sum(45)m =		1578.3921 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET 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	34.7747	30.4141	31.3847	27.3619	26.2544	22.6556	20.9937	24.0906	24.3783	28.4106	31.0124	33.6774 (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	139.1957	139.1957	139.1957	139.1957	139.1957	139.1957	139.1957	139.1957	139.1957	139.1957	139.1957	139.1957 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	24.8989	22.1150	17.9851	13.6159	10.1781	8.5927	9.2848	12.0687	16.1986	20.5678	24.0057	25.5910 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	264.7132	267.4601	260.5380	245.8017	227.1998	209.7166	198.0367	195.2898	202.2119	216.9482	235.5501	253.0333 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.9196	36.9196	36.9196	36.9196	36.9196	36.9196	36.9196	36.9196	36.9196	36.9196	36.9196	36.9196 (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)	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566 (71)
Water heating gains (Table 5)	46.7401	45.2591	42.1837	38.0027	35.2882	31.4661	28.2174	32.3798	33.8588	38.1862	43.0727	45.2653 (72)
Total internal gains	401.1110	399.5930	385.4656	362.1790	337.4247	314.5341	300.2975	304.4970	317.0279	340.4610	367.3872	388.6484 (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				7.0900	11.2829	0.6300		0.7000	0.7700		24.4478 (75)	
Southeast				1.4400	36.7938	0.6300		0.7000	0.7700		16.1923 (77)	
Southwest				7.4200	36.7938	0.6300		0.7000	0.7700		83.4355 (79)	
Solar gains	124.0756	219.4673	321.8545	434.9474	520.1772	530.9311	505.8335	440.0291	360.6695	248.3739	150.0929	105.2260 (83)
Total gains	525.1866	619.0603	707.3200	797.1264	857.6019	845.4651	806.1311	744.5262	677.6975	588.8348	517.4801	493.8743 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	64.1917	64.4040	64.6134	65.6155	65.8065	66.7103	66.7103	66.8804	66.3592	65.8065	65.4213	65.0235
alpha	5.2794	5.2936	5.3076	5.3744	5.3871	5.4474	5.4474	5.4587	5.4239	5.3871	5.3614	5.3349
util living area	0.9992	0.9979	0.9935	0.9749	0.9107	0.7570	0.5834	0.6479	0.8888	0.9869	0.9982	0.9994 (86)
MIT	19.7556	19.9060	20.1511	20.4814	20.7705	20.9437	20.9888	20.9810	20.8560	20.4783	20.0596	19.7360 (87)
Th 2	20.0157	20.0186	20.0215	20.0350	20.0375	20.0493	20.0493	20.0515	20.0448	20.0375	20.0324	20.0271 (88)
util rest of house	0.9989	0.9971	0.9910	0.9648	0.8743	0.6718	0.4652	0.5281	0.8299	0.9800	0.9974	0.9992 (89)
MIT 2	18.8724	19.0249	19.2712	19.6066	19.8768	20.0224	20.0463	20.0458	19.9602	19.6092	19.1896	18.8621 (90)
Living area fraction	18.9872	19.1394	19.3856	19.7204	19.9930	20.1422	20.1689	20.1674	20.0767	19.7222	19.3028	18.9757 (92)
Temperature adjustment												0.0000
adjusted MIT	18.9872	19.1394	19.3856	19.7204	19.9930	20.1422	20.1689	20.1674	20.0767	19.7222	19.3028	18.9757 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9985	0.9962	0.9888	0.9606	0.8723	0.6809	0.4806	0.5436	0.8323	0.9769	0.9966	0.9989 (94)
Useful gains	524.3939	616.6889	699.4306	765.7403	748.0955	575.7113	387.4572	404.6929	564.0285	575.2146	515.7028	493.3394 (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	1674.0737	1617.6820	1459.1365	1206.5592	922.0542	607.8543	391.4291	412.1489	658.9845	1014.2447	1364.7459	1662.6151 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	855.3618	672.6674	565.2212	317.3896	129.4253	0.0000	0.0000	0.0000	0.0000	326.6384	611.3111	869.9412 (98)
Space heating												4347.9558 (98)
Space heating per m2										(98) / (4) =		41.2676 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b												
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	1030.9756	811.6191	831.4347	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8698	0.9307	0.9051	0.0000	0.0000	0.0000	0.0000 (101)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	896.7071	755.3689	752.5038	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1096.6922	1048.4061	978.5143	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												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	143.9893	218.0196	168.1518	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												530.1607 (104)
Cooled fraction									FC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)												
Intermittency factor	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												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	35.9973	54.5049	42.0379	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												132.5402 (107)
Space cooling per m2												1.2580 (108)
Energy for space heating												41.2676 (99)
Energy for space cooling												1.2580 (108)
Total												42.5256 (109)
Target Fabric Energy Efficiency (TFEE)												48.9 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (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	39.5300 (1b)	x 2.3100 (2b)	= 91.3143 (1b) - (3b)
First floor	39.5300 (1c)	x 2.5300 (2c)	= 100.0109 (1c) - (3c)
Second floor	26.3000 (1d)	x 2.3600 (2d)	= 62.0680 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	105.3600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 253.3932 (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							0 * 10 =	0.0000 (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) =						0.0000 / (5) =	0.0000 (8)				
Pressure test							Yes					
Measured/design AP50							4.0100					
Infiltration rate							0.2005	(18)				
Number of sides sheltered							1	(19)				
Shelter factor							(20) = 1 - [0.075 x (19)] =	0.9250 (20)				
Infiltration rate adjusted to include shelter factor							(21) = (18) x (20) =	0.1855 (21)				
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind factor	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)
Adj infilt rate	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)
	0.1947	0.1855	0.1855	0.1716	0.1716	0.1530	0.1576	0.1484	0.1530	0.1623	0.1623	0.1762 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (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 = 1.20)			12.1500	1.1450	13.9122		(27)
French Door (Uw = 1.40)			3.8000	1.3258	5.0379		(27)
Front Door			2.1500	1.0000	2.1500		(26)
FP McCann System			39.5300	0.1100	4.3483	75.0000	2964.7500 (28a)
100mm Knauf Supafil 34	98.5000	15.7900	82.7100	0.2500	20.6775	52.8000	4367.0880 (29a)
WTV	15.3600		15.3600	0.1200	1.8432	9.0000	138.2400 (29a)
Dormer Cheek	6.1900	2.3100	3.8800	0.4400	1.7072	9.0000	34.9200 (29a)
Plane Ceiling-500mm Loft Roll	12.8600		12.8600	0.0900	1.1574	9.0000	115.7400 (30)
Sloping Ceiling	9.9300		9.9300	0.1600	1.5888	9.0000	89.3700 (30)
Dormer Roof	3.5100		3.5100	0.1400	0.4914	9.0000	31.5900 (30)
CTV	13.2300		13.2300	0.1200	1.5876	9.0000	119.0700 (30)
Total net area of external elements Aum(A, m ²)			199.1100				(31)
Fabric heat loss, W/K = Sum (A x U)	(26)...(30) + (32) =				54.5015		(33)
E-WM-30			52.6200	0.0000	0.0000	45.0000	2367.9000 (32)
1F Timber			76.0000			9.0000	684.0000 (32c)
GF Timber			64.5000			9.0000	580.5000 (32c)
SF Timber			35.1800			9.0000	316.6200 (32c)
Internal Floor			65.8300			12.6000	829.4580 (32d)
Internal Ceiling			65.8300			9.0000	592.4700 (32e)
Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =						13231.7160 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							125.5858 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.8336 (36)
Total fabric heat loss	(33) + (36) =						61.3351 (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	41.8099	41.8099	41.8099	41.8099	41.8099	41.8099	41.8099	41.8099	41.8099	41.8099	41.8099	41.8099 (38)
Heat transfer coeff	103.1449	103.1449	103.1449	103.1449	103.1449	103.1449	103.1449	103.1449	103.1449	103.1449	103.1449	103.1449 (39)
Average = Sum(39)m / 12 =												103.1449 (39)
HLP	0.9790	0.9790	0.9790	0.9790	0.9790	0.9790	0.9790	0.9790	0.9790	0.9790	0.9790	0.9790 (40)
HLP (average)												0.9790 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7839 (42)											
Average daily hot water use (litres/day)	100.3180 (43)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	110.3498	106.3370	102.3243	98.3116	94.2989	90.2862	90.2862	94.2989	98.3116	102.3243	106.3370	110.3498 (44)
Energy content	163.6455	143.1254	147.6926	128.7620	123.5502	106.6144	98.7939	113.3675	114.7214	133.6968	145.9405	158.4819 (45)
Energy content (annual)	Total = Sum(45)m =											1578.3921 (45)
Distribution loss (46)m = 0.15 x (45)m	24.5468	21.4688	22.1539	19.3143	18.5325	15.9922	14.8191	17.0051	17.2082	20.0545	21.8911	23.7723 (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	14.1493	12.7688	14.1110	13.6166	14.0362	13.5438	13.9706	14.0131	13.5835	14.0774	13.6631	14.1369 (61)
Total heat required for water heating calculated for each month	177.7948	155.8942	161.8036	142.3786	137.5864	120.1582	112.7646	127.3806	128.3049	147.7742	159.6036	172.6188 (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	177.7948	155.8942	161.8036	142.3786	137.5864	120.1582	112.7646	127.3806	128.3049	147.7742	159.6036	172.6188 (64)
RHI water heating demand	Total per year (kWh/year) = Sum(64)m =											1744.0625 (64)
Heat gains from water heating, kWh/month	57.9495	50.7814	52.6355	46.2175	44.5895	38.8352	36.3416	41.1980	41.5408	47.9735	51.9410	56.2295 (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	167.0348	167.0348	167.0348	167.0348	167.0348	167.0348	167.0348	167.0348	167.0348	167.0348	167.0348	167.0348 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	62.2474	55.2876	44.9629	34.0398	25.4451	21.4819	23.2119	30.1717	40.4964	51.4195	60.0141	63.9774 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	395.0943	399.1942	388.8627	366.8682	339.1041	313.0098	295.5772	291.4774	301.8088	323.8033	351.5674	377.6617 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.4874	54.4874	54.4874	54.4874	54.4874	54.4874	54.4874	54.4874	54.4874	54.4874	54.4874	54.4874 (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)	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566 (71)
Water heating gains (Table 5)	77.8891	75.5675	70.7467	64.1910	59.9321	53.9378	48.8463	55.3736	57.6955	64.4806	72.1402	75.5772 (72)
Total internal gains	648.3964	643.2149	617.7379	578.2647	537.6470	501.5952	480.8011	490.1884	513.1664	552.8690	596.8875	630.3820 (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			7.0900	12.9236	0.4600	0.0000	0.7700	32.4546 (75)				
Southeast			1.4400	40.4699	0.4600	0.0000	0.7700	20.6416 (77)				
Southwest			3.6200	40.4699	0.4600	0.0000	0.7700	51.8907 (79)				
Southwest			3.8000	40.4699	0.4300	0.0000	0.7700	50.9184 (79)				
Solar gains	155.9054	248.9272	362.8282	509.0258	595.9191	651.9917	614.0429	544.3401	442.0386	301.4130	193.3659	130.8531 (83)
Total gains	804.3018	892.1421	980.5661	1087.2904	1133.5662	1153.5869	1094.8440	1034.5285	955.2050	854.2820	790.2533	761.2352 (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	35.6341	35.6341	35.6341	35.6341	35.6341	35.6341	35.6341	35.6341	35.6341	35.6341	35.6341	35.6341
alpha	3.3756	3.3756	3.3756	3.3756	3.3756	3.3756	3.3756	3.3756	3.3756	3.3756	3.3756	3.3756
util living area	0.9519	0.9320	0.8864	0.7910	0.6376	0.4302	0.2888	0.3144	0.5709	0.8176	0.9235	0.9584 (86)
MIT	19.6455	19.8275	20.1735	20.5587	20.8414	20.9699	20.9945	20.9926	20.9181	20.5801	20.0534	19.5897 (87)
Th 2	20.1009	20.1009	20.1009	20.1009	20.1009	20.1009	20.1009	20.1009	20.1009	20.1009	20.1009	20.1009 (88)
util rest of house	0.9441	0.9213	0.8683	0.7586	0.5847	0.3587	0.2065	0.2282	0.4982	0.7814	0.9093	0.9515 (89)
MIT 2	18.3131	18.5722	19.0605	19.5852	19.9429	20.0801	20.0989	20.0980	20.0337	19.6261	18.8994	18.2337 (90)
Living area fraction	18.4864	18.7354	19.2052	19.7117	20.0597	20.1958	20.2153	20.2143	fLA = Living area / (4) =	20.1487	19.7501	19.0494
MIT	18.3364	18.5854	19.0552	19.5617	19.9097	20.0458	20.0653	20.0643	19.9987	19.6001	18.8994	18.2600 (93)

8. Space heating requirement

Utilisation	0.9236	0.8981	0.8429	0.7368	0.5726	0.3542	0.2032	0.2246	0.4894	0.7579	0.8850	0.9323 (94)
Useful gains	742.8438	801.1995	826.5576	801.0784	649.1120	408.5950	222.5111	232.3624	467.4959	647.4668	699.3940	709.6776 (95)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF HEAT DEMAND 09 Jan 2014

Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000 (96)
Heat loss rate W	1365.2657	1339.3771	1202.1749	996.5593	712.7042	417.3023	223.3426	233.5539	494.9636	825.1706	1124.2228	1357.3897 (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	463.0819	361.6554	279.4593	140.7463	47.3126	0.0000	0.0000	0.0000	0.0000	132.2116	305.8768	481.8978 (98)
Space heating												2212.2416 (98)
RHI space heating demand												2212 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (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	39.5300 (1b)	x 2.3100 (2b)	= 91.3143 (1b) - (3b)
First floor	39.5300 (1c)	x 2.5300 (2c)	= 100.0109 (1c) - (3c)
Second floor	26.3000 (1d)	x 2.3600 (2d)	= 62.0680 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	105.3600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 253.3932 (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												0 * 10 =	0.0000 (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) =						0.0000 / (5) =	0.0000 (8)
Pressure test												Yes	
Measured/design AP50													4.0100
Infiltration rate													0.2005 (18)
Number of sides sheltered													1 (19)
Shelter factor												(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor												(21) = (18) x (20) =	0.1855 (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													
	0.2365	0.2318	0.2272	0.2040	0.1994	0.1762	0.1762	0.1716	0.1855	0.1994	0.2086	0.2179 (22b)	
Mechanical extract ventilation - decentralised													
If mechanical ventilation:													0.5000 (23a)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (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 = 1.20)			12.1500	1.1450	13.9122		(27)
French Door (Uw = 1.40)			3.8000	1.3258	5.0379		(27)
Front Door			2.1500	1.0000	2.1500		(26)
FP McCann System			39.5300	0.1100	4.3483	75.0000	2964.7500 (28a)
100mm Knauf Supafil 34	98.5000	15.7900	82.7100	0.2500	20.6775	52.8000	4367.0880 (29a)
WTV	15.3600		15.3600	0.1200	1.8432	9.0000	138.2400 (29a)
Dormer Cheek	6.1900	2.3100	3.8800	0.4400	1.7072	9.0000	34.9200 (29a)
Plane Ceiling-500mm Loft Roll	12.8600		12.8600	0.0900	1.1574	9.0000	115.7400 (30)
Sloping Ceiling	9.9300		9.9300	0.1600	1.5888	9.0000	89.3700 (30)
Dormer Roof	3.5100		3.5100	0.1400	0.4914	9.0000	31.5900 (30)
CTV	13.2300		13.2300	0.1200	1.5876	9.0000	119.0700 (30)
Total net area of external elements Aum(A, m ²)			199.1100				(31)
Fabric heat loss, W/K = Sum (A x U)	(26)...(30) + (32) =				54.5015		(33)
E-WM-30			52.6200	0.0000	0.0000	45.0000	2367.9000 (32)
1F Timber			76.0000			9.0000	684.0000 (32c)
GF Timber			64.5000			9.0000	580.5000 (32c)
SF Timber			35.1800			9.0000	316.6200 (32c)
Internal Floor			65.8300			12.6000	829.4580 (32d)
Internal Ceiling			65.8300			9.0000	592.4700 (32e)
Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =						13231.7160 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							125.5858 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.8336 (36)
Total fabric heat loss	(33) + (36) =						61.3351 (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	41.8099	41.8099	41.8099	41.8099	41.8099	41.8099	41.8099	41.8099	41.8099	41.8099	41.8099	41.8099 (38)
Heat transfer coeff	103.1449	103.1449	103.1449	103.1449	103.1449	103.1449	103.1449	103.1449	103.1449	103.1449	103.1449	103.1449 (39)
Average = Sum(39)m / 12 =												103.1449 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.9790	0.9790	0.9790	0.9790	0.9790	0.9790	0.9790	0.9790	0.9790	0.9790	0.9790	0.9790 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.7839	(42)	
Average daily hot water use (litres/day)												100.3180	(43)	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Daily hot water use	110.3498	106.3370	102.3243	98.3116	94.2989	90.2862	90.2862	94.2989	98.3116	102.3243	106.3370	110.3498	(44)	
Energy content	163.6455	143.1254	147.6926	128.7620	123.5502	106.6144	98.7939	113.3675	114.7214	133.6968	145.9405	158.4819	(45)	
Energy content (annual)												Total = Sum(45)m =	1578.3921	(45)
Distribution loss	(46)m = 0.15 x (45)m													
	24.5468	21.4688	22.1539	19.3143	18.5325	15.9922	14.8191	17.0051	17.2082	20.0545	21.8911	23.7723	(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	14.1493	12.7688	14.1110	13.6166	14.0362	13.5438	13.9706	14.0131	13.5835	14.0774	13.6631	14.1369	(61)	
Total heat required for water heating calculated for each month	177.7948	155.8942	161.8036	142.3786	137.5864	120.1582	112.7646	127.3806	128.3049	147.7742	159.6036	172.6188	(62)	
WWHRS	-58.0955	-51.1175	-52.1716	-42.9189	-39.8478	-32.8702	-27.8149	-33.6788	-34.6632	-42.8551	-49.6480	-56.1533	eq. (G10)	
Total of WWHRS savings													-521.8348	
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)	
								Solar input (sum of months) =	Sum(63)m =	0.0000				(63)
Output from w/h	119.6993	104.7766	109.6320	99.4597	97.7386	87.2881	84.9497	93.7018	93.6417	104.9191	109.9555	116.4655	(64)	
								Total per year (kWh/year) =	Sum(64)m =	1222.2277				(64)
Heat gains from water heating, kWh/month	57.9495	50.7814	52.6355	46.2175	44.5895	38.8352	36.3416	41.1980	41.5408	47.9735	51.9410	56.2295	(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	167.0348	167.0348	167.0348	167.0348	167.0348	167.0348	167.0348	167.0348	167.0348	167.0348	167.0348	167.0348 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	62.2474	55.2876	44.9629	34.0398	25.4451	21.4819	23.2119	30.1717	40.4964	51.4195	60.0141	63.9774 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	395.0943	399.1942	388.8627	366.8682	339.1041	313.0098	295.5772	291.4774	301.8088	323.8033	351.5674	377.6617 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.4874	54.4874	54.4874	54.4874	54.4874	54.4874	54.4874	54.4874	54.4874	54.4874	54.4874	54.4874 (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)	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566 (71)
Water heating gains (Table 5)	77.8891	75.5675	70.7467	64.1910	59.9321	53.9378	48.8463	55.3736	57.6955	64.4806	72.1402	75.5772 (72)
Total internal gains	648.3964	643.2149	617.7379	578.2647	537.6470	501.5952	480.8011	490.1884	513.1664	552.8690	596.8875	630.3820 (73)

6. Solar gains

[Jan]												Gains
					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		W	
Northeast					7.0900	11.2829	0.4600	0.0000	0.7700		28.3346 (75)	
Southeast					1.4400	36.7938	0.4600	0.0000	0.7700		18.7666 (77)	
Southwest					3.6200	36.7938	0.4600	0.0000	0.7700		47.1772 (79)	
Southwest					3.8000	36.7938	0.4300	0.0000	0.7700		46.2933 (79)	
Solar gains	140.5717	248.8572	365.4962	494.7695	592.4293	604.9684	576.2530	500.8225	409.8590	281.7806	170.0864	119.1910 (83)
Total gains	788.9681	892.0721	983.2341	1073.0342	1130.0763	1106.5636	1057.0541	991.0108	923.0254	834.6496	766.9739	749.5731 (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	35.6341	35.6341	35.6341	35.6341	35.6341	35.6341	35.6341	35.6341	35.6341	35.6341	35.6341	35.6341
alpha	3.3756	3.3756	3.3756	3.3756	3.3756	3.3756	3.3756	3.3756	3.3756	3.3756	3.3756	3.3756
util living area	0.9598	0.9392	0.9011	0.8259	0.7047	0.5496	0.4149	0.4571	0.6630	0.8573	0.9398	0.9656 (86)
MIT	19.5048	19.7254	20.0556	20.4395	20.7476	20.9195	20.9763	20.9668	20.8455	20.4467	19.8957	19.4369 (87)
Th 2	20.1009	20.1009	20.1009	20.1009	20.1009	20.1009	20.1009	20.1009	20.1009	20.1009	20.1009	20.1009 (88)
util rest of house	0.9535	0.9298	0.8858	0.7991	0.6606	0.4851	0.3356	0.3756	0.6012	0.8290	0.9289	0.9601 (89)
MIT 2	18.1100	18.4255	18.8940	19.4251	19.8286	20.0314	20.0864	20.0793	19.9555	19.4474	18.6749	18.0125 (90)
Living area fraction	fLA = Living area / (4) = 0.1300 (91)											
MIT	18.2913	18.5945	19.0450	19.5570	19.9481	20.1468	20.2021	20.1947	20.0713	19.5774	18.8336	18.1978 (92)
Temperature adjustment	-0.1500											
adjusted MIT	18.1413	18.4445	18.8950	19.4070	19.7981	19.9968	20.0521	20.0447	19.9213	19.4274	18.6836	18.0478 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9347	0.9075	0.8607	0.7753	0.6444	0.4772	0.3311	0.3703	0.5877	0.8038	0.9063	0.9427 (94)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Useful gains	737.4482	809.5463	846.2217	831.8968	728.2094	528.0349	350.0185	366.9527	542.4510	670.8823	695.1430	706.6055 (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	1427.6636	1397.0500	1278.4849	1083.7420	835.2807	556.6563	356.0675	375.9317	600.4343	910.4993	1194.7898	1428.3259 (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	513.5203	394.8025	321.6038	181.3285	79.6610	0.0000	0.0000	0.0000	0.0000	178.2751	359.7457	536.9600 (98)
Space heating												2565.8969 (98)
Space heating per m2											(98) / (4) =	24.3536 (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 %)												90.5000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												2835.2452 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	513.5203	394.8025	321.6038	181.3285	79.6610	0.0000	0.0000	0.0000	0.0000	178.2751	359.7457	536.9600 (98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000 (210)
Space heating fuel (main heating system)	567.4257	436.2459	355.3633	200.3630	88.0232	0.0000	0.0000	0.0000	0.0000	196.9890	397.5090	593.3260 (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	119.6993	104.7766	109.6320	99.4597	97.7386	87.2881	84.9497	93.7018	93.6417	104.9191	109.9555	116.4655 (64)
Efficiency of water heater	89.8772	89.8096	89.6644	89.3400	88.7085	87.3000	87.3000	87.3000	87.3000	89.2875	89.7300	87.3000 (216)
(217)m	89.8772	89.8096	89.6644	89.3400	88.7085	87.3000	87.3000	87.3000	87.3000	89.2875	89.7300	89.9126 (217)
Fuel for water heating, kWh/month	133.1809	116.6653	122.2693	111.3271	110.1795	99.9863	97.3077	107.3331	107.2643	117.5071	122.5404	129.5320 (219)
Water heating fuel used												1375.0930 (219)
Annual totals kWh/year												
Space heating fuel - main system												2835.2452 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
(MEV)Decentralised, Database: total watage = 6.6170, total flow = 29.0000, SFP = 0.2282)												
mechanical ventilation fans (SFP = 0.2282)												70.5372 (230a)
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												145.5372 (231)
Electricity for lighting (calculated in Appendix L)												439.7232 (232)
Total delivered energy for all uses												4795.5986 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2835.2452	3.4800	98.6665 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1375.0930	3.4800	47.8532 (247)
Mechanical ventilation fans	70.5372	13.1900	9.3039 (249)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	439.7232	13.1900	57.9995 (250)
Additional standing charges			120.0000 (251)
Total energy cost			343.7156 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.9601 (257)
SAP value		86.6066
SAP rating (Section 12)		87 (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	2835.2452	0.2160	612.4130 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1375.0930	0.2160	297.0201 (264)
Space and water heating			909.4331 (265)
Pumps and fans	145.5372	0.5190	75.5338 (267)
Energy for lighting	439.7232	0.5190	228.2164 (268)
Total kg/year			1213.1832 (272)
CO2 emissions per m2			11.5100 (273)
EI value			89.1882

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CALCULATION OF ENERGY RATINGS 09 Jan 2014

EI rating
EI band

89 (274)
B

Calculation of stars for heating and DHW

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9050 = 3.845$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9050 = 0.2387$, stars = 4
Water heating energy efficiency	$3.48 / 0.8879 = 3.919$, stars = 5
Water heating environmental impact	$0.216 / 0.8879 = 0.2433$, stars = 5

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

SAP 2012 WORKSHEET FOR New Build (As Designed) (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	39.5300 (1b)	x 2.3100 (2b)	= 91.3143 (1b) - (3b)
First floor	39.5300 (1c)	x 2.5300 (2c)	= 100.0109 (1c) - (3c)
Second floor	26.3000 (1d)	x 2.3600 (2d)	= 62.0680 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	105.3600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 253.3932 (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							0 * 10 =	0.0000 (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) =						0.0000 / (5) =	0.0000 (8)				
Pressure test							Yes					
Measured/design AP50							4.0100					
Infiltration rate							0.2005 (18)					
Number of sides sheltered							1 (19)					
Shelter factor							(20) = 1 - [0.075 x (19)] =	0.9250 (20)				
Infiltration rate adjusted to include shelter factor							(21) = (18) x (20) =	0.1855 (21)				
Wind speed	Jan 4.2000	Feb 4.0000	Mar 4.0000	Apr 3.7000	May 3.7000	Jun 3.3000	Jul 3.4000	Aug 3.2000	Sep 3.3000	Oct 3.5000	Nov 3.5000	Dec 3.8000 (22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)
Adj infilt rate	0.1947	0.1855	0.1855	0.1716	0.1716	0.1530	0.1576	0.1484	0.1530	0.1623	0.1623	0.1762 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (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 = 1.20)			12.1500	1.1450	13.9122		(27)
French Door (Uw = 1.40)			3.8000	1.3258	5.0379		(27)
Front Door			2.1500	1.0000	2.1500		(26)
FP McCann System			39.5300	0.1100	4.3483	75.0000	2964.7500 (28a)
100mm Knauf Supafil 34	98.5000	15.7900	82.7100	0.2500	20.6775	52.8000	4367.0880 (29a)
WTV	15.3600		15.3600	0.1200	1.8432	9.0000	138.2400 (29a)
Dormer Cheek	6.1900	2.3100	3.8800	0.4400	1.7072	9.0000	34.9200 (29a)
Plane Ceiling-500mm Loft Roll	12.8600		12.8600	0.0900	1.1574	9.0000	115.7400 (30)
Sloping Ceiling	9.9300		9.9300	0.1600	1.5888	9.0000	89.3700 (30)
Dormer Roof	3.5100		3.5100	0.1400	0.4914	9.0000	31.5900 (30)
CTV	13.2300		13.2300	0.1200	1.5876	9.0000	119.0700 (30)
Total net area of external elements Aum(A, m ²)			199.1100				(31)
Fabric heat loss, W/K = Sum (A x U)	(26)...(30) + (32) =				54.5015		(33)
E-WM-30			52.6200	0.0000	0.0000	45.0000	2367.9000 (32)
1F Timber			76.0000			9.0000	684.0000 (32c)
GF Timber			64.5000			9.0000	580.5000 (32c)
SF Timber			35.1800			9.0000	316.6200 (32c)
Internal Floor			65.8300			12.6000	829.4580 (32d)
Internal Ceiling			65.8300			9.0000	592.4700 (32e)
Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =						13231.7160 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							125.5858 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.8336 (36)
Total fabric heat loss	(33) + (36) =						61.3351 (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	41.8099	41.8099	41.8099	41.8099	41.8099	41.8099	41.8099	41.8099	41.8099	41.8099	41.8099	41.8099 (38)
Heat transfer coeff	103.1449	103.1449	103.1449	103.1449	103.1449	103.1449	103.1449	103.1449	103.1449	103.1449	103.1449	103.1449 (39)
Average = Sum(39)m / 12 =												103.1449 (39)
HLP	0.9790	0.9790	0.9790	0.9790	0.9790	0.9790	0.9790	0.9790	0.9790	0.9790	0.9790	0.9790 (40)
HLP (average)												0.9790 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.7839	(42)	
Average daily hot water use (litres/day)												100.3180	(43)	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Daily hot water use	110.3498	106.3370	102.3243	98.3116	94.2989	90.2862	90.2862	94.2989	98.3116	102.3243	106.3370	110.3498	(44)	
Energy content	163.6455	143.1254	147.6926	128.7620	123.5502	106.6144	98.7939	113.3675	114.7214	133.6968	145.9405	158.4819	(45)	
Energy content (annual)												Total = Sum(45)m =	1578.3921	(45)
Distribution loss	(46)m = 0.15 x (45)m													
	24.5468	21.4688	22.1539	19.3143	18.5325	15.9922	14.8191	17.0051	17.2082	20.0545	21.8911	23.7723	(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	14.1493	12.7688	14.1110	13.6166	14.0362	13.5438	13.9706	14.0131	13.5835	14.0774	13.6631	14.1369	(61)	
Total heat required for water heating calculated for each month	177.7948	155.8942	161.8036	142.3786	137.5864	120.1582	112.7646	127.3806	128.3049	147.7742	159.6036	172.6188	(62)	
WWHRS	-58.0955	-51.1175	-52.1716	-42.9189	-39.8478	-32.8702	-27.8149	-33.6788	-34.6632	-42.8551	-49.6480	-56.1533	eq. (G10)	
Total of WWHRS savings													-521.8348	
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)	
								Solar input (sum of months) =	Sum(63)m =	0.0000				(63)
Output from w/h	119.6993	104.7766	109.6320	99.4597	97.7386	87.2881	84.9497	93.7018	93.6417	104.9191	109.9555	116.4655	(64)	
								Total per year (kWh/year) =	Sum(64)m =	1222.2277				(64)
Heat gains from water heating, kWh/month	57.9495	50.7814	52.6355	46.2175	44.5895	38.8352	36.3416	41.1980	41.5408	47.9735	51.9410	56.2295	(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	167.0348	167.0348	167.0348	167.0348	167.0348	167.0348	167.0348	167.0348	167.0348	167.0348	167.0348	167.0348 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	62.2474	55.2876	44.9629	34.0398	25.4451	21.4819	23.2119	30.1717	40.4964	51.4195	60.0141	63.9774 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	395.0943	399.1942	388.8627	366.8682	339.1041	313.0098	295.5772	291.4774	301.8088	323.8033	351.5674	377.6617 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.4874	54.4874	54.4874	54.4874	54.4874	54.4874	54.4874	54.4874	54.4874	54.4874	54.4874	54.4874 (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)	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566 (71)
Water heating gains (Table 5)	77.8891	75.5675	70.7467	64.1910	59.9321	53.9378	48.8463	55.3736	57.6955	64.4806	72.1402	75.5772 (72)
Total internal gains	648.3964	643.2149	617.7379	578.2647	537.6470	501.5952	480.8011	490.1884	513.1664	552.8690	596.8875	630.3820 (73)

6. Solar gains

[Jan]												Gains		
	Area				Solar flux		g		FF		Access		factor	W
	m2				Table 6a		Specific data		Specific data		Table 6d			
					W/m2		or Table 6b		or Table 6c					
Northeast	7.0900				12.9236		0.4600		0.0000		0.7700		32.4546 (75)	
Southeast	1.4400				40.4699		0.4600		0.0000		0.7700		20.6416 (77)	
Southwest	3.6200				40.4699		0.4600		0.0000		0.7700		51.8907 (79)	
Southwest	3.8000				40.4699		0.4300		0.0000		0.7700		50.9184 (79)	
Solar gains	155.9054	248.9272	362.8282	509.0258	595.9191	651.9917	614.0429	544.3401	442.0386	301.4130	193.3659	130.8531 (83)		
Total gains	804.3018	892.1421	980.5661	1087.2904	1133.5662	1153.5869	1094.8440	1034.5285	955.2050	854.2820	790.2533	761.2352 (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	35.6341	35.6341	35.6341	35.6341	35.6341	35.6341	35.6341	35.6341	35.6341	35.6341	35.6341	35.6341
alpha	3.3756	3.3756	3.3756	3.3756	3.3756	3.3756	3.3756	3.3756	3.3756	3.3756	3.3756	3.3756
util living area	0.9519	0.9320	0.8864	0.7910	0.6376	0.4302	0.2888	0.3144	0.5709	0.8176	0.9235	0.9584 (86)
MIT	19.6455	19.8275	20.1735	20.5587	20.8414	20.9699	20.9945	20.9926	20.9181	20.5801	20.0534	19.5897 (87)
Th 2	20.1009	20.1009	20.1009	20.1009	20.1009	20.1009	20.1009	20.1009	20.1009	20.1009	20.1009	20.1009 (88)
util rest of house	0.9441	0.9213	0.8683	0.7586	0.5847	0.3587	0.2065	0.2282	0.4982	0.7814	0.9093	0.9515 (89)
MIT 2	18.3131	18.5722	19.0605	19.5852	19.9429	20.0801	20.0989	20.0980	20.0337	19.6261	18.8994	18.2337 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	18.4864	18.7354	19.2052	19.7117	20.0597	20.1958	20.2153	20.2143	20.1487	19.7501	19.0494	18.4100 (92)
Temperature adjustment	-0.1500											
adjusted MIT	18.3364	18.5854	19.0552	19.5617	19.9097	20.0458	20.0653	20.0643	19.9987	19.6001	18.8994	18.2600 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9236	0.8981	0.8429	0.7368	0.5726	0.3542	0.2032	0.2246	0.4894	0.7579	0.8850	0.9323 (94)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Useful gains	742.8438	801.1995	826.5576	801.0784	649.1120	408.5950	222.5111	232.3624	467.4959	647.4668	699.3940	709.6776 (95)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000 (96)
Heat loss rate W	1365.2657	1339.3771	1202.1749	996.5593	712.7042	417.3023	223.3426	233.5539	494.9636	825.1706	1124.2228	1357.3897 (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	463.0819	361.6554	279.4593	140.7463	47.3126	0.0000	0.0000	0.0000	0.0000	132.2116	305.8768	481.8978 (98)
Space heating												2212.2416 (98)
Space heating per m2												(98) / (4) = 20.9970 (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 %)												90.5000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												2444.4659 (211)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	463.0819	361.6554	279.4593	140.7463	47.3126	0.0000	0.0000	0.0000	0.0000	132.2116	305.8768	481.8978 (98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000 (210)
Space heating fuel (main heating system)	511.6927	399.6192	308.7948	155.5207	52.2791	0.0000	0.0000	0.0000	0.0000	146.0902	337.9854	532.4837 (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	119.6993	104.7766	109.6320	99.4597	97.7386	87.2881	84.9497	93.7018	93.6417	104.9191	109.9555	116.4655 (64)
Efficiency of water heater	89.8237	89.7609	89.5749	89.1470	88.3186	87.3000	87.3000	87.3000	87.3000	89.0557	89.6313	87.3000 (216)
(217)m	89.8237	89.7609	89.5749	89.1470	88.3186	87.3000	87.3000	87.3000	87.3000	89.0557	89.6313	89.8589 (217)
Fuel for water heating, kWh/month	133.2602	116.7286	122.3915	111.5682	110.6659	99.9863	97.3077	107.3331	107.2643	117.8130	122.6755	129.6093 (219)
Water heating fuel used												1376.6036 (219)
Annual totals kWh/year												
Space heating fuel - main system												2444.4659 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
(MEV)Decentralised, Database: total watage = 6.6170, total flow = 29.0000, SFP = 0.2282)												
mechanical ventilation fans (SFP = 0.2282)												70.5372 (230a)
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												145.5372 (231)
Electricity for lighting (calculated in Appendix L)												439.7232 (232)
Total delivered energy for all uses												4406.3299 (238)

10a. Fuel costs - using BEDF prices (440)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2444.4659	3.9200	95.8231 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1376.6036	3.9200	53.9629 (247)
Mechanical ventilation fans	70.5372	16.9600	11.9631 (249)
Pumps and fans for heating	75.0000	16.9600	12.7200 (249)
Energy for lighting	439.7232	16.9600	74.5771 (250)
Additional standing charges			88.0000 (251)
Total energy cost			337.0461 (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	2444.4659	0.2160	528.0046 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1376.6036	0.2160	297.3464 (264)
Space and water heating			825.3510 (265)
Pumps and fans	145.5372	0.5190	75.5338 (267)
Energy for lighting	439.7232	0.5190	228.2164 (268)
Total kg/year			1129.1011 (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	2444.4659	1.2200	2982.2484 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1376.6036	1.2200	1679.4564 (264)
Space and water heating			4661.7048 (265)
Pumps and fans	145.5372	3.0700	446.7991 (267)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Energy for lighting	439.7232	3.0700	1349.9503 (268)
Primary energy kWh/year			6458.4541 (272)
Primary energy kWh/m ² /year			61.2989 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating:	B 87
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	SAP increase too small
O	Not considered
P	Not considered
R	Not considered
S	Not considered
T	Not considered
U Solar photovoltaic panels	Recommended
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
U Solar photovoltaic panels	+ 8.9	-£ 309	-947 kg (83.8%)
Measures omitted - SAP change or cost saving too small:			
N Solar water heating	+ 0.8	-£ 21	-137 kg (12.1%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar photovoltaic panels	£309 8.99 kg/m ²	A 95	A 97
Total Savings	£309 8.99 kg/m ²		

Potential energy efficiency rating:	A 95
Potential environmental impact rating:	A 97

Fuel prices for cost data on this page from database revision number 440 TEST (26 Feb 2019)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Thames Valley):

	Current	Potential	Saving
Electricity	£99	£99	£0
Mains gas	£238	£238	£0
Space heating	£209	£209	£0
Water heating	£54	£54	£0
Lighting	£75	£75	£0
Generated (PV)	-£0	-£309	£309
Total cost of fuels	£337	£28	£309
Total cost of uses	£338	£29	£309
Delivered energy	42 kWh/m ²	25 kWh/m ²	17 kWh/m ²
Carbon dioxide emissions	1.1 tonnes	0.2 tonnes	0.9 tonnes
CO2 emissions per m ²	11 kg/m ²	2 kg/m ²	9 kg/m ²
Primary energy	61 kWh/m ²	8 kWh/m ²	53 kWh/m ²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (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	39.5300 (1b)	x 2.3100 (2b)	= 91.3143 (1b) - (3b)
First floor	39.5300 (1c)	x 2.5300 (2c)	= 100.0109 (1c) - (3c)
Second floor	26.3000 (1d)	x 2.3600 (2d)	= 62.0680 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	105.3600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 253.3932 (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											0 * 10 =	0.0000 (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) =					0.0000 / (5) =	0.0000 (8)	
Pressure test										Yes		
Measured/design AP50										4.0100		
Infiltration rate										0.2005 (18)		
Number of sides sheltered										1 (19)		
Shelter factor					(20) = 1 - [0.075 x (19)] =					0.9250 (20)		
Infiltration rate adjusted to include shelter factor					(21) = (18) x (20) =					0.1855 (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												
	0.2365	0.2318	0.2272	0.2040	0.1994	0.1762	0.1762	0.1716	0.1855	0.1994	0.2086	0.2179 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (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 = 1.20)			12.1500	1.1450	13.9122		(27)
French Door (Uw = 1.40)			3.8000	1.3258	5.0379		(27)
Front Door			2.1500	1.0000	2.1500		(26)
FP McCann System			39.5300	0.1100	4.3483	75.0000	2964.7500 (28a)
100mm Knauf Supafil 34	98.5000	15.7900	82.7100	0.2500	20.6775	52.8000	4367.0880 (29a)
WTV	15.3600		15.3600	0.1200	1.8432	9.0000	138.2400 (29a)
Dormer Cheek	6.1900	2.3100	3.8800	0.4400	1.7072	9.0000	34.9200 (29a)
Plane Ceiling-500mm Loft Roll	12.8600		12.8600	0.0900	1.1574	9.0000	115.7400 (30)
Sloping Ceiling	9.9300		9.9300	0.1600	1.5888	9.0000	89.3700 (30)
Dormer Roof	3.5100		3.5100	0.1400	0.4914	9.0000	31.5900 (30)
CTV	13.2300		13.2300	0.1200	1.5876	9.0000	119.0700 (30)
Total net area of external elements Aum(A, m ²)			199.1100				(31)
Fabric heat loss, W/K = Sum (A x U)	(26)...(30) + (32) =				54.5015		(33)
E-WM-30			52.6200	0.0000	0.0000	45.0000	2367.9000 (32)
1F Timber			76.0000			9.0000	684.0000 (32c)
GF Timber			64.5000			9.0000	580.5000 (32c)
SF Timber			35.1800			9.0000	316.6200 (32c)
Internal Floor			65.8300			12.6000	829.4580 (32d)
Internal Ceiling			65.8300			9.0000	592.4700 (32e)
Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =						13231.7160 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							125.5858 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.8336 (36)
Total fabric heat loss	(33) + (36) =						61.3351 (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	41.8099	41.8099	41.8099	41.8099	41.8099	41.8099	41.8099	41.8099	41.8099	41.8099	41.8099	41.8099 (38)
Heat transfer coeff	103.1449	103.1449	103.1449	103.1449	103.1449	103.1449	103.1449	103.1449	103.1449	103.1449	103.1449	103.1449 (39)
Average = Sum(39)m / 12 =												103.1449 (39)
HLP	0.9790	0.9790	0.9790	0.9790	0.9790	0.9790	0.9790	0.9790	0.9790	0.9790	0.9790	0.9790 (40)
HLP (average)												0.9790 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.7839	(42)	
Average daily hot water use (litres/day)												100.3180	(43)	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Daily hot water use	110.3498	106.3370	102.3243	98.3116	94.2989	90.2862	90.2862	94.2989	98.3116	102.3243	106.3370	110.3498	(44)	
Energy content	163.6455	143.1254	147.6926	128.7620	123.5502	106.6144	98.7939	113.3675	114.7214	133.6968	145.9405	158.4819	(45)	
Energy content (annual)												Total = Sum(45)m =	1578.3921	(45)
Distribution loss	(46)m = 0.15 x (45)m													
	24.5468	21.4688	22.1539	19.3143	18.5325	15.9922	14.8191	17.0051	17.2082	20.0545	21.8911	23.7723	(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	14.1493	12.7688	14.1110	13.6166	14.0362	13.5438	13.9706	14.0131	13.5835	14.0774	13.6631	14.1369	(61)	
Total heat required for water heating calculated for each month	177.7948	155.8942	161.8036	142.3786	137.5864	120.1582	112.7646	127.3806	128.3049	147.7742	159.6036	172.6188	(62)	
WWHRS	-58.0955	-51.1175	-52.1716	-42.9189	-39.8478	-32.8702	-27.8149	-33.6788	-34.6632	-42.8551	-49.6480	-56.1533	eq. (G10)	
Total of WWHRS savings													-521.8348	
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)	
								Solar input (sum of months) =	Sum(63)m =	0.0000				(63)
Output from w/h	119.6993	104.7766	109.6320	99.4597	97.7386	87.2881	84.9497	93.7018	93.6417	104.9191	109.9555	116.4655	(64)	
								Total per year (kWh/year) =	Sum(64)m =	1222.2277				(64)
Heat gains from water heating, kWh/month	57.9495	50.7814	52.6355	46.2175	44.5895	38.8352	36.3416	41.1980	41.5408	47.9735	51.9410	56.2295	(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	167.0348	167.0348	167.0348	167.0348	167.0348	167.0348	167.0348	167.0348	167.0348	167.0348	167.0348	167.0348 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	62.2474	55.2876	44.9629	34.0398	25.4451	21.4819	23.2119	30.1717	40.4964	51.4195	60.0141	63.9774 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	395.0943	399.1942	388.8627	366.8682	339.1041	313.0098	295.5772	291.4774	301.8088	323.8033	351.5674	377.6617 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.4874	54.4874	54.4874	54.4874	54.4874	54.4874	54.4874	54.4874	54.4874	54.4874	54.4874	54.4874 (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)	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566 (71)
Water heating gains (Table 5)	77.8891	75.5675	70.7467	64.1910	59.9321	53.9378	48.8463	55.3736	57.6955	64.4806	72.1402	75.5772 (72)
Total internal gains	648.3964	643.2149	617.7379	578.2647	537.6470	501.5952	480.8011	490.1884	513.1664	552.8690	596.8875	630.3820 (73)

6. Solar gains

[Jan]												Gains
					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		W	
Northeast					7.0900	11.2829	0.4600	0.0000	0.7700		28.3346 (75)	
Southeast					1.4400	36.7938	0.4600	0.0000	0.7700		18.7666 (77)	
Southwest					3.6200	36.7938	0.4600	0.0000	0.7700		47.1772 (79)	
Southwest					3.8000	36.7938	0.4300	0.0000	0.7700		46.2933 (79)	
Solar gains	140.5717	248.8572	365.4962	494.7695	592.4293	604.9684	576.2530	500.8225	409.8590	281.7806	170.0864	119.1910 (83)
Total gains	788.9681	892.0721	983.2341	1073.0342	1130.0763	1106.5636	1057.0541	991.0108	923.0254	834.6496	766.9739	749.5731 (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	35.6341	35.6341	35.6341	35.6341	35.6341	35.6341	35.6341	35.6341	35.6341	35.6341	35.6341	35.6341
alpha	3.3756	3.3756	3.3756	3.3756	3.3756	3.3756	3.3756	3.3756	3.3756	3.3756	3.3756	3.3756
util living area	0.9598	0.9392	0.9011	0.8259	0.7047	0.5496	0.4149	0.4571	0.6630	0.8573	0.9398	0.9656 (86)
MIT	19.5048	19.7254	20.0556	20.4395	20.7476	20.9195	20.9763	20.9668	20.8455	20.4467	19.8957	19.4369 (87)
Th 2	20.1009	20.1009	20.1009	20.1009	20.1009	20.1009	20.1009	20.1009	20.1009	20.1009	20.1009	20.1009 (88)
util rest of house	0.9535	0.9298	0.8858	0.7991	0.6606	0.4851	0.3356	0.3756	0.6012	0.8290	0.9289	0.9601 (89)
MIT 2	18.1100	18.4255	18.8940	19.4251	19.8286	20.0314	20.0864	20.0793	19.9555	19.4474	18.6749	18.0125 (90)
Living area fraction	fLA = Living area / (4) = 0.1300 (91)											
MIT	18.2913	18.5945	19.0450	19.5570	19.9481	20.1468	20.2021	20.1947	20.0713	19.5774	18.8336	18.1978 (92)
Temperature adjustment	-0.1500											
adjusted MIT	18.1413	18.4445	18.8950	19.4070	19.7981	19.9968	20.0521	20.0447	19.9213	19.4274	18.6836	18.0478 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9347	0.9075	0.8607	0.7753	0.6444	0.4772	0.3311	0.3703	0.5877	0.8038	0.9063	0.9427 (94)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Useful gains	737.4482	809.5463	846.2217	831.8968	728.2094	528.0349	350.0185	366.9527	542.4510	670.8823	695.1430	706.6055 (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	1427.6636	1397.0500	1278.4849	1083.7420	835.2807	556.6563	356.0675	375.9317	600.4343	910.4993	1194.7898	1428.3259 (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	513.5203	394.8025	321.6038	181.3285	79.6610	0.0000	0.0000	0.0000	0.0000	178.2751	359.7457	536.9600 (98)
Space heating												2565.8969 (98)
Space heating per m2											(98) / (4) =	24.3536 (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 %)												90.5000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												2835.2452 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	513.5203	394.8025	321.6038	181.3285	79.6610	0.0000	0.0000	0.0000	0.0000	178.2751	359.7457	536.9600 (98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000 (210)
Space heating fuel (main heating system)	567.4257	436.2459	355.3633	200.3630	88.0232	0.0000	0.0000	0.0000	0.0000	196.9890	397.5090	593.3260 (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												
Water heating requirement	119.6993	104.7766	109.6320	99.4597	97.7386	87.2881	84.9497	93.7018	93.6417	104.9191	109.9555	116.4655 (64)
Efficiency of water heater	89.8772	89.8096	89.6644	89.3400	88.7085	87.3000	87.3000	87.3000	87.3000	89.2875	89.7300	87.3000 (216)
(217)m	89.8772	89.8096	89.6644	89.3400	88.7085	87.3000	87.3000	87.3000	87.3000	89.2875	89.7300	89.9126 (217)
Fuel for water heating, kWh/month	133.1809	116.6653	122.2693	111.3271	110.1795	99.9863	97.3077	107.3331	107.2643	117.5071	122.5404	129.5320 (219)
Water heating fuel used												1375.0930 (219)
Annual totals kWh/year												
Space heating fuel - main system												2835.2452 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
(MEV)Decentralised, Database: total watage = 6.6170, total flow = 29.0000, SFP = 0.2282)												
mechanical ventilation fans (SFP = 0.2282)												70.5372 (230a)
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												145.5372 (231)
Electricity for lighting (calculated in Appendix L)												439.7232 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 2.50 * 1080 * 0.80) =									-1727.2394			-1727.2394 (233)
Total delivered energy for all uses												3068.3592 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2835.2452	3.4800	98.6665 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1375.0930	3.4800	47.8532 (247)
Mechanical ventilation fans	70.5372	13.1900	9.3039 (249)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	439.7232	13.1900	57.9995 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-1727.2394	13.1900	-227.8229 (252)
Total energy cost			115.8927 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.4200 (256)
SAP value		95.4841 (257)
SAP rating (Section 12)		95 (258)
SAP band		A

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	2835.2452	0.2160	612.4130 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1375.0930	0.2160	297.0201 (264)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Space and water heating			909.4331 (265)
Pumps and fans	145.5372	0.5190	75.5338 (267)
Energy for lighting	439.7232	0.5190	228.2164 (268)
Energy saving/generation technologies			
PV Unit	-1727.2394	0.5190	-896.4372 (269)
Total kg/year			316.7460 (272)
CO2 emissions per m2			3.0100 (273)
EI value			97.1772
EI rating			97 (274)
EI band			A

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

SAP 2012 WORKSHEET FOR New Build (As Designed) (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	39.5300 (1b)	x 2.3100 (2b)	= 91.3143 (1b) - (3b)
First floor	39.5300 (1c)	x 2.5300 (2c)	= 100.0109 (1c) - (3c)
Second floor	26.3000 (1d)	x 2.3600 (2d)	= 62.0680 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	105.3600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 253.3932 (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							0 * 10 =	0.0000 (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) =						0.0000 / (5) =	0.0000 (8)				
Pressure test							Yes					
Measured/design AP50							4.0100					
Infiltration rate							0.2005 (18)					
Number of sides sheltered							1 (19)					
Shelter factor							(20) = 1 - [0.075 x (19)] =	0.9250 (20)				
Infiltration rate adjusted to include shelter factor							(21) = (18) x (20) =	0.1855 (21)				
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind factor	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)
Adj infilt rate												
	0.1947	0.1855	0.1855	0.1716	0.1716	0.1530	0.1576	0.1484	0.1530	0.1623	0.1623	0.1762 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:	0.5000 (23a)											
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (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 = 1.20)			12.1500	1.1450	13.9122		(27)
French Door (Uw = 1.40)			3.8000	1.3258	5.0379		(27)
Front Door			2.1500	1.0000	2.1500		(26)
FP McCann System			39.5300	0.1100	4.3483	75.0000	2964.7500 (28a)
100mm Knauf Supafil 34	98.5000	15.7900	82.7100	0.2500	20.6775	52.8000	4367.0880 (29a)
WTV	15.3600		15.3600	0.1200	1.8432	9.0000	138.2400 (29a)
Dormer Cheek	6.1900	2.3100	3.8800	0.4400	1.7072	9.0000	34.9200 (29a)
Plane Ceiling-500mm Loft Roll	12.8600		12.8600	0.0900	1.1574	9.0000	115.7400 (30)
Sloping Ceiling	9.9300		9.9300	0.1600	1.5888	9.0000	89.3700 (30)
Dormer Roof	3.5100		3.5100	0.1400	0.4914	9.0000	31.5900 (30)
CTV	13.2300		13.2300	0.1200	1.5876	9.0000	119.0700 (30)
Total net area of external elements Aum(A, m ²)			199.1100				(31)
Fabric heat loss, W/K = Sum (A x U)	(26)...(30) + (32) =				54.5015		(33)
E-WM-30			52.6200	0.0000	0.0000	45.0000	2367.9000 (32)
1F Timber			76.0000			9.0000	684.0000 (32c)
GF Timber			64.5000			9.0000	580.5000 (32c)
SF Timber			35.1800			9.0000	316.6200 (32c)
Internal Floor			65.8300			12.6000	829.4580 (32d)
Internal Ceiling			65.8300			9.0000	592.4700 (32e)
Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =						13231.7160 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							125.5858 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.8336 (36)
Total fabric heat loss	(33) + (36) =						61.3351 (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	41.8099	41.8099	41.8099	41.8099	41.8099	41.8099	41.8099	41.8099	41.8099	41.8099	41.8099	41.8099 (38)
Heat transfer coeff	103.1449	103.1449	103.1449	103.1449	103.1449	103.1449	103.1449	103.1449	103.1449	103.1449	103.1449	103.1449 (39)
Average = Sum(39)m / 12 =												103.1449 (39)
HLP	0.9790	0.9790	0.9790	0.9790	0.9790	0.9790	0.9790	0.9790	0.9790	0.9790	0.9790	0.9790 (40)
HLP (average)												0.9790 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.7839 (42)
Average daily hot water use (litres/day)												100.3180 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	110.3498	106.3370	102.3243	98.3116	94.2989	90.2862	90.2862	94.2989	98.3116	102.3243	106.3370	110.3498 (44)
Energy content (annual)	163.6455	143.1254	147.6926	128.7620	123.5502	106.6144	98.7939	113.3675	114.7214	133.6968	145.9405	158.4819 (45)
Distribution loss (46)m = 0.15 x (45)m	24.5468	21.4688	22.1539	19.3143	18.5325	15.9922	14.8191	17.0051	17.2082	20.0545	21.8911	23.7723 (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	14.1493	12.7688	14.1110	13.6166	14.0362	13.5438	13.9706	14.0131	13.5835	14.0774	13.6631	14.1369 (61)
Total heat required for water heating calculated for each month	177.7948	155.8942	161.8036	142.3786	137.5864	120.1582	112.7646	127.3806	128.3049	147.7742	159.6036	172.6188 (62)
WWHRS	-58.0955	-51.1175	-52.1716	-42.9189	-39.8478	-32.8702	-27.8149	-33.6788	-34.6632	-42.8551	-49.6480	-56.1533 eq. (G10)
Total of WWHRS savings												-521.8348
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	119.6993	104.7766	109.6320	99.4597	97.7386	87.2881	84.9497	93.7018	93.6417	104.9191	109.9555	116.4655 (64)
Heat gains from water heating, kWh/month	57.9495	50.7814	52.6355	46.2175	44.5895	38.8352	36.3416	41.1980	41.5408	47.9735	51.9410	56.2295 (65)
												1222.2277 (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	167.0348	167.0348	167.0348	167.0348	167.0348	167.0348	167.0348	167.0348	167.0348	167.0348	167.0348	167.0348 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	62.2474	55.2876	44.9629	34.0398	25.4451	21.4819	23.2119	30.1717	40.4964	51.4195	60.0141	63.9774 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	395.0943	399.1942	388.8627	366.8682	339.1041	313.0098	295.5772	291.4774	301.8088	323.8033	351.5674	377.6617 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.4874	54.4874	54.4874	54.4874	54.4874	54.4874	54.4874	54.4874	54.4874	54.4874	54.4874	54.4874 (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)	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566	-111.3566 (71)
Water heating gains (Table 5)	77.8891	75.5675	70.7467	64.1910	59.9321	53.9378	48.8463	55.3736	57.6955	64.4806	72.1402	75.5772 (72)
Total internal gains	648.3964	643.2149	617.7379	578.2647	537.6470	501.5952	480.8011	490.1884	513.1664	552.8690	596.8875	630.3820 (73)

6. Solar gains

[Jan]												Gains		
	Area				Solar flux		g		FF		Access		factor	W
	m2				Table 6a		Specific data		Specific data		Table 6d			
					W/m2		or Table 6b		or Table 6c					
Northeast	7.0900				12.9236		0.4600		0.0000		0.7700		32.4546 (75)	
Southeast	1.4400				40.4699		0.4600		0.0000		0.7700		20.6416 (77)	
Southwest	3.6200				40.4699		0.4600		0.0000		0.7700		51.8907 (79)	
Southwest	3.8000				40.4699		0.4300		0.0000		0.7700		50.9184 (79)	
Solar gains	155.9054	248.9272	362.8282	509.0258	595.9191	651.9917	614.0429	544.3401	442.0386	301.4130	193.3659	130.8531 (83)		
Total gains	804.3018	892.1421	980.5661	1087.2904	1133.5662	1153.5869	1094.8440	1034.5285	955.2050	854.2820	790.2533	761.2352 (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	35.6341	35.6341	35.6341	35.6341	35.6341	35.6341	35.6341	35.6341	35.6341	35.6341	35.6341	35.6341
alpha	3.3756	3.3756	3.3756	3.3756	3.3756	3.3756	3.3756	3.3756	3.3756	3.3756	3.3756	3.3756
util living area	0.9519	0.9320	0.8864	0.7910	0.6376	0.4302	0.2888	0.3144	0.5709	0.8176	0.9235	0.9584 (86)
MIT	19.6455	19.8275	20.1735	20.5587	20.8414	20.9699	20.9945	20.9926	20.9181	20.5801	20.0534	19.5897 (87)
Th 2	20.1009	20.1009	20.1009	20.1009	20.1009	20.1009	20.1009	20.1009	20.1009	20.1009	20.1009	20.1009 (88)
util rest of house	0.9441	0.9213	0.8683	0.7586	0.5847	0.3587	0.2065	0.2282	0.4982	0.7814	0.9093	0.9515 (89)
MIT 2	18.3131	18.5722	19.0605	19.5852	19.9429	20.0801	20.0989	20.0980	20.0337	19.6261	18.8994	18.2337 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	18.4864	18.7354	19.2052	19.7117	20.0597	20.1958	20.2153	20.2143	20.1487	19.7501	19.0494	18.4100 (92)
Temperature adjustment	-0.1500											
adjusted MIT	18.3364	18.5854	19.0552	19.5617	19.9097	20.0458	20.0653	20.0643	19.9987	19.6001	18.8994	18.2600 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9236	0.8981	0.8429	0.7368	0.5726	0.3542	0.2032	0.2246	0.4894	0.7579	0.8850	0.9323 (94)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Useful gains	742.8438	801.1995	826.5576	801.0784	649.1120	408.5950	222.5111	232.3624	467.4959	647.4668	699.3940	709.6776 (95)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000 (96)
Heat loss rate W	1365.2657	1339.3771	1202.1749	996.5593	712.7042	417.3023	223.3426	233.5539	494.9636	825.1706	1124.2228	1357.3897 (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	463.0819	361.6554	279.4593	140.7463	47.3126	0.0000	0.0000	0.0000	0.0000	132.2116	305.8768	481.8978 (98)
Space heating												2212.2416 (98)
Space heating per m2												(98) / (4) = 20.9970 (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 %)												90.5000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												2444.4659 (211)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	463.0819	361.6554	279.4593	140.7463	47.3126	0.0000	0.0000	0.0000	0.0000	132.2116	305.8768	481.8978 (98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000 (210)
Space heating fuel (main heating system)	511.6927	399.6192	308.7948	155.5207	52.2791	0.0000	0.0000	0.0000	0.0000	146.0902	337.9854	532.4837 (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	119.6993	104.7766	109.6320	99.4597	97.7386	87.2881	84.9497	93.7018	93.6417	104.9191	109.9555	116.4655 (64)
Efficiency of water heater	89.8237	89.7609	89.5749	89.1470	88.3186	87.3000	87.3000	87.3000	87.3000	89.0557	89.6313	87.3000 (216)
(217)m	89.8237	89.7609	89.5749	89.1470	88.3186	87.3000	87.3000	87.3000	87.3000	89.0557	89.6313	89.8589 (217)
Fuel for water heating, kWh/month	133.2602	116.7286	122.3915	111.5682	110.6659	99.9863	97.3077	107.3331	107.2643	117.8130	122.6755	129.6093 (219)
Water heating fuel used												1376.6036 (219)
Annual totals kWh/year												
Space heating fuel - main system												2444.4659 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
(MEV)Decentralised, Database: total watage = 6.6170, total flow = 29.0000, SFP = 0.2282)												
mechanical ventilation fans (SFP = 0.2282)												70.5372 (230a)
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												145.5372 (231)
Electricity for lighting (calculated in Appendix L)												439.7232 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 2.50 * 1140 * 0.80) =									-1824.1596			-1824.1596 (233)
Total delivered energy for all uses												2582.1702 (238)

10a. Fuel costs - using BEDF prices (440)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2444.4659	3.9200	95.8231 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1376.6036	3.9200	53.9629 (247)
Mechanical ventilation fans	70.5372	16.9600	11.9631 (249)
Pumps and fans for heating	75.0000	16.9600	12.7200 (249)
Energy for lighting	439.7232	16.9600	74.5771 (250)
Additional standing charges			88.0000 (251)
Energy saving/generation technologies			
PV Unit	-1824.1596	16.9600	-309.3775 (252)
Total energy cost			27.6686 (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	2444.4659	0.2160	528.0046 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1376.6036	0.2160	297.3464 (264)
Space and water heating			825.3510 (265)
Pumps and fans	145.5372	0.5190	75.5338 (267)
Energy for lighting	439.7232	0.5190	228.2164 (268)
Energy saving/generation technologies			
PV Unit	-1824.1596	0.5190	-946.7389 (269)
Total kg/year			182.3623 (272)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO ₂ /kWh	Primary energy kWh/year
Space heating - main system 1	2444.4659	1.2200	2982.2484 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1376.6036	1.2200	1679.4564 (264)
Space and water heating			4661.7048 (265)
Pumps and fans	145.5372	3.0700	446.7991 (267)
Energy for lighting	439.7232	3.0700	1349.9503 (268)
Energy saving/generation technologies			
PV Unit	-1824.1596	3.0700	-5600.1701 (269)
Primary energy kWh/year			858.2840 (272)
Primary energy kWh/m ² /year			8.1462 (273)

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

Overheating Calculation Input Data

Dwelling type	SemiDetached House
Number of storeys	3
Cross ventilation possible	Yes
SAP Region	Thames Valley
Front of dwelling faces	North East
Overshading	Average or unknown
Thermal mass parameter	125.6 (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	334.48 (P1)
Transmission heat loss coefficient	61.34 (37)
Summer heat loss coefficient	395.81 (P2)

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

Solar shading	Z blinds	Solar access	Z overhangs	Z summer
Orientation				
North East	1.000	0.90	1.000	0.900 (P8)
South East	1.000	0.90	1.000	0.900 (P8)
South West	1.000	0.90	1.000	0.900 (P8)

[Jul]	Area m ²	Solar flux Table 6a W/m ²	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North East	7.0900	98.8453	0.4600	0.0000	0.9000	290.1366
South East	1.4400	119.9223	0.4600	0.0000	0.9000	71.4929
South West	3.6200	119.9223	0.4600	0.0000	0.9000	179.7252
South West	3.8000	119.9223	0.4300	0.0000	0.9000	176.3578
total:						717.7125

	Jun	Jul	Aug	
Solar gains	762	718	636	(P4)
Internal gains	499	478	487	
Total summer gains	1261	1196	1123	(P5)
Summer gain/loss ratio	3.18	3.02	2.84	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 125.6)	1.12	1.12	1.12	
Threshold temperature	20.31	22.04	21.76	(P7)
Likelihood of high internal temperature	Not significant	Medium	Slight	
Assessment of likelihood of high internal temperature:	Medium			