

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property Reference	X308 Det				Issued on Date	15/12/2022
Assessment Reference	X308 Det	Prop Type Ref	Cypress			
Property	3 Bed, K, WC, U, B, En					
SAP Rating	85 B	DER	15.10	TER	18.33	
Environmental	87 B	% DER<TER	17.63			
CO ₂ Emissions (t/year)	1.29	DFEE	48.98	TFEE	59.08	
General Requirements Compliance	Pass	% DFEE<TFEE	17.09			
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

Detached House, total floor area 103 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) 18.33 kgCO₂/m²

Dwelling Carbon Dioxide Emission Rate (DER) 15.10 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)59.1 kWh/m²/yr

Dwelling Fabric Energy Efficiency (DFEE)49.0 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.25 (max. 0.30)	0.25 (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	0.09 (max. 0.20)	0.09 (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): Slight OK

Based on:

Overshading:

Average

Windows facing North East: 9.60 m², No overhang

Windows facing South East: 2.03 m², No overhang

Windows facing South West: 6.69 m², No overhang

Windows facing North West: 1.88 m², No overhang

Air change rate: 4.00 ach

Blinds/curtains: None

10 Key features

Party wall U-value 0.00 W/m²K

Roof U-value 0.09 W/m²K

Floor U-value 0.11 W/m²K

Door U-value 1.00 W/m²K

Thermal bridging y-value 0.022 W/m²K

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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	51.4300 (1b)	x 2.3100 (2b)	= 118.8033 (1b) - (3b)
First floor	51.4300 (1c)	x 2.5300 (2c)	= 130.1179 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	102.8600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 248.9212 (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)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =											0.0000 / (5) =	0.0000 (8)
Pressure test											Yes	(8)
Measured/design AP50											4.0100	
Infiltration rate											0.2005	(18)
Number of sides sheltered											0	(19)
Shelter factor											(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =	0.2005 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.2556	0.2506	0.2456	0.2206	0.2155	0.1905	0.1905	0.1855	0.2005	0.2155	0.2256	0.2356 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5056	0.5006	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)			16.4000	1.1450	18.7786		(27)
French Door (Uw = 1.40)			3.8000	1.3258	5.0379		(27)
Front Door			2.1500	1.0000	2.1500		(26)
Half-Glazed Door			1.9100	1.3000	2.4830		(26a)
FP McCann System			51.4300	0.1100	5.6573	75.0000	3857.2500 (28a)
100mm Knauf Supafil 34	146.2200	24.2600	121.9600	0.2500	30.4900	52.8000	6439.4880 (29a)
Plane Ceiling-500mm Loft Roll	51.4300		51.4300	0.0900	4.6287	9.0000	462.8700 (30a)
Total net area of external elements Aum(A, m ²)			249.0800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	69.2255		(33)
1F Timber			87.3300			9.0000	785.9700 (32c)
GF Masonry			52.2100			39.0000	2036.1900 (32c)
GF Timber			24.0700			9.0000	216.6300 (32c)
Internal Floor			51.4300			12.6000	648.0180 (32d)
Internal Ceiling			51.4300			9.0000	462.8700 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	14909.2860 (34)
Thermal mass parameter (TMP) = Cm / TFA in kJ/m ² K							144.9474 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.5546 (36)
Total fabric heat loss						(33) + (36) =	74.7801 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 41.5351	Feb 41.1233	Mar 41.0720	Apr 41.0720	May 41.0720	Jun 41.0720	Jul 41.0720	Aug 41.0720	Sep 41.0720	Oct 41.0720	Nov 41.0720	Dec 41.0720 (38)
Heat transfer coeff	116.3152	115.9035	115.8521	115.8521	115.8521	115.8521	115.8521	115.8521	115.8521	115.8521	115.8521	115.8521 (39)
Average = Sum(39)m / 12 =												115.8950 (39)
HLP	Jan 1.1308	Feb 1.1268	Mar 1.1263	Apr 1.1263	May 1.1263	Jun 1.1263	Jul 1.1263	Aug 1.1263	Sep 1.1263	Oct 1.1263	Nov 1.1263	Dec 1.1263 (40)
HLP (average)												1.1267 (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	2.7645 (42)
Average daily hot water use (litres/day)	99.8562 (43)

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	109.8418	105.8476	101.8533	97.8591	93.8648	89.8706	89.8706	93.8648	97.8591	101.8533	105.8476	109.8418	(44)
Energy conte	162.8922	142.4666	147.0127	128.1693	122.9815	106.1237	98.3392	112.8456	114.1934	133.0814	145.2687	157.7524	(45)
Energy content (annual)													(45)
Distribution loss (46)m = 0.15 x (45)m	24.4338	21.3700	22.0519	19.2254	18.4472	15.9185	14.7509	16.9268	17.1290	19.9622	21.7903	23.6629	(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													
Combi loss	14.1475	12.7672	14.1094	13.6138	14.0336	13.5417	13.9687	14.0108	13.5810	14.0760	13.6614	14.1352	(61)
Total heat required for water heating calculated for each month	177.0397	155.2338	161.1221	141.7831	137.0151	119.6654	112.3078	126.8564	127.7744	147.1573	158.9302	171.8876	(62)
WWHRS	-50.8932	-44.7802	-45.7036	-37.5990	-34.9091	-28.7966	-24.3685	-29.5056	-30.3677	-37.5438	-43.4939	-49.1916	eq. (G10)
Total of WWHRS savings													-457.1528
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	126.1465	110.4536	115.4185	104.1841	102.1060	90.8688	87.9394	97.3508	97.4066	109.6136	115.4363	122.6960	(64)
Heat gains from water heating, kWh/month	57.6985	50.5619	52.4091	46.0197	44.3997	38.6715	36.1899	41.0239	41.3645	47.7685	51.7172	55.9865	(65)
Total per year (kWh/year) = Sum(64)m =													1279.6200 (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	138.2235	138.2235	138.2235	138.2235	138.2235	138.2235	138.2235	138.2235	138.2235	138.2235	138.2235	138.2235	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	23.4677	20.8438	16.9513	12.8332	9.5930	8.0988	8.7510	11.3749	15.2674	19.3855	22.6257	24.1199	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	260.8702	263.5772	256.7556	242.2332	223.9013	206.6720	195.1617	192.4547	199.2763	213.7986	232.1305	249.3599	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.8224	36.8224	36.8224	36.8224	36.8224	36.8224	36.8224	36.8224	36.8224	36.8224	36.8224	36.8224	(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)	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788	(71)
Water heating gains (Table 5)	77.5518	75.2410	70.4423	63.9163	59.6771	53.7105	48.6424	55.1396	57.4508	64.2050	71.8295	75.2506	(72)
Total internal gains	429.3567	427.1290	411.6162	386.4498	360.6385	335.9483	320.0222	326.4363	339.4615	364.8562	394.0527	416.1975	(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				5.8000	11.2829	0.4600	0.7000	0.7700	14.6029 (75)				
Southeast				2.0300	36.7938	0.4600	0.7000	0.7700	16.6671 (77)				
Southwest				6.6900	36.7938	0.4600	0.7000	0.7700	54.9276 (79)				
Northwest				1.8800	11.2829	0.4600	0.7000	0.7700	4.7334 (81)				
Northeast				3.8000	11.2829	0.4300	0.0000	0.7700	14.1960 (75)				
Solar gains	105.1269	190.2080	289.8356	408.7088	503.0499	519.3214	492.3959	418.9694	330.5218	218.1972	127.9461	88.6542	(83)
Total gains	534.4836	617.3370	701.4519	795.1586	863.6884	855.2697	812.4181	745.4057	669.9833	583.0534	521.9989	504.8517	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
tau	35.6056	35.7320	35.7479	35.7479	35.7479	35.7479	35.7479	35.7479	35.7479	35.7479	35.7479	35.7479	
alpha	3.3737	3.3821	3.3832	3.3832	3.3832	3.3832	3.3832	3.3832	3.3832	3.3832	3.3832	3.3832	
util living area	0.9906	0.9840	0.9690	0.9307	0.8487	0.7140	0.5720	0.6299	0.8347	0.9538	0.9849	0.9923	(86)
MIT	19.0580	19.2683	19.6237	20.0893	20.5261	20.8200	20.9380	20.9128	20.6695	20.1072	19.4915	19.0110	(87)
Th 2	19.9758	19.9790	19.9794	19.9794	19.9794	19.9794	19.9794	19.9794	19.9794	19.9794	19.9794	19.9794	(88)
util rest of house	0.9887	0.9806	0.9621	0.9142	0.8105	0.6384	0.4599	0.5196	0.7782	0.9397	0.9812	0.9907	(89)
MIT 2	17.3691	17.6769	18.1922	18.8575	19.4571	19.8237	19.9433	19.9242	19.6574	18.8935	18.0043	17.3029	(90)
Living area fraction	17.6139	17.9076	18.3997	19.0360	19.6120	19.9681	20.0875	20.0675	19.8041	19.0695	18.2199	17.5505	(91)
MIT	17.6139	17.9076	18.3997	19.0360	19.6120	19.9681	20.0875	20.0675	19.8041	19.0695	18.2199	17.5505	(92)
Temperature adjustment													-0.1500
adjusted MIT	17.4639	17.7576	18.2497	18.8860	19.4620	19.8181	19.9375	19.9175	19.6541	18.9195	18.0699	17.4005	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	524.3965	598.5869	663.2784	708.4790	679.8704	534.4134	369.5627	381.7337	506.5214	535.7722	506.5297	496.8328	(94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1531.1607	1490.2408	1361.2243	1156.9012	899.2495	604.5324	386.6587	407.5081	643.4545	963.8280	1270.8871	1529.3046	(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)

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Space heating kWh	749.0326	599.1914	519.2718	322.8640	163.2181	0.0000	0.0000	0.0000	0.0000	318.4735	550.3373	768.1591 (98)
Space heating												3990.5477 (98)
Space heating per m2												(98) / (4) = 38.7959 (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												4409.4450 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	749.0326	599.1914	519.2718	322.8640	163.2181	0.0000	0.0000	0.0000	0.0000	318.4735	550.3373	768.1591 (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)	827.6604	662.0899	573.7809	356.7558	180.3515	0.0000	0.0000	0.0000	0.0000	351.9044	608.1075	848.7945 (211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	126.1465	110.4536	115.4185	104.1841	102.1060	90.8688	87.9394	97.3508	97.4066	109.6136	115.4363	122.6960 (64)
Efficiency of water heater	90.0244	89.9866	89.9007	89.6979	89.2411	87.3000	87.3000	87.3000	87.3000	89.6585	89.9285	87.3000 (216)
(217)m												90.0454 (217)
Fuel for water heating, kWh/month	140.1248	122.7445	128.3844	116.1500	114.4158	104.0879	100.7324	111.5130	111.5769	122.2568	128.3646	136.2601 (219)
Water heating fuel used												1436.6111 (219)
Annual totals kWh/year												
Space heating fuel - main system												4409.4450 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
(MEV)Decentralised, Database: total watage = 10.3610, total flow = 45.0000, SFP = 0.2302)												
mechanical ventilation fans (SFP = 0.2302)												69.9215 (230a)
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												144.9215 (231)
Electricity for lighting (calculated in Appendix L)												414.4463 (232)
Total delivered energy for all uses												6405.4239 (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	4409.4450	0.2160	952.4401 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1436.6111	0.2160	310.3080 (264)
Space and water heating			1262.7481 (265)
Pumps and fans	144.9215	0.5190	75.2143 (267)
Energy for lighting	414.4463	0.5190	215.0976 (268)
Total CO2, kg/year			1553.0600 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			15.1000 (273)

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

DER		15.1000 ZC1
Total Floor Area	TFA	102.8600
Assumed number of occupants	N	2.7645
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190
CO2 emissions from appliances, equation (L14)		15.0288 ZC2
CO2 emissions from cooking, equation (L16)		1.8019 ZC3
Total CO2 emissions		31.9307 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		31.9307 ZC8

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	51.4300 (1b)	x 2.3100 (2b)	= 118.8033 (1b) - (3b)
First floor	51.4300 (1c)	x 2.5300 (2c)	= 130.1179 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	102.8600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 248.9212 (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) = 0.1607 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4107 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.4107 (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	0.5236	0.5134	0.5031	0.4518	0.4415	0.3902	0.3902	0.3799	0.4107	0.4415	0.4620	0.4826 (22b)
Effective ac	0.6371	0.6318	0.6266	0.6020	0.5975	0.5761	0.5761	0.5722	0.5843	0.5975	0.6067	0.6164 (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 Semi-glazed door			1.9100	1.2000	2.2920		(26a)
TER Opening Type (Uw = 1.40)			20.2000	1.3258	26.7803		(27)
FP McCann System			51.4300	0.1300	6.6859		(28a)
100mm Knauf Supafil 34	146.2200	24.2600	121.9600	0.1800	21.9528		(29a)
Plane Ceiling-500mm Loft Roll	51.4300		51.4300	0.1300	6.6859		(30)
Total net area of external elements Aum, m ²			249.0800				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		66.5469		(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)							11.9271 (36)
Total fabric heat loss						(33) + (36) =	78.4740 (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	52.3336	51.8963	51.4677	49.4544	49.0777	47.3241	47.3241	46.9994	47.9996	49.0777	49.8397	50.6364 (38)
Heat transfer coeff	130.8076	130.3703	129.9417	127.9284	127.5517	125.7981	125.7981	125.4734	126.4736	127.5517	128.3137	129.1104 (39)
Average = Sum(39)m / 12 =												127.9266 (39)
HLP	1.2717	1.2675	1.2633	1.2437	1.2401	1.2230	1.2230	1.2198	1.2296	1.2401	1.2475	1.2552 (40)
HLP (average)												1.2437 (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												2.7645 (42)
Average daily hot water use (litres/day)												99.8562 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	109.8418	105.8476	101.8533	97.8591	93.8648	89.8706	89.8706	93.8648	97.8591	101.8533	105.8476	109.8418 (44)
Energy content (annual)	162.8922	142.4666	147.0127	128.1693	122.9815	106.1237	98.3392	112.8456	114.1934	133.0814	145.2687	157.7524 (45)
Distribution loss (46)m = 0.15 x (45)m	24.4338	21.3700	22.0519	19.2254	18.4472	15.9185	14.7509	16.9268	17.1290	19.9622	21.7903	23.6629 (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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	50.9589	46.0274	50.9589	48.2593	47.8325	44.3197	45.7971	47.8325	48.2593	50.9589	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month	213.8511	188.4940	197.9716	176.4285	170.8139	150.4434	144.1362	160.6781	162.4526	184.0403	194.5838	208.7113 (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	213.8511	188.4940	197.9716	176.4285	170.8139	150.4434	144.1362	160.6781	162.4526	184.0403	194.5838	208.7113 (64)
Heat gains from water heating, kWh/month	66.9014	58.8770	61.6215	54.6811	52.8495	46.3660	44.1470	49.4793	50.0341	56.9893	60.6306	65.1924 (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	138.2235	138.2235	138.2235	138.2235	138.2235	138.2235	138.2235	138.2235	138.2235	138.2235	138.2235	138.2235 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	23.4677	20.8438	16.9513	12.8332	9.5930	8.0988	8.7510	11.3749	15.2674	19.3855	22.6257	24.1199 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	260.8702	263.5772	256.7556	242.2332	223.9013	206.6720	195.1617	192.4547	199.2763	213.7986	232.1305	249.3599 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.8224	36.8224	36.8224	36.8224	36.8224	36.8224	36.8224	36.8224	36.8224	36.8224	36.8224	36.8224 (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)	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788 (71)
Water heating gains (Table 5)	89.9212	87.6146	82.8245	75.9460	71.0342	64.3973	59.3374	66.5044	69.4918	76.5985	84.2092	87.6242 (72)
Total internal gains	441.7261	439.5026	423.9985	398.4795	371.9956	346.6351	330.7172	337.8011	351.5025	377.2497	406.4325	428.5710 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g		FF		Access factor Table 6d		Gains W			
						Specific data or Table 6b		Specific data or Table 6c							
Northeast				9.6000	11.2829	0.6300		0.7000		0.7700		33.1028 (75)			
Southeast				2.0300	36.7938	0.6300		0.7000		0.7700		22.8267 (77)			
Southwest				6.6900	36.7938	0.6300		0.7000		0.7700		75.2269 (79)			
Northwest				1.8800	11.2829	0.6300		0.7000		0.7700		6.4826 (81)			
Solar gains				137.6390	247.5989	373.7009	521.5737	637.6388	656.5310	623.1849	533.0020	424.3433	283.0663	167.2544	116.2409 (83)
Total gains				579.3651	687.1015	797.6994	920.0532	1009.6344	1003.1661	953.9021	870.8030	775.8458	660.3160	573.6868	544.8119 (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	54.6073	54.7905	54.9712	55.8364	56.0013	56.7819	56.7819	56.9288	56.4786	56.0013	55.6687	55.3252
alpha	4.6405	4.6527	4.6647	4.7224	4.7334	4.7855	4.7855	4.7953	4.7652	4.7334	4.7112	4.6883
util living area	0.9984	0.9963	0.9895	0.9634	0.8849	0.7257	0.5614	0.6285	0.8713	0.9812	0.9968	0.9988 (86)
MIT	19.5654	19.7356	20.0205	20.4061	20.7370	20.9305	20.9838	20.9731	20.8230	20.3904	19.9129	19.5443 (87)
Th 2	19.8631	19.8664	19.8697	19.8852	19.8881	19.9016	19.9016	19.9042	19.8964	19.8881	19.8822	19.8761 (88)
util rest of house	0.9979	0.9949	0.9855	0.9487	0.8393	0.6300	0.4308	0.4953	0.8023	0.9712	0.9954	0.9984 (89)
MIT 2	17.9561	18.2068	18.6234	19.1851	19.6288	19.8555	19.8958	19.8931	19.7506	19.1731	18.4775	17.9341 (90)
Living area fraction	18.1894	18.4284	18.8260	19.3621	19.7895	20.0113	20.0535	20.0496	19.9061	19.3495	18.6855	0.1450 (91)
MIT	18.1894	18.4284	18.8260	19.3621	19.7895	20.0113	20.0535	20.0496	19.9061	19.3495	18.6855	18.1675 (92)
Temperature adjustment												0.0000
adjusted MIT	18.1894	18.4284	18.8260	19.3621	19.7895	20.0113	20.0535	20.0496	19.9061	19.3495	18.6855	18.1675 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9966	0.9924	0.9802	0.9397	0.8344	0.6404	0.4496	0.5142	0.8031	0.9642	0.9931	0.9974 (94)
Ext temp.	577.3995	681.8543	781.8943	864.5695	842.4739	642.4578	428.8995	447.7275	623.0453	636.6622	569.6999	543.4209 (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	1816.8342	1763.7074	1601.6568	1338.4015	1031.8233	680.7318	434.4462	457.9337	734.3126	1116.0181	1486.5832	1803.3542 (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	922.1394	727.0052	609.9033	341.1591	140.8759	0.0000	0.0000	0.0000	0.0000	356.6408	660.1560	937.3904 (98)
Space heating per m2												4695.2700 (98)
										(98) / (4) =		45.6472 (99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.4000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													5027.0557 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	922.1394	727.0052	609.9033	341.1591	140.8759	0.0000	0.0000	0.0000	0.0000	356.6408	660.1560	937.3904	(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)	987.3013	778.3782	653.0014	365.2667	150.8307	0.0000	0.0000	0.0000	0.0000	381.8424	706.8051	1003.6299	(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	213.8511	188.4940	197.9716	176.4285	170.8139	150.4434	144.1362	160.6781	162.4526	184.0403	194.5838	208.7113	(64)
Efficiency of water heater (217)m	88.3090	88.1180	87.6970	86.6836	84.5706	80.3000	80.3000	80.3000	80.3000	86.6886	87.8836	80.3000	(216)
Fuel for water heating, kWh/month	242.1622	213.9108	225.7451	203.5317	201.9780	187.3517	179.4972	200.0973	202.3071	212.3005	221.4109	236.1635	(219)
Water heating fuel used												2526.4560	(219)
Annual totals kWh/year													
Space heating fuel - main system												5027.0557	(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)												414.4463	(232)
Total delivered energy for all uses												8042.9580	(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	5027.0557	0.2160	1085.8440 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2526.4560	0.2160	545.7145 (264)
Space and water heating			1631.5585 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	414.4463	0.5190	215.0976 (268)
Total CO2, kg/m2/year			1885.5811 (272)
Emissions per m2 for space and water heating			15.8619 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.0912 (272b)
Emissions per m2 for pumps and fans			0.3784 (272c)
Target Carbon Dioxide Emission Rate (TER) = (15.8619 * 1.00) + 2.0912 + 0.3784, rounded to 2 d.p.			18.3300 (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	51.4300 (1b)	x 2.3100 (2b)	= 118.8033 (1b) - (3b)
First floor	51.4300 (1c)	x 2.5300 (2c)	= 130.1179 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	102.8600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 248.9212 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				40.0000 / (5) =	0.1607 (8)
Pressure test					Yes
Measured/design AP50					4.0100
Infiltration rate					0.3612 (18)
Number of sides sheltered					0 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		1.0000 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3612 (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	0.4605	0.4515	0.4425	0.3973	0.3883	0.3431	0.3431	0.3341	0.3612	0.3883	0.4063	0.4244 (22b)
Effective ac	0.6060	0.6019	0.5979	0.5789	0.5754	0.5589	0.5589	0.5558	0.5652	0.5754	0.5826	0.5901 (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)			16.4000	1.1450	18.7786		(27)
French Door (Uw = 1.40)			3.8000	1.3258	5.0379		(27)
Front Door			2.1500	1.0000	2.1500		(26)
Half-Glazed Door			1.9100	1.3000	2.4830		(26a)
FP McCann System			51.4300	0.1100	5.6573	75.0000	3857.2500 (28a)
100mm Knauf Supafil 34	146.2200	24.2600	121.9600	0.2500	30.4900	52.8000	6439.4880 (29a)
Plane Ceiling-500mm Loft Roll	51.4300		51.4300	0.0900	4.6287	9.0000	462.8700 (30)
Total net area of external elements Aum(A, m ²)			249.0800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	69.2255		(33)
1F Timber			87.3300			9.0000	785.9700 (32c)
GF Masonry			52.2100			39.0000	2036.1900 (32c)
GF Timber			24.0700			9.0000	216.6300 (32c)
Internal Floor			51.4300			12.6000	648.0180 (32d)
Internal Ceiling			51.4300			9.0000	462.8700 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	14909.2860 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							144.9474 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.5546 (36)
Total fabric heat loss						(33) + (36) =	74.7801 (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	49.7826	49.4443	49.1128	47.5555	47.2642	45.9078	45.9078	45.6567	46.4303	47.2642	47.8536	48.4698 (38)
Heat transfer coeff	124.5627	124.2244	123.8929	122.3357	122.0443	120.6880	120.6880	120.4368	121.2104	122.0443	122.6337	123.2499 (39)
Average = Sum(39)m / 12 =												122.3343 (39)
HLP	1.2110	1.2077	1.2045	1.1893	1.1865	1.1733	1.1733	1.1709	1.1784	1.1865	1.1922	1.1982 (40)
HLP (average)												1.1893 (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												2.7645 (42)
Average daily hot water use (litres/day)												99.8562 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	109.8418	105.8476	101.8533	97.8591	93.8648	89.8706	89.8706	93.8648	97.8591	101.8533	105.8476	109.8418 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Energy conte	162.8922	142.4666	147.0127	128.1693	122.9815	106.1237	98.3392	112.8456	114.1934	133.0814	145.2687	157.7524 (45)
Energy content (annual)										Total =	Sum (45)m =	1571.1266 (45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	34.6146	30.2741	31.2402	27.2360	26.1336	22.5513	20.8971	23.9797	24.2661	28.2798	30.8696	33.5224 (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	138.2235	138.2235	138.2235	138.2235	138.2235	138.2235	138.2235	138.2235	138.2235	138.2235	138.2235	138.2235 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	23.4677	20.8438	16.9513	12.8332	9.5930	8.0988	8.7510	11.3749	15.2674	19.3855	22.6257	24.1199 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	260.8702	263.5772	256.7556	242.2332	223.9013	206.6720	195.1617	192.4547	199.2763	213.7986	232.1305	249.3599 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.8224	36.8224	36.8224	36.8224	36.8224	36.8224	36.8224	36.8224	36.8224	36.8224	36.8224	36.8224 (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)	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788 (71)
Water heating gains (Table 5)	46.5250	45.0508	41.9895	37.8277	35.1258	31.3212	28.0875	32.2308	33.7029	38.0105	42.8744	45.0570 (72)
Total internal gains	395.3299	393.9388	380.1635	357.3612	333.0871	310.5590	296.4672	300.5274	312.7136	335.6616	362.0977	383.0038 (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	5.8000	11.2829	0.4600	0.7000	0.7700	14.6029 (75)
Southeast	2.0300	36.7938	0.4600	0.7000	0.7700	16.6671 (77)
Southwest	6.6900	36.7938	0.4600	0.7000	0.7700	54.9276 (79)
Northwest	1.8800	11.2829	0.4600	0.7000	0.7700	4.7334 (81)
Northeast	3.8000	11.2829	0.4300	0.0000	0.7700	14.1960 (75)

Solar gains	105.1269	190.2080	289.8356	408.7088	503.0499	519.3214	492.3959	418.9694	330.5218	218.1972	127.9461	88.6542 (83)
Total gains	500.4568	584.1468	669.9991	766.0700	836.1371	829.8804	788.8632	719.4969	643.2354	553.8588	490.0439	471.6580 (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	33.2481	33.3386	33.4278	33.8533	33.9341	34.3155	34.3155	34.3871	34.1676	33.9341	33.7710	33.6022
alpha	3.2165	3.2226	3.2285	3.2569	3.2623	3.2877	3.2877	3.2925	3.2778	3.2623	3.2514	3.2401
util living area	0.9922	0.9865	0.9736	0.9399	0.8666	0.7385	0.5998	0.6589	0.8553	0.9612	0.9876	0.9936 (86)
MIT	18.8702	19.0836	19.4586	19.9716	20.4444	20.7833	20.9214	20.8914	20.6117	20.0024	19.3501	18.8382 (87)
Th 2	19.9112	19.9138	19.9164	19.9285	19.9308	19.9414	19.9414	19.9434	19.9373	19.9308	19.9262	19.9214 (88)
util rest of house	0.9905	0.9836	0.9675	0.9248	0.8302	0.6625	0.4820	0.5448	0.8013	0.9487	0.9844	0.9922 (89)
MIT 2	17.9627	18.1767	18.5504	19.0619	19.5106	19.8126	19.9101	19.8961	19.6767	19.1005	18.4522	17.9381 (90)
Living area fraction	18.0943	18.3082	18.6821	19.1937	19.6460	19.9533	20.0567	20.0403	19.8122	19.2313	18.5823	18.0686 (92)
Temperature adjustment	18.0943	18.3082	18.6821	19.1937	19.6460	19.9533	20.0567	20.0403	19.8122	19.2313	18.5823	18.0686 (93)
adjusted MIT	18.0943	18.3082	18.6821	19.1937	19.6460	19.9533	20.0567	20.0403	19.8122	19.2313	18.5823	18.0686 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	493.7101	571.0324	642.0239	698.4707	684.4996	550.6222	391.2967	400.3642	510.4824	519.3795	479.5984	466.3688 (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	1718.2499	1665.6237	1509.2713	1259.2901	969.7617	646.0777	417.1863	438.4305	692.3817	1053.3959	1408.1200	1709.3015 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	911.0576	735.5653	645.2321	403.7900	212.2350	0.0000	0.0000	0.0000	0.0000	397.3082	668.5356	924.7419 (98)
Space heating												4898.4657 (98)
Space heating per m2										(98) / (4) =		47.6226 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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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	1134.4670	893.0911	915.3198	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7463	0.8170	0.7800	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	846.7033	729.6869	713.9602	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1076.6736	1026.4196	947.2591	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	165.5786	220.7691	173.5744	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling													
Cooled fraction									FC = cooled area / (4) =			559.9222	(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	41.3947	55.1923	43.3936	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling													
Space cooling per m2												139.9805	(107)
Energy for space heating												1.3609	(108)
Energy for space cooling												47.6226	(99)
Total												1.3609	(108)
Dwelling Fabric Energy Efficiency (DFEE)												48.9835	(109)
												49.0	(109)

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	51.4300 (1b)	x 2.3100 (2b)	= 118.8033 (1b) - (3b)
First floor	51.4300 (1c)	x 2.5300 (2c)	= 130.1179 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	102.8600		(3a) + (3b) + (3c) + (3d) + (3e)...(3n) = 248.9212 (5)
Dwelling volume			

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) = 0.1607 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4107 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.4107 (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	0.5236	0.5134	0.5031	0.4518	0.4415	0.3902	0.3902	0.3799	0.4107	0.4415	0.4620	0.4826 (22b)
Effective ac	0.6371	0.6318	0.6266	0.6020	0.5975	0.5761	0.5761	0.5722	0.5843	0.5975	0.6067	0.6164 (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 Semi-glazed door			1.9100	1.2000	2.2920		(26a)
TER Opening Type (Uw = 1.40)			20.2000	1.3258	26.7803		(27)
FP McCann System			51.4300	0.1300	6.6859		(28a)
100mm Knauf Supafil 34	146.2200	24.2600	121.9600	0.1800	21.9528		(29a)
Plane Ceiling-500mm Loft Roll	51.4300		51.4300	0.1300	6.6859		(30)
Total net area of external elements Aum, m ²			249.0800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	66.5469		(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)							11.9271 (36)
Total fabric heat loss						(33) + (36) =	78.4740 (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	52.3336	51.8963	51.4677	49.4544	49.0777	47.3241	47.3241	46.9994	47.9996	49.0777	49.8397	50.6364 (38)
Heat transfer coeff	130.8076	130.3703	129.9417	127.9284	127.5517	125.7981	125.7981	125.4734	126.4736	127.5517	128.3137	129.1104 (39)
Average = Sum(39)m / 12 =												127.9266 (39)
HLP	1.2717	1.2675	1.2633	1.2437	1.2401	1.2230	1.2230	1.2198	1.2296	1.2401	1.2475	1.2552 (40)
HLP (average)												1.2437 (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												2.7645 (42)
Average daily hot water use (litres/day)												99.8562 (43)
Daily hot water use	109.8418	105.8476	101.8533	97.8591	93.8648	89.8706	89.8706	93.8648	97.8591	101.8533	105.8476	109.8418 (44)
Energy conte	162.8922	142.4666	147.0127	128.1693	122.9815	106.1237	98.3392	112.8456	114.1934	133.0814	145.2687	157.7524 (45)
Energy content (annual)										Total = Sum(45)m =		1571.1266 (45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)

FULL SAP CALCULATION PRINTOUT

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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	(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	(59)
Heat gains from water heating, kWh/month	34.6146	30.2741	31.2402	27.2360	26.1336	22.5513	20.8971	23.9797	24.2661	28.2798	30.8696	(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	138.2235	138.2235	138.2235	138.2235	138.2235	138.2235	138.2235	138.2235	138.2235	138.2235	138.2235	138.2235	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	23.4677	20.8438	16.9513	12.8332	9.5930	8.0988	8.7510	11.3749	15.2674	19.3855	22.6257	24.1199	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	260.8702	263.5772	256.7556	242.2332	223.9013	206.6720	195.1617	192.4547	199.2763	213.7986	232.1305	249.3599	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.8224	36.8224	36.8224	36.8224	36.8224	36.8224	36.8224	36.8224	36.8224	36.8224	36.8224	36.8224	(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)	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788	(71)
Water heating gains (Table 5)	46.5250	45.0508	41.9895	37.8277	35.1258	31.3212	28.0875	32.2308	33.7029	38.0105	42.8744	45.0570	(72)
Total internal gains	395.3299	393.9388	380.1635	357.3612	333.0871	310.5590	296.4672	300.5274	312.7136	335.6616	362.0977	383.0038	(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				9.6000	11.2829	0.6300	0.7000		0.7700		33.1028 (75)	
Southeast				2.0300	36.7938	0.6300	0.7000		0.7700		22.8267 (77)	
Southwest				6.6900	36.7938	0.6300	0.7000		0.7700		75.2269 (79)	
Northwest				1.8800	11.2829	0.6300	0.7000		0.7700		6.4826 (81)	
Solar gains	137.6390	247.5989	373.7009	521.5737	637.6388	656.5310	623.1849	533.0020	424.3433	283.0663	167.2544	116.2409 (83)
Total gains	532.9689	641.5377	753.8644	878.9350	970.7259	967.0900	919.6522	833.5294	737.0569	618.7279	529.3521	499.2447 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)													21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
tau	54.6073	54.7905	54.9712	55.8364	56.0013	56.7819	56.7819	56.9288	56.4786	56.0013	55.6687	55.3252		
alpha	4.6405	4.6527	4.6647	4.7224	4.7334	4.7855	4.7855	4.7953	4.7652	4.7334	4.7112	4.6883		
util living area	0.9989	0.9972	0.9916	0.9689	0.8971	0.7438	0.5796	0.6510	0.8883	0.9854	0.9977	0.9992	(86)	
MIT	19.5243	19.6956	19.9832	20.3749	20.7166	20.9227	20.9815	20.9688	20.8039	20.3560	19.8737	19.5037	(87)	
Th 2	19.8631	19.8664	19.8697	19.8852	19.8881	19.9016	19.9016	19.9042	19.8964	19.8881	19.8822	19.8761	(88)	
util rest of house	0.9985	0.9962	0.9884	0.9562	0.8544	0.6487	0.4461	0.5156	0.8243	0.9774	0.9967	0.9989	(89)	
MIT 2	18.5200	18.6935	18.9821	19.3781	19.6949	19.8660	19.8970	19.8952	19.7834	19.3671	18.8841	18.5097	(90)	
Living area fraction									fLA = Living area / (4) =			0.1450	(91)	
MIT	18.6656	18.8388	19.1272	19.5226	19.8430	20.0192	20.0542	20.0508	19.9314	19.5104	19.0276	18.6538	(92)	
Temperature adjustment												0.0000		
adjusted MIT	18.6656	18.8388	19.1272	19.5226	19.8430	20.0192	20.0542	20.0508	19.9314	19.5104	19.0276	18.6538	(93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Useful gains	0.9979	0.9949	0.9855	0.9508	0.8523	0.6599	0.4655	0.5351	0.8268	0.9736	0.9956	0.9985	(94)	
Ext temp.	531.8657	638.2609	742.9025	835.7058	827.3330	638.2253	428.1110	446.0148	609.4002	602.3763	527.0178	498.4885	(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	1879.1262	1817.2022	1640.8025	1358.9272	1038.6538	681.7194	434.5353	458.0834	737.5125	1136.5421	1530.4738	1866.1298	(97)	
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)	
Space heating per m2	1002.3618	792.2485	668.0376	376.7194	157.2227	0.0000	0.0000	0.0000	0.0000	397.4193	722.4883	1017.5251	(98)	
												5134.0228	(98)	
												49.9127	(99)	

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000		
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1182.5025	930.9062	953.5979	0.0000	0.0000	0.0000	0.0000	(100)	
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8453	0.9089	0.8748	0.0000	0.0000	0.0000	0.0000	(101)	
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	999.5201	846.0967	834.2025	0.0000	0.0000	0.0000	0.0000	(102)	
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1237.0484	1179.2898	1080.5439	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														

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	0.0000	0.0000	0.0000	0.0000	0.0000	171.0204	247.8957	183.2780	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												602.1941 (104)
Cooled fraction									FC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	42.7551	61.9739	45.8195	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												150.5485 (107)
Space cooling per m2												1.4636 (108)
Energy for space heating												49.9127 (99)
Energy for space cooling												1.4636 (108)
Total												51.3763 (109)
Target Fabric Energy Efficiency (TFEE)												59.1 (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	51.4300 (1b)	x 2.3100 (2b)	= 118.8033 (1b) - (3b)
First floor	51.4300 (1c)	x 2.5300 (2c)	= 130.1179 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	102.8600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 248.9212 (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)
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												0 (19)
Shelter factor											(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =	0.2005 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	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												
	0.2105	0.2005	0.2005	0.1855	0.1855	0.1654	0.1704	0.1604	0.1654	0.1754	0.1754	0.1905 (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 m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K						
Window (Uw = 1.20)			16.4000	1.1450	18.7786			(27)					
French Door (Uw = 1.40)			3.8000	1.3258	5.0379			(27)					
Front Door			2.1500	1.0000	2.1500			(26)					
Half-Glazed Door			1.9100	1.3000	2.4830			(26a)					
FP McCann System			51.4300	0.1100	5.6573	75.0000	3857.2500	(28a)					
100mm Knauf Supafil 34	146.2200	24.2600	121.9600	0.2500	30.4900	52.8000	6439.4880	(29a)					
Plane Ceiling-500mm Loft Roll	51.4300		51.4300	0.0900	4.6287	9.0000	462.8700	(30)					
Total net area of external elements Aum(A, m2)			249.0800					(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	69.2255			(33)					
1F Timber			87.3300			9.0000	785.9700	(32c)					
GF Masonry			52.2100			39.0000	2036.1900	(32c)					
GF Timber			24.0700			9.0000	216.6300	(32c)					
Internal Floor			51.4300			12.6000	648.0180	(32d)					
Internal Ceiling			51.4300			9.0000	462.8700	(32e)					
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		14909.2860	(34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							144.9474	(35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.5546	(36)					
Total fabric heat loss						(33) + (36) =	74.7801	(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 41.0720	Feb 41.0720	Mar 41.0720	Apr 41.0720	May 41.0720	Jun 41.0720	Jul 41.0720	Aug 41.0720	Sep 41.0720	Oct 41.0720	Nov 41.0720	Dec 41.0720	(38)
Heat transfer coeff	115.8521	115.8521	115.8521	115.8521	115.8521	115.8521	115.8521	115.8521	115.8521	115.8521	115.8521	115.8521	(39)
Average = Sum(39)m / 12 =												115.8521	(39)
HLP	Jan 1.1263	Feb 1.1263	Mar 1.1263	Apr 1.1263	May 1.1263	Jun 1.1263	Jul 1.1263	Aug 1.1263	Sep 1.1263	Oct 1.1263	Nov 1.1263	Dec 1.1263	(40)
HLP (average)												1.1263	(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	2.7645 (42)
Average daily hot water use (litres/day)	99.8562 (43)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	109.8418	105.8476	101.8533	97.8591	93.8648	89.8706	89.8706	93.8648	97.8591	101.8533	105.8476	109.8418	(44)
Energy conte	162.8922	142.4666	147.0127	128.1693	122.9815	106.1237	98.3392	112.8456	114.1934	133.0814	145.2687	157.7524	(45)
Energy content (annual)										Total =	Sum (45)m =	1571.1266	(45)
Distribution loss (46)m = 0.15 x (45)m	24.4338	21.3700	22.0519	19.2254	18.4472	15.9185	14.7509	16.9268	17.1290	19.9622	21.7903	23.6629	(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	14.1475	12.7672	14.1094	13.6138	14.0336	13.5417	13.9687	14.0108	13.5810	14.0760	13.6614	14.1352	(61)
Total heat required for water heating calculated for each month	177.0397	155.2338	161.1221	141.7831	137.0151	119.6654	112.3078	126.8564	127.7744	147.1573	158.9302	171.8876	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Solar input (sum of months) =										Sum (63)m =		0.0000	(63)
Output from w/h	177.0397	155.2338	161.1221	141.7831	137.0151	119.6654	112.3078	126.8564	127.7744	147.1573	158.9302	171.8876	(64)
RHI water heating demand										Total per year (kWh/year) =	Sum (64)m =	1736.7728	(64)
Heat gains from water heating, kWh/month	57.6985	50.5619	52.4091	46.0197	44.3997	38.6715	36.1899	41.0239	41.3645	47.7685	51.7172	55.9865	(65)
												1737	(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	165.8683	165.8683	165.8683	165.8683	165.8683	165.8683	165.8683	165.8683	165.8683	165.8683	165.8683	165.8683	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	58.6692	52.1094	42.3782	32.0830	23.9825	20.2470	21.8776	28.4373	38.1685	48.4637	56.5643	60.2998	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	389.3584	393.3988	383.2173	361.5421	334.1811	308.4656	291.2861	287.2458	297.4272	319.1024	346.4634	372.1789	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.3513	54.3513	54.3513	54.3513	54.3513	54.3513	54.3513	54.3513	54.3513	54.3513	54.3513	54.3513	(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)	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788	(71)
Water heating gains (Table 5)	77.5518	75.2410	70.4423	63.9163	59.6771	53.7105	48.6424	55.1396	57.4508	64.2050	71.8295	75.2506	(72)
Total internal gains	638.2201	633.3899	608.6785	570.1822	530.4813	495.0638	474.4468	483.4634	505.6872	544.4119	587.4979	620.3700	(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					5.8000	12.9236		0.4600	0.7000	0.7700		16.7263 (75)
Southeast					2.0300	40.4699		0.4600	0.7000	0.7700		18.3323 (77)
Southwest					6.6900	40.4699		0.4600	0.7000	0.7700		60.4154 (79)
Northwest					1.8800	12.9236		0.4600	0.7000	0.7700		5.4216 (81)
Northeast					3.8000	12.9236		0.4300	0.0000	0.7700		16.2602 (75)

Solar gains	117.1558	191.3893	289.6772	423.1305	508.5556	562.0911	527.1112	458.0190	358.8903	234.8889	146.2082	97.7635 (83)
Total gains	755.3759	824.7792	898.3557	993.3127	1039.0369	1057.1549	1001.5580	941.4825	864.5775	779.3008	733.7061	718.1335 (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	35.7479	35.7479	35.7479	35.7479	35.7479	35.7479	35.7479	35.7479	35.7479	35.7479	35.7479	35.7479	
alpha	3.3832	3.3832	3.3832	3.3832	3.3832	3.3832	3.3832	3.3832	3.3832	3.3832	3.3832	3.3832	
util living area	0.9705	0.9591	0.9298	0.8598	0.7259	0.5131	0.3513	0.3834	0.6668	0.8808	0.9530	0.9744	(86)
MIT	19.4739	19.6334	19.9812	20.4056	20.7625	20.9493	20.9900	20.9866	20.8687	20.4460	19.8896	19.4280	(87)
Th 2	19.9794	19.9794	19.9794	19.9794	19.9794	19.9794	19.9794	19.9794	19.9794	19.9794	19.9794	19.9794	(88)
util rest of house	0.9646	0.9509	0.9152	0.8299	0.6674	0.4209	0.2391	0.2659	0.5810	0.8483	0.9419	0.9692	(89)
MIT 2	17.9736	18.2026	18.6992	19.2873	19.7474	19.9469	19.9764	19.9751	19.8759	19.3552	18.5750	17.9078	(90)
Living area fraction									fLA = Living area / (4) =			0.1450	(91)
MIT	18.1911	18.4100	18.8850	19.4494	19.8945	20.0922	20.1234	20.1217	20.0198	19.5133	18.7656	18.1282	(92)
Temperature adjustment												-0.1500	
adjusted MIT	18.0411	18.2600	18.7350	19.2994	19.7445	19.9422	19.9734	19.9717	19.8698	19.3633	18.6156	17.9782	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9487	0.9321	0.8921	0.8060	0.6523	0.4173	0.2384	0.2650	0.5708	0.8237	0.9216	0.9544	(94)
Useful gains	716.5923	768.8053	801.4483	800.5640	677.7869	441.1581	238.7421	249.4649	493.4617	641.9366	676.1635	685.4197	(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	1499.2498	1466.6857	1313.1839	1088.9381	781.3658	456.7155	240.2023	251.5933	541.0033	899.3956	1229.8405	1491.9647	(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													

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF HEAT DEMAND 09 Jan 2014

	582.2972	468.9756	380.7313	207.6294	77.0627	0.0000	0.0000	0.0000	0.0000	191.5495	398.6475	600.0695 (98)
Space heating												2906.9626 (98)
RHI space heating demand												2907 (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	51.4300 (1b)	x 2.3100 (2b)	= 118.8033 (1b) - (3b)
First floor	51.4300 (1c)	x 2.5300 (2c)	= 130.1179 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	102.8600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 248.9212 (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)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =											0.0000 / (5) =	0.0000 (8)
Pressure test											Yes	(8)
Measured/design AP50											4.0100	
Infiltration rate											0.2005	(18)
Number of sides sheltered											0	(19)
Shelter factor											(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =	0.2005 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.2556	0.2506	0.2456	0.2206	0.2155	0.1905	0.1905	0.1855	0.2005	0.2155	0.2256	0.2356 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5056	0.5006	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 m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K						
Window (Uw = 1.20)			16.4000	1.1450	18.7786			(27)					
French Door (Uw = 1.40)			3.8000	1.3258	5.0379			(27)					
Front Door			2.1500	1.0000	2.1500			(26)					
Half-Glazed Door			1.9100	1.3000	2.4830			(26a)					
FP McCann System			51.4300	0.1100	5.6573	75.0000	3857.2500	(28a)					
100mm Knauf Supafil 34	146.2200	24.2600	121.9600	0.2500	30.4900	52.8000	6439.4880	(29a)					
Plane Ceiling-500mm Loft Roll	51.4300		51.4300	0.0900	4.6287	9.0000	462.8700	(30)					
Total net area of external elements Aum(A, m2)			249.0800					(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	69.2255			(33)					
1F Timber			87.3300			9.0000	785.9700	(32c)					
GF Masonry			52.2100			39.0000	2036.1900	(32c)					
GF Timber			24.0700			9.0000	216.6300	(32c)					
Internal Floor			51.4300			12.6000	648.0180	(32d)					
Internal Ceiling			51.4300			9.0000	462.8700	(32e)					
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		14909.2860	(34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							144.9474	(35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.5546	(36)					
Total fabric heat loss						(33) + (36) =	74.7801	(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 41.5351	Feb 41.1233	Mar 41.0720	Apr 41.0720	May 41.0720	Jun 41.0720	Jul 41.0720	Aug 41.0720	Sep 41.0720	Oct 41.0720	Nov 41.0720	Dec 41.0720	(38)
Heat transfer coeff	116.3152	115.9035	115.8521	115.8521	115.8521	115.8521	115.8521	115.8521	115.8521	115.8521	115.8521	115.8521	(39)
Average = Sum(39)m / 12 =												115.8950	(39)
HLP	Jan 1.1308	Feb 1.1268	Mar 1.1263	Apr 1.1263	May 1.1263	Jun 1.1263	Jul 1.1263	Aug 1.1263	Sep 1.1263	Oct 1.1263	Nov 1.1263	Dec 1.1263	(40)
HLP (average)												1.1267	(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	2.7645 (42)
Average daily hot water use (litres/day)	99.8562 (43)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	109.8418	105.8476	101.8533	97.8591	93.8648	89.8706	89.8706	93.8648	97.8591	101.8533	105.8476	109.8418	(44)
Energy conte	162.8922	142.4666	147.0127	128.1693	122.9815	106.1237	98.3392	112.8456	114.1934	133.0814	145.2687	157.7524	(45)
Energy content (annual)										Total =	Sum (45)m =	1571.1266	(45)
Distribution loss (46)m = 0.15 x (45)m	24.4338	21.3700	22.0519	19.2254	18.4472	15.9185	14.7509	16.9268	17.1290	19.9622	21.7903	23.6629	(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	14.1475	12.7672	14.1094	13.6138	14.0336	13.5417	13.9687	14.0108	13.5810	14.0760	13.6614	14.1352	(61)
Total heat required for water heating calculated for each month	177.0397	155.2338	161.1221	141.7831	137.0151	119.6654	112.3078	126.8564	127.7744	147.1573	158.9302	171.8876	(62)
WWHRS	-50.8932	-44.7802	-45.7036	-37.5990	-34.9091	-28.7966	-24.3685	-29.5056	-30.3677	-37.5438	-43.4939	-49.1916	eq. (G10)
Total of WWHRS savings												-457.1528	
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	126.1465	110.4536	115.4185	104.1841	102.1060	90.8688	87.9394	97.3508	97.4066	109.6136	115.4363	122.6960	(64)
Heat gains from water heating, kWh/month	57.6985	50.5619	52.4091	46.0197	44.3997	38.6715	36.1899	41.0239	41.3645	47.7685	51.7172	55.9865	(65)
Total per year (kWh/year) =										Sum (64)m =		1279.6200	(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	165.8683	165.8683	165.8683	165.8683	165.8683	165.8683	165.8683	165.8683	165.8683	165.8683	165.8683	165.8683	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	58.6692	52.1094	42.3782	32.0830	23.9825	20.2470	21.8776	28.4373	38.1685	48.4637	56.5643	60.2998	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	389.3584	393.3988	383.2173	361.5421	334.1811	308.4656	291.2861	287.2458	297.4272	319.1024	346.4634	372.1789	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.3513	54.3513	54.3513	54.3513	54.3513	54.3513	54.3513	54.3513	54.3513	54.3513	54.3513	54.3513	(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)	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788	(71)
Water heating gains (Table 5)	77.5518	75.2410	70.4423	63.9163	59.6771	53.7105	48.6424	55.1396	57.4508	64.2050	71.8295	75.2506	(72)
Total internal gains	638.2201	633.3899	608.6785	570.1822	530.4813	495.0638	474.4468	483.4634	505.6872	544.4119	587.4979	620.3700	(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					5.8000	11.2829	0.4600	0.7000			0.7700			14.6029 (75)
Southeast					2.0300	36.7938	0.4600	0.7000			0.7700			16.6671 (77)
Southwest					6.6900	36.7938	0.4600	0.7000			0.7700			54.9276 (79)
Northwest					1.8800	11.2829	0.4600	0.7000			0.7700			4.7334 (81)
Northeast					3.8000	11.2829	0.4300	0.0000			0.7700			14.1960 (75)
Solar gains	105.1269	190.2080	289.8356	408.7088	503.0499	519.3214	492.3959	418.9694	330.5218	218.1972	127.9461	88.6542	(83)	
Total gains	743.3470	823.5979	898.5142	978.8910	1033.5313	1014.3852	966.8427	902.4328	836.2090	762.6091	715.4440	709.0242	(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	35.6056	35.7320	35.7479	35.7479	35.7479	35.7479	35.7479	35.7479	35.7479	35.7479	35.7479	35.7479
alpha	3.3737	3.3821	3.3832	3.3832	3.3832	3.3832	3.3832	3.3832	3.3832	3.3832	3.3832	3.3832
util living area	0.9755	0.9639	0.9401	0.8871	0.7876	0.6397	0.4968	0.5454	0.7542	0.9097	0.9632	0.9789 (86)
MIT	19.3268	19.5247	19.8508	20.2659	20.6376	20.8727	20.9595	20.9439	20.7678	20.2967	19.7323	19.2767 (87)
Th 2	19.9758	19.9790	19.9794	19.9794	19.9794	19.9794	19.9794	19.9794	19.9794	19.9794	19.9794	19.9794 (88)
util rest of house	0.9707	0.9569	0.9282	0.8635	0.7422	0.5627	0.3934	0.4410	0.6873	0.8858	0.9549	0.9748 (89)
MIT 2	17.7579	18.0451	18.5128	19.0959	19.5923	19.8737	19.9569	19.9458	19.7649	19.1508	18.3490	17.6878 (90)
Living area fraction	17.9853	18.2596	18.7068	19.2655	19.7438	20.0185	20.1023	20.0904	19.9103	19.3169	18.5495	17.9182 (91)
MIT	17.9853	18.2596	18.7068	19.2655	19.7438	20.0185	20.1023	20.0904	19.9103	19.3169	18.5495	17.9182 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.8353	18.1096	18.5568	19.1155	19.5938	19.8685	19.9523	19.9404	19.7603	19.1669	18.3995	17.7682 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	710.9294	773.5490	814.2891	821.2376	746.7892	561.5028	377.5497	394.1318	560.8972	656.8470	670.2274	681.8688	(94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1574.3626	1531.0395	1396.8041	1183.4908	914.5156	610.3688	388.3662	410.1672	655.7574	992.4970	1309.0723	1571.9000	(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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Space heating kWh	642.3943	509.0336	433.3911	260.8223	124.7884	0.0000	0.0000	0.0000	0.0000	249.7237	459.9684	662.1832 (98)
Space heating												3342.3050 (98)
Space heating per m2												(98) / (4) = 32.4937 (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												3693.1546 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	642.3943	509.0336	433.3911	260.8223	124.7884	0.0000	0.0000	0.0000	0.0000	249.7237	459.9684	662.1832 (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)	709.8280	562.4681	478.8852	288.2014	137.8878	0.0000	0.0000	0.0000	0.0000	275.9378	508.2523	731.6941 (211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	126.1465	110.4536	115.4185	104.1841	102.1060	90.8688	87.9394	97.3508	97.4066	109.6136	115.4363	122.6960 (64)
Efficiency of water heater (217)m	89.9588	89.9124	89.8077	89.5629	89.0314	87.3000	87.3000	87.3000	87.3000	89.4993	89.8394	87.3000 (216)
Fuel for water heating, kWh/month	140.2270	122.8458	128.5174	116.3250	114.6854	104.0879	100.7324	111.5130	111.5769	122.4742	128.4919	136.3525 (219)
Water heating fuel used												1437.8294 (219)
Annual totals kWh/year												
Space heating fuel - main system												3693.1546 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
(MEV)Decentralised, Database: total watage = 10.3610, total flow = 45.0000, SFP = 0.2302)												
mechanical ventilation fans (SFP = 0.2302)												69.9215 (230a)
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												144.9215 (231)
Electricity for lighting (calculated in Appendix L)												414.4463 (232)
Total delivered energy for all uses												5690.3519 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3693.1546	3.4800	128.5218 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1437.8294	3.4800	50.0365 (247)
Mechanical ventilation fans	69.9215	13.1900	9.2226 (249)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	414.4463	13.1900	54.6655 (250)
Additional standing charges			120.0000 (251)
Total energy cost			372.3389 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.0576 (257)
SAP value		85.2460
SAP rating (Section 12)		85 (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	3693.1546	0.2160	797.7214 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1437.8294	0.2160	310.5712 (264)
Space and water heating			1108.2926 (265)
Pumps and fans	144.9215	0.5190	75.2143 (267)
Energy for lighting	414.4463	0.5190	215.0976 (268)
Total kg/year			1398.6044 (272)
CO2 emissions per m2			13.6000 (273)
EI value			87.3250
EI rating			87 (274)
EI band			B

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Calculation of stars for heating and DHW

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9050 = 3.845$, 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	$3.48 / 0.8890 = 3.915$, stars = 5
Water heating environmental impact	$0.216 / 0.8890 = 0.2430$, 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	51.4300 (1b)	x 2.3100 (2b)	= 118.8033 (1b) - (3b)
First floor	51.4300 (1c)	x 2.5300 (2c)	= 130.1179 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	102.8600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 248.9212 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																0 * 10 =	0.0000 (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) =				0.0000 / (5) =		0.0000 (8)	
Pressure test														Yes			
Measured/design AP50														4.0100			
Infiltration rate														0.2005 (18)			
Number of sides sheltered														0 (19)			
Shelter factor										(20) = 1 - [0.075 x (19)] =				1.0000 (20)			
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =				0.2005 (21)			
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
	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																	
	0.2105	0.2005	0.2005	0.1855	0.1855	0.1654	0.1704	0.1604	0.1654	0.1754	0.1754	0.1905 (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)			16.4000	1.1450	18.7786		(27)
French Door (Uw = 1.40)			3.8000	1.3258	5.0379		(27)
Front Door			2.1500	1.0000	2.1500		(26)
Half-Glazed Door			1.9100	1.3000	2.4830		(26a)
FP McCann System			51.4300	0.1100	5.6573	75.0000	3857.2500 (28a)
100mm Knauf Supafil 34	146.2200	24.2600	121.9600	0.2500	30.4900	52.8000	6439.4880 (29a)
Plane Ceiling-500mm Loft Roll	51.4300		51.4300	0.0900	4.6287	9.0000	462.8700 (30a)
Total net area of external elements Aum(A, m ²)			249.0800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	69.2255		(33)
1F Timber			87.3300			9.0000	785.9700 (32c)
GF Masonry			52.2100			39.0000	2036.1900 (32c)
GF Timber			24.0700			9.0000	216.6300 (32c)
Internal Floor			51.4300			12.6000	648.0180 (32d)
Internal Ceiling			51.4300			9.0000	462.8700 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	14909.2860 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							144.9474 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.5546 (36)
Total fabric heat loss						(33) + (36) =	74.7801 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 41.0720	Feb 41.0720	Mar 41.0720	Apr 41.0720	May 41.0720	Jun 41.0720	Jul 41.0720	Aug 41.0720	Sep 41.0720	Oct 41.0720	Nov 41.0720	Dec 41.0720 (38)
Heat transfer coeff	115.8521	115.8521	115.8521	115.8521	115.8521	115.8521	115.8521	115.8521	115.8521	115.8521	115.8521	115.8521 (39)
Average = Sum(39)m / 12 =												115.8521 (39)
HLP	Jan 1.1263	Feb 1.1263	Mar 1.1263	Apr 1.1263	May 1.1263	Jun 1.1263	Jul 1.1263	Aug 1.1263	Sep 1.1263	Oct 1.1263	Nov 1.1263	Dec 1.1263 (40)
HLP (average)												1.1263 (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	2.7645 (42)
Average daily hot water use (litres/day)	99.8562 (43)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	109.8418	105.8476	101.8533	97.8591	93.8648	89.8706	89.8706	93.8648	97.8591	101.8533	105.8476	109.8418	(44)
Energy conte	162.8922	142.4666	147.0127	128.1693	122.9815	106.1237	98.3392	112.8456	114.1934	133.0814	145.2687	157.7524	(45)
Energy content (annual)	Total = Sum (45)m = 1571.1266 (45)												
Distribution loss (46)m = 0.15 x (45)m	24.4338	21.3700	22.0519	19.2254	18.4472	15.9185	14.7509	16.9268	17.1290	19.9622	21.7903	23.6629	(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	14.1475	12.7672	14.1094	13.6138	14.0336	13.5417	13.9687	14.0108	13.5810	14.0760	13.6614	14.1352	(61)
Total heat required for water heating calculated for each month	177.0397	155.2338	161.1221	141.7831	137.0151	119.6654	112.3078	126.8564	127.7744	147.1573	158.9302	171.8876	(62)
WWHRS	-50.8932	-44.7802	-45.7036	-37.5990	-34.9091	-28.7966	-24.3685	-29.5056	-30.3677	-37.5438	-43.4939	-49.1916	eq. (G10)
Total of WWHRS savings	-457.1528												
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	126.1465	110.4536	115.4185	104.1841	102.1060	90.8688	87.9394	97.3508	97.4066	109.6136	115.4363	122.6960	(64)
Heat gains from water heating, kWh/month	57.6985	50.5619	52.4091	46.0197	44.3997	38.6715	36.1899	41.0239	41.3645	47.7685	51.7172	55.9865	(65)
Total per year (kWh/year) = Sum (64)m =	1279.6200 (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	165.8683	165.8683	165.8683	165.8683	165.8683	165.8683	165.8683	165.8683	165.8683	165.8683	165.8683	165.8683	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	58.6692	52.1094	42.3782	32.0830	23.9825	20.2470	21.8776	28.4373	38.1685	48.4637	56.5643	60.2998	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	389.3584	393.3988	383.2173	361.5421	334.1811	308.4656	291.2861	287.2458	297.4272	319.1024	346.4634	372.1789	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.3513	54.3513	54.3513	54.3513	54.3513	54.3513	54.3513	54.3513	54.3513	54.3513	54.3513	54.3513	(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)	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788	(71)
Water heating gains (Table 5)	77.5518	75.2410	70.4423	63.9163	59.6771	53.7105	48.6424	55.1396	57.4508	64.2050	71.8295	75.2506	(72)
Total internal gains	638.2201	633.3899	608.6785	570.1822	530.4813	495.0638	474.4468	483.4634	505.6872	544.4119	587.4979	620.3700	(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					5.8000	12.9236	0.4600	0.7000	0.7700	16.7263 (75)			
Southeast					2.0300	40.4699	0.4600	0.7000	0.7700	18.3323 (77)			
Southwest					6.6900	40.4699	0.4600	0.7000	0.7700	60.4154 (79)			
Northwest					1.8800	12.9236	0.4600	0.7000	0.7700	5.4216 (81)			
Northeast					3.8000	12.9236	0.4300	0.0000	0.7700	16.2602 (75)			
Solar gains	117.1558	191.3893	289.6772	423.1305	508.5556	562.0911	527.1112	458.0190	358.8903	234.8889	146.2082	97.7635	(83)
Total gains	755.3759	824.7792	898.3557	993.3127	1039.0369	1057.1549	1001.5580	941.4825	864.5775	779.3008	733.7061	718.1335	(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	35.7479	35.7479	35.7479	35.7479	35.7479	35.7479	35.7479	35.7479	35.7479	35.7479	35.7479	35.7479	
alpha	3.3832	3.3832	3.3832	3.3832	3.3832	3.3832	3.3832	3.3832	3.3832	3.3832	3.3832	3.3832	
util living area	0.9705	0.9591	0.9298	0.8598	0.7259	0.5131	0.3513	0.3834	0.6668	0.8808	0.9530	0.9744 (86)	
MIT	19.4739	19.6334	19.9812	20.4056	20.7625	20.9493	20.9900	20.9866	20.8687	20.4460	19.8896	19.4280 (87)	
Th 2	19.9794	19.9794	19.9794	19.9794	19.9794	19.9794	19.9794	19.9794	19.9794	19.9794	19.9794	19.9794 (88)	
util rest of house	0.9646	0.9509	0.9152	0.8299	0.6674	0.4209	0.2391	0.2659	0.5810	0.8483	0.9419	0.9692 (89)	
MIT 2	17.9736	18.2026	18.6992	19.2873	19.7474	19.9469	19.9764	19.9751	19.8759	19.3552	18.5750	17.9078 (90)	
Living area fraction	fLA = Living area / (4) =												0.1450 (91)
MIT	18.1911	18.4100	18.8850	19.4494	19.8945	20.0922	20.1234	20.1217	20.0198	19.5133	18.7656	18.1282 (92)	
Temperature adjustment													-0.1500
adjusted MIT	18.0411	18.2600	18.7350	19.2994	19.7445	19.9422	19.9734	19.9717	19.8698	19.3633	18.6156	17.9782 (93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	716.5923	768.8053	801.4483	800.5640	677.7869	441.1581	238.7421	249.4649	493.4617	641.9366	676.1635	685.4197	(94)
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	1499.2498	1466.6857	1313.1839	1088.9381	781.3658	456.7155	240.2023	251.5933	541.0033	899.3956	1229.8405	1491.9647	(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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Space heating kWh	582.2972	468.9756	380.7313	207.6294	77.0627	0.0000	0.0000	0.0000	0.0000	191.5495	398.6475	600.0695 (98)
Space heating												2906.9626 (98)
Space heating per m2												(98) / (4) = 28.2614 (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												3212.1134 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	582.2972	468.9756	380.7313	207.6294	77.0627	0.0000	0.0000	0.0000	0.0000	191.5495	398.6475	600.0695 (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)	643.4223	518.2051	420.6976	229.4247	85.1522	0.0000	0.0000	0.0000	0.0000	211.6569	440.4944	663.0602 (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	126.1465	110.4536	115.4185	104.1841	102.1060	90.8688	87.9394	97.3508	97.4066	109.6136	115.4363	122.6960 (64)
Efficiency of water heater (217)m	89.9131	89.8720	89.7348	89.4050	88.6482	87.3000	87.3000	87.3000	87.3000	89.3085	89.7612	87.3000 (216)
Fuel for water heating, kWh/month	140.2982	122.9009	128.6217	116.5305	115.1811	104.0879	100.7324	111.5130	111.5769	122.7359	128.6038	136.4193 (219)
Water heating fuel used												1439.2015 (219)
Annual totals kWh/year												
Space heating fuel - main system												3212.1134 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
(MEV)Decentralised, Database: total watage = 10.3610, total flow = 45.0000, SFP = 0.2302)												
mechanical ventilation fans (SFP = 0.2302)												69.9215 (230a)
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												144.9215 (231)
Electricity for lighting (calculated in Appendix L)												414.4463 (232)
Total delivered energy for all uses												5210.6827 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3212.1134	3.9200	125.9148 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1439.2015	3.9200	56.4167 (247)
Mechanical ventilation fans	69.9215	16.9600	11.8587 (249)
Pumps and fans for heating	75.0000	16.9600	12.7200 (249)
Energy for lighting	414.4463	16.9600	70.2901 (250)
Additional standing charges			88.0000 (251)
Total energy cost			365.2003 (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	3212.1134	0.2160	693.8165 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1439.2015	0.2160	310.8675 (264)
Space and water heating			1004.6840 (265)
Pumps and fans	144.9215	0.5190	75.2143 (267)
Energy for lighting	414.4463	0.5190	215.0976 (268)
Total kg/year			1294.9959 (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	3212.1134	1.2200	3918.7783 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1439.2015	1.2200	1755.8259 (264)
Space and water heating			5674.6042 (265)
Pumps and fans	144.9215	3.0700	444.9091 (267)
Energy for lighting	414.4463	3.0700	1272.3500 (268)
Primary energy kWh/year			7391.8633 (272)
Primary energy kWh/m2/year			71.8633 (273)

FULL SAP CALCULATION PRINTOUT

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

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 85
Current environmental impact rating: B 87

(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	+ 9.0	-£ 309	-947 kg (73.1%)
Measures omitted - SAP change or cost saving too small:			
N Solar water heating	+ 0.8	-£ 22	-143 kg (11.0%)

	Typical annual savings	Energy efficiency	Environmental impact
Recommended measures			
Solar photovoltaic panels	£309	9.20 kg/m ²	A 94 A 95
Total Savings	£309	9.20 kg/m ²	
Potential energy efficiency rating:		A 94	
Potential environmental impact rating:			A 95

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	£95	£95	£0
Mains gas	£270	£270	£0
Space heating	£238	£238	£0
Water heating	£56	£56	£0
Lighting	£70	£70	£0
Generated (PV)	-£0	-£309	£309
Total cost of fuels	£365	£56	£309
Total cost of uses	£364	£55	£309
Delivered energy	51 kWh/m ²	33 kWh/m ²	18 kWh/m ²
Carbon dioxide emissions	1.3 tonnes	0.3 tonnes	0.9 tonnes
CO2 emissions per m ²	13 kg/m ²	3 kg/m ²	9 kg/m ²
Primary energy	72 kWh/m ²	17 kWh/m ²	54 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	51.4300 (1b)	x 2.3100 (2b)	= 118.8033 (1b) - (3b)
First floor	51.4300 (1c)	x 2.5300 (2c)	= 130.1179 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	102.8600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 248.9212 (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)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =											0.0000 / (5) =	0.0000 (8)
Pressure test											Yes	(8)
Measured/design AP50											4.0100	
Infiltration rate											0.2005	(18)
Number of sides sheltered											0	(19)
Shelter factor											(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =	0.2005 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
	0.2556	0.2506	0.2456	0.2206	0.2155	0.1905	0.1905	0.1855	0.2005	0.2155	0.2256	0.2356 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5056	0.5006	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 m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K						
Window (Uw = 1.20)			16.4000	1.1450	18.7786			(27)					
French Door (Uw = 1.40)			3.8000	1.3258	5.0379			(27)					
Front Door			2.1500	1.0000	2.1500			(26)					
Half-Glazed Door			1.9100	1.3000	2.4830			(26a)					
FP McCann System			51.4300	0.1100	5.6573	75.0000	3857.2500	(28a)					
100mm Knauf Supafil 34	146.2200	24.2600	121.9600	0.2500	30.4900	52.8000	6439.4880	(29a)					
Plane Ceiling-500mm Loft Roll	51.4300		51.4300	0.0900	4.6287	9.0000	462.8700	(30)					
Total net area of external elements Aum(A, m2)			249.0800					(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	69.2255			(33)					
1F Timber			87.3300			9.0000	785.9700	(32c)					
GF Masonry			52.2100			39.0000	2036.1900	(32c)					
GF Timber			24.0700			9.0000	216.6300	(32c)					
Internal Floor			51.4300			12.6000	648.0180	(32d)					
Internal Ceiling			51.4300			9.0000	462.8700	(32e)					
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		14909.2860	(34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							144.9474	(35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.5546	(36)					
Total fabric heat loss						(33) + (36) =	74.7801	(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 41.5351	Feb 41.1233	Mar 41.0720	Apr 41.0720	May 41.0720	Jun 41.0720	Jul 41.0720	Aug 41.0720	Sep 41.0720	Oct 41.0720	Nov 41.0720	Dec 41.0720	(38)
Heat transfer coeff	116.3152	115.9035	115.8521	115.8521	115.8521	115.8521	115.8521	115.8521	115.8521	115.8521	115.8521	115.8521	(39)
Average = Sum(39)m / 12 =												115.8950	(39)
HLP	Jan 1.1308	Feb 1.1268	Mar 1.1263	Apr 1.1263	May 1.1263	Jun 1.1263	Jul 1.1263	Aug 1.1263	Sep 1.1263	Oct 1.1263	Nov 1.1263	Dec 1.1263	(40)
HLP (average)												1.1267	(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	2.7645 (42)
Average daily hot water use (litres/day)	99.8562 (43)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	109.8418	105.8476	101.8533	97.8591	93.8648	89.8706	89.8706	93.8648	97.8591	101.8533	105.8476	109.8418	(44)
Energy conte	162.8922	142.4666	147.0127	128.1693	122.9815	106.1237	98.3392	112.8456	114.1934	133.0814	145.2687	157.7524	(45)
Energy content (annual)										Total =	Sum (45)m =	1571.1266	(45)
Distribution loss (46)m = 0.15 x (45)m	24.4338	21.3700	22.0519	19.2254	18.4472	15.9185	14.7509	16.9268	17.1290	19.9622	21.7903	23.6629	(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													
Combi loss	14.1475	12.7672	14.1094	13.6138	14.0336	13.5417	13.9687	14.0108	13.5810	14.0760	13.6614	14.1352	(61)
Total heat required for water heating calculated for each month	177.0397	155.2338	161.1221	141.7831	137.0151	119.6654	112.3078	126.8564	127.7744	147.1573	158.9302	171.8876	(62)
WWHRS	-50.8932	-44.7802	-45.7036	-37.5990	-34.9091	-28.7966	-24.3685	-29.5056	-30.3677	-37.5438	-43.4939	-49.1916	eq. (G10)
Total of WWHRS savings												-457.1528	
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	126.1465	110.4536	115.4185	104.1841	102.1060	90.8688	87.9394	97.3508	97.4066	109.6136	115.4363	122.6960	(64)
Heat gains from water heating, kWh/month	57.6985	50.5619	52.4091	46.0197	44.3997	38.6715	36.1899	41.0239	41.3645	47.7685	51.7172	55.9865	(65)
Total per year (kWh/year) =										Sum (64)m =		1279.6200	(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	165.8683	165.8683	165.8683	165.8683	165.8683	165.8683	165.8683	165.8683	165.8683	165.8683	165.8683	165.8683	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	58.6692	52.1094	42.3782	32.0830	23.9825	20.2470	21.8776	28.4373	38.1685	48.4637	56.5643	60.2998	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	389.3584	393.3988	383.2173	361.5421	334.1811	308.4656	291.2861	287.2458	297.4272	319.1024	346.4634	372.1789	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.3513	54.3513	54.3513	54.3513	54.3513	54.3513	54.3513	54.3513	54.3513	54.3513	54.3513	54.3513	(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)	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788	(71)
Water heating gains (Table 5)	77.5518	75.2410	70.4423	63.9163	59.6771	53.7105	48.6424	55.1396	57.4508	64.2050	71.8295	75.2506	(72)
Total internal gains	638.2201	633.3899	608.6785	570.1822	530.4813	495.0638	474.4468	483.4634	505.6872	544.4119	587.4979	620.3700	(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					5.8000	11.2829	0.4600	0.7000			0.7700			14.6029 (75)
Southeast					2.0300	36.7938	0.4600	0.7000			0.7700			16.6671 (77)
Southwest					6.6900	36.7938	0.4600	0.7000			0.7700			54.9276 (79)
Northwest					1.8800	11.2829	0.4600	0.7000			0.7700			4.7334 (81)
Northeast					3.8000	11.2829	0.4300	0.0000			0.7700			14.1960 (75)
Solar gains	105.1269	190.2080	289.8356	408.7088	503.0499	519.3214	492.3959	418.9694	330.5218	218.1972	127.9461	88.6542	(83)	
Total gains	743.3470	823.5979	898.5142	978.8910	1033.5313	1014.3852	966.8427	902.4328	836.2090	762.6091	715.4440	709.0242	(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	35.6056	35.7320	35.7479	35.7479	35.7479	35.7479	35.7479	35.7479	35.7479	35.7479	35.7479	35.7479
alpha	3.3737	3.3821	3.3832	3.3832	3.3832	3.3832	3.3832	3.3832	3.3832	3.3832	3.3832	3.3832
util living area	0.9755	0.9639	0.9401	0.8871	0.7876	0.6397	0.4968	0.5454	0.7542	0.9097	0.9632	0.9789 (86)
MIT	19.3268	19.5247	19.8508	20.2659	20.6376	20.8727	20.9595	20.9439	20.7678	20.2967	19.7323	19.2767 (87)
Th 2	19.9758	19.9790	19.9794	19.9794	19.9794	19.9794	19.9794	19.9794	19.9794	19.9794	19.9794	19.9794 (88)
util rest of house	0.9707	0.9569	0.9282	0.8635	0.7422	0.5627	0.3934	0.4410	0.6873	0.8858	0.9549	0.9748 (89)
MIT 2	17.7579	18.0451	18.5128	19.0959	19.5923	19.8737	19.9569	19.9458	19.7649	19.1508	18.3490	17.6878 (90)
Living area fraction	17.9853	18.2596	18.7068	19.2655	19.7438	20.0185	20.1023	20.0904	19.9103	19.3169	18.5495	17.9182 (91)
MIT	17.9853	18.2596	18.7068	19.2655	19.7438	20.0185	20.1023	20.0904	19.9103	19.3169	18.5495	17.9182 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.8353	18.1096	18.5568	19.1155	19.5938	19.8685	19.9523	19.9404	19.7603	19.1669	18.3995	17.7682 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	710.9294	773.5490	814.2891	821.2376	746.7892	561.5028	377.5497	394.1318	560.8972	656.8470	670.2274	681.8688	(94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1574.3626	1531.0395	1396.8041	1183.4908	914.5156	610.3688	388.3662	410.1672	655.7574	992.4970	1309.0723	1571.9000	(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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Space heating kWh	642.3943	509.0336	433.3911	260.8223	124.7884	0.0000	0.0000	0.0000	0.0000	249.7237	459.9684	662.1832 (98)
Space heating												3342.3050 (98)
Space heating per m2												(98) / (4) = 32.4937 (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												3693.1546 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	642.3943	509.0336	433.3911	260.8223	124.7884	0.0000	0.0000	0.0000	0.0000	249.7237	459.9684	662.1832 (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)	709.8280	562.4681	478.8852	288.2014	137.8878	0.0000	0.0000	0.0000	0.0000	275.9378	508.2523	731.6941 (211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	126.1465	110.4536	115.4185	104.1841	102.1060	90.8688	87.9394	97.3508	97.4066	109.6136	115.4363	122.6960 (64)
Efficiency of water heater	89.9588	89.9124	89.8077	89.5629	89.0314	87.3000	87.3000	87.3000	87.3000	89.4993	89.8394	87.3000 (216)
(217)m	89.9588	89.9124	89.8077	89.5629	89.0314	87.3000	87.3000	87.3000	87.3000	89.4993	89.8394	89.9844 (217)
Fuel for water heating, kWh/month	140.2270	122.8458	128.5174	116.3250	114.6854	104.0879	100.7324	111.5130	111.5769	122.4742	128.4919	136.3525 (219)
Water heating fuel used												1437.8294 (219)
Annual totals kWh/year												
Space heating fuel - main system												3693.1546 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
(MEV)Decentralised, Database: total watage = 10.3610, total flow = 45.0000, SFP = 0.2302)												
mechanical ventilation fans (SFP = 0.2302)												69.9215 (230a)
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												144.9215 (231)
Electricity for lighting (calculated in Appendix L)												414.4463 (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												3963.1125 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3693.1546	3.4800	128.5218 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1437.8294	3.4800	50.0365 (247)
Mechanical ventilation fans	69.9215	13.1900	9.2226 (249)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	414.4463	13.1900	54.6655 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-1727.2394	13.1900	-227.8229 (252)
Total energy cost			144.5160 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.4105 (257)
SAP value		94.2735
SAP rating (Section 12)		94 (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	3693.1546	0.2160	797.7214 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1437.8294	0.2160	310.5712 (264)
Space and water heating			1108.2926 (265)
Pumps and fans	144.9215	0.5190	75.2143 (267)
Energy for lighting	414.4463	0.5190	215.0976 (268)

Energy saving/generation technologies

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

PV Unit	-1727.2394	0.5190	-896.4372 (269)
Total kg/year			502.1672 (272)
CO2 emissions per m2			4.8800 (273)
EI value			95.4490
EI rating			95 (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	51.4300 (1b)	x 2.3100 (2b)	= 118.8033 (1b) - (3b)
First floor	51.4300 (1c)	x 2.5300 (2c)	= 130.1179 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	102.8600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 248.9212 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																0 * 10 =	0.0000 (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) =					Air changes per hour		
Pressure test															0.0000 / (5) =		0.0000 (8)
Measured/design AP50															Yes		
Infiltration rate															4.0100		
Number of sides sheltered															0.2005 (18)		
															0 (19)		
Shelter factor										(20) = 1 - [0.075 x (19)] =					1.0000 (20)		
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =					0.2005 (21)		
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
	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																	
	0.2105	0.2005	0.2005	0.1855	0.1855	0.1654	0.1704	0.1604	0.1654	0.1754	0.1754	0.1905 (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 m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K						
Window (Uw = 1.20)			16.4000	1.1450	18.7786			(27)					
French Door (Uw = 1.40)			3.8000	1.3258	5.0379			(27)					
Front Door			2.1500	1.0000	2.1500			(26)					
Half-Glazed Door			1.9100	1.3000	2.4830			(26a)					
FP McCann System			51.4300	0.1100	5.6573	75.0000	3857.2500	(28a)					
100mm Knauf Supafil 34	146.2200	24.2600	121.9600	0.2500	30.4900	52.8000	6439.4880	(29a)					
Plane Ceiling-500mm Loft Roll	51.4300		51.4300	0.0900	4.6287	9.0000	462.8700	(30)					
Total net area of external elements Aum(A, m2)			249.0800					(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	69.2255			(33)					
1F Timber			87.3300			9.0000	785.9700	(32c)					
GF Masonry			52.2100			39.0000	2036.1900	(32c)					
GF Timber			24.0700			9.0000	216.6300	(32c)					
Internal Floor			51.4300			12.6000	648.0180	(32d)					
Internal Ceiling			51.4300			9.0000	462.8700	(32e)					
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		14909.2860	(34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							144.9474	(35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.5546	(36)					
Total fabric heat loss						(33) + (36) =	74.7801	(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 41.0720	Feb 41.0720	Mar 41.0720	Apr 41.0720	May 41.0720	Jun 41.0720	Jul 41.0720	Aug 41.0720	Sep 41.0720	Oct 41.0720	Nov 41.0720	Dec 41.0720	(38)
Heat transfer coeff	115.8521	115.8521	115.8521	115.8521	115.8521	115.8521	115.8521	115.8521	115.8521	115.8521	115.8521	115.8521	(39)
Average = Sum(39)m / 12 =												115.8521	(39)
HLP	Jan 1.1263	Feb 1.1263	Mar 1.1263	Apr 1.1263	May 1.1263	Jun 1.1263	Jul 1.1263	Aug 1.1263	Sep 1.1263	Oct 1.1263	Nov 1.1263	Dec 1.1263	(40)
HLP (average)												1.1263	(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	2.7645 (42)
Average daily hot water use (litres/day)	99.8562 (43)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	109.8418	105.8476	101.8533	97.8591	93.8648	89.8706	89.8706	93.8648	97.8591	101.8533	105.8476	109.8418	(44)
Energy conte	162.8922	142.4666	147.0127	128.1693	122.9815	106.1237	98.3392	112.8456	114.1934	133.0814	145.2687	157.7524	(45)
Energy content (annual)	Total = Sum (45)m = 1571.1266 (45)												
Distribution loss (46)m = 0.15 x (45)m	24.4338	21.3700	22.0519	19.2254	18.4472	15.9185	14.7509	16.9268	17.1290	19.9622	21.7903	23.6629	(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	14.1475	12.7672	14.1094	13.6138	14.0336	13.5417	13.9687	14.0108	13.5810	14.0760	13.6614	14.1352	(61)
Total heat required for water heating calculated for each month	177.0397	155.2338	161.1221	141.7831	137.0151	119.6654	112.3078	126.8564	127.7744	147.1573	158.9302	171.8876	(62)
WWHRS	-50.8932	-44.7802	-45.7036	-37.5990	-34.9091	-28.7966	-24.3685	-29.5056	-30.3677	-37.5438	-43.4939	-49.1916	eq. (G10)
Total of WWHRS savings	-457.1528												
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	126.1465	110.4536	115.4185	104.1841	102.1060	90.8688	87.9394	97.3508	97.4066	109.6136	115.4363	122.6960	(64)
Heat gains from water heating, kWh/month	57.6985	50.5619	52.4091	46.0197	44.3997	38.6715	36.1899	41.0239	41.3645	47.7685	51.7172	55.9865	(65)
Total per year (kWh/year) = Sum (64)m =	1279.6200 (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	165.8683	165.8683	165.8683	165.8683	165.8683	165.8683	165.8683	165.8683	165.8683	165.8683	165.8683	165.8683	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	58.6692	52.1094	42.3782	32.0830	23.9825	20.2470	21.8776	28.4373	38.1685	48.4637	56.5643	60.2998	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	389.3584	393.3988	383.2173	361.5421	334.1811	308.4656	291.2861	287.2458	297.4272	319.1024	346.4634	372.1789	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.3513	54.3513	54.3513	54.3513	54.3513	54.3513	54.3513	54.3513	54.3513	54.3513	54.3513	54.3513	(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)	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788	-110.5788	(71)
Water heating gains (Table 5)	77.5518	75.2410	70.4423	63.9163	59.6771	53.7105	48.6424	55.1396	57.4508	64.2050	71.8295	75.2506	(72)
Total internal gains	638.2201	633.3899	608.6785	570.1822	530.4813	495.0638	474.4468	483.4634	505.6872	544.4119	587.4979	620.3700	(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				5.8000	12.9236	0.4600	0.7000	0.7700	16.7263 (75)				
Southeast				2.0300	40.4699	0.4600	0.7000	0.7700	18.3323 (77)				
Southwest				6.6900	40.4699	0.4600	0.7000	0.7700	60.4154 (79)				
Northwest				1.8800	12.9236	0.4600	0.7000	0.7700	5.4216 (81)				
Northeast				3.8000	12.9236	0.4300	0.0000	0.7700	16.2602 (75)				
Solar gains	117.1558	191.3893	289.6772	423.1305	508.5556	562.0911	527.1112	458.0190	358.8903	234.8889	146.2082	97.7635	(83)
Total gains	755.3759	824.7792	898.3557	993.3127	1039.0369	1057.1549	1001.5580	941.4825	864.5775	779.3008	733.7061	718.1335	(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	35.7479	35.7479	35.7479	35.7479	35.7479	35.7479	35.7479	35.7479	35.7479	35.7479	35.7479	35.7479
alpha	3.3832	3.3832	3.3832	3.3832	3.3832	3.3832	3.3832	3.3832	3.3832	3.3832	3.3832	3.3832
util living area	0.9705	0.9591	0.9298	0.8598	0.7259	0.5131	0.3513	0.3834	0.6668	0.8808	0.9530	0.9744 (86)
MIT	19.4739	19.6334	19.9812	20.4056	20.7625	20.9493	20.9900	20.9866	20.8687	20.4460	19.8896	19.4280 (87)
Th 2	19.9794	19.9794	19.9794	19.9794	19.9794	19.9794	19.9794	19.9794	19.9794	19.9794	19.9794	19.9794 (88)
util rest of house	0.9646	0.9509	0.9152	0.8299	0.6674	0.4209	0.2391	0.2659	0.5810	0.8483	0.9419	0.9692 (89)
MIT 2	17.9736	18.2026	18.6992	19.2873	19.7474	19.9469	19.9764	19.9751	19.8759	19.3552	18.5750	17.9078 (90)
Living area fraction	fLA = Living area / (4) = 0.1450 (91)											
MIT	18.1911	18.4100	18.8850	19.4494	19.8945	20.0922	20.1234	20.1217	20.0198	19.5133	18.7656	18.1282 (92)
Temperature adjustment	-0.1500											
adjusted MIT	18.0411	18.2600	18.7350	19.2994	19.7445	19.9422	19.9734	19.9717	19.8698	19.3633	18.6156	17.9782 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	716.5923	768.8053	801.4483	800.5640	677.7869	441.1581	238.7421	249.4649	493.4617	641.9366	676.1635	685.4197	(94)
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	1499.2498	1466.6857	1313.1839	1088.9381	781.3658	456.7155	240.2023	251.5933	541.0033	899.3956	1229.8405	1491.9647	(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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Space heating kWh	582.2972	468.9756	380.7313	207.6294	77.0627	0.0000	0.0000	0.0000	0.0000	191.5495	398.6475	600.0695 (98)
Space heating												2906.9626 (98)
Space heating per m2												(98) / (4) = 28.2614 (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												3212.1134 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	582.2972	468.9756	380.7313	207.6294	77.0627	0.0000	0.0000	0.0000	0.0000	191.5495	398.6475	600.0695 (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)	643.4223	518.2051	420.6976	229.4247	85.1522	0.0000	0.0000	0.0000	0.0000	211.6569	440.4944	663.0602 (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	126.1465	110.4536	115.4185	104.1841	102.1060	90.8688	87.9394	97.3508	97.4066	109.6136	115.4363	122.6960 (64)
Efficiency of water heater	89.9131	89.8720	89.7348	89.4050	88.6482	87.3000	87.3000	87.3000	87.3000	89.3085	89.7612	87.3000 (216)
(217)m	89.9131	89.8720	89.7348	89.4050	88.6482	87.3000	87.3000	87.3000	87.3000	89.3085	89.7612	89.9403 (217)
Fuel for water heating, kWh/month	140.2982	122.9009	128.6217	116.5305	115.1811	104.0879	100.7324	111.5130	111.5769	122.7359	128.6038	136.4193 (219)
Water heating fuel used												1439.2015 (219)
Annual totals kWh/year												
Space heating fuel - main system												3212.1134 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
(MEV)Decentralised, Database: total watage = 10.3610, total flow = 45.0000, SFP = 0.2302)												
mechanical ventilation fans (SFP = 0.2302)												69.9215 (230a)
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												144.9215 (231)
Electricity for lighting (calculated in Appendix L)												414.4463 (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												3386.5231 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3212.1134	3.9200	125.9148 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1439.2015	3.9200	56.4167 (247)
Mechanical ventilation fans	69.9215	16.9600	11.8587 (249)
Pumps and fans for heating	75.0000	16.9600	12.7200 (249)
Energy for lighting	414.4463	16.9600	70.2901 (250)
Additional standing charges			88.0000 (251)
Energy saving/generation technologies			
PV Unit	-1824.1596	16.9600	-309.3775 (252)
Total energy cost			55.8228 (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	3212.1134	0.2160	693.8165 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1439.2015	0.2160	310.8675 (264)
Space and water heating			1004.6840 (265)
Pumps and fans	144.9215	0.5190	75.2143 (267)
Energy for lighting	414.4463	0.5190	215.0976 (268)
Energy saving/generation technologies			
PV Unit	-1824.1596	0.5190	-946.7389 (269)
Total kg/year			348.2571 (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	3212.1134	1.2200	3918.7783 (261)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1439.2015	1.2200	1755.8259 (264)
Space and water heating			5674.6042 (265)
Pumps and fans	144.9215	3.0700	444.9091 (267)
Energy for lighting	414.4463	3.0700	1272.3500 (268)
Energy saving/generation technologies			
PV Unit	-1824.1596	3.0700	-5600.1701 (269)
Primary energy kWh/year			1791.6932 (272)
Primary energy kWh/m2/year			17.4188 (273)

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

Overheating Calculation Input Data

Dwelling type	Detached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Thames Valley
Front of dwelling faces	South West
Overshading	Average or unknown
Thermal mass parameter	144.9 (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	328.58 (P1)
Transmission heat loss coefficient	74.78 (37)
Summer heat loss coefficient	403.36 (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
North West	0.000	1.000	None

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

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North East	5.8000	98.8453	0.4600	0.7000	0.9000	149.5288
South East	2.0300	119.9223	0.4600	0.7000	0.9000	63.4946
South West	6.6900	119.9223	0.4600	0.7000	0.9000	209.2508
North West	1.8800	98.8453	0.4600	0.7000	0.9000	48.4679
North East	3.8000	98.8453	0.4300	0.0000	0.9000	145.3619

total:						616.1040
Solar gains	Jun	Jul	Aug			(P3/P4)
Internal gains	657	616	535			
Total summer gains	492	471	480			
	1149	1088	1016			(P5)
Summer gain/loss ratio	2.85	2.70	2.52			(P6)
Summer external temperature	16.00	17.90	17.80			
Thermal mass temperature increment (TMP = 144.9)	0.99	0.99	0.99			
Threshold temperature	19.83	21.58	21.30			(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight			
Assessment of likelihood of high internal temperature:	Slight					