

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property Reference	X204 Semi			Issued on Date	15/12/2022
Assessment Reference	X204 Semi	Prop Type Ref	Holly		
Property	2 Bed, K, WC, B				
SAP Rating	86 B	DER	13.75	TER	18.20
Environmental	89 B	% DER<TER	24.47		
CO ₂ Emissions (t/year)	0.91	DFEE	39.36	TFEE	51.07
General Requirements Compliance	Pass	% DFEE<TFEE	22.93		
Assessor Details	Mr. Christopher MacDougall, Chris MacDougall, Tel: 02032 902 902, chris.macdougall@aessc.co.uk			Assessor ID	Q920-0001
Client					

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

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DWELLING AS DESIGNED

Semi-Detached House, total floor area 79 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) 18.20 kgCO₂/m²

Dwelling Carbon Dioxide Emission Rate (DER) 13.75 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)51.1 kWh/m²/yr

Dwelling Fabric Energy Efficiency (DFEE)39.4 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	1.21 (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 ESP1 35

Combi boiler

Efficiency: 89.6% SEDBUK2009

Minimum: 88.0% OK

Secondary heating system:

None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls: Time and temperature zone control OK

Hot water controls:

No cylinder

Boiler interlock

Yes

OK

7 Low energy lights

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

8 Mechanical ventilation

Continuous extract system (decentralised)

Specific fan power: 0.1700 0.1800
Maximum 0.7 OK

9 Summertime temperature

Overheating risk (Thames Valley): Medium OK

Based on:

Overshading:
Average
Windows facing North East: 2.26 m², No overhang
Windows facing South East: 6.71 m², No overhang
Windows facing North West: 4.92 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

10 Key features

Party wall U-value	0.00 W/m ² K
Roof U-value	0.09 W/m ² K
Floor U-value	0.11 W/m ² K
Door U-value	1.00 W/m ² K
Thermal bridging y-value	0.030 W/m ² K

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	39.5300 (1b)	x 2.3100 (2b)	= 91.3143 (1b) - (3b)
First floor	39.5300 (1c)	x 2.5300 (2c)	= 100.0109 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.0600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 191.3252 (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														1 (19)			
Shelter factor										(20) = 1 - [0.075 x (19)] =				0.9250 (20)			
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =				0.1855 (21)			
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)					
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)					
Adj infilt rate																	
	0.2365	0.2318	0.2272	0.2040	0.1994	0.1762	0.1762	0.1716	0.1855	0.1994	0.2086	0.2179 (22b)					
Mechanical extract ventilation - decentralised																	
If mechanical ventilation:																0.5000 (23a)	
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)					

3. Heat losses and heat loss parameter

Element	Gross 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)			10.8000	1.1450	12.3664		(27)					
French Door (Uw = 1.40)			3.0900	1.3258	4.0966		(27)					
Front Door			2.1500	1.0000	2.1500		(26)					
FP McCann System			39.5300	0.1100	4.3483	75.0000	2964.7500 (28a)					
100mm Knauf Supafil 34	86.2500	16.0400	70.2100	0.2500	17.5525	52.8000	3707.0880 (29a)					
Plane Ceiling-500mm Loft Roll	39.5300		39.5300	0.0900	3.5577	9.0000	355.7700 (30)					
Total net area of external elements Aum(A, m2)			165.3100				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	44.0715		(33)					
E-WM-30			40.3700	0.0000	0.0000	45.0000	1816.6500 (32)					
1F Timber			75.0300			9.0000	675.2700 (32c)					
GF Timber			64.3100			9.0000	578.7900 (32c)					
Internal Floor			39.5300			12.6000	498.0780 (32d)					
Internal Ceiling			39.5300			9.0000	355.7700 (32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	10952.1660 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							138.5298 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.9287 (36)					
Total fabric heat loss						(33) + (36) =	49.0002 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 31.5687	Feb 31.5687	Mar 31.5687	Apr 31.5687	May 31.5687	Jun 31.5687	Jul 31.5687	Aug 31.5687	Sep 31.5687	Oct 31.5687	Nov 31.5687	Dec 31.5687 (38)
Heat transfer coeff	80.5688	80.5688	80.5688	80.5688	80.5688	80.5688	80.5688	80.5688	80.5688	80.5688	80.5688	80.5688 (39)
Average = Sum(39)m / 12 =												80.5688 (39)
HLP	Jan 1.0191	Feb 1.0191	Mar 1.0191	Apr 1.0191	May 1.0191	Jun 1.0191	Jul 1.0191	Aug 1.0191	Sep 1.0191	Oct 1.0191	Nov 1.0191	Dec 1.0191 (40)
HLP (average)												1.0191 (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												2.4448 (42)
Average daily hot water use (litres/day)												92.2636 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Daily hot water use	101.4900	97.7994	94.1089	90.4183	86.7278	83.0372	83.0372	86.7278	90.4183	94.1089	97.7994	101.4900 (44)
Energy conte	150.5067	131.6341	135.8346	118.4239	113.6306	98.0545	90.8619	104.2654	105.5107	122.9625	134.2232	145.7577 (45)
Energy content (annual)												
Distribution loss (46)m = 0.15 x (45)m	22.5760	19.7451	20.3752	17.7636	17.0446	14.7082	13.6293	15.6398	15.8266	18.4444	20.1335	21.8637 (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	14.1178	12.7342	14.0634	13.5698	13.9931	13.5082	13.9376	13.9736	13.5418	14.0343	13.6278	14.1064 (61)
Total heat required for water heating calculated for each month	164.6245	144.3684	149.8980	131.9937	127.6236	111.5627	104.7996	118.2390	119.0524	136.9968	147.8510	159.8641 (62)
WWHRS	-51.9667	-45.7221	-46.6664	-38.4089	-35.6703	-29.4311	-24.9172	-30.1660	-31.0421	-38.3648	-44.4274	-50.2252 eq. (G10)
Total of WWHRS savings												-467.0082
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	112.6578	98.6463	103.2316	93.5848	91.9533	82.1317	79.8824	88.0729	88.0103	98.6320	103.4236	109.6388 (64)
Total per year (kWh/year) = Sum(64)m =												1149.8655 (64)
Heat gains from water heating, kWh/month	53.5729	46.9519	48.6808	42.7684	41.2804	35.9802	33.6960	38.1616	38.4677	44.3936	48.0362	51.9910 (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	122.2392	122.2392	122.2392	122.2392	122.2392	122.2392	122.2392	122.2392	122.2392	122.2392	122.2392	122.2392 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	19.8803	17.6575	14.3601	10.8715	8.1266	6.8608	7.4133	9.6361	12.9336	16.4221	19.1671	20.4328 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	217.4647	219.7213	214.0348	201.9287	186.6470	172.2844	162.6893	160.4327	166.1193	178.2253	193.5070	207.8696 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.2239	35.2239	35.2239	35.2239	35.2239	35.2239	35.2239	35.2239	35.2239	35.2239	35.2239	35.2239 (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)	-97.7913	-97.7913	-97.7913	-97.7913	-97.7913	-97.7913	-97.7913	-97.7913	-97.7913	-97.7913	-97.7913	-97.7913 (71)
Water heating gains (Table 5)	72.0066	69.8689	65.4312	59.4005	55.4844	49.9725	45.2903	51.2925	53.4274	59.6688	66.7169	69.8804 (72)
Total internal gains	372.0234	369.9195	356.4978	334.8725	312.9298	291.7894	278.0647	284.0331	295.1520	316.9880	342.0627	360.8546 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
Northeast				2.2600	11.2829	0.4600	0.0000	0.7700	9.0319 (75)			
Southeast				3.6200	36.7938	0.4600	0.0000	0.7700	47.1772 (77)			
Northwest				4.9200	11.2829	0.4600	0.0000	0.7700	19.6624 (81)			
Southeast				3.0900	36.7938	0.4300	0.0000	0.7700	37.6437 (77)			
Solar gains	113.5152	202.8895	302.9185	417.7646	506.6629	520.0358	494.2800	425.3533	342.2796	231.0620	137.7008	96.0222 (83)
Total gains	485.5386	572.8090	659.4163	752.6371	819.5927	811.8252	772.3447	709.3864	637.4316	548.0500	479.7635	456.8769 (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	37.7599	37.7599	37.7599	37.7599	37.7599	37.7599	37.7599	37.7599	37.7599	37.7599	37.7599	37.7599
alpha	3.5173	3.5173	3.5173	3.5173	3.5173	3.5173	3.5173	3.5173	3.5173	3.5173	3.5173	3.5173
util living area	0.9821	0.9677	0.9370	0.8669	0.7425	0.5813	0.4425	0.4956	0.7226	0.9089	0.9704	0.9854 (86)
MIT	19.3455	19.5851	19.9517	20.3858	20.7319	20.9167	20.9757	20.9637	20.8185	20.3528	19.7536	19.2794 (87)
Th 2	20.0675	20.0675	20.0675	20.0675	20.0675	20.0675	20.0675	20.0675	20.0675	20.0675	20.0675	20.0675 (88)
util rest of house	0.9788	0.9618	0.9253	0.8424	0.6973	0.5118	0.3552	0.4052	0.6588	0.8865	0.9639	0.9826 (89)
MIT 2	17.8492	18.1953	18.7202	19.3261	19.7811	19.9976	20.0534	20.0449	19.8978	19.2849	18.4429	17.7534 (90)
Living area fraction	18.0884	18.4175	18.9171	19.4955	19.9331	20.1445	20.2009	20.1918	20.0450	19.4640	18.6525	17.9974 (92)
MIT	17.9384	18.2675	18.7671	19.3455	19.7831	19.9945	20.0509	20.0418	19.8950	19.3140	18.5025	17.8474 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	469.8232	541.9247	596.4246	617.1130	559.0178	410.7833	273.0893	285.5606	411.5495	473.3269	455.1264	444.4802 (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	1098.8332	1077.0002	988.3443	841.5837	651.2461	434.6314	278.0313	293.4176	466.8929	702.0798	918.6856	1099.5526 (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	467.9835	359.5708	291.5883	161.6189	68.6179	0.0000	0.0000	0.0000	0.0000	170.1921	333.7626	487.3739 (98)

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Space heating 2340.7079 (98)
 Space heating per m2 (98) / (4) = 29.6067 (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													2586.4176 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	467.9835	359.5708	291.5883	161.6189	68.6179	0.0000	0.0000	0.0000	0.0000	170.1921	333.7626	487.3739	(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)	517.1088	397.3158	322.1970	178.5845	75.8209	0.0000	0.0000	0.0000	0.0000	188.0576	368.7985	538.5347	(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	112.6578	98.6463	103.2316	93.5848	91.9533	82.1317	79.8824	88.0729	88.0103	98.6320	103.4236	109.6388	(64)
Efficiency of water heater	89.8609	89.7914	89.6409	89.2997	88.6394	87.3000	87.3000	87.3000	87.3000	89.2990	89.7220	87.3000	(216)
(217)m	89.8609	89.7914	89.6409	89.2997	88.6394	87.3000	87.3000	87.3000	87.3000	89.2990	89.7220	89.8949	(217)
Fuel for water heating, kWh/month	125.3690	109.8615	115.1613	104.7986	103.7387	94.0798	91.5033	100.8854	100.8136	110.4514	115.2712	121.9634	(219)
Water heating fuel used												1293.8973	(219)
Annual totals kWh/year													
Space heating fuel - main system												2586.4176	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 6.6170, total flow = 29.0000, SFP = 0.2282)													
mechanical ventilation fans (SFP = 0.2282)												53.2593	(230a)
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												128.2593	(231)
Electricity for lighting (calculated in Appendix L)												351.0924	(232)
Total delivered energy for all uses												4359.6666	(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	2586.4176	0.2160	558.6662 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1293.8973	0.2160	279.4818 (264)
Space and water heating			838.1480 (265)
Pumps and fans	128.2593	0.5190	66.5666 (267)
Energy for lighting	351.0924	0.5190	182.2169 (268)
Total CO2, kg/year			1086.9315 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.7500 (273)

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

DER	13.7500	ZC1
Total Floor Area	79.0600	TFA
Assumed number of occupants	2.4448	N
CO2 emission factor in Table 12 for electricity displaced from grid	0.5190	EF
CO2 emissions from appliances, equation (L14)	16.2996	ZC2
CO2 emissions from cooking, equation (L16)	2.2473	ZC3
Total CO2 emissions	32.2970	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	32.2970	ZC8

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	39.5300 (1b)	x 2.3100 (2b)	= 91.3143 (1b) - (3b)
First floor	39.5300 (1c)	x 2.5300 (2c)	= 100.0109 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.0600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 191.3252 (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																3 * 10 =	30.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000	/ (5) =	0.1568 (8)
Pressure test										Yes							
Measured/design AP50										5.0000							
Infiltration rate										0.4068 (18)							
Number of sides sheltered										1 (19)							
Shelter factor										(20) = 1 - [0.075 x (19)] =					0.9250 (20)		
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =					0.3763 (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	0.4798	0.4704	0.4610	0.4139	0.4045	0.3575	0.3575	0.3481	0.3763	0.4045	0.4233	0.4421	(22b)				
Effective ac	0.6151	0.6106	0.6062	0.5857	0.5818	0.5639	0.5639	0.5606	0.5708	0.5818	0.5896	0.5977	(25)				

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opaque door			2.1500	1.0000	2.1500		(26)					
TER Opening Type (Uw = 1.40)			13.8900	1.3258	18.4148		(27)					
FP McCann System			39.5300	0.1300	5.1389		(28a)					
100mm Knauf Supafil 34	86.2500	16.0400	70.2100	0.1800	12.6378		(29a)					
Plane Ceiling-500mm Loft Roll	39.5300		39.5300	0.1300	5.1389		(30)					
Total net area of external elements Aum(A, m2)			165.3100				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26) ... (30) + (32) =		43.4804		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.4274 (36)					
Total fabric heat loss						(33) + (36) =	52.9078 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 38.8351	Feb 38.5530	Mar 38.2764	Apr 36.9773	May 36.7343	Jun 35.6028	Jul 35.6028	Aug 35.3933	Sep 36.0386	Oct 36.7343	Nov 37.2260	Dec 37.7400 (38)
Heat transfer coeff	91.7429	91.4607	91.1842	89.8851	89.6420	88.5106	88.5106	88.3010	88.9464	89.6420	90.1337	90.6478 (39)
Average = Sum(39)m / 12 =												89.8839 (39)
HLP	Jan 1.1604	Feb 1.1569	Mar 1.1534	Apr 1.1369	May 1.1338	Jun 1.1195	Jul 1.1195	Aug 1.1169	Sep 1.1250	Oct 1.1338	Nov 1.1401	Dec 1.1466 (40)
HLP (average)												1.1369 (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												2.4448 (42)
Average daily hot water use (litres/day)												92.2636 (43)
Daily hot water use	Jan 101.4900	Feb 97.7994	Mar 94.1089	Apr 90.4183	May 86.7278	Jun 83.0372	Jul 83.0372	Aug 86.7278	Sep 90.4183	Oct 94.1089	Nov 97.7994	Dec 101.4900 (44)
Energy conte	150.5067	131.6341	135.8346	118.4239	113.6306	98.0545	90.8619	104.2654	105.5107	122.9625	134.2232	145.7577 (45)
Energy content (annual)										Total = Sum(45)m =		1451.6658 (45)
Distribution loss (46)m = 0.15 x (45)m												
	22.5760	19.7451	20.3752	17.7636	17.0446	14.7082	13.6293	15.6398	15.8266	18.4444	20.1335	21.8637 (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												

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Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Combi 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 (57)
Total heat required for water heating calculated for each month	50.9589	45.0145	47.9569	44.5899	44.1955	40.9499	42.3149	44.1955	44.5899	47.9569	48.2299	50.9589 (61)
Solar input	201.4656	176.6486	183.7915	163.0138	157.8261	139.0044	133.1768	148.4609	150.1005	170.9194	182.4530	196.7166 (62)
Output from w/h	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)
Heat gains from water heating, kWh/month	201.4656	176.6486	183.7915	163.0138	157.8261	139.0044	133.1768	148.4609	150.1005	170.9194	182.4530	196.7166 (64)
	62.7832	55.0220	57.1542	50.5234	48.8310	42.8406	40.7903	45.7171	46.2298	52.8742	56.6867	61.2042 (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	122.2392	122.2392	122.2392	122.2392	122.2392	122.2392	122.2392	122.2392	122.2392	122.2392	122.2392	122.2392	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	19.8803	17.6575	14.3601	10.8715	8.1266	6.8608	7.4133	9.6361	12.9336	16.4221	19.1671	20.4328	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	217.4647	219.7213	214.0348	201.9287	186.6470	172.2844	162.6893	160.4327	166.1193	178.2253	193.5070	207.8696	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.2239	35.2239	35.2239	35.2239	35.2239	35.2239	35.2239	35.2239	35.2239	35.2239	35.2239	35.2239	(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)	-97.7913	-97.7913	-97.7913	-97.7913	-97.7913	-97.7913	-97.7913	-97.7913	-97.7913	-97.7913	-97.7913	-97.7913	(71)
Water heating gains (Table 5)	84.3860	81.8779	76.8202	70.1714	65.6331	59.5008	54.8257	61.4478	64.2080	71.0675	78.7315	82.2637	(72)
Total internal gains	384.4028	381.9285	367.8868	345.6434	323.0785	301.3178	287.6001	294.1883	305.9326	328.3867	354.0773	373.2379	(73)

6. Solar gains

[Jan]			Area m2		Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
Northeast			2.2600		11.2829		0.6300		0.7000		0.7700		7.7930 (75)
Southeast			6.7100		36.7938		0.6300		0.7000		0.7700		75.4518 (77)
Northwest			4.9200		11.2829		0.6300		0.7000		0.7700		16.9652 (81)
Solar gains	100.2099	178.9182	266.6473	367.0020	444.4916	455.9770	433.4931	373.4351	301.0463	203.6324	121.5260	84.7898	(83)
Total gains	484.6127	560.8468	634.5340	712.6454	767.5700	757.2948	721.0932	667.6234	606.9789	532.0191	475.6033	458.0276	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.8442	60.0288	60.2109	61.0811	61.2467	62.0296	62.0296	62.1768	61.7257	61.2467	60.9126	60.5672	
alpha	4.9896	5.0019	5.0141	5.0721	5.0831	5.1353	5.1353	5.1451	5.1150	5.0831	5.0608	5.0378	
util living area	0.9978	0.9950	0.9867	0.9563	0.8681	0.6970	0.5293	0.5890	0.8411	0.9744	0.9954	0.9984	(86)
MIT	19.7568	19.9151	20.1737	20.5164	20.8006	20.9538	20.9907	20.9845	20.8768	20.5069	20.0724	19.7334	(87)
Th 2	19.9518	19.9547	19.9575	19.9708	19.9733	19.9849	19.9849	19.9871	19.9804	19.9733	19.9682	19.9630	(88)
util rest of house	0.9971	0.9933	0.9820	0.9399	0.8209	0.6064	0.4128	0.4690	0.7686	0.9617	0.9935	0.9978	(89)
MIT 2	18.2973	18.5301	18.9072	19.4035	19.7787	19.9545	19.9815	19.9807	19.8816	19.3999	18.7702	18.2710	(90)
Living area fraction	18.5306	18.7515	19.1097	19.5814	19.9421	20.1142	20.1429	20.1412	20.0407	19.5769	18.9784	18.5048	(92)
MIT	18.5306	18.7515	19.1097	19.5814	19.9421	20.1142	20.1429	20.1412	20.0407	19.5769	18.9784	18.5048	(93)
Temperature adjustment													
adjusted MIT	18.5306	18.7515	19.1097	19.5814	19.9421	20.1142	20.1429	20.1412	20.0407	19.5769	18.9784	18.5048	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	482.4374	555.5001	619.6839	664.2124	628.8440	468.5721	311.1048	325.8221	469.5201	508.0854	471.2190	456.4586	(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	1305.5581	1266.8713	1149.8055	960.0988	738.8359	488.0689	313.5822	330.3522	528.4059	804.7034	1070.6419	1296.6996	(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	612.4018	478.0415	394.4104	213.0382	81.8339	0.0000	0.0000	0.0000	0.0000	220.6838	431.5845	625.1393	(98)
Space heating												3057.1334	(98)
Space heating per m2												38.6685	(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													3273.1621 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	612.4018	478.0415	394.4104	213.0382	81.8339	0.0000	0.0000	0.0000	0.0000	220.6838	431.5845	625.1393	(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)	655.6765	511.8217	422.2810	228.0923	87.6166	0.0000	0.0000	0.0000	0.0000	236.2782	462.0819	669.3140	(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	201.4656	176.6486	183.7915	163.0138	157.8261	139.0044	133.1768	148.4609	150.1005	170.9194	182.4530	196.7166	(64)
Efficiency of water heater	87.6704	87.4327	86.9247	85.7259	83.4849	80.3000	80.3000	80.3000	80.3000	85.6955	87.1432	80.3000	(216)
Fuel for water heating, kWh/month	229.7990	202.0394	211.4376	190.1569	189.0474	173.1064	165.8491	184.8829	186.9247	199.4495	209.3716	224.1581	(219)
Water heating fuel used												2366.2225	(219)
Annual totals kWh/year													
Space heating fuel - main system												3273.1621	(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)												351.0924	(232)
Total delivered energy for all uses												6065.4770	(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	3273.1621	0.2160	707.0030 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2366.2225	0.2160	511.1041 (264)
Space and water heating			1218.1071 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	351.0924	0.5190	182.2169 (268)
Total CO2, kg/m2/year			1439.2490 (272)
Emissions per m2 for space and water heating			15.4074 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.3048 (272b)
Emissions per m2 for pumps and fans			0.4923 (272c)
Target Carbon Dioxide Emission Rate (TER) = (15.4074 * 1.00) + 2.3048 + 0.4923, rounded to 2 d.p.			18.2000 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	39.5300 (1b)	x 2.3100 (2b)	= 91.3143 (1b) - (3b)
First floor	39.5300 (1c)	x 2.5300 (2c)	= 100.0109 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.0600		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 191.3252 (5)
Dwelling volume			

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					3 * 10 = 30.0000 (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) =					30.0000 / (5) = 0.1568 (8)
Pressure test					Yes
Measured/design AP50					4.0100
Infiltration rate					0.3573 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3305 (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												
Effective ac	0.4214	0.4131	0.4049	0.3636	0.3553	0.3140	0.3140	0.3057	0.3305	0.3553	0.3718	0.3883 (22b)
	0.5888	0.5853	0.5820	0.5661	0.5631	0.5493	0.5493	0.5467	0.5546	0.5631	0.5691	0.5754 (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)			10.8000	1.1450	12.3664		(27)
French Door (Uw = 1.40)			3.0900	1.3258	4.0966		(27)
Front Door			2.1500	1.0000	2.1500		(26)
FP McCann System			39.5300	0.1100	4.3483	75.0000	2964.7500 (28a)
100mm Knauf Supafil 34	86.2500	16.0400	70.2100	0.2500	17.5525	52.8000	3707.0880 (29a)
Plane Ceiling-500mm Loft Roll	39.5300		39.5300	0.0900	3.5577	9.0000	355.7700 (30)
Total net area of external elements Aum(A, m ²)			165.3100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	44.0715		(33)
E-WM-30			40.3700	0.0000	0.0000	45.0000	1816.6500 (32)
1F Timber			75.0300			9.0000	675.2700 (32c)
GF Timber			64.3100			9.0000	578.7900 (32c)
Internal Floor			39.5300			12.6000	498.0780 (32d)
Internal Ceiling			39.5300			9.0000	355.7700 (32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss
(28)...(30) + (32) + (32a)...(32e) = 10952.1660 (34)
138.5298 (35)
4.9287 (36)
(33) + (36) = 49.0002 (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	37.1743	36.9567	36.7433	35.7411	35.5536	34.6808	34.6808	34.5191	35.0170	35.5536	35.9329	36.3295 (38)
Heat transfer coeff	86.1745	85.9568	85.7435	84.7413	84.5538	83.6809	83.6809	83.5193	84.0171	84.5538	84.9331	85.3297 (39)
Average = Sum(39)m / 12 =												84.7404 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0900	1.0872	1.0845	1.0719	1.0695	1.0584	1.0584	1.0564	1.0627	1.0695	1.0743	1.0793 (40)
HLP (average)												1.0718 (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
Average daily hot water use (litres/day)
2.4448 (42)
92.2636 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	101.4900	97.7994	94.1089	90.4183	86.7278	83.0372	83.0372	86.7278	90.4183	94.1089	97.7994	101.4900 (44)
Energy conte	150.5067	131.6341	135.8346	118.4239	113.6306	98.0545	90.8619	104.2654	105.5107	122.9625	134.2232	145.7577 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Energy content (annual)	Total = Sum(45)m = 1451.6658 (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	31.9827	27.9722	28.8649	25.1651	24.1465	20.8366	19.3082	22.1564	22.4210	26.1295	28.5224	30.9735 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(66)
(66)m	122.2392	122.2392	122.2392	122.2392	122.2392	122.2392	122.2392	122.2392	122.2392	122.2392	122.2392	122.2392	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	19.8803	17.6575	14.3601	10.8715	8.1266	6.8608	7.4133	9.6361	12.9336	16.4221	19.1671	20.4328	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	217.4647	219.7213	214.0348	201.9287	186.6470	172.2844	162.6893	160.4327	166.1193	178.2253	193.5070	207.8696	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.2239	35.2239	35.2239	35.2239	35.2239	35.2239	35.2239	35.2239	35.2239	35.2239	35.2239	35.2239	(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)	-97.7913	-97.7913	-97.7913	-97.7913	-97.7913	-97.7913	-97.7913	-97.7913	-97.7913	-97.7913	-97.7913	-97.7913	(71)
Water heating gains (Table 5)	42.9875	41.6254	38.7968	34.9515	32.4550	28.9397	25.9518	29.7801	31.1403	35.1203	39.6145	41.6311	(72)
Total internal gains	340.0042	338.6760	326.8634	307.4235	286.9003	267.7567	255.7262	259.5207	269.8649	289.4395	311.9603	329.6053	(73)

6. Solar gains

[Jan]			Area m2		Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
Northeast			2.2600		11.2829		0.4600		0.0000		0.7700		9.0319 (75)
Southeast			3.6200		36.7938		0.4600		0.0000		0.7700		47.1772 (77)
Northwest			4.9200		11.2829		0.4600		0.0000		0.7700		19.6624 (81)
Southeast			3.0900		36.7938		0.4300		0.0000		0.7700		37.6437 (77)
Solar gains	113.5152	202.8895	302.9185	417.7646	506.6629	520.0358	494.2800	425.3533	342.2796	231.0620	137.7008	96.0222	(83)
Total gains	453.5195	541.5654	629.7819	725.1881	793.5632	787.7924	750.0062	684.8740	612.1445	520.5015	449.6610	425.6275	(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	35.3036	35.3930	35.4811	35.9007	35.9803	36.3556	36.3556	36.4259	36.2101	35.9803	35.8196	35.6531	
alpha	3.3536	3.3595	3.3654	3.3934	3.3987	3.4237	3.4237	3.4284	3.4140	3.3987	3.3880	3.3769	
util living area	0.9857	0.9735	0.9473	0.8844	0.7691	0.6089	0.4681	0.5242	0.7520	0.9237	0.9761	0.9883	(86)
MIT	19.1487	19.4001	19.7913	20.2796	20.6696	20.8948	20.9677	20.9525	20.7754	20.2519	19.6098	19.1041	(87)
Th 2	20.0090	20.0113	20.0135	20.0239	20.0258	20.0349	20.0349	20.0366	20.0314	20.0258	20.0219	20.0178	(88)
util rest of house	0.9829	0.9684	0.9369	0.8615	0.7244	0.5365	0.3743	0.4279	0.6884	0.9037	0.9707	0.9860	(89)
MIT 2	18.3147	18.5650	18.9507	19.4276	19.7834	19.9744	20.0222	20.0164	19.8867	19.4127	18.7828	18.2769	(90)
Living area fraction	18.4480	18.6985	19.0851	19.5638	19.9251	20.1215	20.1734	20.1661	20.0288	19.5469	18.9150	18.4092	(91)
Temperature adjustment	18.4480	18.6985	19.0851	19.5638	19.9251	20.1215	20.1734	20.1661	20.0288	19.5469	18.9150	18.4092	(92)
adjusted MIT	18.4480	18.6985	19.0851	19.5638	19.9251	20.1215	20.1734	20.1661	20.0288	19.5469	18.9150	18.4092	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation	0.9769	0.9597	0.9249	0.8489	0.7193	0.5434	0.3882	0.4415	0.6882	0.8915	0.9625	0.9809	(94)	
Useful gains	443.0438	519.7151	582.4548	615.6364	570.7816	428.0970	291.1712	302.3474	421.2811	464.0349	432.8100	417.4907	(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	1219.1990	1186.0751	1079.0916	903.6640	695.4630	462.0481	299.0237	314.5420	498.1199	756.4936	1003.4883	1212.4625	(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	577.4594	447.7939	369.4978	207.3799	92.7630	0.0000	0.0000	0.0000	0.0000	217.5892	410.8883	591.4591	(98)	
Space heating	2914.8306												(99)	
Space heating per m2	(98) / (4) =										36.8686			(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												

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Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	786.6007	619.2388	634.7466	0.0000	0.0000	0.0000	0.0000 (100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.8601	0.9090	0.8845	0.0000	0.0000	0.0000	0.0000 (101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	676.5801	562.8602	561.4029	0.0000	0.0000	0.0000	0.0000 (102)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1012.0757	966.0440	891.4975	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	241.5568	299.9687	245.5904	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction									FC = cooled area / (4) =			787.1160 (104)
Intermittency factor (Table 10b)												1.0000 (105)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	60.3892	74.9922	61.3976	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling per m2												196.7790 (107)
Energy for space heating												2.4890 (108)
Energy for space cooling												36.8686 (99)
Total												2.4890 (108)
Dwelling Fabric Energy Efficiency (DFEE)												39.3576 (109)
												39.4 (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	39.5300 (1b)	x 2.3100 (2b)	= 91.3143 (1b) - (3b)
First floor	39.5300 (1c)	x 2.5300 (2c)	= 100.0109 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.0600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 191.3252 (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																3 * 10 =	30.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000	/ (5) =	0.1568 (8)
Pressure test										Yes							
Measured/design AP50										5.0000							
Infiltration rate										0.4068 (18)							
Number of sides sheltered										1 (19)							
Shelter factor										(20) = 1 - [0.075 x (19)] =					0.9250 (20)		
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =					0.3763 (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	0.4798	0.4704	0.4610	0.4139	0.4045	0.3575	0.3575	0.3481	0.3763	0.4045	0.4233	0.4421	(22b)				
Effective ac	0.6151	0.6106	0.6062	0.5857	0.5818	0.5639	0.5639	0.5606	0.5708	0.5818	0.5896	0.5977	(25)				

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opaque door			2.1500	1.0000	2.1500		(26)					
TER Opening Type (Uw = 1.40)			13.8900	1.3258	18.4148		(27)					
FP McCann System			39.5300	0.1300	5.1389		(28a)					
100mm Knauf Supafil 34	86.2500	16.0400	70.2100	0.1800	12.6378		(29a)					
Plane Ceiling-500mm Loft Roll	39.5300		39.5300	0.1300	5.1389		(30)					
Total net area of external elements Aum(A, m2)			165.3100				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	43.4804		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.4274 (36)					
Total fabric heat loss						(33) + (36) =	52.9078 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 38.8351	Feb 38.5530	Mar 38.2764	Apr 36.9773	May 36.7343	Jun 35.6028	Jul 35.6028	Aug 35.3933	Sep 36.0386	Oct 36.7343	Nov 37.2260	Dec 37.7400 (38)
Heat transfer coeff	91.7429	91.4607	91.1842	89.8851	89.6420	88.5106	88.5106	88.3010	88.9464	89.6420	90.1337	90.6478 (39)
Average = Sum(39)m / 12 =												89.8839 (39)
HLP	Jan 1.1604	Feb 1.1569	Mar 1.1534	Apr 1.1369	May 1.1338	Jun 1.1195	Jul 1.1195	Aug 1.1169	Sep 1.1250	Oct 1.1338	Nov 1.1401	Dec 1.1466 (40)
HLP (average)												1.1369 (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												2.4448 (42)
Average daily hot water use (litres/day)												92.2636 (43)
Daily hot water use	Jan 101.4900	Feb 97.7994	Mar 94.1089	Apr 90.4183	May 86.7278	Jun 83.0372	Jul 83.0372	Aug 86.7278	Sep 90.4183	Oct 94.1089	Nov 97.7994	Dec 101.4900 (44)
Energy conte	150.5067	131.6341	135.8346	118.4239	113.6306	98.0545	90.8619	104.2654	105.5107	122.9625	134.2232	145.7577 (45)
Energy content (annual)										Total = Sum(45)m =		1451.6658 (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												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Heat gains from water heating, kWh/month	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
	31.9827	27.9722	28.8649	25.1651	24.1465	20.8366	19.3082	22.1564	22.4210	26.1295	28.5224	30.9735	(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	122.2392	122.2392	122.2392	122.2392	122.2392	122.2392	122.2392	122.2392	122.2392	122.2392	122.2392	122.2392	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	19.8803	17.6575	14.3601	10.8715	8.1266	6.8608	7.4133	9.6361	12.9336	16.4221	19.1671	20.4328	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	217.4647	219.7213	214.0348	201.9287	186.6470	172.2844	162.6893	160.4327	166.1193	178.2253	193.5070	207.8696	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.2239	35.2239	35.2239	35.2239	35.2239	35.2239	35.2239	35.2239	35.2239	35.2239	35.2239	35.2239	(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)	-97.7913	-97.7913	-97.7913	-97.7913	-97.7913	-97.7913	-97.7913	-97.7913	-97.7913	-97.7913	-97.7913	-97.7913	(71)
Water heating gains (Table 5)	42.9875	41.6254	38.7968	34.9515	32.4550	28.9397	25.9518	29.7801	31.1403	35.1203	39.6145	41.6311	(72)
Total internal gains	340.0042	338.6760	326.8634	307.4235	286.9003	267.7567	255.7262	259.5207	269.8649	289.4395	311.9603	329.6053	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W		
Northeast				2.2600	11.2829	0.6300	0.7000	0.7700		7.7930 (75)		
Southeast				6.7100	36.7938	0.6300	0.7000	0.7700		75.4518 (77)		
Northwest				4.9200	11.2829	0.6300	0.7000	0.7700		16.9652 (81)		
Solar gains	100.2099	178.9182	266.6473	367.0020	444.4916	455.9770	433.4931	373.4351	301.0463	203.6324	121.5260	84.7898 (83)
Total gains	440.2142	517.5942	593.5107	674.4255	731.3919	723.7337	689.2193	632.9558	570.9112	493.0719	433.4863	414.3950 (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	59.8442	60.0288	60.2109	61.0811	61.2467	62.0296	62.0296	62.1768	61.7257	61.2467	60.9126	60.5672		
alpha	4.9896	5.0019	5.0141	5.0721	5.0831	5.1353	5.1353	5.1451	5.1150	5.0831	5.0608	5.0378		
util living area	0.9986	0.9965	0.9900	0.9644	0.8851	0.7205	0.5515	0.6166	0.8652	0.9811	0.9970	0.9990	(86)	
MIT	19.7047	19.8649	20.1279	20.4794	20.7780	20.9463	20.9889	20.9810	20.8570	20.4656	20.0233	19.6819	(87)	
Th 2	19.9518	19.9547	19.9575	19.9708	19.9733	19.9849	19.9849	19.9871	19.9804	19.9733	19.9682	19.9630	(88)	
util rest of house	0.9981	0.9953	0.9863	0.9505	0.8414	0.6300	0.4313	0.4932	0.7978	0.9714	0.9957	0.9986	(89)	
MIT 2	18.7702	18.9323	19.1956	19.5492	19.8229	19.9603	19.9821	19.9816	19.8998	19.5428	19.1016	18.7564	(90)	
Living area fraction									fLA = Living area / (4) =			0.1599	(91)	
MIT	18.9196	19.0814	19.3447	19.6979	19.9756	20.1179	20.1431	20.1414	20.0528	19.6904	19.2490	18.9044	(92)	
Temperature adjustment												0.0000		
adjusted MIT	18.9196	19.0814	19.3447	19.6979	19.9756	20.1179	20.1431	20.1414	20.0528	19.6904	19.2490	18.9044	(93)	

8. Space heating requirement

Utilisation	0.9974	0.9939	0.9834	0.9459	0.8415	0.6428	0.4506	0.5130	0.8034	0.9678	0.9944	0.9981	(94)	
Useful gains	439.0733	514.4393	583.6564	637.9509	615.4502	465.2465	310.5772	324.6983	458.6802	477.1754	431.0711	413.6008	(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	1341.2453	1297.0401	1171.2325	970.5739	741.8382	488.3920	313.5975	330.3697	529.4823	814.8804	1095.0305	1332.9202	(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	671.2160	525.9077	437.1566	239.4885	94.0327	0.0000	0.0000	0.0000	0.0000	251.2525	478.0508	683.9737	(98)	
Space heating												3381.0786	(98)	
Space heating per m2												42.7660	(99)	

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b														
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000		
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	831.9994	654.9782	671.0879	0.0000	0.0000	0.0000	0.0000	(100)	
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8825	0.9367	0.9123	0.0000	0.0000	0.0000	0.0000	(101)	
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	734.2407	613.5289	612.2280	0.0000	0.0000	0.0000	0.0000	(102)	
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	937.2019	894.9944	830.8139	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	146.1320	209.4103	162.6279	0.0000	0.0000	0.0000	0.0000	(104)	
Space cooling												518.1703	(104)	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Cooled fraction											FC = cooled area / (4) =	1.0000 (105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	36.5330	52.3526	40.6570	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												129.5426 (107)
Space cooling per m2												1.6385 (108)
Energy for space heating												42.7660 (99)
Energy for space cooling												1.6385 (108)
Total												44.4045 (109)
Target Fabric Energy Efficiency (TFEE)												51.1 (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	39.5300 (1b)	x 2.3100 (2b)	= 91.3143 (1b) - (3b)
First floor	39.5300 (1c)	x 2.5300 (2c)	= 100.0109 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.0600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 191.3252 (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												1 (19)
Shelter factor											(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =	0.1855 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)
Adj infilt rate												
	0.1947	0.1855	0.1855	0.1716	0.1716	0.1530	0.1576	0.1484	0.1530	0.1623	0.1623	0.1762 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross 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)			10.8000	1.1450	12.3664		(27)					
French Door (Uw = 1.40)			3.0900	1.3258	4.0966		(27)					
Front Door			2.1500	1.0000	2.1500		(26)					
FP McCann System			39.5300	0.1100	4.3483	75.0000	2964.7500 (28a)					
100mm Knauf Supafil 34	86.2500	16.0400	70.2100	0.2500	17.5525	52.8000	3707.0880 (29a)					
Plane Ceiling-500mm Loft Roll	39.5300		39.5300	0.0900	3.5577	9.0000	355.7700 (30)					
Total net area of external elements Aum(A, m2)			165.3100				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	44.0715		(33)					
E-WM-30			40.3700	0.0000	0.0000	45.0000	1816.6500 (32)					
1F Timber			75.0300			9.0000	675.2700 (32c)					
GF Timber			64.3100			9.0000	578.7900 (32c)					
Internal Floor			39.5300			12.6000	498.0780 (32d)					
Internal Ceiling			39.5300			9.0000	355.7700 (32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	10952.1660 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							138.5298 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.9287 (36)					
Total fabric heat loss						(33) + (36) =	49.0002 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 31.5687	Feb 31.5687	Mar 31.5687	Apr 31.5687	May 31.5687	Jun 31.5687	Jul 31.5687	Aug 31.5687	Sep 31.5687	Oct 31.5687	Nov 31.5687	Dec 31.5687 (38)
Heat transfer coeff	80.5688	80.5688	80.5688	80.5688	80.5688	80.5688	80.5688	80.5688	80.5688	80.5688	80.5688	80.5688 (39)
Average = Sum(39)m / 12 =												80.5688 (39)
HLP	Jan 1.0191	Feb 1.0191	Mar 1.0191	Apr 1.0191	May 1.0191	Jun 1.0191	Jul 1.0191	Aug 1.0191	Sep 1.0191	Oct 1.0191	Nov 1.0191	Dec 1.0191 (40)
HLP (average)												1.0191 (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												2.4448 (42)
Average daily hot water use (litres/day)												92.2636 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Daily hot water use	101.4900	97.7994	94.1089	90.4183	86.7278	83.0372	83.0372	86.7278	90.4183	94.1089	97.7994	101.4900 (44)
Energy conte	150.5067	131.6341	135.8346	118.4239	113.6306	98.0545	90.8619	104.2654	105.5107	122.9625	134.2232	145.7577 (45)
Energy content (annual)										Total =	Sum (45)m =	1451.6658 (45)
Distribution loss (46)m = 0.15 x (45)m	22.5760	19.7451	20.3752	17.7636	17.0446	14.7082	13.6293	15.6398	15.8266	18.4444	20.1335	21.8637 (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	14.1178	12.7342	14.0634	13.5698	13.9931	13.5082	13.9376	13.9736	13.5418	14.0343	13.6278	14.1064 (61)
Total heat required for water heating calculated for each month	164.6245	144.3684	149.8980	131.9937	127.6236	111.5627	104.7996	118.2390	119.0524	136.9968	147.8510	159.8641 (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	164.6245	144.3684	149.8980	131.9937	127.6236	111.5627	104.7996	118.2390	119.0524	136.9968	147.8510	159.8641 (64)
RHI water heating demand												1617 (64)
Heat gains from water heating, kWh/month	53.5729	46.9519	48.6808	42.7684	41.2804	35.9802	33.6960	38.1616	38.4677	44.3936	48.0362	51.9910 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	146.6870	146.6870	146.6870	146.6870	146.6870	146.6870	146.6870	146.6870	146.6870	146.6870	146.6870	146.6870 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	49.7008	44.1438	35.9001	27.1787	20.3164	17.1520	18.5333	24.0903	32.3339	41.0554	47.9177	51.0821 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	324.5742	327.9423	319.4549	301.3862	278.5777	257.1409	242.8198	239.4518	247.9392	266.0079	288.8164	310.2532 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.1135	52.1135	52.1135	52.1135	52.1135	52.1135	52.1135	52.1135	52.1135	52.1135	52.1135	52.1135 (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)	-97.7913	-97.7913	-97.7913	-97.7913	-97.7913	-97.7913	-97.7913	-97.7913	-97.7913	-97.7913	-97.7913	-97.7913 (71)
Water heating gains (Table 5)	72.0066	69.8689	65.4312	59.4005	55.4844	49.9725	45.2903	51.2925	53.4274	59.6688	66.7169	69.8804 (72)
Total internal gains	550.2907	545.9641	524.7954	491.9746	458.3877	428.2745	410.6526	418.8438	437.7097	470.7412	507.4601	535.2248 (73)

6. Solar gains

[Jan]			Area m2		Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
Northeast			2.2600		12.9236		0.4600		0.0000		0.7700		10.3452 (75)
Southeast			3.6200		40.4699		0.4600		0.0000		0.7700		51.8907 (77)
Northwest			4.9200		12.9236		0.4600		0.0000		0.7700		22.5214 (81)
Southeast			3.0900		40.4699		0.4300		0.0000		0.7700		41.4047 (77)
Solar gains	126.1620	203.4778	301.6292	431.0480	510.8450	561.5895	527.8363	463.5588	370.2922	247.8622	156.9010		105.6223 (83)
Total gains	676.4528	749.4419	826.4246	923.0226	969.2327	989.8640	938.4889	882.4026	808.0019	718.6034	664.3611		640.8471 (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	37.7599	37.7599	37.7599	37.7599	37.7599	37.7599	37.7599	37.7599	37.7599	37.7599	37.7599	37.7599
alpha	3.5173	3.5173	3.5173	3.5173	3.5173	3.5173	3.5173	3.5173	3.5173	3.5173	3.5173	3.5173
util living area	0.9471	0.9251	0.8735	0.7662	0.6020	0.3966	0.2643	0.2894	0.5395	0.7986	0.9154	0.9543 (86)
MIT	19.7803	19.9572	20.2879	20.6436	20.8836	20.9804	20.9967	20.9954	20.9403	20.6506	20.1634	19.7248 (87)
Th 2	20.0675	20.0675	20.0675	20.0675	20.0675	20.0675	20.0675	20.0675	20.0675	20.0675	20.0675	20.0675 (88)
util rest of house	0.9380	0.9126	0.8526	0.7300	0.5465	0.3265	0.1857	0.2064	0.4649	0.7580	0.8989	0.9462 (89)
MIT 2	18.4734	18.7237	19.1860	19.6620	19.9565	20.0548	20.0664	20.0659	20.0214	19.6838	19.0212	18.3949 (90)
Living area fraction									fLA = Living area / (4) =			0.1599 (91)
MIT	18.6823	18.9209	19.3622	19.8190	20.1047	20.2028	20.2151	20.2145	20.1683	19.8384	19.2038	18.6075 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.5323	18.7709	19.2122	19.6690	19.9547	20.0528	20.0651	20.0645	20.0183	19.6884	19.0538	18.4575 (93)

8. Space heating requirement

Utilisation	0.9184	0.8909	0.8300	0.7130	0.5394	0.3254	0.1855	0.2061	0.4608	0.7391	0.8765	0.9277 (94)
Useful gains	621.2762	667.6661	685.9629	658.0810	522.7732	322.0760	174.0592	181.8801	372.3178	531.1327	582.3299	594.5319 (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	1082.2268	1061.1647	951.6920	787.0736	560.3352	326.5312	174.4413	182.4466	388.2063	651.6689	890.5921	1076.2000 (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	342.9472	264.4310	197.7025	92.8747	27.9461	0.0000	0.0000	0.0000	0.0000	89.6789	221.9488	358.3611 (98)
Space heating												1595.8904 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF HEAT DEMAND 09 Jan 2014

RHI space heating demand

1596 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	39.5300 (1b)	x 2.3100 (2b)	= 91.3143 (1b) - (3b)
First floor	39.5300 (1c)	x 2.5300 (2c)	= 100.0109 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.0600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 191.3252 (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												1 (19)
Shelter factor											(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =	0.1855 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
	0.2365	0.2318	0.2272	0.2040	0.1994	0.1762	0.1762	0.1716	0.1855	0.1994	0.2086	0.2179 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross 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)			10.8000	1.1450	12.3664		(27)					
French Door (Uw = 1.40)			3.0900	1.3258	4.0966		(27)					
Front Door			2.1500	1.0000	2.1500		(26)					
FP McCann System			39.5300	0.1100	4.3483	75.0000	2964.7500 (28a)					
100mm Knauf Supafil 34	86.2500	16.0400	70.2100	0.2500	17.5525	52.8000	3707.0880 (29a)					
Plane Ceiling-500mm Loft Roll	39.5300		39.5300	0.0900	3.5577	9.0000	355.7700 (30)					
Total net area of external elements Aum(A, m2)			165.3100				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	44.0715		(33)					
E-WM-30			40.3700	0.0000	0.0000	45.0000	1816.6500 (32)					
1F Timber			75.0300			9.0000	675.2700 (32c)					
GF Timber			64.3100			9.0000	578.7900 (32c)					
Internal Floor			39.5300			12.6000	498.0780 (32d)					
Internal Ceiling			39.5300			9.0000	355.7700 (32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	10952.1660 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							138.5298 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.9287 (36)					
Total fabric heat loss						(33) + (36) =	49.0002 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 31.5687	Feb 31.5687	Mar 31.5687	Apr 31.5687	May 31.5687	Jun 31.5687	Jul 31.5687	Aug 31.5687	Sep 31.5687	Oct 31.5687	Nov 31.5687	Dec 31.5687 (38)
Heat transfer coeff	80.5688	80.5688	80.5688	80.5688	80.5688	80.5688	80.5688	80.5688	80.5688	80.5688	80.5688	80.5688 (39)
Average = Sum(39)m / 12 =												80.5688 (39)
HLP	Jan 1.0191	Feb 1.0191	Mar 1.0191	Apr 1.0191	May 1.0191	Jun 1.0191	Jul 1.0191	Aug 1.0191	Sep 1.0191	Oct 1.0191	Nov 1.0191	Dec 1.0191 (40)
HLP (average)												1.0191 (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												2.4448 (42)
Average daily hot water use (litres/day)												92.2636 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Daily hot water use	101.4900	97.7994	94.1089	90.4183	86.7278	83.0372	83.0372	86.7278	90.4183	94.1089	97.7994	101.4900 (44)
Energy conte	150.5067	131.6341	135.8346	118.4239	113.6306	98.0545	90.8619	104.2654	105.5107	122.9625	134.2232	145.7577 (45)
Energy content (annual)												1451.6658 (45)
Distribution loss (46)m = 0.15 x (45)m	22.5760	19.7451	20.3752	17.7636	17.0446	14.7082	13.6293	15.6398	15.8266	18.4444	20.1335	21.8637 (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	14.1178	12.7342	14.0634	13.5698	13.9931	13.5082	13.9376	13.9736	13.5418	14.0343	13.6278	14.1064 (61)
Total heat required for water heating calculated for each month	164.6245	144.3684	149.8980	131.9937	127.6236	111.5627	104.7996	118.2390	119.0524	136.9968	147.8510	159.8641 (62)
WWHRS	-51.9667	-45.7221	-46.6664	-38.4089	-35.6703	-29.4311	-24.9172	-30.1660	-31.0421	-38.3648	-44.4274	-50.2252 eq. (G10)
Total of WWHRS savings												-467.0082
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	112.6578	98.6463	103.2316	93.5848	91.9533	82.1317	79.8824	88.0729	88.0103	98.6320	103.4236	109.6388 (64)
Total per year (kWh/year) = Sum(64)m =												1149.8655 (64)
Heat gains from water heating, kWh/month	53.5729	46.9519	48.6808	42.7684	41.2804	35.9802	33.6960	38.1616	38.4677	44.3936	48.0362	51.9910 (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	146.6870	146.6870	146.6870	146.6870	146.6870	146.6870	146.6870	146.6870	146.6870	146.6870	146.6870	146.6870 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	49.7008	44.1438	35.9001	27.1787	20.3164	17.1520	18.5333	24.0903	32.3339	41.0554	47.9177	51.0821 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	324.5742	327.9423	319.4549	301.3862	278.5777	257.1409	242.8198	239.4518	247.9392	266.0079	288.8164	310.2532 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.1135	52.1135	52.1135	52.1135	52.1135	52.1135	52.1135	52.1135	52.1135	52.1135	52.1135	52.1135 (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)	-97.7913	-97.7913	-97.7913	-97.7913	-97.7913	-97.7913	-97.7913	-97.7913	-97.7913	-97.7913	-97.7913	-97.7913 (71)
Water heating gains (Table 5)	72.0066	69.8689	65.4312	59.4005	55.4844	49.9725	45.2903	51.2925	53.4274	59.6688	66.7169	69.8804 (72)
Total internal gains	550.2907	545.9641	524.7954	491.9746	458.3877	428.2745	410.6526	418.8438	437.7097	470.7412	507.4601	535.2248 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
Northeast				2.2600	11.2829	0.4600	0.0000	0.7700	9.0319 (75)			
Southeast				3.6200	36.7938	0.4600	0.0000	0.7700	47.1772 (77)			
Northwest				4.9200	11.2829	0.4600	0.0000	0.7700	19.6624 (81)			
Southeast				3.0900	36.7938	0.4300	0.0000	0.7700	37.6437 (77)			

Solar gains	113.5152	202.8895	302.9185	417.7646	506.6629	520.0358	494.2800	425.3533	342.2796	231.0620	137.7008	96.0222 (83)
Total gains	663.8060	748.8536	827.7139	909.7392	965.0506	948.3103	904.9327	844.1971	779.9893	701.8032	645.1609	631.2471 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	37.7599	37.7599	37.7599	37.7599	37.7599	37.7599	37.7599	37.7599	37.7599	37.7599	37.7599	37.7599
alpha	3.5173	3.5173	3.5173	3.5173	3.5173	3.5173	3.5173	3.5173	3.5173	3.5173	3.5173	3.5173
util living area	0.9560	0.9332	0.8901	0.8047	0.6718	0.5127	0.3828	0.4251	0.6333	0.8420	0.9336	0.9623 (86)
MIT	19.6459	19.8604	20.1781	20.5376	20.8077	20.9439	20.9846	20.9776	20.8820	20.5295	20.0141	19.5789 (87)
Th 2	20.0675	20.0675	20.0675	20.0675	20.0675	20.0675	20.0675	20.0675	20.0675	20.0675	20.0675	20.0675 (88)
util rest of house	0.9486	0.9223	0.8724	0.7743	0.6242	0.4472	0.3053	0.3443	0.5678	0.8099	0.9208	0.9559 (89)
MIT 2	18.2801	18.5852	19.0324	19.5225	19.8674	20.0217	20.0588	20.0540	19.9618	19.5251	18.9102	18.1843 (90)
Living area fraction	18.4984	18.7891	19.2156	19.6848	20.0177	20.1691	20.2068	20.2017	20.1089	19.6857	19.0027	18.4073 (91)
MIT	18.4984	18.7891	19.2156	19.6848	20.0177	20.1691	20.2068	20.2017	20.1089	19.6857	19.0027	18.4073 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.3484	18.6391	19.0656	19.5348	19.8677	20.0191	20.0568	20.0517	19.9589	19.5357	18.8527	18.2573 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	617.6489	674.9305	703.2544	686.6209	591.8769	420.7402	275.4403	289.4659	436.5099	553.3395	580.3976	592.7481 (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	1131.8668	1106.9408	1012.3925	856.8356	658.0607	436.6108	278.5103	294.2095	472.0438	719.9376	946.8985	1132.5784 (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	382.5781	290.3109	229.9988	122.5546	49.2407	0.0000	0.0000	0.0000	0.0000	123.9490	263.8807	401.6337 (98)

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Space heating 1864.1465 (98)
 Space heating per m2 (98) / (4) = 23.5789 (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 2059.8304 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	382.5781	290.3109	229.9988	122.5546	49.2407	0.0000	0.0000	0.0000	0.0000	123.9490	263.8807	401.6337 (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)	422.7382	320.7855	254.1423	135.4195	54.4096	0.0000	0.0000	0.0000	0.0000	136.9602	291.5809	443.7942 (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	112.6578	98.6463	103.2316	93.5848	91.9533	82.1317	79.8824	88.0729	88.0103	98.6320	103.4236	109.6388 (64)
Efficiency of water heater (217)m	89.7516	89.6664	89.4839	89.0861	88.3900	87.3000	87.3000	87.3000	87.3000	89.0535	89.5755	87.3000 (216)
Fuel for water heating, kWh/month	125.5217	110.0147	115.3633	105.0498	104.0314	94.0798	91.5033	100.8854	100.8136	110.7559	115.4598	122.1002 (219)
Water heating fuel used												1295.5790 (219)
Annual totals kWh/year												
Space heating fuel - main system												2059.8304 (211)
Space heating fuel - secondary												0.0000 (215)

Electricity for pumps and fans:
 (MEVDecentralised, Database: total watage = 6.6170, total flow = 29.0000, SFP = 0.2282)
 mechanical ventilation fans (SFP = 0.2282) 53.2593 (230a)
 central heating pump 30.0000 (230c)
 main heating flue fan 45.0000 (230e)
 Total electricity for the above, kWh/year 128.2593 (231)
 Electricity for lighting (calculated in Appendix L) 351.0924 (232)
 Total delivered energy for all uses 3834.7610 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2059.8304	3.4800	71.6821 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1295.5790	3.4800	45.0861 (247)
Mechanical ventilation fans	53.2593	13.1900	7.0249 (249)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	351.0924	13.1900	46.3091 (250)
Additional standing charges			120.0000 (251)
Total energy cost			299.9947 (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] = 1.0156 (257)
 SAP value 85.8321
 SAP rating (Section 12) 86 (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	2059.8304	0.2160	444.9234 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1295.5790	0.2160	279.8451 (264)
Space and water heating			724.7684 (265)
Pumps and fans	128.2593	0.5190	66.5666 (267)
Energy for lighting	351.0924	0.5190	182.2169 (268)
Total kg/year			973.5519 (272)
CO2 emissions per m2			12.3100 (273)
EI value			89.4844
EI rating			89 (274)
EI band			B

Calculation of stars for heating and DHW

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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	$3.48 / 0.8867 = 3.925$, stars = 5
Water heating environmental impact	$0.216 / 0.8867 = 0.2436$, stars = 5

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	39.5300 (1b)	x 2.3100 (2b)	= 91.3143 (1b) - (3b)
First floor	39.5300 (1c)	x 2.5300 (2c)	= 100.0109 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.0600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 191.3252 (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												1 (19)
Shelter factor											(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =	0.1855 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)
Adj infilt rate												
	0.1947	0.1855	0.1855	0.1716	0.1716	0.1530	0.1576	0.1484	0.1530	0.1623	0.1623	0.1762 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Window (Uw = 1.20)			10.8000	1.1450	12.3664		(27)
French Door (Uw = 1.40)			3.0900	1.3258	4.0966		(27)
Front Door			2.1500	1.0000	2.1500		(26)
FP McCann System			39.5300	0.1100	4.3483	75.0000	2964.7500 (28a)
100mm Knauf Supafil 34	86.2500	16.0400	70.2100	0.2500	17.5525	52.8000	3707.0880 (29a)
Plane Ceiling-500mm Loft Roll	39.5300		39.5300	0.0900	3.5577	9.0000	355.7700 (30)
Total net area of external elements Aum(A, m ²)			165.3100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	44.0715		(33)
E-WM-30			40.3700	0.0000	0.0000	45.0000	1816.6500 (32)
1F Timber			75.0300			9.0000	675.2700 (32c)
GF Timber			64.3100			9.0000	578.7900 (32c)
Internal Floor			39.5300			12.6000	498.0780 (32d)
Internal Ceiling			39.5300			9.0000	355.7700 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	10952.1660 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							138.5298 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.9287 (36)
Total fabric heat loss						(33) + (36) =	49.0002 (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	31.5687	31.5687	31.5687	31.5687	31.5687	31.5687	31.5687	31.5687	31.5687	31.5687	31.5687	31.5687 (38)
Heat transfer coeff	80.5688	80.5688	80.5688	80.5688	80.5688	80.5688	80.5688	80.5688	80.5688	80.5688	80.5688	80.5688 (39)
Average = Sum(39)m / 12 =												80.5688 (39)
HLP	1.0191	1.0191	1.0191	1.0191	1.0191	1.0191	1.0191	1.0191	1.0191	1.0191	1.0191	1.0191 (40)
HLP (average)												1.0191 (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												2.4448 (42)
Average daily hot water use (litres/day)												92.2636 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

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Daily hot water use	101.4900	97.7994	94.1089	90.4183	86.7278	83.0372	83.0372	86.7278	90.4183	94.1089	97.7994	101.4900 (44)
Energy conte	150.5067	131.6341	135.8346	118.4239	113.6306	98.0545	90.8619	104.2654	105.5107	122.9625	134.2232	145.7577 (45)
Energy content (annual)												1451.6658 (45)
Distribution loss (46)m = 0.15 x (45)m	22.5760	19.7451	20.3752	17.7636	17.0446	14.7082	13.6293	15.6398	15.8266	18.4444	20.1335	21.8637 (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	14.1178	12.7342	14.0634	13.5698	13.9931	13.5082	13.9376	13.9736	13.5418	14.0343	13.6278	14.1064 (61)
Total heat required for water heating calculated for each month	164.6245	144.3684	149.8980	131.9937	127.6236	111.5627	104.7996	118.2390	119.0524	136.9968	147.8510	159.8641 (62)
WWHRS	-51.9667	-45.7221	-46.6664	-38.4089	-35.6703	-29.4311	-24.9172	-30.1660	-31.0421	-38.3648	-44.4274	-50.2252 eq. (G10)
Total of WWHRS savings												-467.0082
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	112.6578	98.6463	103.2316	93.5848	91.9533	82.1317	79.8824	88.0729	88.0103	98.6320	103.4236	109.6388 (64)
Total per year (kWh/year) = Sum(64)m =												1149.8655 (64)
Heat gains from water heating, kWh/month	53.5729	46.9519	48.6808	42.7684	41.2804	35.9802	33.6960	38.1616	38.4677	44.3936	48.0362	51.9910 (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	146.6870	146.6870	146.6870	146.6870	146.6870	146.6870	146.6870	146.6870	146.6870	146.6870	146.6870	146.6870 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	49.7008	44.1438	35.9001	27.1787	20.3164	17.1520	18.5333	24.0903	32.3339	41.0554	47.9177	51.0821 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	324.5742	327.9423	319.4549	301.3862	278.5777	257.1409	242.8198	239.4518	247.9392	266.0079	288.8164	310.2532 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.1135	52.1135	52.1135	52.1135	52.1135	52.1135	52.1135	52.1135	52.1135	52.1135	52.1135	52.1135 (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)	-97.7913	-97.7913	-97.7913	-97.7913	-97.7913	-97.7913	-97.7913	-97.7913	-97.7913	-97.7913	-97.7913	-97.7913 (71)
Water heating gains (Table 5)	72.0066	69.8689	65.4312	59.4005	55.4844	49.9725	45.2903	51.2925	53.4274	59.6688	66.7169	69.8804 (72)
Total internal gains	550.2907	545.9641	524.7954	491.9746	458.3877	428.2745	410.6526	418.8438	437.7097	470.7412	507.4601	535.2248 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W		
Northeast					2.2600	12.9236	0.4600	0.0000	0.7700	10.3452 (75)		
Southeast					3.6200	40.4699	0.4600	0.0000	0.7700	51.8907 (77)		
Northwest					4.9200	12.9236	0.4600	0.0000	0.7700	22.5214 (81)		
Southeast					3.0900	40.4699	0.4300	0.0000	0.7700	41.4047 (77)		

Solar gains	126.1620	203.4778	301.6292	431.0480	510.8450	561.5895	527.8363	463.5588	370.2922	247.8622	156.9010	105.6223 (83)
Total gains	676.4528	749.4419	826.4246	923.0226	969.2327	989.8640	938.4889	882.4026	808.0019	718.6034	664.3611	640.8471 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	37.7599	37.7599	37.7599	37.7599	37.7599	37.7599	37.7599	37.7599	37.7599	37.7599	37.7599	37.7599
alpha	3.5173	3.5173	3.5173	3.5173	3.5173	3.5173	3.5173	3.5173	3.5173	3.5173	3.5173	3.5173
util living area	0.9471	0.9251	0.8735	0.7662	0.6020	0.3966	0.2643	0.2894	0.5395	0.7986	0.9154	0.9543 (86)
MIT	19.7803	19.9572	20.2879	20.6436	20.8836	20.9804	20.9967	20.9954	20.9403	20.6506	20.1634	19.7248 (87)
Th 2	20.0675	20.0675	20.0675	20.0675	20.0675	20.0675	20.0675	20.0675	20.0675	20.0675	20.0675	20.0675 (88)
util rest of house	0.9380	0.9126	0.8526	0.7300	0.5465	0.3265	0.1857	0.2064	0.4649	0.7580	0.8989	0.9462 (89)
MIT 2	18.4734	18.7237	19.1860	19.6620	19.9565	20.0548	20.0664	20.0659	20.0214	19.6838	19.0212	18.3949 (90)
Living area fraction	18.6823	18.9209	19.3622	19.8190	20.1047	20.2028	20.2151	20.2145	20.1683	19.8384	19.2038	18.6075 (91)
MIT	18.6823	18.9209	19.3622	19.8190	20.1047	20.2028	20.2151	20.2145	20.1683	19.8384	19.2038	18.6075 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.5323	18.7709	19.2122	19.6690	19.9547	20.0528	20.0651	20.0645	20.0183	19.6884	19.0538	18.4575 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	621.2762	667.6661	685.9629	658.0810	522.7732	322.0760	174.0592	181.8801	372.3178	531.1327	582.3299	594.5319 (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	1082.2268	1061.1647	951.6920	787.0736	560.3352	326.5312	174.4413	182.4466	388.2063	651.6689	890.5921	1076.2000 (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	342.9472	264.4310	197.7025	92.8747	27.9461	0.0000	0.0000	0.0000	0.0000	89.6789	221.9488	358.3611 (98)

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Space heating 1595.8904 (98)
 Space heating per m2 (98) / (4) = 20.1858 (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													1763.4148 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	342.9472	264.4310	197.7025	92.8747	27.9461	0.0000	0.0000	0.0000	0.0000	89.6789	221.9488	358.3611	(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)	378.9472	292.1890	218.4557	102.6240	30.8797	0.0000	0.0000	0.0000	0.0000	99.0928	245.2473	395.9791	(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	112.6578	98.6463	103.2316	93.5848	91.9533	82.1317	79.8824	88.0729	88.0103	98.6320	103.4236	109.6388	(64)
Efficiency of water heater	89.6871	89.6076	89.3762	88.8651	88.0255	87.3000	87.3000	87.3000	87.3000	88.7952	89.4577	87.3000	(216)
(217)m													89.7295 (217)
Fuel for water heating, kWh/month	125.6120	110.0869	115.5023	105.3110	104.4622	94.0798	91.5033	100.8854	100.8136	111.0781	115.6118	122.1882	(219)
Water heating fuel used													1297.1347 (219)
Annual totals kWh/year													
Space heating fuel - main system													1763.4148 (211)
Space heating fuel - secondary													0.0000 (215)
Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 6.6170, total flow = 29.0000, SFP = 0.2282)													
mechanical ventilation fans (SFP = 0.2282)													53.2593 (230a)
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													128.2593 (231)
Electricity for lighting (calculated in Appendix L)													351.0924 (232)
Total delivered energy for all uses													3539.9012 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1763.4148	3.9200	69.1259 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1297.1347	3.9200	50.8477 (247)
Mechanical ventilation fans	53.2593	16.9600	9.0328 (249)
Pumps and fans for heating	75.0000	16.9600	12.7200 (249)
Energy for lighting	351.0924	16.9600	59.5453 (250)
Additional standing charges			88.0000 (251)
Total energy cost			289.2716 (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	1763.4148	0.2160	380.8976 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1297.1347	0.2160	280.1811 (264)
Space and water heating			661.0787 (265)
Pumps and fans	128.2593	0.5190	66.5666 (267)
Energy for lighting	351.0924	0.5190	182.2169 (268)
Total kg/year			909.8622 (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	1763.4148	1.2200	2151.3661 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1297.1347	1.2200	1582.5044 (264)
Space and water heating			3733.8704 (265)
Pumps and fans	128.2593	3.0700	393.7559 (267)
Energy for lighting	351.0924	3.0700	1077.8536 (268)
Primary energy kWh/year			5205.4800 (272)
Primary energy kWh/m2/year			65.8421 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 86
Current environmental impact rating: B 89

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

Recommended measures:	SAP change	Cost change	CO2 change
U Solar photovoltaic panels	+ 10.8	-£ 309	-947 kg (104.1%)
Measures omitted - SAP change or cost saving too small:			
N Solar water heating	+ 0.9	-£ 20	-130 kg (14.3%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar photovoltaic panels	£309	11.97 kg/m²	A 97 A 99
Total Savings	£309	11.97 kg/m²	
Potential energy efficiency rating:		A 97	
Potential environmental impact rating:			A 99

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	£81	£81	£0
Mains gas	£208	£208	£0
Space heating	£179	£179	£0
Water heating	£51	£51	£0
Lighting	£60	£60	£0
Generated (PV)	-£0	-£309	£309
Total cost of fuels	£289	-£20	£309
Total cost of uses	£290	-£19	£309
Delivered energy	45 kWh/m²	22 kWh/m²	23 kWh/m²
Carbon dioxide emissions	0.9 tonnes	0.0 tonnes	0.9 tonnes
CO2 emissions per m²	12 kg/m²	0 kg/m²	12 kg/m²
Primary energy	66 kWh/m²	-5 kWh/m²	71 kWh/m²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	39.5300 (1b)	x 2.3100 (2b)	= 91.3143 (1b) - (3b)
First floor	39.5300 (1c)	x 2.5300 (2c)	= 100.0109 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.0600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 191.3252 (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												1 (19)
Shelter factor											(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =	0.1855 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
	0.2365	0.2318	0.2272	0.2040	0.1994	0.1762	0.1762	0.1716	0.1855	0.1994	0.2086	0.2179 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross 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)			10.8000	1.1450	12.3664		(27)					
French Door (Uw = 1.40)			3.0900	1.3258	4.0966		(27)					
Front Door			2.1500	1.0000	2.1500		(26)					
FP McCann System			39.5300	0.1100	4.3483	75.0000	2964.7500 (28a)					
100mm Knauf Supafil 34	86.2500	16.0400	70.2100	0.2500	17.5525	52.8000	3707.0880 (29a)					
Plane Ceiling-500mm Loft Roll	39.5300		39.5300	0.0900	3.5577	9.0000	355.7700 (30)					
Total net area of external elements Aum(A, m2)			165.3100				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	44.0715		(33)					
E-WM-30			40.3700	0.0000	0.0000	45.0000	1816.6500 (32)					
1F Timber			75.0300			9.0000	675.2700 (32c)					
GF Timber			64.3100			9.0000	578.7900 (32c)					
Internal Floor			39.5300			12.6000	498.0780 (32d)					
Internal Ceiling			39.5300			9.0000	355.7700 (32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	10952.1660 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							138.5298 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.9287 (36)					
Total fabric heat loss						(33) + (36) =	49.0002 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 31.5687	Feb 31.5687	Mar 31.5687	Apr 31.5687	May 31.5687	Jun 31.5687	Jul 31.5687	Aug 31.5687	Sep 31.5687	Oct 31.5687	Nov 31.5687	Dec 31.5687 (38)
Heat transfer coeff	80.5688	80.5688	80.5688	80.5688	80.5688	80.5688	80.5688	80.5688	80.5688	80.5688	80.5688	80.5688 (39)
Average = Sum(39)m / 12 =												80.5688 (39)
HLP	Jan 1.0191	Feb 1.0191	Mar 1.0191	Apr 1.0191	May 1.0191	Jun 1.0191	Jul 1.0191	Aug 1.0191	Sep 1.0191	Oct 1.0191	Nov 1.0191	Dec 1.0191 (40)
HLP (average)												1.0191 (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												2.4448 (42)
Average daily hot water use (litres/day)												92.2636 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Daily hot water use	101.4900	97.7994	94.1089	90.4183	86.7278	83.0372	83.0372	86.7278	90.4183	94.1089	97.7994	101.4900 (44)
Energy conte	150.5067	131.6341	135.8346	118.4239	113.6306	98.0545	90.8619	104.2654	105.5107	122.9625	134.2232	145.7577 (45)
Energy content (annual)												1451.6658 (45)
Distribution loss (46)m = 0.15 x (45)m												
	22.5760	19.7451	20.3752	17.7636	17.0446	14.7082	13.6293	15.6398	15.8266	18.4444	20.1335	21.8637 (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	14.1178	12.7342	14.0634	13.5698	13.9931	13.5082	13.9376	13.9736	13.5418	14.0343	13.6278	14.1064 (61)
Total heat required for water heating calculated for each month												
	164.6245	144.3684	149.8980	131.9937	127.6236	111.5627	104.7996	118.2390	119.0524	136.9968	147.8510	159.8641 (62)
WWHRS	-51.9667	-45.7221	-46.6664	-38.4089	-35.6703	-29.4311	-24.9172	-30.1660	-31.0421	-38.3648	-44.4274	-50.2252 eq. (G10)
Total of WWHRS savings												-467.0082
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												
	112.6578	98.6463	103.2316	93.5848	91.9533	82.1317	79.8824	88.0729	88.0103	98.6320	103.4236	109.6388 (64)
Total per year (kWh/year) = Sum(64)m =												1149.8655 (64)
Heat gains from water heating, kWh/month												
	53.5729	46.9519	48.6808	42.7684	41.2804	35.9802	33.6960	38.1616	38.4677	44.3936	48.0362	51.9910 (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	146.6870	146.6870	146.6870	146.6870	146.6870	146.6870	146.6870	146.6870	146.6870	146.6870	146.6870	146.6870 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	49.7008	44.1438	35.9001	27.1787	20.3164	17.1520	18.5333	24.0903	32.3339	41.0554	47.9177	51.0821 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	324.5742	327.9423	319.4549	301.3862	278.5777	257.1409	242.8198	239.4518	247.9392	266.0079	288.8164	310.2532 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.1135	52.1135	52.1135	52.1135	52.1135	52.1135	52.1135	52.1135	52.1135	52.1135	52.1135	52.1135 (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)	-97.7913	-97.7913	-97.7913	-97.7913	-97.7913	-97.7913	-97.7913	-97.7913	-97.7913	-97.7913	-97.7913	-97.7913 (71)
Water heating gains (Table 5)	72.0066	69.8689	65.4312	59.4005	55.4844	49.9725	45.2903	51.2925	53.4274	59.6688	66.7169	69.8804 (72)
Total internal gains	550.2907	545.9641	524.7954	491.9746	458.3877	428.2745	410.6526	418.8438	437.7097	470.7412	507.4601	535.2248 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
Northeast				2.2600	11.2829		0.4600		0.0000		0.7700		9.0319 (75)
Southeast				3.6200	36.7938		0.4600		0.0000		0.7700		47.1772 (77)
Northwest				4.9200	11.2829		0.4600		0.0000		0.7700		19.6624 (81)
Southeast				3.0900	36.7938		0.4300		0.0000		0.7700		37.6437 (77)
Solar gains	113.5152	202.8895	302.9185	417.7646	506.6629	520.0358	494.2800	425.3533	342.2796	231.0620	137.7008	96.0222	(83)
Total gains	663.8060	748.8536	827.7139	909.7392	965.0506	948.3103	904.9327	844.1971	779.9893	701.8032	645.1609	631.2471	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	37.7599	37.7599	37.7599	37.7599	37.7599	37.7599	37.7599	37.7599	37.7599	37.7599	37.7599	37.7599
alpha	3.5173	3.5173	3.5173	3.5173	3.5173	3.5173	3.5173	3.5173	3.5173	3.5173	3.5173	3.5173
util living area	0.9560	0.9332	0.8901	0.8047	0.6718	0.5127	0.3828	0.4251	0.6333	0.8420	0.9336	0.9623 (86)
MIT	19.6459	19.8604	20.1781	20.5376	20.8077	20.9439	20.9846	20.9776	20.8820	20.5295	20.0141	19.5789 (87)
Th 2	20.0675	20.0675	20.0675	20.0675	20.0675	20.0675	20.0675	20.0675	20.0675	20.0675	20.0675	20.0675 (88)
util rest of house	0.9486	0.9223	0.8724	0.7743	0.6242	0.4472	0.3053	0.3443	0.5678	0.8099	0.9208	0.9559 (89)
MIT 2	18.2801	18.5852	19.0324	19.5225	19.8674	20.0217	20.0588	20.0540	19.9618	19.5251	18.9102	18.1843 (90)
Living area fraction	18.4984	18.7891	19.2156	19.6848	20.0177	20.1691	20.2068	20.2017	20.1089	19.6857	19.0027	18.4073 (91)
MIT	18.4984	18.7891	19.2156	19.6848	20.0177	20.1691	20.2068	20.2017	20.1089	19.6857	19.0027	18.4073 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.3484	18.6391	19.0656	19.5348	19.8677	20.0191	20.0568	20.0517	19.9589	19.5357	18.8527	18.2573 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	617.6489	674.9305	703.2544	686.6209	591.8769	420.7402	275.4403	289.4659	436.5099	553.3395	580.3976	592.7481 (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												
	1131.8668	1106.9408	1012.3925	856.8356	658.0607	436.6108	278.5103	294.2095	472.0438	719.9376	946.8985	1132.5784 (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	382.5781	290.3109	229.9988	122.5546	49.2407	0.0000	0.0000	0.0000	0.0000	123.9490	263.8807	401.6337 (98)

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Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Space heating 1864.1465 (98)
 Space heating per m2 (98) / (4) = 23.5789 (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 2059.8304 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	382.5781	290.3109	229.9988	122.5546	49.2407	0.0000	0.0000	0.0000	0.0000	123.9490	263.8807	401.6337 (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)	422.7382	320.7855	254.1423	135.4195	54.4096	0.0000	0.0000	0.0000	0.0000	136.9602	291.5809	443.7942 (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	112.6578	98.6463	103.2316	93.5848	91.9533	82.1317	79.8824	88.0729	88.0103	98.6320	103.4236	109.6388 (64)
Efficiency of water heater (217)m	89.7516	89.6664	89.4839	89.0861	88.3900	87.3000	87.3000	87.3000	87.3000	89.0535	89.5755	87.3000 (216)
Fuel for water heating, kWh/month	125.5217	110.0147	115.3633	105.0498	104.0314	94.0798	91.5033	100.8854	100.8136	110.7559	115.4598	122.1002 (219)
Water heating fuel used												1295.5790 (219)
Annual totals kWh/year												
Space heating fuel - main system												2059.8304 (211)
Space heating fuel - secondary												0.0000 (215)

Electricity for pumps and fans:
 (MEV)Decentralised, Database: total watage = 6.6170, total flow = 29.0000, SFP = 0.2282)
 mechanical ventilation fans (SFP = 0.2282) 53.2593 (230a)
 central heating pump 30.0000 (230c)
 main heating flue fan 45.0000 (230e)
 Total electricity for the above, kWh/year 128.2593 (231)
 Electricity for lighting (calculated in Appendix L) 351.0924 (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 2107.5216 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2059.8304	3.4800	71.6821 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1295.5790	3.4800	45.0861 (247)
Mechanical ventilation fans	53.2593	13.1900	7.0249 (249)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	351.0924	13.1900	46.3091 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-1727.2394	13.1900	-227.8229 (252)
Total energy cost			72.1719 (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] = 0.2443 (257)
 SAP value 96.5915
 SAP rating (Section 12) 97 (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	2059.8304	0.2160	444.9234 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1295.5790	0.2160	279.8451 (264)
Space and water heating			724.7684 (265)
Pumps and fans	128.2593	0.5190	66.5666 (267)
Energy for lighting	351.0924	0.5190	182.2169 (268)
Energy saving/generation technologies			
PV Unit	-1727.2394	0.5190	-896.4372 (269)
Total kg/year			77.1147 (272)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

CO2 emissions per m2	0.9800 (273)
EI value	99.1671
EI rating	99 (274)
EI band	A

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
 CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	39.5300 (1b)	x 2.3100 (2b)	= 91.3143 (1b) - (3b)
First floor	39.5300 (1c)	x 2.5300 (2c)	= 100.0109 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.0600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 191.3252 (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												1 (19)
Shelter factor											(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =	0.1855 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)
Adj infilt rate												
	0.1947	0.1855	0.1855	0.1716	0.1716	0.1530	0.1576	0.1484	0.1530	0.1623	0.1623	0.1762 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Window (Uw = 1.20)			10.8000	1.1450	12.3664		(27)
French Door (Uw = 1.40)			3.0900	1.3258	4.0966		(27)
Front Door			2.1500	1.0000	2.1500		(26)
FP McCann System			39.5300	0.1100	4.3483	75.0000	2964.7500 (28a)
100mm Knauf Supafil 34	86.2500	16.0400	70.2100	0.2500	17.5525	52.8000	3707.0880 (29a)
Plane Ceiling-500mm Loft Roll	39.5300		39.5300	0.0900	3.5577	9.0000	355.7700 (30)
Total net area of external elements Aum(A, m ²)			165.3100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	44.0715		(33)
E-WM-30			40.3700	0.0000	0.0000	45.0000	1816.6500 (32)
1F Timber			75.0300			9.0000	675.2700 (32c)
GF Timber			64.3100			9.0000	578.7900 (32c)
Internal Floor			39.5300			12.6000	498.0780 (32d)
Internal Ceiling			39.5300			9.0000	355.7700 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	10952.1660 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							138.5298 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.9287 (36)
Total fabric heat loss						(33) + (36) =	49.0002 (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	31.5687	31.5687	31.5687	31.5687	31.5687	31.5687	31.5687	31.5687	31.5687	31.5687	31.5687	31.5687 (38)
Heat transfer coeff	80.5688	80.5688	80.5688	80.5688	80.5688	80.5688	80.5688	80.5688	80.5688	80.5688	80.5688	80.5688 (39)
Average = Sum(39)m / 12 =												80.5688 (39)
HLP	1.0191	1.0191	1.0191	1.0191	1.0191	1.0191	1.0191	1.0191	1.0191	1.0191	1.0191	1.0191 (40)
HLP (average)												1.0191 (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												2.4448 (42)
Average daily hot water use (litres/day)												92.2636 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

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

Daily hot water use	101.4900	97.7994	94.1089	90.4183	86.7278	83.0372	83.0372	86.7278	90.4183	94.1089	97.7994	101.4900 (44)
Energy conte	150.5067	131.6341	135.8346	118.4239	113.6306	98.0545	90.8619	104.2654	105.5107	122.9625	134.2232	145.7577 (45)
Energy content (annual)										Total = Sum (45)m =		1451.6658 (45)
Distribution loss (46)m = 0.15 x (45)m	22.5760	19.7451	20.3752	17.7636	17.0446	14.7082	13.6293	15.6398	15.8266	18.4444	20.1335	21.8637 (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	14.1178	12.7342	14.0634	13.5698	13.9931	13.5082	13.9376	13.9736	13.5418	14.0343	13.6278	14.1064 (61)
Total heat required for water heating calculated for each month												
WWHRS	164.6245	144.3684	149.8980	131.9937	127.6236	111.5627	104.7996	118.2390	119.0524	136.9968	147.8510	159.8641 (62)
Total of WWHRS savings	-51.9667	-45.7221	-46.6664	-38.4089	-35.6703	-29.4311	-24.9172	-30.1660	-31.0421	-38.3648	-44.4274	-50.2252 eq. (G10)
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	112.6578	98.6463	103.2316	93.5848	91.9533	82.1317	79.8824	88.0729	88.0103	98.6320	103.4236	109.6388 (64)
Heat gains from water heating, kWh/month	53.5729	46.9519	48.6808	42.7684	41.2804	35.9802	33.6960	38.1616	38.4677	44.3936	48.0362	51.9910 (65)
Total per year (kWh/year) = Sum (64)m =												1149.8655 (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	146.6870	146.6870	146.6870	146.6870	146.6870	146.6870	146.6870	146.6870	146.6870	146.6870	146.6870	146.6870 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	49.7008	44.1438	35.9001	27.1787	20.3164	17.1520	18.5333	24.0903	32.3339	41.0554	47.9177	51.0821 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	324.5742	327.9423	319.4549	301.3862	278.5777	257.1409	242.8198	239.4518	247.9392	266.0079	288.8164	310.2532 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.1135	52.1135	52.1135	52.1135	52.1135	52.1135	52.1135	52.1135	52.1135	52.1135	52.1135	52.1135 (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)	-97.7913	-97.7913	-97.7913	-97.7913	-97.7913	-97.7913	-97.7913	-97.7913	-97.7913	-97.7913	-97.7913	-97.7913 (71)
Water heating gains (Table 5)	72.0066	69.8689	65.4312	59.4005	55.4844	49.9725	45.2903	51.2925	53.4274	59.6688	66.7169	69.8804 (72)
Total internal gains	550.2907	545.9641	524.7954	491.9746	458.3877	428.2745	410.6526	418.8438	437.7097	470.7412	507.4601	535.2248 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
Northeast	2.2600	12.9236	0.4600	0.0000	0.7700	10.3452 (75)
Southeast	3.6200	40.4699	0.4600	0.0000	0.7700	51.8907 (77)
Northwest	4.9200	12.9236	0.4600	0.0000	0.7700	22.5214 (81)
Southeast	3.0900	40.4699	0.4300	0.0000	0.7700	41.4047 (77)

Solar gains	126.1620	203.4778	301.6292	431.0480	510.8450	561.5895	527.8363	463.5588	370.2922	247.8622	156.9010	105.6223 (83)
Total gains	676.4528	749.4419	826.4246	923.0226	969.2327	989.8640	938.4889	882.4026	808.0019	718.6034	664.3611	640.8471 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	37.7599	37.7599	37.7599	37.7599	37.7599	37.7599	37.7599	37.7599	37.7599	37.7599	37.7599	37.7599
alpha	3.5173	3.5173	3.5173	3.5173	3.5173	3.5173	3.5173	3.5173	3.5173	3.5173	3.5173	3.5173
util living area	0.9471	0.9251	0.8735	0.7662	0.6020	0.3966	0.2643	0.2894	0.5395	0.7986	0.9154	0.9543 (86)
MIT	19.7803	19.9572	20.2879	20.6436	20.8836	20.9804	20.9967	20.9954	20.9403	20.6506	20.1634	19.7248 (87)
Th 2	20.0675	20.0675	20.0675	20.0675	20.0675	20.0675	20.0675	20.0675	20.0675	20.0675	20.0675	20.0675 (88)
util rest of house	0.9380	0.9126	0.8526	0.7300	0.5465	0.3265	0.1857	0.2064	0.4649	0.7580	0.8989	0.9462 (89)
MIT 2	18.4734	18.7237	19.1860	19.6620	19.9565	20.0548	20.0664	20.0659	20.0214	19.6838	19.0212	18.3949 (90)
Living area fraction	18.6823	18.9209	19.3622	19.8190	20.1047	20.2028	20.2151	20.2145	20.1683	19.8384	19.2038	18.6075 (91)
MIT	18.6823	18.9209	19.3622	19.8190	20.1047	20.2028	20.2151	20.2145	20.1683	19.8384	19.2038	18.6075 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.5323	18.7709	19.2122	19.6690	19.9547	20.0528	20.0651	20.0645	20.0183	19.6884	19.0538	18.4575 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	621.2762	667.6661	685.9629	658.0810	522.7732	322.0760	174.0592	181.8801	372.3178	531.1327	582.3299	594.5319 (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	1082.2268	1061.1647	951.6920	787.0736	560.3352	326.5312	174.4413	182.4466	388.2063	651.6689	890.5921	1076.2000 (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	342.9472	264.4310	197.7025	92.8747	27.9461	0.0000	0.0000	0.0000	0.0000	89.6789	221.9488	358.3611 (98)

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Space heating 1595.8904 (98)
 Space heating per m2 (98) / (4) = 20.1858 (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													1763.4148 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	342.9472	264.4310	197.7025	92.8747	27.9461	0.0000	0.0000	0.0000	0.0000	89.6789	221.9488	358.3611	(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)	378.9472	292.1890	218.4557	102.6240	30.8797	0.0000	0.0000	0.0000	0.0000	99.0928	245.2473	395.9791	(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	112.6578	98.6463	103.2316	93.5848	91.9533	82.1317	79.8824	88.0729	88.0103	98.6320	103.4236	109.6388	(64)
Efficiency of water heater (217)m	89.6871	89.6076	89.3762	88.8651	88.0255	87.3000	87.3000	87.3000	87.3000	88.7952	89.4577	89.7295	(216)
Fuel for water heating, kWh/month	125.6120	110.0869	115.5023	105.3110	104.4622	94.0798	91.5033	100.8854	100.8136	111.0781	115.6118	122.1882	(219)
Water heating fuel used												1297.1347	(219)
Annual totals kWh/year													
Space heating fuel - main system												1763.4148	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 6.6170, total flow = 29.0000, SFP = 0.2282)													
mechanical ventilation fans (SFP = 0.2282)												53.2593	(230a)
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												128.2593	(231)
Electricity for lighting (calculated in Appendix L)												351.0924	(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												1715.7415	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1763.4148	3.9200	69.1259 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1297.1347	3.9200	50.8477 (247)
Mechanical ventilation fans	53.2593	16.9600	9.0328 (249)
Pumps and fans for heating	75.0000	16.9600	12.7200 (249)
Energy for lighting	351.0924	16.9600	59.5453 (250)
Additional standing charges			88.0000 (251)
Energy saving/generation technologies			
PV Unit	-1824.1596	16.9600	-309.3775 (252)
Total energy cost			-20.1059 (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	1763.4148	0.2160	380.8976 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1297.1347	0.2160	280.1811 (264)
Space and water heating			661.0787 (265)
Pumps and fans	128.2593	0.5190	66.5666 (267)
Energy for lighting	351.0924	0.5190	182.2169 (268)
Energy saving/generation technologies			
PV Unit	-1824.1596	0.5190	-946.7389 (269)
Total kg/year			-36.8766 (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	1763.4148	1.2200	2151.3661 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1297.1347	1.2200	1582.5044 (264)

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Space and water heating			3733.8704 (265)
Pumps and fans	128.2593	3.0700	393.7559 (267)
Energy for lighting	351.0924	3.0700	1077.8536 (268)
Energy saving/generation technologies			
PV Unit	-1824.1596	3.0700	-5600.1701 (269)
Primary energy kWh/year			-394.6901 (272)
Primary energy kWh/m2/year			-4.9923 (273)

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

Overheating Calculation Input Data

Dwelling type	SemiDetached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Thames Valley
Front of dwelling faces	North West
Overshading	Average or unknown
Thermal mass parameter	138.5 (calculated from construction elements)
Night ventilation	No
Ventilation rate during hot weather (ach)	4.00 (Windows half open)

Overheating Calculation

Summer ventilation heat loss coefficient	252.55 (P1)
Transmission heat loss coefficient	49.00 (37)
Summer heat loss coefficient	301.55 (P2)

Overhangs	Ratio	Z_overhangs	Overhang type
Orientation			
North East	0.000	1.000	None
South East	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)
North West	1.000	0.90	1.000	0.900 (P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North East	2.2600	98.8453	0.4600	0.0000	0.9000	92.4836
South East	3.6200	119.9223	0.4600	0.0000	0.9000	179.7252
North West	4.9200	98.8453	0.4600	0.0000	0.9000	201.3360
South East	3.0900	119.9223	0.4300	0.0000	0.9000	143.4067
total:						616.9515

	Jun	Jul	Aug	
Solar gains	656	617	542	(P4)
Internal gains	425	408	416	
Total summer gains	1082	1025	958	(P5)
Summer gain/loss ratio	3.59	3.40	3.18	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 138.5)	1.03	1.03	1.03	
Threshold temperature	20.62	22.33	22.01	(P7)
Likelihood of high internal temperature	Slight	Medium	Medium	
Assessment of likelihood of high internal temperature:	Medium			