

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property Reference	Becket - Det			Issued on Date	15/12/2022
Assessment Reference	Becket - Det	Prop Type Ref			
Property	Plot, 3 Bed, K, WC, U, B, ES				
SAP Rating	86 B	DER	14.35	TER	18.18
Environmental	88 B	% DER<TER	21.06		
CO ₂ Emissions (t/year)	1.14	DFEE	43.49	TFEE	55.13
General Requirements Compliance	Pass	% DFEE<TFEE	21.12		
Assessor Details	Mr. Christopher MacDougall, Chris MacDougall, Tel: 02032 902 902, chris.macdougall@aessc.co.uk			Assessor ID	Q920-0001
Client					

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

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DWELLING AS DESIGNED

Detached House, total floor area 95 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) 18.18 kgCO₂/m²

Dwelling Carbon Dioxide Emission Rate (DER) 14.35 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)55.1 kWh/m²/yr

Dwelling Fabric Energy Efficiency (DFEE)43.5 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.25 (max. 0.30)	0.25 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.11 (max. 0.25)	0.11 (max. 0.70)	OK
Roof	0.09 (max. 0.20)	0.09 (max. 0.35)	OK
Openings	1.22 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals:	4.01 (design value)	
Maximum	10.0	OK

4 Heating efficiency

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

Data from database

Ideal LOGIC COMBI 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): Slight OK

Based on:

Overshading: Average

Windows facing East: 5.85 m², No overhang

Windows facing South: 6.78 m², No overhang

Windows facing West: 1.98 m², No overhang

Air change rate: 4.00 ach

Blinds/curtains: None

10 Key features

Party wall U-value 0.00 W/m²K

Roof U-value 0.09 W/m²K

Floor U-value 0.11 W/m²K

Door U-value 1.00 W/m²K

Window U-value 0.90 W/m²K

Thermal bridging y-value 0.021 W/m²K

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	47.6000 (1b)	x 2.3100 (2b)	= 109.9560 (1b) - (3b)
First floor	47.6000 (1c)	x 2.6100 (2c)	= 124.2360 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	95.2000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 234.1920 (5)

2. Ventilation rate

					main heating	secondary heating	other		total	m3 per hour		
Number of chimneys					0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues					0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans											0 * 10 =	0.0000 (7a)
Number of passive vents											0 * 10 =	0.0000 (7b)
Number of flueless gas fires											0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =											0.0000 / (5) =	0.0000 (8)
Pressure test											Yes	(8)
Measured/design AP50											4.0100	
Infiltration rate											0.2005	(18)
Number of sides sheltered											0	(19)
Shelter factor											(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =	0.2005 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.2556	0.2506	0.2456	0.2206	0.2155	0.1905	0.1905	0.1855	0.2005	0.2155	0.2256	0.2356 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5056	0.5006	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Solid Door			1.9800	1.0000	1.9800		(26)					
Half Glaze			1.9800	1.3000	2.5740		(26a)					
Window (Uw = 1.20)			11.4600	1.1450	13.1221		(27)					
French Door (Uw = 1.40)			3.1500	1.3258	4.1761		(27)					
FP McCann System			47.6000	0.1100	5.2360	75.0000	3570.0000 (28a)					
100mm Knauf Supafil 34	138.7900	18.5700	120.2200	0.2500	30.0550	52.8000	6347.6160 (29a)					
Plane Ceiling-500mm Loft Roll	47.6000		47.6000	0.0900	4.2840	9.0000	428.4000 (30)					
Total net area of external elements Aum(A, m2)			233.9900				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		61.4273		(33)					
Timber GF			53.1900			9.0000	478.7100 (32c)					
Timber 1F			101.6300			9.0000	914.6700 (32c)					
Masonry GF			25.7200			39.0000	1003.0800 (32c)					
Internal Floor			47.6000			12.6000	599.7600 (32d)					
Internal Ceiling			47.6000			9.0000	428.4000 (32e)					
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		13770.6360 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							144.6495 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.9781 (36)					
Total fabric heat loss						(33) + (36) =	66.4054 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 39.0774	Feb 38.6900	Mar 38.6417	Apr 38.6417	May 38.6417	Jun 38.6417	Jul 38.6417	Aug 38.6417	Sep 38.6417	Oct 38.6417	Nov 38.6417	Dec 38.6417 (38)
Heat transfer coeff	105.4827	105.0953	105.0470	105.0470	105.0470	105.0470	105.0470	105.0470	105.0470	105.0470	105.0470	105.0470 (39)
Average = Sum(39)m / 12 =												105.0874 (39)
HLP	Jan 1.1080	Feb 1.1039	Mar 1.1034	Apr 1.1034	May 1.1034	Jun 1.1034	Jul 1.1034	Aug 1.1034	Sep 1.1034	Oct 1.1034	Nov 1.1034	Dec 1.1034 (40)
HLP (average)												1.1039 (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	2.6904 (42)
Average daily hot water use (litres/day)	98.0976 (43)

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.9074	103.9835	100.0596	96.1357	92.2118	88.2879	88.2879	92.2118	96.1357	100.0596	103.9835	107.9074	(44)
Energy conte	160.0236	139.9576	144.4237	125.9121	120.8157	104.2547	96.6073	110.8583	112.1823	130.7377	142.7104	154.9743	(45)
Energy content (annual)										Total =	Sum (45)m =	1543.4579	(45)
Distribution loss (46)m = 0.15 x (45)m	24.0035	20.9936	21.6636	18.8868	18.1224	15.6382	14.4911	16.6288	16.8274	19.6107	21.4066	23.2461	(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	14.1406	12.7612	14.1032	13.6033	14.0239	13.5337	13.9613	14.0019	13.5716	14.0703	13.6553	14.1285	(61)
Total heat required for water heating calculated for each month	174.1642	152.7188	158.5269	139.5154	134.8396	117.7884	110.5686	124.8602	125.7540	144.8080	156.3657	169.1028	(62)
WWHRS	-49.7139	-43.7420	-44.6443	-36.7312	-34.1052	-28.1348	-23.8109	-28.8296	-29.6709	-36.6797	-42.4893	-48.0509	eq. (G10)
Total of WWHRS savings												-446.6025	
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	124.4503	108.9768	113.8826	102.7843	100.7344	89.6536	86.7578	96.0306	96.0831	108.1283	113.8765	121.0519	(64)
Heat gains from water heating, kWh/month	56.7430	49.7262	51.5467	45.2666	43.6772	38.0481	35.6123	40.3609	40.6935	46.9879	50.8650	55.0611	(65)
Total per year (kWh/year) =										Sum (64)m =		1262.4103	(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	134.5214	134.5214	134.5214	134.5214	134.5214	134.5214	134.5214	134.5214	134.5214	134.5214	134.5214	134.5214	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	23.2917	20.6875	16.8242	12.7370	9.5211	8.0381	8.6854	11.2896	15.1529	19.2401	22.4561	23.9390	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	248.3263	250.9031	244.4095	230.5855	213.1351	196.7342	185.7774	183.2005	189.6941	203.5182	220.9685	237.3695	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.4521	36.4521	36.4521	36.4521	36.4521	36.4521	36.4521	36.4521	36.4521	36.4521	36.4521	36.4521	(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)	-107.6171	-107.6171	-107.6171	-107.6171	-107.6171	-107.6171	-107.6171	-107.6171	-107.6171	-107.6171	-107.6171	-107.6171	(71)
Water heating gains (Table 5)	76.2675	73.9973	69.2832	62.8703	58.7059	52.8446	47.8659	54.2485	56.5188	63.1557	70.6459	74.0068	(72)
Total internal gains	414.2418	411.9443	396.8733	372.5492	347.7185	323.9733	308.6851	315.0950	327.7222	352.2704	380.4269	401.6717	(73)

6. Solar gains

[Jan]			Area m2		Solar flux Table 6a W/m2		Specific data g or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
East			2.7000		19.6403		0.4600		0.0000		0.7700		18.7828 (76)
South			6.7800		46.7521		0.4600		0.0000		0.7700		112.2740 (78)
West			1.9800		19.6403		0.4600		0.0000		0.7700		13.7740 (80)
East			3.1500		19.6403		0.4300		0.0000		0.7700		20.4841 (76)
Solar gains	165.3149	287.6351	405.1019	513.9388	581.2807	578.1301	557.0457	507.5853	443.4126	321.4464	199.2187	140.6333	(83)
Total gains	579.5567	699.5794	801.9752	886.4880	928.9991	902.1034	865.7309	822.6803	771.1348	673.7169	579.6456	542.3050	(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	36.2635	36.3972	36.4139	36.4139	36.4139	36.4139	36.4139	36.4139	36.4139	36.4139	36.4139	36.4139
alpha	3.4176	3.4265	3.4276	3.4276	3.4276	3.4276	3.4276	3.4276	3.4276	3.4276	3.4276	3.4276
util living area	0.9849	0.9710	0.9442	0.8896	0.7932	0.6501	0.5030	0.5442	0.7496	0.9171	0.9742	0.9878 (86)
MIT	19.2180	19.4827	19.8523	20.2771	20.6403	20.8713	20.9599	20.9467	20.7801	20.2889	19.6582	19.1583 (87)
Th 2	19.9943	19.9976	19.9980	19.9980	19.9980	19.9980	19.9980	19.9980	19.9980	19.9980	19.9980	19.9980 (88)
util rest of house	0.9818	0.9653	0.9330	0.8666	0.7489	0.5741	0.4005	0.4416	0.6832	0.8949	0.9681	0.9853 (89)
MIT 2	17.6130	17.9977	18.5284	19.1256	19.6119	19.8901	19.9755	19.9658	19.7946	19.1546	18.2561	17.5287 (90)
Living area fraction									fLA = Living area / (4) =			0.1957 (91)
MIT	17.9271	18.2883	18.7875	19.3509	19.8131	20.0821	20.1681	20.1578	19.9874	19.3766	18.5305	17.8476 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.7771	18.1383	18.6375	19.2009	19.6631	19.9321	20.0181	20.0078	19.8374	19.2266	18.3805	17.6976 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9719	0.9505	0.9131	0.8444	0.7320	0.6686	0.4026	0.4427	0.6711	0.8729	0.9540	0.9768	(94)
Useful gains	563.2556	664.9470	732.3028	748.5065	679.9918	512.9451	348.5613	364.1613	517.5344	588.1088	552.9939	529.7031	(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	1421.5990	1391.2873	1275.0051	1082.0814	836.5018	560.1221	359.0656	378.9863	602.7021	906.1985	1184.9785	1417.8833	(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													

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638.6075	488.1007	403.7705	240.1739	116.4434	0.0000	0.0000	0.0000	0.0000	236.6588	455.0290	660.8060 (98)
Space heating											3239.5898 (98)
Space heating per m2										(98) / (4) =	34.0293 (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												3579.6572 (211)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	638.6075	488.1007	403.7705	240.1739	116.4434	0.0000	0.0000	0.0000	0.0000	236.6588	455.0290	660.8060 (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)	705.6437	539.3378	446.1552	265.3855	128.6668	0.0000	0.0000	0.0000	0.0000	261.5014	502.7944	730.1724 (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	124.4503	108.9768	113.8826	102.7843	100.7344	89.6536	86.7578	96.0306	96.0831	108.1283	113.8765	121.0519 (64)
Efficiency of water heater (217)m	89.9622	89.8986	89.7760	89.5166	88.9870	87.3000	87.3000	87.3000	87.3000	89.4715	89.8408	87.3000 (216)
Fuel for water heating, kWh/month	138.3363	121.2220	126.8519	114.8215	113.2012	102.6960	99.3789	110.0007	110.0608	120.8523	126.7536	141.8693 (219)
Water heating fuel used												1418.6933 (219)
Annual totals kWh/year												
Space heating fuel - main system												3579.6572 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
(MEV)Decentralised, Database: total watage = 10.3610, total flow = 45.0000, SFP = 0.2302)												
mechanical ventilation fans (SFP = 0.2302)												65.7841 (230a)
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												140.7841 (231)
Electricity for lighting (calculated in Appendix L)												411.3386 (232)
Total delivered energy for all uses												5550.4732 (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	3579.6572	0.2160	773.2060 (261)	
Space heating - secondary	0.0000	0.0000	0.0000 (263)	
Water heating (other fuel)	1418.6933	0.2160	306.4377 (264)	
Space and water heating			1079.6437 (265)	
Pumps and fans	140.7841	0.5190	73.0670 (267)	
Energy for lighting	411.3386	0.5190	213.4847 (268)	
Total CO2, kg/year			1366.1954 (272)	
Dwelling Carbon Dioxide Emission Rate (DER)			14.3500 (273)	

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

DER			14.3500 ZC1
Total Floor Area		TFA	95.2000
Assumed number of occupants		N	2.6904
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190
CO2 emissions from appliances, equation (L14)			15.4572 ZC2
CO2 emissions from cooking, equation (L16)			1.9283 ZC3
Total CO2 emissions			31.7355 ZC4
Residual CO2 emissions offset from biofuel CHP			0.0000 ZC5
Additional allowable electricity generation, kWh/m²/year			0.0000 ZC6
Resulting CO2 emissions offset from additional allowable electricity generation			0.0000 ZC7
Net CO2 emissions			31.7355 ZC8

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	47.6000 (1b)	x 2.3100 (2b)	= 109.9560 (1b) - (3b)
First floor	47.6000 (1c)	x 2.6100 (2c)	= 124.2360 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	95.2000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 234.1920 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					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) = 0.1281 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3781 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3781 (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	0.4821	0.4726	0.4632	0.4159	0.4065	0.3592	0.3592	0.3497	0.3781	0.4065	0.4254	0.4443 (22b)
Effective ac	0.6162	0.6117	0.6073	0.5865	0.5826	0.5645	0.5645	0.5612	0.5715	0.5826	0.5905	0.5987 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			1.9800	1.0000	1.9800		(26)
TER Semi-glazed door			1.9800	1.2000	2.3760		(26a)
TER Opening Type (Uw = 1.40)			14.6100	1.3258	19.3693		(27)
FP McCann System			47.6000	0.1300	6.1880		(28a)
100mm Knauf Supafil 34	138.7900	18.5700	120.2200	0.1800	21.6396		(29a)
Plane Ceiling-500mm Loft Roll	47.6000		47.6000	0.1300	6.1880		(30)
Total net area of external elements Aum, m ²			233.9900				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		57.7409		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.9034 (36)
Total fabric heat loss						(33) + (36) =	68.6443 (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	47.6220	47.2732	46.9314	45.3260	45.0256	43.6273	43.6273	43.3683	44.1659	45.0256	45.6332	46.2685 (38)
Heat transfer coeff	116.2663	115.9176	115.5758	113.9703	113.6699	112.2716	112.2716	112.0126	112.8102	113.6699	114.2776	114.9128 (39)
Average = Sum(39)m / 12 =												113.9688 (39)
HLP	1.2213	1.2176	1.2140	1.1972	1.1940	1.1793	1.1793	1.1766	1.1850	1.1940	1.2004	1.2071 (40)
HLP (average)												1.1972 (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												2.6904 (42)
Average daily hot water use (litres/day)												98.0976 (43)
Daily hot water use	107.9074	103.9835	100.0596	96.1357	92.2118	88.2879	88.2879	92.2118	96.1357	100.0596	103.9835	107.9074 (44)
Energy conte	160.0236	139.9576	144.4237	125.9121	120.8157	104.2547	96.6073	110.8583	112.1823	130.7377	142.7104	154.9743 (45)
Energy content (annual)										Total = Sum(45)m =		1543.4579 (45)
Distribution loss (46)m = 0.15 x (45)m	24.0035	20.9936	21.6636	18.8868	18.1224	15.6382	14.4911	16.6288	16.8274	19.6107	21.4066	23.2461 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	47.4094	46.9901	43.5392	44.9905	46.9901	47.4094	50.9589	49.3151	50.9589	50.9589	(61)
Total heat required for water heating calculated for each month	210.9825	185.9850	195.3826	173.3215	167.8058	147.7940	141.5979	157.8485	159.5917	181.6966	192.0255	205.9332	205.9332	(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	0.0000	(63)
Output from w/h	210.9825	185.9850	195.3826	173.3215	167.8058	147.7940	141.5979	157.8485	159.5917	181.6966	192.0255	205.9332	205.9332	(64)
Heat gains from water heating, kWh/month	65.9476	58.0428	60.7606	53.7181	51.9187	45.5495	43.3696	48.6079	49.1530	56.2100	59.7800	64.2687	64.2687	(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	134.5214	134.5214	134.5214	134.5214	134.5214	134.5214	134.5214	134.5214	134.5214	134.5214	134.5214	134.5214	(66)	
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	23.2917	20.6875	16.8242	12.7370	9.5211	8.0381	8.6854	11.2896	15.1529	19.2401	22.4561	23.9390	(67)	
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	248.3263	250.9031	244.4095	230.5855	213.1351	196.7342	185.7774	183.2005	189.6941	203.5182	220.9685	237.3695	(68)	
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.4521	36.4521	36.4521	36.4521	36.4521	36.4521	36.4521	36.4521	36.4521	36.4521	36.4521	36.4521	(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)	-107.6171	-107.6171	-107.6171	-107.6171	-107.6171	-107.6171	-107.6171	-107.6171	-107.6171	-107.6171	-107.6171	-107.6171	(71)	
Water heating gains (Table 5)	88.6392	86.3732	81.6675	74.6085	69.7833	63.2632	58.2924	65.3332	68.2680	75.5511	83.0278	86.3826	(72)	
Total internal gains	426.6136	424.3202	409.2576	384.2874	358.7958	334.3919	319.1116	326.1798	339.4714	364.6658	392.8088	414.0475	(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	
East					5.8500	19.6403	0.6300	0.7000			0.7700	35.1136 (76)	
South					6.7800	46.7521	0.6300	0.7000			0.7700	96.8729 (78)	
West					1.9800	19.6403	0.6300	0.7000			0.7700	11.8846 (80)	
Solar gains	143.8711	250.5912	353.5050	449.2335	508.6445	506.0942	487.5535	443.9019	387.2081	280.2146	173.4286	122.3561	(83)
Total gains	570.4846	674.9114	762.7626	833.5209	867.4403	840.4861	806.6651	770.0817	726.6796	644.8804	566.2374	536.4036	(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	56.8618	57.0329	57.2015	58.0073	58.1606	58.8850	58.8850	59.0211	58.6038	58.1606	57.8513	57.5315			
alpha	4.7908	4.8022	4.8134	4.8672	4.8774	4.9257	4.9257	4.9347	4.9069	4.8774	4.8568	4.8354			
util living area	0.9980	0.9952	0.9875	0.9640	0.9005	0.7602	0.5900	0.6355	0.8579	0.9757	0.9957	0.9985	(86)		
MIT	19.6636	19.8358	20.1003	20.4371	20.7299	20.9219	20.9822	20.9746	20.8481	20.4588	19.9984	19.6380	(87)		
Th 2	19.9030	19.9059	19.9088	19.9223	19.9248	19.9366	19.9366	19.9388	19.9320	19.9248	19.9197	19.9143	(88)		
util rest of house	0.9973	0.9935	0.9830	0.9498	0.8594	0.6682	0.4586	0.5051	0.7869	0.9633	0.9939	0.9980	(89)		
MIT 2	18.1270	18.3802	18.7663	19.2568	19.6532	19.8826	19.9299	19.9281	19.8085	19.2959	18.6279	18.0976	(90)		
Living area fraction	18.4277	18.6651	19.0273	19.4877	19.8639	20.0860	20.1358	20.1329	20.0119	19.5235	18.8961	18.3990	(92)		
Temperature adjustment	18.4277	18.6651	19.0273	19.4877	19.8639	20.0860	20.1358	20.1329	20.0119	19.5235	18.8961	18.3990	(93)		
adjusted MIT	18.4277	18.6651	19.0273	19.4877	19.8639	20.0860	20.1358	20.1329	20.0119	19.5235	18.8961	18.3990	(93)		

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Useful gains	568.1318	668.6176	745.8484	785.4599	743.0369	573.6282	390.7476	408.4908	576.3974	617.1537	561.3446	534.7407	(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	1642.5704	1595.6135	1447.8573	1206.6874	927.9913	615.9236	396.9752	418.1333	666.9243	1014.3337	1348.0322	1631.6520	(97)	
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000	(97a)	
Space heating kWh	799.3823	622.9413	522.2946	303.2838	137.6061	0.0000	0.0000	0.0000	0.0000	295.5019	566.4150	816.1020	(98)	
Space heating												4063.5270	(98)	
Space heating per m2												42.6841	(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													4350.6713 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	799.3823	622.9413	522.2946	303.2838	137.6061	0.0000	0.0000	0.0000	0.0000	295.5019	566.4150	816.1020	(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)	855.8697	666.9607	559.2020	324.7149	147.3299	0.0000	0.0000	0.0000	0.0000	316.3832	606.4401	873.7709	(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	210.9825	185.9850	195.3826	173.3215	167.8058	147.7940	141.5979	157.8485	159.5917	181.6966	192.0255	205.9332	(64)
Efficiency of water heater (217)m	88.0864	87.8592	87.4070	86.4459	84.5565	80.3000	80.3000	80.3000	80.3000	86.2685	87.6100	88.1656	(216)
Fuel for water heating, kWh/month	239.5176	211.6852	223.5321	200.4970	198.4541	184.0523	176.3361	196.5734	198.7444	210.6175	219.1820	233.5755	(219)
Water heating fuel used												2492.7671	(219)
Annual totals kWh/year													
Space heating fuel - main system												4350.6713	(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)												411.3386	(232)
Total delivered energy for all uses												7329.7770	(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	4350.6713	0.2160	939.7450 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2492.7671	0.2160	538.4377 (264)
Space and water heating			1478.1827 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	411.3386	0.5190	213.4847 (268)
Total CO2, kg/m2/year			1730.5924 (272)
Emissions per m2 for space and water heating			15.5271 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.2425 (272b)
Emissions per m2 for pumps and fans			0.4089 (272c)
Target Carbon Dioxide Emission Rate (TER) = (15.5271 * 1.00) + 2.2425 + 0.4089, rounded to 2 d.p.			18.1800 (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	47.6000 (1b)	x 2.3100 (2b)	= 109.9560 (1b) - (3b)
First floor	47.6000 (1c)	x 2.6100 (2c)	= 124.2360 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	95.2000		(3a) + (3b) + (3c) + (3d) + (3e)...(3n) = 234.1920 (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) = 0.1281 (8)
Pressure test					Yes
Measured/design AP50					4.0100
Infiltration rate					0.3286 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3286 (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	0.4190	0.4108	0.4025	0.3615	0.3532	0.3122	0.3122	0.3040	0.3286	0.3532	0.3697	0.3861 (22b)
Effective ac	0.5878	0.5844	0.5810	0.5653	0.5624	0.5487	0.5487	0.5462	0.5540	0.5624	0.5683	0.5745 (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
Solid Door			1.9800	1.0000	1.9800		(26)
Half Glaze			1.9800	1.3000	2.5740		(26a)
Window (Uw = 1.20)			11.4600	1.1450	13.1221		(27)
French Door (Uw = 1.40)			3.1500	1.3258	4.1761		(27)
FP McCann System			47.6000	0.1100	5.2360	75.0000	3570.0000 (28a)
100mm Knauf Supafil 34	138.7900	18.5700	120.2200	0.2500	30.0550	52.8000	6347.6160 (29a)
Plane Ceiling-500mm Loft Roll	47.6000		47.6000	0.0900	4.2840	9.0000	428.4000 (30)
Total net area of external elements Aum(A, m ²)			233.9900				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 61.4273		(33)
Timber GF			53.1900			9.0000	478.7100 (32c)
Timber 1F			101.6300			9.0000	914.6700 (32c)
Masonry GF			25.7200			39.0000	1003.0800 (32c)
Internal Floor			47.6000			12.6000	599.7600 (32d)
Internal Ceiling			47.6000			9.0000	428.4000 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 13770.6360 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							144.6495 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.9781 (36)
Total fabric heat loss							(33) + (36) = 66.4054 (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	45.4245	45.1611	44.9030	43.6903	43.4635	42.4073	42.4073	42.2117	42.8141	43.4635	43.9224	44.4023 (38)
Heat transfer coeff	111.8299	111.5665	111.3083	110.0957	109.8688	108.8127	108.8127	108.6171	109.2195	109.8688	110.3278	110.8076 (39)
Average = Sum(39)m / 12 =												110.0946 (39)
HLP	1.1747	1.1719	1.1692	1.1565	1.1541	1.1430	1.1430	1.1409	1.1473	1.1541	1.1589	1.1639 (40)
HLP (average)												1.1565 (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												2.6904 (42)
Average daily hot water use (litres/day)												98.0976 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	107.9074	103.9835	100.0596	96.1357	92.2118	88.2879	88.2879	92.2118	96.1357	100.0596	103.9835	107.9074 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Energy content (annual)	160.0236	139.9576	144.4237	125.9121	120.8157	104.2547	96.6073	110.8583	112.1823	130.7377	142.7104	154.9743 (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	1543.4579 (45)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	34.0050	29.7410	30.6900	26.7563	25.6733	22.1541	20.5291	23.5574	23.8387	27.7818	30.3260	32.9320 (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	134.5214	134.5214	134.5214	134.5214	134.5214	134.5214	134.5214	134.5214	134.5214	134.5214	134.5214	134.5214 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	23.2917	20.6875	16.8242	12.7370	9.5211	8.0381	8.6854	11.2896	15.1529	19.2401	22.4561	23.9390 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	248.3263	250.9031	244.4095	230.5855	213.1351	196.7342	185.7774	183.2005	189.6941	203.5182	220.9685	237.3695 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.4521	36.4521	36.4521	36.4521	36.4521	36.4521	36.4521	36.4521	36.4521	36.4521	36.4521	36.4521 (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)	-107.6171	-107.6171	-107.6171	-107.6171	-107.6171	-107.6171	-107.6171	-107.6171	-107.6171	-107.6171	-107.6171	-107.6171 (71)
Water heating gains (Table 5)	45.7057	44.2574	41.2501	37.1616	34.5072	30.7696	27.5928	31.6632	33.1094	37.3411	42.1194	44.2635 (72)
Total internal gains	380.6800	379.2044	365.8402	343.8404	320.5197	298.8983	285.4120	289.5097	301.3128	323.4558	348.9004	368.9284 (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

East	2.7000	19.6403	0.4600	0.0000	0.7700	18.7828 (76)
South	6.7800	46.7521	0.4600	0.0000	0.7700	112.2740 (78)
West	1.9800	19.6403	0.4600	0.0000	0.7700	13.7740 (80)
East	3.1500	19.6403	0.4300	0.0000	0.7700	20.4841 (76)

Solar gains	165.3149	287.6351	405.1019	513.9388	581.2807	578.1301	557.0457	507.5853	443.4126	321.4464	199.2187	140.6333 (83)
Total gains	545.9949	666.8395	770.9421	857.7793	901.8004	877.0284	842.4577	797.0950	744.7254	644.9022	548.1191	509.5617 (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	34.2053	34.2861	34.3656	34.7441	34.8159	35.1538	35.1538	35.2171	35.0228	34.8159	34.6710	34.5209
alpha	3.2804	3.2857	3.2910	3.3163	3.3211	3.3436	3.3436	3.3478	3.3349	3.3211	3.3114	3.3014
util living area	0.9874	0.9754	0.9521	0.9027	0.8141	0.6745	0.5277	0.5705	0.7739	0.9288	0.9784	0.9899 (86)
MIT	19.0480	19.3151	19.7050	20.1763	20.5749	20.8446	20.9493	20.9334	20.7375	20.1967	19.5283	18.9999 (87)
Th 2	19.9403	19.9425	19.9447	19.9550	19.9569	19.9659	19.9659	19.9675	19.9624	19.9569	19.9530	19.9490 (88)
util rest of house	0.9848	0.9704	0.9420	0.8813	0.7709	0.5969	0.4192	0.4628	0.7082	0.9086	0.9732	0.9878 (89)
MIT 2	18.1603	18.4262	18.8111	19.2739	19.6436	19.8764	19.9464	19.9399	19.7953	19.3037	18.6476	18.1189 (90)
Living area fraction									fLA = Living area / (4) =			0.1957 (91)
MIT	18.3340	18.6002	18.9861	19.4505	19.8259	20.0658	20.1427	20.1344	19.9797	19.4784	18.8199	18.2913 (92)
Temperature adjustment												0.0000
adjusted MIT	18.3340	18.6002	18.9861	19.4505	19.8259	20.0658	20.1427	20.1344	19.9797	19.4784	18.8199	18.2913 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	534.7215	641.4862	717.3032	745.3066	689.6037	530.6487	369.6442	383.6997	528.3205	578.4997	529.2406	500.9792 (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	1569.4225	1528.4782	1389.8031	1161.5670	892.7792	594.7537	385.4890	405.6142	642.1753	975.4618	1293.0326	1561.4279 (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	769.8175	596.0586	500.3399	299.7075	151.1626	0.0000	0.0000	0.0000	0.0000	295.3398	549.9302	788.9739 (98)
Space heating												3951.3299 (98)
Space heating per m2										(98) / (4) =		41.5056 (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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1022.8391	805.2138	825.4899	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8059	0.8691	0.8481	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	824.2753	699.7938	700.1129	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1127.8759	1085.3200	1034.2439	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	218.5925	286.8314	248.5935	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												754.0174	(104)
Cooled fraction									FC = cooled area / (4) =			1.0000	(105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	54.6481	71.7079	62.1484	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												188.5043	(107)
Space cooling per m2												1.9801	(108)
Energy for space heating												41.5056	(99)
Energy for space cooling												1.9801	(108)
Total												43.4857	(109)
Dwelling Fabric Energy Efficiency (DFEE)												43.5	(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	47.6000 (1b)	x 2.3100 (2b)	= 109.9560 (1b) - (3b)
First floor	47.6000 (1c)	x 2.6100 (2c)	= 124.2360 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	95.2000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 234.1920 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					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) = 0.1281 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3781 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3781 (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	0.4821	0.4726	0.4632	0.4159	0.4065	0.3592	0.3592	0.3497	0.3781	0.4065	0.4254	0.4443 (22b)
Effective ac	0.6162	0.6117	0.6073	0.5865	0.5826	0.5645	0.5645	0.5612	0.5715	0.5826	0.5905	0.5987 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			1.9800	1.0000	1.9800		(26)
TER Semi-glazed door			1.9800	1.2000	2.3760		(26a)
TER Opening Type (Uw = 1.40)			14.6100	1.3258	19.3693		(27)
FP McCann System			47.6000	0.1300	6.1880		(28a)
100mm Knauf Supafil 34	138.7900	18.5700	120.2200	0.1800	21.6396		(29a)
Plane Ceiling-500mm Loft Roll	47.6000		47.6000	0.1300	6.1880		(30)
Total net area of external elements Aum, m ²			233.9900				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		57.7409		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.9034 (36)
Total fabric heat loss						(33) + (36) =	68.6443 (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	47.6220	47.2732	46.9314	45.3260	45.0256	43.6273	43.6273	43.3683	44.1659	45.0256	45.6332	46.2685 (38)
Heat transfer coeff	116.2663	115.9176	115.5758	113.9703	113.6699	112.2716	112.2716	112.0126	112.8102	113.6699	114.2776	114.9128 (39)
Average = Sum(39)m / 12 =												113.9688 (39)
HLP	1.2213	1.2176	1.2140	1.1972	1.1940	1.1793	1.1793	1.1766	1.1850	1.1940	1.2004	1.2071 (40)
HLP (average)												1.1972 (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												2.6904 (42)
Average daily hot water use (litres/day)												98.0976 (43)
Daily hot water use	107.9074	103.9835	100.0596	96.1357	92.2118	88.2879	88.2879	92.2118	96.1357	100.0596	103.9835	107.9074 (44)
Energy conte	160.0236	139.9576	144.4237	125.9121	120.8157	104.2547	96.6073	110.8583	112.1823	130.7377	142.7104	154.9743 (45)
Energy content (annual)										Total = Sum(45)m =		1543.4579 (45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month	34.0050	29.7410	30.6900	26.7563	25.6733	22.1541	20.5291	23.5574	23.8387	27.7818	30.3260	32.9320 (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	134.5214	134.5214	134.5214	134.5214	134.5214	134.5214	134.5214	134.5214	134.5214	134.5214	134.5214	134.5214	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	23.2917	20.6875	16.8242	12.7370	9.5211	8.0381	8.6854	11.2896	15.1529	19.2401	22.4561	23.9390	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	248.3263	250.9031	244.4095	230.5855	213.1351	196.7342	185.7774	183.2005	189.6941	203.5182	220.9685	237.3695	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.4521	36.4521	36.4521	36.4521	36.4521	36.4521	36.4521	36.4521	36.4521	36.4521	36.4521	36.4521	(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)	-107.6171	-107.6171	-107.6171	-107.6171	-107.6171	-107.6171	-107.6171	-107.6171	-107.6171	-107.6171	-107.6171	-107.6171	(71)
Water heating gains (Table 5)	45.7057	44.2574	41.2501	37.1616	34.5072	30.7696	27.5928	31.6632	33.1094	37.3411	42.1194	44.2635	(72)
Total internal gains	380.6800	379.2044	365.8402	343.8404	320.5197	298.8983	285.4120	289.5097	301.3128	323.4558	348.9004	368.9284	(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	
East	5.8500	19.6403	0.6300	0.7000	0.7700	35.1136	(76)
South	6.7800	46.7521	0.6300	0.7000	0.7700	96.8729	(78)
West	1.9800	19.6403	0.6300	0.7000	0.7700	11.8846	(80)

Solar gains	143.8711	250.5912	353.5050	449.2335	508.6445	506.0942	487.5535	443.9019	387.2081	280.2146	173.4286	122.3561	(83)
Total gains	524.5511	629.7957	719.3452	793.0739	829.1642	804.9925	772.9655	733.4116	688.5209	603.6704	522.3290	491.2845	(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	56.8618	57.0329	57.2015	58.0073	58.1606	58.8850	58.8850	59.0211	58.6038	58.1606	57.8513	57.5315	
alpha	4.7908	4.8022	4.8134	4.8672	4.8774	4.9257	4.9257	4.9347	4.9069	4.8774	4.8568	4.8354	
util living area	0.9986	0.9964	0.9902	0.9701	0.9132	0.7808	0.6117	0.6608	0.8773	0.9812	0.9970	0.9990	(86)
MIT	19.6192	19.7928	20.0604	20.4036	20.7065	20.9117	20.9793	20.9699	20.8291	20.4227	19.9563	19.5943	(87)
Th 2	19.9030	19.9059	19.9088	19.9223	19.9248	19.9366	19.9366	19.9388	19.9320	19.9248	19.9197	19.9143	(88)
util rest of house	0.9981	0.9951	0.9865	0.9579	0.8756	0.6905	0.4775	0.5282	0.8113	0.9713	0.9957	0.9987	(89)
MIT 2	18.6462	18.8216	19.0896	19.4366	19.7203	19.8941	19.9312	19.9299	19.8347	19.4613	18.9960	18.6303	(90)
Living area fraction													(91)
MIT	18.8366	19.0116	19.2796	19.6258	19.9133	20.0932	20.1363	20.1335	20.0293	19.6494	19.1839	18.8189	(92)
Temperature adjustment													(93)
adjusted MIT	18.8366	19.0116	19.2796	19.6258	19.9133	20.0932	20.1363	20.1335	20.0293	19.6494	19.1839	18.8189	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	523.2189	625.8225	707.6024	756.2565	725.5781	567.8102	389.6256	406.5415	563.5306	584.2923	519.4291	490.3735	(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	1690.1184	1635.7870	1477.0088	1222.4255	933.6055	616.7336	397.0220	418.1959	668.8821	1028.6497	1380.9193	1679.9027	(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	868.1733	678.6962	572.4383	335.6417	154.7724	0.0000	0.0000	0.0000	0.0000	330.6019	620.2729	885.0097	(98)
Space heating												4445.6064	(98)
Space heating per m2												46.6975	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1055.3529	830.8098	851.2961	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8266	0.8994	0.8772	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	872.3397	747.2072	746.7654	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1043.6782	1004.0953	959.8088	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	123.3637	191.1247	158.5043	0.0000	0.0000	0.0000	0.0000	(104)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling												472.9927 (104)
Cooled fraction												1.0000 (105)
Intermittency factor (Table 10b)												
	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	30.8409	47.7812	39.6261	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												118.2482 (107)
Space cooling per m2												1.2421 (108)
Energy for space heating												46.6975 (99)
Energy for space cooling												1.2421 (108)
Total												47.9396 (109)
Target Fabric Energy Efficiency (TFEE)												55.1 (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	47.6000 (1b)	x 2.3100 (2b)	= 109.9560 (1b) - (3b)
First floor	47.6000 (1c)	x 2.6100 (2c)	= 124.2360 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	95.2000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 234.1920 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					0 * 10 = 0.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					0.0000 / (5) = 0.0000 (8)
Pressure test					Yes
Measured/design AP50					4.0100
Infiltration rate					0.2005 (18)
Number of sides sheltered					0 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		1.0000 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.2005 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)
Adj infilt rate	0.2105	0.2005	0.2005	0.1855	0.1855	0.1654	0.1704	0.1604	0.1654	0.1754	0.1754	0.1905 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid Door			1.9800	1.0000	1.9800		(26)
Half Glaze			1.9800	1.3000	2.5740		(26a)
Window (Uw = 1.20)			11.4600	1.1450	13.1221		(27)
French Door (Uw = 1.40)			3.1500	1.3258	4.1761		(27)
FP McCann System			47.6000	0.1100	5.2360	75.0000	3570.0000 (28a)
100mm Knauf Supafil 34	138.7900	18.5700	120.2200	0.2500	30.0550	52.8000	6347.6160 (29a)
Plane Ceiling-500mm Loft Roll	47.6000		47.6000	0.0900	4.2840	9.0000	428.4000 (30)
Total net area of external elements Aum(A, m ²)			233.9900				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		61.4273		(33)
Timber GF			53.1900			9.0000	478.7100 (32c)
Timber 1F			101.6300			9.0000	914.6700 (32c)
Masonry GF			25.7200			39.0000	1003.0800 (32c)
Internal Floor			47.6000			12.6000	599.7600 (32d)
Internal Ceiling			47.6000			9.0000	428.4000 (32e)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		13770.6360 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							144.6495 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.9781 (36)
Total fabric heat loss						(33) + (36) =	66.4054 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	38.6417	38.6417	38.6417	38.6417	38.6417	38.6417	38.6417	38.6417	38.6417	38.6417	38.6417	38.6417 (38)
Average = Sum(39)m / 12 =	105.0470	105.0470	105.0470	105.0470	105.0470	105.0470	105.0470	105.0470	105.0470	105.0470	105.0470	105.0470 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1034	1.1034	1.1034	1.1034	1.1034	1.1034	1.1034	1.1034	1.1034	1.1034	1.1034	1.1034 (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	2.6904 (42)
Average daily hot water use (litres/day)	98.0976 (43)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.9074	103.9835	100.0596	96.1357	92.2118	88.2879	88.2879	92.2118	96.1357	100.0596	103.9835	107.9074	(44)
Energy conte	160.0236	139.9576	144.4237	125.9121	120.8157	104.2547	96.6073	110.8583	112.1823	130.7377	142.7104	154.9743	(45)
Energy content (annual)	Total = Sum (45)m = 1543.4579												(45)
Distribution loss (46)m = 0.15 x (45)m	24.0035	20.9936	21.6636	18.8868	18.1224	15.6382	14.4911	16.6288	16.8274	19.6107	21.4066	23.2461	(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	14.1406	12.7612	14.1032	13.6033	14.0239	13.5337	13.9613	14.0019	13.5716	14.0703	13.6553	14.1285	(61)
Total heat required for water heating calculated for each month	174.1642	152.7188	158.5269	139.5154	134.8396	117.7884	110.5686	124.8602	125.7540	144.8080	156.3657	169.1028	(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	174.1642	152.7188	158.5269	139.5154	134.8396	117.7884	110.5686	124.8602	125.7540	144.8080	156.3657	169.1028	(64)
RHI water heating demand	Total per year (kWh/year) = Sum (64)m = 1709.0128												(64)
Heat gains from water heating, kWh/month	56.7430	49.7262	51.5467	45.2666	43.6772	38.0481	35.6123	40.3609	40.6935	46.9879	50.8650	55.0611	(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	161.4256	161.4256	161.4256	161.4256	161.4256	161.4256	161.4256	161.4256	161.4256	161.4256	161.4256	161.4256	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	58.2292	51.7187	42.0605	31.8425	23.8026	20.0952	21.7136	28.2241	37.8823	48.1003	56.1402	59.8476	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	370.6362	374.4823	364.7904	344.1574	318.1121	293.6331	277.2797	273.4336	283.1255	303.7584	329.8038	354.2828	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.8330	53.8330	53.8330	53.8330	53.8330	53.8330	53.8330	53.8330	53.8330	53.8330	53.8330	53.8330	(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)	-107.6171	-107.6171	-107.6171	-107.6171	-107.6171	-107.6171	-107.6171	-107.6171	-107.6171	-107.6171	-107.6171	-107.6171	(71)
Water heating gains (Table 5)	76.2675	73.9973	69.2832	62.8703	58.7059	52.8446	47.8659	54.2485	56.5188	63.1557	70.6459	74.0068	(72)
Total internal gains	615.7744	610.8398	586.7755	549.5117	511.2621	477.2144	457.5007	466.5477	488.1682	525.6560	567.2314	598.7787	(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
East					2.7000	22.3313	0.4600	0.0000			0.7700			21.3563 (76)
South					6.7800	50.9848	0.4600	0.0000			0.7700			122.4388 (78)
West					1.9800	22.3313	0.4600	0.0000			0.7700			15.6613 (80)
East					3.1500	22.3313	0.4300	0.0000			0.7700			23.2908 (76)

Solar gains	182.7472	286.0789	398.3943	522.4897	577.8286	616.1840	586.8021	545.0447	473.1461	341.4122	225.5954	153.9818 (83)		
Total gains	798.5217	896.9187	985.1698	1072.0014	1089.0908	1093.3984	1044.3027	1011.5925	961.3143	867.0683	792.8268	752.7605 (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	36.4139	36.4139	36.4139	36.4139	36.4139	36.4139	36.4139	36.4139	36.4139	36.4139	36.4139	36.4139
alpha	3.4276	3.4276	3.4276	3.4276	3.4276	3.4276	3.4276	3.4276	3.4276	3.4276	3.4276	3.4276
util living area	0.9568	0.9363	0.8924	0.8055	0.6655	0.4593	0.3079	0.3272	0.5777	0.8216	0.9285	0.9632 (86)
MIT	19.6421	19.8344	20.1767	20.5467	20.8268	20.9655	20.9938	20.9922	20.9192	20.5879	20.0568	19.5837 (87)
Th 2	19.9980	19.9980	19.9980	19.9980	19.9980	19.9980	19.9980	19.9980	19.9980	19.9980	19.9980	19.9980 (88)
util rest of house	0.9486	0.9247	0.8726	0.7700	0.6058	0.3751	0.2102	0.2271	0.4954	0.7808	0.9131	0.9560 (89)
MIT 2	18.2258	18.4989	18.9803	19.4817	19.8327	19.9763	19.9962	19.9956	19.9370	19.5477	18.8208	18.1429 (90)
Living area fraction									fIA = Living area / (4) =			0.1957 (91)
MIT	18.5030	18.7602	19.2144	19.6901	20.0272	20.1699	20.1914	20.1906	20.1292	19.7513	19.0627	18.4248 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.3530	18.6102	19.0644	19.5401	19.8772	20.0199	20.0414	20.0406	19.9792	19.6013	18.9127	18.2748 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9306	0.9040	0.8502	0.7516	0.5980	0.3770	0.2145	0.2315	0.4937	0.7620	0.8917	0.9393	(94)
Useful gains	743.1344	810.7969	837.5664	805.7343	651.3200	412.1908	224.0323	234.1467	474.6185	660.6659	706.9604	707.1008	(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	1392.1872	1366.6837	1225.3109	1012.6655	722.4346	422.2810	224.9483	235.3681	502.0418	840.5089	1146.3445	1383.9777	(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	482.8953	373.5559	288.4819	148.9905	52.9093	0.0000	0.0000	0.0000	0.0000	133.8032	316.3566	503.5964	(98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF HEAT DEMAND 09 Jan 2014

Space heating
RHI space heating demand

2300.5890 (98)
2301 (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	47.6000 (1b)	x 2.3100 (2b)	= 109.9560 (1b) - (3b)
First floor	47.6000 (1c)	x 2.6100 (2c)	= 124.2360 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	95.2000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 234.1920 (5)

2. Ventilation rate

					main heating	secondary heating	other		total	m3 per hour		
Number of chimneys					0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues					0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans											0 * 10 =	0.0000 (7a)
Number of passive vents											0 * 10 =	0.0000 (7b)
Number of flueless gas fires											0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =											0.0000 / (5) =	0.0000 (8)
Pressure test											Yes	(8)
Measured/design AP50											4.0100	
Infiltration rate											0.2005	(18)
Number of sides sheltered											0	(19)
Shelter factor											(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =	0.2005 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.2556	0.2506	0.2456	0.2206	0.2155	0.1905	0.1905	0.1855	0.2005	0.2155	0.2256	0.2356 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5056	0.5006	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Solid Door			1.9800	1.0000	1.9800		(26)					
Half Glaze			1.9800	1.3000	2.5740		(26a)					
Window (Uw = 1.20)			11.4600	1.1450	13.1221		(27)					
French Door (Uw = 1.40)			3.1500	1.3258	4.1761		(27)					
FP McCann System			47.6000	0.1100	5.2360	75.0000	3570.0000 (28a)					
100mm Knauf Supafil 34	138.7900	18.5700	120.2200	0.2500	30.0550	52.8000	6347.6160 (29a)					
Plane Ceiling-500mm Loft Roll	47.6000		47.6000	0.0900	4.2840	9.0000	428.4000 (30)					
Total net area of external elements Aum(A, m2)			233.9900				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		61.4273		(33)					
Timber GF			53.1900			9.0000	478.7100 (32c)					
Timber 1F			101.6300			9.0000	914.6700 (32c)					
Masonry GF			25.7200			39.0000	1003.0800 (32c)					
Internal Floor			47.6000			12.6000	599.7600 (32d)					
Internal Ceiling			47.6000			9.0000	428.4000 (32e)					
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		13770.6360 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							144.6495 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.9781 (36)					
Total fabric heat loss						(33) + (36) =	66.4054 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 39.0774	Feb 38.6900	Mar 38.6417	Apr 38.6417	May 38.6417	Jun 38.6417	Jul 38.6417	Aug 38.6417	Sep 38.6417	Oct 38.6417	Nov 38.6417	Dec 38.6417 (38)
Heat transfer coeff	105.4827	105.0953	105.0470	105.0470	105.0470	105.0470	105.0470	105.0470	105.0470	105.0470	105.0470	105.0470 (39)
Average = Sum(39)m / 12 =												105.0874 (39)
HLP	Jan 1.1080	Feb 1.1039	Mar 1.1034	Apr 1.1034	May 1.1034	Jun 1.1034	Jul 1.1034	Aug 1.1034	Sep 1.1034	Oct 1.1034	Nov 1.1034	Dec 1.1034 (40)
HLP (average)												1.1039 (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	2.6904 (42)
Average daily hot water use (litres/day)	98.0976 (43)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.9074	103.9835	100.0596	96.1357	92.2118	88.2879	88.2879	92.2118	96.1357	100.0596	103.9835	107.9074	(44)
Energy conte	160.0236	139.9576	144.4237	125.9121	120.8157	104.2547	96.6073	110.8583	112.1823	130.7377	142.7104	154.9743	(45)
Energy content (annual)										Total =	Sum (45)m =	1543.4579	(45)
Distribution loss (46)m = 0.15 x (45)m	24.0035	20.9936	21.6636	18.8868	18.1224	15.6382	14.4911	16.6288	16.8274	19.6107	21.4066	23.2461	(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	14.1406	12.7612	14.1032	13.6033	14.0239	13.5337	13.9613	14.0019	13.5716	14.0703	13.6553	14.1285	(61)
Total heat required for water heating calculated for each month	174.1642	152.7188	158.5269	139.5154	134.8396	117.7884	110.5686	124.8602	125.7540	144.8080	156.3657	169.1028	(62)
WWHRS	-49.7139	-43.7420	-44.6443	-36.7312	-34.1052	-28.1348	-23.8109	-28.8296	-29.6709	-36.6797	-42.4893	-48.0509	eq. (G10)
Total of WWHRS savings												-446.6025	
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	124.4503	108.9768	113.8826	102.7843	100.7344	89.6536	86.7578	96.0306	96.0831	108.1283	113.8765	121.0519	(64)
Heat gains from water heating, kWh/month	56.7430	49.7262	51.5467	45.2666	43.6772	38.0481	35.6123	40.3609	40.6935	46.9879	50.8650	55.0611	(65)
Total per year (kWh/year) =										Sum (64)m =		1262.4103	(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	161.4256	161.4256	161.4256	161.4256	161.4256	161.4256	161.4256	161.4256	161.4256	161.4256	161.4256	161.4256	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	58.2292	51.7187	42.0605	31.8425	23.8026	20.0952	21.7136	28.2241	37.8823	48.1003	56.1402	59.8476	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	370.6362	374.4823	364.7904	344.1574	318.1121	293.6331	277.2797	273.4336	283.1255	303.7584	329.8038	354.2828	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.8330	53.8330	53.8330	53.8330	53.8330	53.8330	53.8330	53.8330	53.8330	53.8330	53.8330	53.8330	(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)	-107.6171	-107.6171	-107.6171	-107.6171	-107.6171	-107.6171	-107.6171	-107.6171	-107.6171	-107.6171	-107.6171	-107.6171	(71)
Water heating gains (Table 5)	76.2675	73.9973	69.2832	62.8703	58.7059	52.8446	47.8659	54.2485	56.5188	63.1557	70.6459	74.0068	(72)
Total internal gains	615.7744	610.8398	586.7755	549.5117	511.2621	477.2144	457.5007	466.5477	488.1682	525.6560	567.2314	598.7787	(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
East				2.7000	19.6403		0.4600		0.0000		0.7700		18.7828 (76)
South				6.7800	46.7521		0.4600		0.0000		0.7700		112.2740 (78)
West				1.9800	19.6403		0.4600		0.0000		0.7700		13.7740 (80)
East				3.1500	19.6403		0.4300		0.0000		0.7700		20.4841 (76)
Solar gains	165.3149	287.6351	405.1019	513.9388	581.2807	578.1301	557.0457	507.5853	443.4126	321.4464	199.2187	140.6333	(83)
Total gains	781.0893	898.4749	991.8774	1063.4506	1092.5428	1055.3446	1014.5464	974.1330	931.5807	847.1025	766.4501	739.4120	(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	36.2635	36.3972	36.4139	36.4139	36.4139	36.4139	36.4139	36.4139	36.4139	36.4139	36.4139	36.4139	36.4139	
alpha	3.4176	3.4265	3.4276	3.4276	3.4276	3.4276	3.4276	3.4276	3.4276	3.4276	3.4276	3.4276	3.4276	
util living area	0.9645	0.9429	0.9057	0.8377	0.7291	0.5800	0.4383	0.4724	0.6691	0.8610	0.9446	0.9699	0.9699	(86)
MIT	19.4912	19.7343	20.0638	20.4302	20.7297	20.9098	20.9737	20.9654	20.8480	20.4559	19.8970	19.4302	19.4302	(87)
Th 2	19.9943	19.9976	19.9980	19.9980	19.9980	19.9980	19.9980	19.9980	19.9980	19.9980	19.9980	19.9980	19.9980	(88)
util rest of house	0.9579	0.9328	0.8889	0.8083	0.6802	0.5057	0.3454	0.3786	0.5992	0.8294	0.9330	0.9643	0.9643	(89)
MIT 2	18.0058	18.3550	18.8211	19.3260	19.7159	19.9249	19.9837	19.9779	19.8634	19.3733	18.5939	17.9208	17.9208	(90)
Living area fraction									fLA = Living area / (4) =			0.1957	0.1957	(91)
MIT	18.2965	18.6249	19.0643	19.5421	19.9143	20.1176	20.1775	20.1712	20.0560	19.5852	18.8489	18.2162	18.2162	(92)
Temperature adjustment												-0.1500	-0.1500	
adjusted MIT	18.1465	18.4749	18.9143	19.3921	19.7643	19.9676	20.0275	20.0212	19.9060	19.4352	18.6989	18.0662	18.0662	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
0.9415	0.9128	0.8666	0.7878	0.6676	0.5033	0.3482	0.3809	0.5922	0.8081	0.9131	0.9493	0.9493	(94)
Useful gains	735.4180	820.1420	859.5307	837.7639	729.4033	531.1823	353.3112	371.0146	551.6715	684.5509	699.8517	701.9108	(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	1460.5624	1426.6565	1304.0871	1102.1636	847.1303	563.8520	360.0459	380.3956	609.9083	928.1074	1218.4324	1456.6005	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

Space heating	539.5075	407.5778	330.7500	190.3678	87.5889	0.0000	0.0000	0.0000	0.0000	181.2060	373.3781	561.4891 (98)
Space heating per m2												2671.8651 (98)
											(98) / (4) =	28.0658 (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												2952.3371 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	539.5075	407.5778	330.7500	190.3678	87.5889	0.0000	0.0000	0.0000	0.0000	181.2060	373.3781	561.4891 (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)	596.1408	450.3622	365.4696	210.3511	96.7833	0.0000	0.0000	0.0000	0.0000	200.2276	412.5725	620.4300 (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	124.4503	108.9768	113.8826	102.7843	100.7344	89.6536	86.7578	96.0306	96.0831	108.1283	113.8765	121.0519 (64)
Efficiency of water heater	89.8825	89.8055	89.6583	89.3517	88.7597	87.3000	87.3000	87.3000	87.3000	89.2770	89.7313	87.3000 (216)
(217)m												89.9155 (217)
Fuel for water heating, kWh/month	138.4590	121.3476	127.0186	115.0334	113.4912	102.6960	99.3789	110.0007	110.0608	121.1155	126.9083	134.6286 (219)
Water heating fuel used												1420.1385 (219)
Annual totals kWh/year												
Space heating fuel - main system												2952.3371 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
(MEV)Decentralised, Database: total watage = 10.3610, total flow = 45.0000, SFP = 0.2302)												
mechanical ventilation fans (SFP = 0.2302)												65.7841 (230a)
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												140.7841 (231)
Electricity for lighting (calculated in Appendix L)												411.3386 (232)
Total delivered energy for all uses												4924.5984 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2952.3371	3.4800	102.7413 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1420.1385	3.4800	49.4208 (247)
Mechanical ventilation fans	65.7841	13.1900	8.6769 (249)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	411.3386	13.1900	54.2556 (250)
Additional standing charges			120.0000 (251)
Total energy cost			344.9871 (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] =	1.0335 (257)
SAP value		85.5829
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	2952.3371	0.2160	637.7048 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1420.1385	0.2160	306.7499 (264)
Space and water heating			944.4547 (265)
Pumps and fans	140.7841	0.5190	73.0670 (267)
Energy for lighting	411.3386	0.5190	213.4847 (268)
Total kg/year			1231.0064 (272)
CO2 emissions per m2			12.9300 (273)
EI value			88.2343
EI rating			88 (274)
EI band			B

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

Calculation of stars for heating and DHW

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9050 = 3.845$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9050 = 0.2387$, stars = 4
Water heating energy efficiency	$3.48 / 0.8880 = 3.919$, stars = 5
Water heating environmental impact	$0.216 / 0.8880 = 0.2432$, 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	47.6000 (1b)	x 2.3100 (2b)	= 109.9560 (1b) - (3b)
First floor	47.6000 (1c)	x 2.6100 (2c)	= 124.2360 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	95.2000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 234.1920 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																0 * 10 =	0.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =					Air changes per hour		
Pressure test															0.0000 / (5) =		0.0000 (8)
Measured/design AP50															Yes		
Infiltration rate															4.0100		
Number of sides sheltered															0.2005 (18)		
															0 (19)		
Shelter factor										(20) = 1 - [0.075 x (19)] =					1.0000 (20)		
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =					0.2005 (21)		
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)					
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)					
Adj infilt rate																	
	0.2105	0.2005	0.2005	0.1855	0.1855	0.1654	0.1704	0.1604	0.1654	0.1754	0.1754	0.1905 (22b)					
Mechanical extract ventilation - decentralised																	
If mechanical ventilation:															0.5000 (23a)		
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)					

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Solid Door			1.9800	1.0000	1.9800		(26)					
Half Glaze			1.9800	1.3000	2.5740		(26a)					
Window (Uw = 1.20)			11.4600	1.1450	13.1221		(27)					
French Door (Uw = 1.40)			3.1500	1.3258	4.1761		(27)					
FP McCann System			47.6000	0.1100	5.2360	75.0000	3570.0000 (28a)					
100mm Knauf Supafil 34	138.7900	18.5700	120.2200	0.2500	30.0550	52.8000	6347.6160 (29a)					
Plane Ceiling-500mm Loft Roll	47.6000		47.6000	0.0900	4.2840	9.0000	428.4000 (30)					
Total net area of external elements Aum(A, m2)			233.9900				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		61.4273		(33)					
Timber GF			53.1900			9.0000	478.7100 (32c)					
Timber 1F			101.6300			9.0000	914.6700 (32c)					
Masonry GF			25.7200			39.0000	1003.0800 (32c)					
Internal Floor			47.6000			12.6000	599.7600 (32d)					
Internal Ceiling			47.6000			9.0000	428.4000 (32e)					
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		13770.6360 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							144.6495 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.9781 (36)					
Total fabric heat loss						(33) + (36) =	66.4054 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 38.6417	Feb 38.6417	Mar 38.6417	Apr 38.6417	May 38.6417	Jun 38.6417	Jul 38.6417	Aug 38.6417	Sep 38.6417	Oct 38.6417	Nov 38.6417	Dec 38.6417 (38)
Heat transfer coeff	105.0470	105.0470	105.0470	105.0470	105.0470	105.0470	105.0470	105.0470	105.0470	105.0470	105.0470	105.0470 (39)
Average = Sum(39)m / 12 =												105.0470 (39)
HLP	Jan 1.1034	Feb 1.1034	Mar 1.1034	Apr 1.1034	May 1.1034	Jun 1.1034	Jul 1.1034	Aug 1.1034	Sep 1.1034	Oct 1.1034	Nov 1.1034	Dec 1.1034 (40)
HLP (average)												1.1034 (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	2.6904 (42)
Average daily hot water use (litres/day)	98.0976 (43)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.9074	103.9835	100.0596	96.1357	92.2118	88.2879	88.2879	92.2118	96.1357	100.0596	103.9835	107.9074	(44)
Energy conte	160.0236	139.9576	144.4237	125.9121	120.8157	104.2547	96.6073	110.8583	112.1823	130.7377	142.7104	154.9743	(45)
Energy content (annual)	Total = Sum (45)m = 1543.4579												(45)
Distribution loss (46)m = 0.15 x (45)m	24.0035	20.9936	21.6636	18.8868	18.1224	15.6382	14.4911	16.6288	16.8274	19.6107	21.4066	23.2461	(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	14.1406	12.7612	14.1032	13.6033	14.0239	13.5337	13.9613	14.0019	13.5716	14.0703	13.6553	14.1285	(61)
Total heat required for water heating calculated for each month	174.1642	152.7188	158.5269	139.5154	134.8396	117.7884	110.5686	124.8602	125.7540	144.8080	156.3657	169.1028	(62)
WWHRS	-49.7139	-43.7420	-44.6443	-36.7312	-34.1052	-28.1348	-23.8109	-28.8296	-29.6709	-36.6797	-42.4893	-48.0509	eq. (G10)
Total of WWHRS savings	-446.6025												
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	124.4503	108.9768	113.8826	102.7843	100.7344	89.6536	86.7578	96.0306	96.0831	108.1283	113.8765	121.0519	(64)
Heat gains from water heating, kWh/month	56.7430	49.7262	51.5467	45.2666	43.6772	38.0481	35.6123	40.3609	40.6935	46.9879	50.8650	55.0611	(65)
Total per year (kWh/year) = Sum (64)m =	1262.4103												(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	161.4256	161.4256	161.4256	161.4256	161.4256	161.4256	161.4256	161.4256	161.4256	161.4256	161.4256	161.4256	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	58.2292	51.7187	42.0605	31.8425	23.8026	20.0952	21.7136	28.2241	37.8823	48.1003	56.1402	59.8476	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	370.6362	374.4823	364.7904	344.1574	318.1121	293.6331	277.2797	273.4336	283.1255	303.7584	329.8038	354.2828	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.8330	53.8330	53.8330	53.8330	53.8330	53.8330	53.8330	53.8330	53.8330	53.8330	53.8330	53.8330	(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)	-107.6171	-107.6171	-107.6171	-107.6171	-107.6171	-107.6171	-107.6171	-107.6171	-107.6171	-107.6171	-107.6171	-107.6171	(71)
Water heating gains (Table 5)	76.2675	73.9973	69.2832	62.8703	58.7059	52.8446	47.8659	54.2485	56.5188	63.1557	70.6459	74.0068	(72)
Total internal gains	615.7744	610.8398	586.7755	549.5117	511.2621	477.2144	457.5007	466.5477	488.1682	525.6560	567.2314	598.7787	(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
East					2.7000	22.3313	0.4600	0.0000	0.7700					21.3563 (76)
South					6.7800	50.9848	0.4600	0.0000	0.7700					122.4388 (78)
West					1.9800	22.3313	0.4600	0.0000	0.7700					15.6613 (80)
East					3.1500	22.3313	0.4300	0.0000	0.7700					23.2908 (76)

Solar gains	182.7472	286.0789	398.3943	522.4897	577.8286	616.1840	586.8021	545.0447	473.1461	341.4122	225.5954			153.9818 (83)
Total gains	798.5217	896.9187	985.1698	1072.0014	1089.0908	1093.3984	1044.3027	1011.5925	961.3143	867.0683	792.8268			752.7605 (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	36.4139	36.4139	36.4139	36.4139	36.4139	36.4139	36.4139	36.4139	36.4139	36.4139	36.4139	36.4139	
alpha	3.4276	3.4276	3.4276	3.4276	3.4276	3.4276	3.4276	3.4276	3.4276	3.4276	3.4276	3.4276	
util living area	0.9568	0.9363	0.8924	0.8055	0.6655	0.4593	0.3079	0.3272	0.5777	0.8216	0.9285	0.9632	(86)
MIT	19.6421	19.8344	20.1767	20.5467	20.8268	20.9655	20.9938	20.9922	20.9192	20.5879	20.0568	19.5837	(87)
Th 2	19.9980	19.9980	19.9980	19.9980	19.9980	19.9980	19.9980	19.9980	19.9980	19.9980	19.9980	19.9980	(88)
util rest of house	0.9486	0.9247	0.8726	0.7700	0.6058	0.3751	0.2102	0.2271	0.4954	0.7808	0.9131	0.9560	(89)
MIT 2	18.2258	18.4989	18.9803	19.4817	19.8327	19.9763	19.9962	19.9956	19.9370	19.5477	18.8208	18.1429	(90)
Living area fraction	fLA = Living area / (4) =												0.1957 (91)
MIT	18.5030	18.7602	19.2144	19.6901	20.0272	20.1699	20.1914	20.1906	20.1292	19.7513	19.0627	18.4248	(92)
Temperature adjustment													-0.1500
adjusted MIT	18.3530	18.6102	19.0644	19.5401	19.8772	20.0199	20.0414	20.0406	19.9792	19.6013	18.9127	18.2748	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9306	0.9040	0.8502	0.7516	0.9980	0.9770	0.9145	0.9315	0.4937	0.7620	0.8917	0.9393	(94)
Useful gains	743.1344	810.7969	837.5664	805.7343	651.3200	412.1908	224.0323	234.1467	474.6185	660.6659	706.9604	707.1008	(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	1392.1872	1366.6837	1225.3109	1012.6655	722.4346	422.2810	224.9483	235.3681	502.0418	840.5089	1146.3445	1383.9777	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Space heating	482.8953	373.5559	288.4819	148.9905	52.9093	0.0000	0.0000	0.0000	0.0000	133.8032	316.3566	503.5964 (98)
Space heating per m2												2300.5890 (98)
										(98) / (4) =		24.1659 (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												2542.0873 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	482.8953	373.5559	288.4819	148.9905	52.9093	0.0000	0.0000	0.0000	0.0000	133.8032	316.3566	503.5964 (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)	533.5859	412.7690	318.7645	164.6303	58.4633	0.0000	0.0000	0.0000	0.0000	147.8488	349.5653	556.4601 (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	124.4503	108.9768	113.8826	102.7843	100.7344	89.6536	86.7578	96.0306	96.0831	108.1283	113.8765	121.0519 (64)
Efficiency of water heater (217)m	89.8253	89.7570	89.5707	89.1657	88.3761	87.3000	87.3000	87.3000	87.3000	89.0413	89.6304	87.3000 (216)
Fuel for water heating, kWh/month	138.5470	121.4133	127.1427	115.2733	113.9838	102.6960	99.3789	110.0007	110.0608	121.4362	127.0512	134.7092 (219)
Water heating fuel used												1421.6930 (219)
Annual totals kWh/year												2542.0873 (211)
Space heating fuel - main system												0.0000 (215)
Space heating fuel - secondary												
Electricity for pumps and fans:												
(MEV)Decentralised, Database: total watage = 10.3610, total flow = 45.0000, SFP = 0.2302)												
mechanical ventilation fans (SFP = 0.2302)												65.7841 (230a)
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												140.7841 (231)
Electricity for lighting (calculated in Appendix L)												411.3386 (232)
Total delivered energy for all uses												4515.9030 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2542.0873	3.9200	99.6498 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1421.6930	3.9200	55.7304 (247)
Mechanical ventilation fans	65.7841	16.9600	11.1570 (249)
Pumps and fans for heating	75.0000	16.9600	12.7200 (249)
Energy for lighting	411.3386	16.9600	69.7630 (250)
Additional standing charges			88.0000 (251)
Total energy cost			337.0202 (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	2542.0873	0.2160	549.0908 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1421.6930	0.2160	307.0857 (264)
Space and water heating			856.1765 (265)
Pumps and fans	140.7841	0.5190	73.0670 (267)
Energy for lighting	411.3386	0.5190	213.4847 (268)
Total kg/year			1142.7282 (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	2542.0873	1.2200	3101.3465 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1421.6930	1.2200	1734.4655 (264)
Space and water heating			4835.8119 (265)
Pumps and fans	140.7841	3.0700	432.2072 (267)
Energy for lighting	411.3386	3.0700	1262.8095 (268)
Primary energy kWh/year			6530.8287 (272)
Primary energy kWh/m2/year			68.6011 (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 88

(For testing purposes):

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

Recommended measures:	SAP change	Cost change	CO2 change
U Solar photovoltaic panels	+ 9.5	-£ 309	-947 kg (82.8%)

Measures omitted - SAP change or cost saving too small:	SAP change	Cost change	CO2 change
N Solar water heating	+ 0.8	-£ 22	-142 kg (12.4%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar photovoltaic panels	£309 9.94 kg/m²	A 95	A 97
Total Savings	£309 9.94 kg/m²		

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

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

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

	Current	Potential	Saving
Electricity	£94	£94	£0
Mains gas	£243	£243	£0
Space heating	£212	£212	£0
Water heating	£56	£56	£0
Lighting	£70	£70	£0
Generated (PV)	-£0	-£309	£309
Total cost of fuels	£337	£28	£309
Total cost of uses	£338	£29	£309
Delivered energy	47 kWh/m²	28 kWh/m²	19 kWh/m²
Carbon dioxide emissions	1.1 tonnes	0.2 tonnes	0.9 tonnes
CO2 emissions per m²	12 kg/m²	2 kg/m²	10 kg/m²
Primary energy	69 kWh/m²	10 kWh/m²	59 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	47.6000 (1b)	x 2.3100 (2b)	= 109.9560 (1b) - (3b)
First floor	47.6000 (1c)	x 2.6100 (2c)	= 124.2360 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	95.2000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 234.1920 (5)

2. Ventilation rate

					main heating	secondary heating	other		total	m3 per hour		
Number of chimneys					0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues					0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans											0 * 10 =	0.0000 (7a)
Number of passive vents											0 * 10 =	0.0000 (7b)
Number of flueless gas fires											0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =											0.0000 / (5) =	0.0000 (8)
Pressure test											Yes	(8)
Measured/design AP50											4.0100	
Infiltration rate											0.2005	(18)
Number of sides sheltered											0	(19)
Shelter factor											(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =	0.2005 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.2556	0.2506	0.2456	0.2206	0.2155	0.1905	0.1905	0.1855	0.2005	0.2155	0.2256	0.2356 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5056	0.5006	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Solid Door			1.9800	1.0000	1.9800		(26)					
Half Glaze			1.9800	1.3000	2.5740		(26a)					
Window (Uw = 1.20)			11.4600	1.1450	13.1221		(27)					
French Door (Uw = 1.40)			3.1500	1.3258	4.1761		(27)					
FP McCann System			47.6000	0.1100	5.2360	75.0000	3570.0000 (28a)					
100mm Knauf Supafil 34	138.7900	18.5700	120.2200	0.2500	30.0550	52.8000	6347.6160 (29a)					
Plane Ceiling-500mm Loft Roll	47.6000		47.6000	0.0900	4.2840	9.0000	428.4000 (30)					
Total net area of external elements Aum(A, m2)			233.9900				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		61.4273		(33)					
Timber GF			53.1900			9.0000	478.7100 (32c)					
Timber 1F			101.6300			9.0000	914.6700 (32c)					
Masonry GF			25.7200			39.0000	1003.0800 (32c)					
Internal Floor			47.6000			12.6000	599.7600 (32d)					
Internal Ceiling			47.6000			9.0000	428.4000 (32e)					
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		13770.6360 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							144.6495 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.9781 (36)					
Total fabric heat loss						(33) + (36) =	66.4054 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 39.0774	Feb 38.6900	Mar 38.6417	Apr 38.6417	May 38.6417	Jun 38.6417	Jul 38.6417	Aug 38.6417	Sep 38.6417	Oct 38.6417	Nov 38.6417	Dec 38.6417 (38)
Heat transfer coeff	105.4827	105.0953	105.0470	105.0470	105.0470	105.0470	105.0470	105.0470	105.0470	105.0470	105.0470	105.0470 (39)
Average = Sum(39)m / 12 =												105.0874 (39)
HLP	Jan 1.1080	Feb 1.1039	Mar 1.1034	Apr 1.1034	May 1.1034	Jun 1.1034	Jul 1.1034	Aug 1.1034	Sep 1.1034	Oct 1.1034	Nov 1.1034	Dec 1.1034 (40)
HLP (average)												1.1039 (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	2.6904 (42)
Average daily hot water use (litres/day)	98.0976 (43)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.9074	103.9835	100.0596	96.1357	92.2118	88.2879	88.2879	92.2118	96.1357	100.0596	103.9835	107.9074	(44)
Energy conte	160.0236	139.9576	144.4237	125.9121	120.8157	104.2547	96.6073	110.8583	112.1823	130.7377	142.7104	154.9743	(45)
Energy content (annual)										Total =	Sum (45)m =	1543.4579	(45)
Distribution loss (46)m = 0.15 x (45)m	24.0035	20.9936	21.6636	18.8868	18.1224	15.6382	14.4911	16.6288	16.8274	19.6107	21.4066	23.2461	(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	14.1406	12.7612	14.1032	13.6033	14.0239	13.5337	13.9613	14.0019	13.5716	14.0703	13.6553	14.1285	(61)
Total heat required for water heating calculated for each month	174.1642	152.7188	158.5269	139.5154	134.8396	117.7884	110.5686	124.8602	125.7540	144.8080	156.3657	169.1028	(62)
WWHRS	-49.7139	-43.7420	-44.6443	-36.7312	-34.1052	-28.1348	-23.8109	-28.8296	-29.6709	-36.6797	-42.4893	-48.0509	eq. (G10)
Total of WWHRS savings												-446.6025	
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	124.4503	108.9768	113.8826	102.7843	100.7344	89.6536	86.7578	96.0306	96.0831	108.1283	113.8765	121.0519	(64)
Heat gains from water heating, kWh/month	56.7430	49.7262	51.5467	45.2666	43.6772	38.0481	35.6123	40.3609	40.6935	46.9879	50.8650	55.0611	(65)
Total per year (kWh/year) =										Sum (64)m =		1262.4103	(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	161.4256	161.4256	161.4256	161.4256	161.4256	161.4256	161.4256	161.4256	161.4256	161.4256	161.4256	161.4256	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	58.2292	51.7187	42.0605	31.8425	23.8026	20.0952	21.7136	28.2241	37.8823	48.1003	56.1402	59.8476	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	370.6362	374.4823	364.7904	344.1574	318.1121	293.6331	277.2797	273.4336	283.1255	303.7584	329.8038	354.2828	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.8330	53.8330	53.8330	53.8330	53.8330	53.8330	53.8330	53.8330	53.8330	53.8330	53.8330	53.8330	(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)	-107.6171	-107.6171	-107.6171	-107.6171	-107.6171	-107.6171	-107.6171	-107.6171	-107.6171	-107.6171	-107.6171	-107.6171	(71)
Water heating gains (Table 5)	76.2675	73.9973	69.2832	62.8703	58.7059	52.8446	47.8659	54.2485	56.5188	63.1557	70.6459	74.0068	(72)
Total internal gains	615.7744	610.8398	586.7755	549.5117	511.2621	477.2144	457.5007	466.5477	488.1682	525.6560	567.2314	598.7787	(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
East				2.7000	19.6403		0.4600		0.0000		0.7700		18.7828 (76)
South				6.7800	46.7521		0.4600		0.0000		0.7700		112.2740 (78)
West				1.9800	19.6403		0.4600		0.0000		0.7700		13.7740 (80)
East				3.1500	19.6403		0.4300		0.0000		0.7700		20.4841 (76)
Solar gains	165.3149	287.6351	405.1019	513.9388	581.2807	578.1301	557.0457	507.5853	443.4126	321.4464	199.2187	140.6333	(83)
Total gains	781.0893	898.4749	991.8774	1063.4506	1092.5428	1055.3446	1014.5464	974.1330	931.5807	847.1025	766.4501	739.4120	(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	36.2635	36.3972	36.4139	36.4139	36.4139	36.4139	36.4139	36.4139	36.4139	36.4139	36.4139	36.4139		
alpha	3.4176	3.4265	3.4276	3.4276	3.4276	3.4276	3.4276	3.4276	3.4276	3.4276	3.4276	3.4276		
util living area	0.9645	0.9429	0.9057	0.8377	0.7291	0.5800	0.4383	0.4724	0.6691	0.8610	0.9446	0.9699	(86)	
MIT	19.4912	19.7343	20.0638	20.4302	20.7297	20.9098	20.9737	20.9654	20.8480	20.4559	19.8970	19.4302	(87)	
Th 2	19.9943	19.9976	19.9980	19.9980	19.9980	19.9980	19.9980	19.9980	19.9980	19.9980	19.9980	19.9980	(88)	
util rest of house	0.9579	0.9328	0.8889	0.8083	0.6802	0.5057	0.3454	0.3786	0.5992	0.8294	0.9330	0.9643	(89)	
MIT 2	18.0058	18.3550	18.8211	19.3260	19.7159	19.9249	19.9837	19.9779	19.8634	19.3733	18.5939	17.9208	(90)	
Living area fraction									fLA = Living area / (4) =			0.1957	(91)	
MIT	18.2965	18.6249	19.0643	19.5421	19.9143	20.1176	20.1775	20.1712	20.0560	19.5852	18.8489	18.2162	(92)	
Temperature adjustment												-0.1500		
adjusted MIT	18.1465	18.4749	18.9143	19.3921	19.7643	19.9676	20.0275	20.0212	19.9060	19.4352	18.6989	18.0662	(93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9415	0.9128	0.8666	0.7878	0.6676	0.5033	0.3482	0.3809	0.5922	0.8081	0.9131	0.9493	(94)
Useful gains	735.4180	820.1420	859.5307	837.7639	729.4033	531.1823	353.3112	371.0146	551.6715	684.5509	699.8517	701.9108	(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	1460.5624	1426.6565	1304.0871	1102.1636	847.1303	563.8520	360.0459	380.3956	609.9083	928.1074	1218.4324	1456.6005	(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													

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CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

539.5075	407.5778	330.7500	190.3678	87.5889	0.0000	0.0000	0.0000	0.0000	181.2060	373.3781	561.4891 (98)
Space heating											2671.8651 (98)
Space heating per m2										(98) / (4) =	28.0658 (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												2952.3371 (211)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	539.5075	407.5778	330.7500	190.3678	87.5889	0.0000	0.0000	0.0000	0.0000	181.2060	373.3781	561.4891 (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)	596.1408	450.3622	365.4696	210.3511	96.7833	0.0000	0.0000	0.0000	0.0000	200.2276	412.5725	620.4300 (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	124.4503	108.9768	113.8826	102.7843	100.7344	89.6536	86.7578	96.0306	96.0831	108.1283	113.8765	121.0519 (64)
Efficiency of water heater	89.8825	89.8055	89.6583	89.3517	88.7597	87.3000	87.3000	87.3000	87.3000	89.2770	89.7313	87.3000 (216)
Fuel for water heating, kWh/month	138.4590	121.3476	127.0186	115.0334	113.4912	102.6960	99.3789	110.0007	110.0608	121.1155	126.9083	134.6286 (219)
Water heating fuel used												1420.1385 (219)
Annual totals kWh/year												
Space heating fuel - main system												2952.3371 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
(MEV)Decentralised, Database: total watage = 10.3610, total flow = 45.0000, SFP = 0.2302)												
mechanical ventilation fans (SFP = 0.2302)												65.7841 (230a)
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												140.7841 (231)
Electricity for lighting (calculated in Appendix L)												411.3386 (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												3197.3590 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2952.3371	3.4800	102.7413 (240)	
Space heating - secondary	0.0000	0.0000	0.0000 (242)	
Water heating (other fuel)	1420.1385	3.4800	49.4208 (247)	
Mechanical ventilation fans	65.7841	13.1900	8.6769 (249)	
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)	
Energy for lighting	411.3386	13.1900	54.2556 (250)	
Additional standing charges			120.0000 (251)	
Energy saving/generation technologies				
PV Unit	-1727.2394	13.1900	-227.8229 (252)	
Total energy cost			117.1643 (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] =	0.3510 (257)
SAP value			95.1037
SAP rating (Section 12)			95 (258)
SAP band			A

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2952.3371	0.2160	637.7048 (261)	
Space heating - secondary	0.0000	0.0000	0.0000 (263)	
Water heating (other fuel)	1420.1385	0.2160	306.7499 (264)	
Space and water heating			944.4547 (265)	
Pumps and fans	140.7841	0.5190	73.0670 (267)	
Energy for lighting	411.3386	0.5190	213.4847 (268)	
Energy saving/generation technologies				
PV Unit	-1727.2394	0.5190	-896.4372 (269)	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Total kg/year
CO2 emissions per m2
EI value
EI rating
EI band

334.5692 (272)
3.5100 (273)
96.8023
97 (274)
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	47.6000 (1b)	x 2.3100 (2b)	= 109.9560 (1b) - (3b)
First floor	47.6000 (1c)	x 2.6100 (2c)	= 124.2360 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	95.2000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 234.1920 (5)

2. Ventilation rate

										main heating	secondary heating	other	total	m3 per hour			
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																0 * 10 =	0.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =					0.0000 / (5) =	0.0000 (8)	
Pressure test															Yes		
Measured/design AP50															4.0100		
Infiltration rate															0.2005 (18)		
Number of sides sheltered															0 (19)		
Shelter factor										(20) = 1 - [0.075 x (19)] =					1.0000 (20)		
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =					0.2005 (21)		
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)					
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)					
Adj infilt rate																	
	0.2105	0.2005	0.2005	0.1855	0.1855	0.1654	0.1704	0.1604	0.1654	0.1754	0.1754	0.1905 (22b)					
Mechanical extract ventilation - decentralised																	
If mechanical ventilation:															0.5000 (23a)		
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)					

3. Heat losses and heat loss parameter

Element	Gross 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
Solid Door			1.9800	1.0000	1.9800		(26)
Half Glaze			1.9800	1.3000	2.5740		(26a)
Window (Uw = 1.20)			11.4600	1.1450	13.1221		(27)
French Door (Uw = 1.40)			3.1500	1.3258	4.1761		(27)
FP McCann System			47.6000	0.1100	5.2360	75.0000	3570.0000 (28a)
100mm Knauf Supafil 34	138.7900	18.5700	120.2200	0.2500	30.0550	52.8000	6347.6160 (29a)
Plane Ceiling-500mm Loft Roll	47.6000		47.6000	0.0900	4.2840	9.0000	428.4000 (30)
Total net area of external elements Aum(A, m ²)			233.9900				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		61.4273		(33)
Timber GF			53.1900			9.0000	478.7100 (32c)
Timber 1F			101.6300			9.0000	914.6700 (32c)
Masonry GF			25.7200			39.0000	1003.0800 (32c)
Internal Floor			47.6000			12.6000	599.7600 (32d)
Internal Ceiling			47.6000			9.0000	428.4000 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	13770.6360 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							144.6495 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.9781 (36)
Total fabric heat loss						(33) + (36) =	66.4054 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 38.6417	Feb 38.6417	Mar 38.6417	Apr 38.6417	May 38.6417	Jun 38.6417	Jul 38.6417	Aug 38.6417	Sep 38.6417	Oct 38.6417	Nov 38.6417	Dec 38.6417 (38)
Heat transfer coeff	105.0470	105.0470	105.0470	105.0470	105.0470	105.0470	105.0470	105.0470	105.0470	105.0470	105.0470	105.0470 (39)
Average = Sum(39)m / 12 =												105.0470 (39)
HLP	Jan 1.1034	Feb 1.1034	Mar 1.1034	Apr 1.1034	May 1.1034	Jun 1.1034	Jul 1.1034	Aug 1.1034	Sep 1.1034	Oct 1.1034	Nov 1.1034	Dec 1.1034 (40)
HLP (average)												1.1034 (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	2.6904 (42)
Average daily hot water use (litres/day)	98.0976 (43)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.9074	103.9835	100.0596	96.1357	92.2118	88.2879	88.2879	92.2118	96.1357	100.0596	103.9835	107.9074	(44)
Energy conte	160.0236	139.9576	144.4237	125.9121	120.8157	104.2547	96.6073	110.8583	112.1823	130.7377	142.7104	154.9743	(45)
Energy content (annual)	Total = Sum (45)m = 1543.4579												(45)
Distribution loss (46)m = 0.15 x (45)m	24.0035	20.9936	21.6636	18.8868	18.1224	15.6382	14.4911	16.6288	16.8274	19.6107	21.4066	23.2461	(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	14.1406	12.7612	14.1032	13.6033	14.0239	13.5337	13.9613	14.0019	13.5716	14.0703	13.6553	14.1285	(61)
Total heat required for water heating calculated for each month	174.1642	152.7188	158.5269	139.5154	134.8396	117.7884	110.5686	124.8602	125.7540	144.8080	156.3657	169.1028	(62)
WWHRS	-49.7139	-43.7420	-44.6443	-36.7312	-34.1052	-28.1348	-23.8109	-28.8296	-29.6709	-36.6797	-42.4893	-48.0509	eq. (G10)
Total of WWHRS savings	-446.6025												
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	124.4503	108.9768	113.8826	102.7843	100.7344	89.6536	86.7578	96.0306	96.0831	108.1283	113.8765	121.0519	(64)
Heat gains from water heating, kWh/month	56.7430	49.7262	51.5467	45.2666	43.6772	38.0481	35.6123	40.3609	40.6935	46.9879	50.8650	55.0611	(65)
Total per year (kWh/year) = Sum (64)m =	1262.4103												(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	161.4256	161.4256	161.4256	161.4256	161.4256	161.4256	161.4256	161.4256	161.4256	161.4256	161.4256	161.4256	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	58.2292	51.7187	42.0605	31.8425	23.8026	20.0952	21.7136	28.2241	37.8823	48.1003	56.1402	59.8476	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	370.6362	374.4823	364.7904	344.1574	318.1121	293.6331	277.2797	273.4336	283.1255	303.7584	329.8038	354.2828	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.8330	53.8330	53.8330	53.8330	53.8330	53.8330	53.8330	53.8330	53.8330	53.8330	53.8330	53.8330	(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)	-107.6171	-107.6171	-107.6171	-107.6171	-107.6171	-107.6171	-107.6171	-107.6171	-107.6171	-107.6171	-107.6171	-107.6171	(71)
Water heating gains (Table 5)	76.2675	73.9973	69.2832	62.8703	58.7059	52.8446	47.8659	54.2485	56.5188	63.1557	70.6459	74.0068	(72)
Total internal gains	615.7744	610.8398	586.7755	549.5117	511.2621	477.2144	457.5007	466.5477	488.1682	525.6560	567.2314	598.7787	(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
East					2.7000	22.3313	0.4600	0.0000	0.7700					21.3563 (76)
South					6.7800	50.9848	0.4600	0.0000	0.7700					122.4388 (78)
West					1.9800	22.3313	0.4600	0.0000	0.7700					15.6613 (80)
East					3.1500	22.3313	0.4300	0.0000	0.7700					23.2908 (76)

Solar gains	182.7472	286.0789	398.3943	522.4897	577.8286	616.1840	586.8021	545.0447	473.1461	341.4122	225.5954			153.9818 (83)
Total gains	798.5217	896.9187	985.1698	1072.0014	1089.0908	1093.3984	1044.3027	1011.5925	961.3143	867.0683	792.8268			752.7605 (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	36.4139	36.4139	36.4139	36.4139	36.4139	36.4139	36.4139	36.4139	36.4139	36.4139	36.4139	36.4139		
alpha	3.4276	3.4276	3.4276	3.4276	3.4276	3.4276	3.4276	3.4276	3.4276	3.4276	3.4276	3.4276		
util living area	0.9568	0.9363	0.8924	0.8055	0.6655	0.4593	0.3079	0.3272	0.5777	0.8216	0.9285	0.9632	(86)	
MIT	19.6421	19.8344	20.1767	20.5467	20.8268	20.9655	20.9938	20.9922	20.9192	20.5879	20.0568	19.5837	(87)	
Th 2	19.9980	19.9980	19.9980	19.9980	19.9980	19.9980	19.9980	19.9980	19.9980	19.9980	19.9980	19.9980	(88)	
util rest of house	0.9486	0.9247	0.8726	0.7700	0.6058	0.3751	0.2102	0.2271	0.4954	0.7808	0.9131	0.9560	(89)	
MIT 2	18.2258	18.4989	18.9803	19.4817	19.8327	19.9763	19.9962	19.9956	19.9370	19.5477	18.8208	18.1429	(90)	
Living area fraction	fLA = Living area / (4) =												0.1957	(91)
MIT	18.5030	18.7602	19.2144	19.6901	20.0272	20.1699	20.1914	20.1906	20.1292	19.7513	19.0627	18.4248	(92)	
Temperature adjustment	-0.1500													
adjusted MIT	18.3530	18.6102	19.0644	19.5401	19.8772	20.0199	20.0414	20.0406	19.9792	19.6013	18.9127	18.2748	(93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9306	0.9040	0.8502	0.7516	0.5980	0.3770	0.2145	0.2315	0.4937	0.7620	0.8917	0.9393	(94)
Useful gains	743.1344	810.7969	837.5664	805.7343	651.3200	412.1908	224.0323	234.1467	474.6185	660.6659	706.9604	707.1008	(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													
	1392.1872	1366.6837	1225.3109	1012.6655	722.4346	422.2810	224.9483	235.3681	502.0418	840.5089	1146.3445	1383.9777	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Space heating	482.8953	373.5559	288.4819	148.9905	52.9093	0.0000	0.0000	0.0000	0.0000	133.8032	316.3566	503.5964 (98)
Space heating per m2												2300.5890 (98)
											(98) / (4) =	24.1659 (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												2542.0873 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	482.8953	373.5559	288.4819	148.9905	52.9093	0.0000	0.0000	0.0000	0.0000	133.8032	316.3566	503.5964 (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)	533.5859	412.7690	318.7645	164.6303	58.4633	0.0000	0.0000	0.0000	0.0000	147.8488	349.5653	556.4601 (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	124.4503	108.9768	113.8826	102.7843	100.7344	89.6536	86.7578	96.0306	96.0831	108.1283	113.8765	121.0519 (64)
Efficiency of water heater	89.8253	89.7570	89.5707	89.1657	88.3761	87.3000	87.3000	87.3000	87.3000	89.0413	89.6304	87.3000 (216)
Fuel for water heating, kWh/month	138.5470	121.4133	127.1427	115.2733	113.9838	102.6960	99.3789	110.0007	110.0608	121.4362	127.0512	134.7092 (219)
Water heating fuel used												1421.6930 (219)
Annual totals kWh/year												
Space heating fuel - main system												2542.0873 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
(MEV)Decentralised, Database: total watage = 10.3610, total flow = 45.0000, SFP = 0.2302)												
mechanical ventilation fans (SFP = 0.2302)												65.7841 (230a)
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												140.7841 (231)
Electricity for lighting (calculated in Appendix L)												411.3386 (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												2691.7433 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2542.0873	3.9200	99.6498 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1421.6930	3.9200	55.7304 (247)
Mechanical ventilation fans	65.7841	16.9600	11.1570 (249)
Pumps and fans for heating	75.0000	16.9600	12.7200 (249)
Energy for lighting	411.3386	16.9600	69.7630 (250)
Additional standing charges			88.0000 (251)
Energy saving/generation technologies			
PV Unit	-1824.1596	16.9600	-309.3775 (252)
Total energy cost			27.6427 (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	2542.0873	0.2160	549.0908 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1421.6930	0.2160	307.0857 (264)
Space and water heating			856.1765 (265)
Pumps and fans	140.7841	0.5190	73.0670 (267)
Energy for lighting	411.3386	0.5190	213.4847 (268)
Energy saving/generation technologies			
PV Unit	-1824.1596	0.5190	-946.7389 (269)
Total kg/year			195.9894 (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	2542.0873	1.2200	3101.3465 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Water heating (other fuel)	1421.6930	1.2200	1734.4655 (264)
Space and water heating			4835.8119 (265)
Pumps and fans	140.7841	3.0700	432.2072 (267)
Energy for lighting	411.3386	3.0700	1262.8095 (268)
Energy saving/generation technologies			
PV Unit	-1824.1596	3.0700	-5600.1701 (269)
Primary energy kWh/year			930.6586 (272)
Primary energy kWh/m2/year			9.7758 (273)

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

Overheating Calculation Input Data

Dwelling type	Detached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Thames Valley
Front of dwelling faces	South
Overshading	Average or unknown
Thermal mass parameter	144.6 (calculated from construction elements)
Night ventilation	No
Ventilation rate during hot weather (ach)	4.00 (Windows half open)

Overheating Calculation

Summer ventilation heat loss coefficient	309.13 (P1)
Transmission heat loss coefficient	66.41 (37)
Summer heat loss coefficient	375.54 (P2)

Overhangs

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

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer
East	1.000	0.90	1.000	0.900 (P8)
South	1.000	0.90	1.000	0.900 (P8)
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
East	2.7000	117.5071	0.4600	0.0000	0.9000	131.3494
South	6.7800	112.2060	0.4600	0.0000	0.9000	314.9533
West	1.9800	117.5071	0.4600	0.0000	0.9000	96.3229
East	3.1500	117.5071	0.4300	0.0000	0.9000	143.2470
total:						685.8725

	Jun	Jul	Aug	
Solar gains	720	686	637	(P3/P4)
Internal gains	474	455	464	
Total summer gains	1194	1140	1101	(P5)
Summer gain/loss ratio	3.18	3.04	2.93	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 144.6)	0.99	0.99	0.99	
Threshold temperature	20.17	21.92	21.72	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	
Assessment of likelihood of high internal temperature:	Slight			