

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property Reference	X413 Det				Issued on Date	15/12/2022
Assessment Reference	X413 Det		Prop Type Ref	Chestnut		
Property	4 Bed, K, WC, B, En					
SAP Rating	86 B	DER	13.42	TER	17.10	
Environmental	88 B	% DER<TER	21.54			
CO ₂ Emissions (t/year)	1.43	DFEE	45.63	TFEE	58.50	
General Requirements Compliance	Pass	% DFEE<TFEE	21.99			
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 127 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) 17.10 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 13.42 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)58.5 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)45.6 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	1.26 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

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

4 Heating efficiency

Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Ideal LOGIC COMBI ESP1 35
Combi boiler
Efficiency: 89.6% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system:

None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls: Time and temperature zone control OK

Hot water controls:

No cylinder

Boiler interlock

Yes

OK

7 Low energy lights

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

8 Mechanical ventilation

Continuous extract system (decentralised)
Specific fan power: 0.1700 0.1800
Maximum 0.7 OK

9 Summertime temperature

Overheating risk (Thames Valley): Medium OK

Based on:

Overshading: Average
Windows facing North: 17.15 m², No overhang
Windows facing East: 2.31 m², No overhang
Windows facing South: 10.85 m², No overhang
Windows facing West: 1.53 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

10 Key features

Party wall U-value 0.00 W/m²K
Roof U-value 0.09 W/m²K
Floor U-value 0.11 W/m²K
Door U-value 1.00 W/m²K
Thermal bridging y-value 0.021 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	63.5500 (1b)	x 2.5400 (2b)	= 161.4170 (1b) - (3b)
First floor	63.5500 (1c)	x 2.6100 (2c)	= 165.8655 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	127.1000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 327.2825 (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					
	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)					
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)					
Adj infilt rate																	
	0.2556	0.2506	0.2456	0.2206	0.2155	0.1905	0.1905	0.1855	0.2005	0.2155	0.2256	0.2356 (22b)					
Mechanical extract ventilation - decentralised																	
If mechanical ventilation:															0.5000 (23a)		
Effective ac	0.5056	0.5006	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)					

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Window (Uw = 1.20)			19.6100	1.1450	22.4542		(27)					
French Door (Uw = 1.40)			12.2300	1.3258	16.2140		(27)					
Front Door			2.1500	1.0000	2.1500		(26)					
FP McCann System			63.5500	0.1100	6.9905	75.0000	4766.2500 (28a)					
100mm Knauf Supafil 34	166.0400	33.9900	132.0500	0.2500	33.0125	52.8000	6972.2400 (29a)					
Plane Ceiling-500mm Loft Roll	63.5500		63.5500	0.0900	5.7195	9.0000	571.9500 (30)					
Total net area of external elements Aum(A, m2)			293.1400				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	86.5407		(33)					
1F Timber			113.4200			9.0000	1020.7800 (32c)					
GF Masonry			77.8800			39.0000	3037.3200 (32c)					
GF Timber			34.3900			9.0000	309.5100 (32c)					
Internal Floor			63.5500			13.8000	876.9900 (32d)					
Internal Ceiling			63.5500			9.0000	571.9500 (32e)					
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		18126.9900 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							142.6199 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.0208 (36)					
Total fabric heat loss						(33) + (36) =	92.5615 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 54.6105	Feb 54.0691	Mar 54.0016	Apr 54.0016	May 54.0016	Jun 54.0016	Jul 54.0016	Aug 54.0016	Sep 54.0016	Oct 54.0016	Nov 54.0016	Dec 54.0016 (38)
Heat transfer coeff	147.1720	146.6306	146.5631	146.5631	146.5631	146.5631	146.5631	146.5631	146.5631	146.5631	146.5631	146.5631 (39)
Average = Sum(39)m / 12 =												146.6195 (39)
HLP	Jan 1.1579	Feb 1.1537	Mar 1.1531	Apr 1.1531	May 1.1531	Jun 1.1531	Jul 1.1531	Aug 1.1531	Sep 1.1531	Oct 1.1531	Nov 1.1531	Dec 1.1531 (40)
HLP (average)												1.1536 (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												2.8871 (42)
Average daily hot water use (litres/day)												102.7676 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

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Daily hot water use	113.0443	108.9336	104.8229	100.7122	96.6015	92.4908	92.4908	96.6015	100.7122	104.8229	108.9336	113.0443 (44)
Energy conte	167.6415	146.6203	151.2990	131.9062	126.5671	109.2178	101.2063	116.1358	117.5228	136.9615	149.5042	162.3518 (45)
Energy content (annual)										Total = Sum (45)m =		1616.9343 (45)
Distribution loss (46)m = 0.15 x (45)m	25.1462	21.9930	22.6949	19.7859	18.9851	16.3827	15.1810	17.4204	17.6284	20.5442	22.4256	24.3528 (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	14.1589	12.7772	14.1197	13.6294	14.0500	13.5552	13.9812	14.0258	13.5949	14.0853	13.6716	14.1462 (61)
Total heat required for water heating calculated for each month	181.8004	159.3975	165.4187	145.5355	140.6171	122.7730	115.1876	130.1616	131.1176	151.0467	163.1758	176.4980 (62)
WWHRS	-59.9595	-52.7585	-53.8459	-44.2906	-41.1183	-33.9161	-28.6962	-34.7472	-35.7645	-44.2208	-51.2358	-57.9563 eq. (G10)
Total of WWHRS savings												-538.5096
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	121.8409	106.6390	111.5728	101.2450	99.4988	88.8569	86.4914	95.4144	95.3531	106.8260	111.9400	118.5418 (64)
Heat gains from water heating, kWh/month	59.2805	51.9456	53.8369	47.2661	45.5961	39.7037	37.1464	42.1216	42.4750	49.0610	53.1280	57.5185 (65)
Total per year (kWh/year) = Sum (64)m =												1244.2200 (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	144.3528	144.3528	144.3528	144.3528	144.3528	144.3528	144.3528	144.3528	144.3528	144.3528	144.3528	144.3528 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	26.2273	23.2948	18.9446	14.3423	10.7210	9.0512	9.7801	12.7125	17.0627	21.6651	25.2863	26.9562 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	294.1903	297.2430	289.5501	273.1729	252.4995	233.0695	220.0891	217.0363	224.7292	241.1064	261.7798	281.2098 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.4353	37.4353	37.4353	37.4353	37.4353	37.4353	37.4353	37.4353	37.4353	37.4353	37.4353	37.4353 (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)	-115.4823	-115.4823	-115.4823	-115.4823	-115.4823	-115.4823	-115.4823	-115.4823	-115.4823	-115.4823	-115.4823	-115.4823 (71)
Water heating gains (Table 5)	79.6781	77.2999	72.3614	65.6474	61.2850	55.1441	49.9280	56.6150	58.9931	65.9422	73.7889	77.3099 (72)
Total internal gains	469.4015	467.1436	450.1620	422.4685	393.8115	366.5706	349.1030	355.6697	370.0909	398.0196	430.1609	454.7817 (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
				4.9200	10.6334		0.4600		0.0000		0.7700		18.5304 (74)
North				2.3100	19.6403		0.4600		0.0000		0.7700		16.0697 (76)
East				10.8500	46.7521		0.4600		0.0000		0.7700		179.6715 (78)
South				1.5300	19.6403		0.4600		0.0000		0.7700		10.6436 (80)
West				12.2300	10.6334		0.4300		0.0000		0.7700		43.0584 (74)
North													
Solar gains	267.9735	464.2117	660.8888	870.4025	1028.0329	1045.5823	997.5363	875.0441	732.1091	519.4950	322.2580	228.5638	(83)
Total gains	737.3750	931.3554	1111.0508	1292.8709	1421.8443	1412.1529	1346.6393	1230.7138	1102.1999	917.5146	752.4189	683.3456	(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	34.2135	34.3399	34.3557	34.3557	34.3557	34.3557	34.3557	34.3557	34.3557	34.3557	34.3557	34.3557
alpha	3.2809	3.2893	3.2904	3.2904	3.2904	3.2904	3.2904	3.2904	3.2904	3.2904	3.2904	3.2904
util living area	0.9864	0.9711	0.9398	0.8710	0.7505	0.5941	0.4558	0.5108	0.7329	0.9155	0.9759	0.9893 (86)
MIT	19.0682	19.3723	19.7916	20.2763	20.6691	20.8892	20.9652	20.9491	20.7725	20.2351	19.5435	19.0033 (87)
Th 2	19.9538	19.9572	19.9577	19.9577	19.9577	19.9577	19.9577	19.9577	19.9577	19.9577	19.9577	19.9577 (88)
util rest of house	0.9837	0.9653	0.9278	0.8451	0.7018	0.5171	0.3569	0.4088	0.6638	0.8927	0.9701	0.9871 (89)
MIT 2	17.3729	17.8148	18.4161	19.0931	19.6099	19.8677	19.9388	19.9278	19.7500	19.0532	18.0674	17.2809 (90)
Living area fraction									fLA = Living area / (4) =			0.1334 (91)
MIT	17.5991	18.0226	18.5996	19.2510	19.7513	20.0040	20.0758	20.0641	19.8864	19.2109	18.2644	17.5107 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.4491	17.8726	18.4496	19.1010	19.6013	19.8540	19.9258	19.9141	19.7364	19.0609	18.1144	17.3607 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9735	0.9489	0.9047	0.8193	0.6831	0.5089	0.3537	0.4043	0.6471	0.8669	0.9550	0.9785 (94)
Useful gains	717.8054	883.7499	1005.1501	1059.2030	971.2208	718.6219	476.3118	497.5710	713.2043	795.4183	718.5487	668.6587 (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	1935.1821	1902.1794	1751.3708	1495.0890	1158.0363	770.0399	487.4339	515.0306	826.0955	1240.0574	1614.3061	1928.8738 (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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905.7283	684.3846	555.1882	313.8379	138.9908	0.0000	0.0000	0.0000	0.0000	330.8115	644.9453	937.6000 (98)
Space heating											4511.4866 (98)
Space heating per m2										(98) / (4) =	35.4956 (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												4985.0681 (211)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	905.7283	684.3846	555.1882	313.8379	138.9908	0.0000	0.0000	0.0000	0.0000	330.8115	644.9453	937.6000 (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)	1000.8047	756.2261	613.4676	346.7822	153.5809	0.0000	0.0000	0.0000	0.0000	365.5376	712.6468	1036.0221 (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	121.8409	106.6390	111.5728	101.2450	99.4988	88.8569	86.4914	95.4144	95.3531	106.8260	111.9400	118.5418 (64)
Efficiency of water heater	90.1084	90.0550	89.9483	89.6980	89.1369	87.3000	87.3000	87.3000	87.3000	89.6974	90.0120	87.3000 (216)
Fuel for water heating, kWh/month	135.2160	118.4154	124.0411	112.8732	111.6247	101.7834	99.0737	109.2948	109.2247	119.0959	124.3611	131.5243 (219)
Water heating fuel used												1396.5283 (219)
Annual totals kWh/year												
Space heating fuel - main system												4985.0681 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
(MEV)Decentralised, Database: total watage = 8.4890, total flow = 37.0000, SFP = 0.2294)												
mechanical ventilation fans (SFP = 0.2294)												91.6088 (230a)
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												166.6088 (231)
Electricity for lighting (calculated in Appendix L)												463.1819 (232)
Total delivered energy for all uses												7011.3872 (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	4985.0681	0.2160	1076.7747 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1396.5283	0.2160	301.6501 (264)
Space and water heating			1378.4248 (265)
Pumps and fans	166.6088	0.5190	86.4700 (267)
Energy for lighting	463.1819	0.5190	240.3914 (268)
Total CO2, kg/year			1705.2862 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.4200 (273)

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

DER		13.4200 ZC1
Total Floor Area	TFA	127.1000
Assumed number of occupants	N	2.8871
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190
CO2 emissions from appliances, equation (L14)		13.7160 ZC2
CO2 emissions from cooking, equation (L16)		1.4814 ZC3
Total CO2 emissions		28.6175 ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000 ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000 ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000 ZC7
Net CO2 emissions		28.6175 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	63.5500 (1b)	x 2.5400 (2b)	= 161.4170 (1b) - (3b)
First floor	63.5500 (1c)	x 2.6100 (2c)	= 165.8655 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	127.1000		(3a) + (3b) + (3c) + (3d) + (3e)...(3n) = 327.2825 (5)
Dwelling volume			

2. Ventilation rate

					main heating	+	secondary heating	+	other	=	total	m3 per hour
Number of chimneys					0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues					0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans											4 * 10 =	40.0000 (7a)
Number of passive vents											0 * 10 =	0.0000 (7b)
Number of flueless gas fires											0 * 40 =	0.0000 (7c)
												Air changes per hour
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =										40.0000 / (5) =	0.1222 (8)
Pressure test											Yes	
Measured/design AP50											5.0000	
Infiltration rate											0.3722 (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) =	0.3722 (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	0.4746	0.4653	0.4560	0.4094	0.4001	0.3536	0.3536	0.3443	0.3722	0.4001	0.4187	0.4374 (22b)
Effective ac	0.6126	0.6082	0.6040	0.5838	0.5801	0.5625	0.5625	0.5593	0.5693	0.5801	0.5877	0.5956 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opaque door			2.1500	1.0000	2.1500		(26)					
TER Opening Type (Uw = 1.40)			29.6300	1.3258	39.2822		(27)					
FP McCann System			63.5500	0.1300	8.2615		(28a)					
100mm Knauf Supafil 34	166.0400	31.7800	134.2600	0.1800	24.1668		(29a)					
Plane Ceiling-500mm Loft Roll	63.5500		63.5500	0.1300	8.2615		(30)					
Total net area of external elements Aum(A, m2)			293.1400				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26) ... (30) + (32) =		82.1220		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							12.9667 (36)					
Total fabric heat loss						(33) + (36) =	95.0887 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 66.1641	Feb 65.6918	Mar 65.2289	Apr 63.0545	May 62.6477	Jun 60.7539	Jul 60.7539	Aug 60.4032	Sep 61.4834	Oct 62.6477	Nov 63.4707	Dec 64.3311 (38)
Heat transfer coeff	161.2528	160.7805	160.3176	158.1432	157.7364	155.8426	155.8426	155.4919	156.5721	157.7364	158.5594	159.4198 (39)
Average = Sum(39)m / 12 =												158.1413 (39)
HLP	Jan 1.2687	Feb 1.2650	Mar 1.2614	Apr 1.2442	May 1.2410	Jun 1.2261	Jul 1.2261	Aug 1.2234	Sep 1.2319	Oct 1.2410	Nov 1.2475	Dec 1.2543 (40)
HLP (average)												1.2442 (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												2.8871 (42)
Average daily hot water use (litres/day)												102.7676 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	113.0443	108.9336	104.8229	100.7122	96.6015	92.4908	92.4908	96.6015	100.7122	104.8229	108.9336	113.0443 (44)
Energy content (annual)	167.6415	146.6203	151.2990	131.9062	126.5671	109.2178	101.2063	116.1358	117.5228	136.9615	149.5042	162.3518 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		1616.9343 (45)
	25.1462	21.9930	22.6949	19.7859	18.9851	16.3827	15.1810	17.4204	17.6284	20.5442	22.4256	24.3528 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												

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Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Total heat required for water heating calculated for each month	50.9589	46.0274	50.9589	49.3151	49.2271	45.6119	47.1323	49.2271	49.3151	50.9589	49.3151	50.9589 (61)
Solar input	218.6004	192.6477	202.2579	181.2212	175.7942	154.8297	148.3387	165.3628	166.8379	187.9204	198.8192	213.3107 (62)
Output from w/h	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Heat gains from water heating, kWh/month	218.6004	192.6477	202.2579	181.2212	175.7942	154.8297	148.3387	165.3628	166.8379	187.9204	198.8192	213.3107 (64)
	68.4805	60.2581	63.0467	56.1876	54.3903	47.7179	45.4342	50.9219	51.4051	58.2794	62.0389	66.7217 (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	144.3528	144.3528	144.3528	144.3528	144.3528	144.3528	144.3528	144.3528	144.3528	144.3528	144.3528	144.3528	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	26.2273	23.2948	19.9446	14.3423	10.7210	9.0512	9.7801	12.7125	17.0627	21.6651	25.2863	26.9562	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	294.1903	297.2430	289.5501	273.1729	252.4995	233.0695	220.0891	217.0363	224.7292	241.1064	261.7798	281.2098	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.4353	37.4353	37.4353	37.4353	37.4353	37.4353	37.4353	37.4353	37.4353	37.4353	37.4353	37.4353	(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)	-115.4823	-115.4823	-115.4823	-115.4823	-115.4823	-115.4823	-115.4823	-115.4823	-115.4823	-115.4823	-115.4823	-115.4823	(71)
Water heating gains (Table 5)	92.0437	89.6698	84.7401	78.0383	73.1053	66.2749	61.0675	68.4434	71.3960	78.3326	86.1651	89.6797	(72)
Total internal gains	481.7671	479.5135	462.5408	434.8593	405.6317	377.7014	360.2425	367.4981	382.4937	410.4099	442.5371	467.1516	(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	
North					15.9600	10.6334	0.6300	0.7000	0.7700		51.8653 (74)	
East					2.1500	19.6403	0.6300	0.7000	0.7700		12.9050 (76)	
South					10.1000	46.7521	0.6300	0.7000	0.7700		144.3092 (78)	
West					1.4200	19.6403	0.6300	0.7000	0.7700		8.5233 (80)	

Solar gains	217.6027	377.3767	538.5145	711.4733	842.3922	857.6724	817.8930	716.0510	597.2787	422.6418	261.7566	185.5554 (83)
Total gains	699.3698	856.8902	1001.0553	1146.3326	1248.0239	1235.3738	1178.1355	1083.5491	979.7724	833.0517	704.2937	652.7070 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	54.7363	54.8971	55.0556	55.8126	55.9566	56.6366	56.6366	56.7643	56.3727	55.9566	55.6661	55.3657	
alpha	4.6491	4.6598	4.6704	4.7208	4.7304	4.7758	4.7758	4.7843	4.7582	4.7304	4.7111	4.6910	
util living area	0.9986	0.9961	0.9888	0.9623	0.8850	0.7285	0.5628	0.6263	0.8641	0.9796	0.9968	0.9990	(86)
MIT	19.5574	19.7443	20.0333	20.4113	20.7365	20.9290	20.9835	20.9733	20.8298	20.4008	19.9096	19.5307	(87)
Th 2	19.8654	19.8684	19.8712	19.8848	19.8873	19.8991	19.8991	19.9013	19.8946	19.8873	19.8822	19.8768	(88)
util rest of house	0.9981	0.9947	0.9846	0.9473	0.8393	0.6326	0.4317	0.4930	0.7931	0.9689	0.9955	0.9986	(89)
MIT 2	17.9460	18.2208	18.6429	19.1919	19.6276	19.8518	19.8932	19.8904	19.7558	19.1870	18.4726	17.9148	(90)
Living area fraction	18.1610	18.4241	18.8284	19.3546	19.7756	19.9956	20.0387	20.0349	fLA = Living area / (4) =	19.3490	18.6643	0.1334	(91)
Temperature adjustment	18.1610	18.4241	18.8284	19.3546	19.7756	19.9956	20.0387	20.0349	19.8991	19.3490	18.6643	18.1304	(92)
adjusted MIT	18.1610	18.4241	18.8284	19.3546	19.7756	19.9956	20.0387	20.0349	19.8991	19.3490	18.6643	18.1304	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9969	0.9921	0.9790	0.9379	0.8338	0.6418	0.4490	0.5103	0.7935	0.9615	0.9932	0.9977	(94)
Ext temp.	697.2000	850.0813	980.0050	1075.1873	1040.6338	792.8949	529.0341	552.8962	777.4196	800.9500	699.4922	651.2301	(95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Month fracti	2235.1253	2174.4109	1976.4615	1653.3232	1273.8086	840.8570	535.8942	565.1955	907.9731	1380.0337	1833.6327	2220.7809	(97)
Space heating kWh	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 per m2	1144.2164	889.9495	741.3636	416.2579	173.4820	0.0000	0.0000	0.0000	0.0000	430.8382	816.5811	1167.7457	(98)
												5780.4346	(98)
												45.4794	(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													6188.9021 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1144.2164	889.9495	741.3636	416.2579	173.4820	0.0000	0.0000	0.0000	0.0000	430.8382	816.5811	1167.7457	(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)	1225.0711	952.8367	793.7512	445.6722	185.7409	0.0000	0.0000	0.0000	0.0000	461.2829	874.2839	1250.2631	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	218.6004	192.6477	202.2579	181.2212	175.7942	154.8297	148.3387	165.3628	166.8379	187.9204	198.8192	213.3107	(64)
Efficiency of water heater (217)m	88.6122	88.4209	88.0268	87.0780	85.0179	80.3000	80.3000	80.3000	80.3000	87.0738	88.2272	88.6773	(216)
Fuel for water heating, kWh/month	246.6933	217.8757	229.7685	208.1137	206.7732	192.8141	184.7306	205.9313	207.7682	215.8173	225.3493	240.5473	(219)
Water heating fuel used												2582.1824	(219)
Annual totals kWh/year													
Space heating fuel - main system												6188.9021	(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)												463.1819	(232)
Total delivered energy for all uses												9309.2664	(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	6188.9021	0.2160	1336.8029 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2582.1824	0.2160	557.7514 (264)
Space and water heating			1894.5542 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	463.1819	0.5190	240.3914 (268)
Total CO2, kg/m2/year			2173.8707 (272)
Emissions per m2 for space and water heating			14.9060 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			1.8914 (272b)
Emissions per m2 for pumps and fans			0.3063 (272c)
Target Carbon Dioxide Emission Rate (TER) = (14.9060 * 1.00) + 1.8914 + 0.3063, rounded to 2 d.p.			17.1000 (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	63.5500 (1b)	x 2.5400 (2b)	= 161.4170 (1b) - (3b)
First floor	63.5500 (1c)	x 2.6100 (2c)	= 165.8655 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	127.1000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 327.2825 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.1222 (8)
Pressure test					Yes
Measured/design AP50					4.0100
Infiltration rate					0.3227 (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) =	0.3227 (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	0.4115	0.4034	0.3953	0.3550	0.3469	0.3066	0.3066	0.2985	0.3227	0.3469	0.3631	0.3792 (22b)
Effective ac	0.5847	0.5814	0.5781	0.5630	0.5602	0.5470	0.5470	0.5446	0.5521	0.5602	0.5659	0.5719 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Window (Uw = 1.20)			19.6100	1.1450	22.4542		(27)
French Door (Uw = 1.40)			12.2300	1.3258	16.2140		(27)
Front Door			2.1500	1.0000	2.1500		(26)
FP McCann System			63.5500	0.1100	6.9905	75.0000	4766.2500 (28a)
100mm Knauf Supafil 34	166.0400	33.9900	132.0500	0.2500	33.0125	52.8000	6972.2400 (29a)
Plane Ceiling-500mm Loft Roll	63.5500		63.5500	0.0900	5.7195	9.0000	571.9500 (30)
Total net area of external elements Aum(A, m ²)			293.1400				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		86.5407		(33)
1F Timber			113.4200			9.0000	1020.7800 (32c)
GF Masonry			77.8800			39.0000	3037.3200 (32c)
GF Timber			34.3900			9.0000	309.5100 (32c)
Internal Floor			63.5500			13.8000	876.9900 (32d)
Internal Ceiling			63.5500			9.0000	571.9500 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 18126.9900 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							142.6199 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.0208 (36)
Total fabric heat loss							(33) + (36) = 92.5615 (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	63.1443	62.7893	62.4413	60.8068	60.5010	59.0774	59.0774	58.8138	59.6257	60.5010	61.1196	61.7664 (38)
Heat transfer coeff	155.7058	155.3508	155.0028	153.3683	153.0625	151.6389	151.6389	151.3752	152.1872	153.0625	153.6811	154.3279 (39)
Average = Sum(39)m / 12 =												153.3668 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2251	1.2223	1.2195	1.2067	1.2043	1.1931	1.1931	1.1910	1.1974	1.2043	1.2091	1.2142 (40)
HLP (average)												1.2067 (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	2.8871 (42)
Average daily hot water use (litres/day)	102.7676 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	113.0443	108.9336	104.8229	100.7122	96.6015	92.4908	92.4908	96.6015	100.7122	104.8229	108.9336	113.0443 (44)
Energy conte	167.6415	146.6203	151.2990	131.9062	126.5671	109.2178	101.2063	116.1358	117.5228	136.9615	149.5042	162.3518 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Energy content (annual)	Total = Sum(45)m = 1616.9343 (45)											
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	35.6238	31.1568	32.1510	28.0301	26.8955	23.2088	21.5063	24.6788	24.9736	29.1043	31.7696	34.4998 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(66)
(66)m	144.3528	144.3528	144.3528	144.3528	144.3528	144.3528	144.3528	144.3528	144.3528	144.3528	144.3528	144.3528	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	26.2273	23.2948	19.9446	14.3423	10.7210	9.0512	9.7801	12.7125	17.0627	21.6651	25.2863	26.9562	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	294.1903	297.2430	289.5501	273.1729	252.4995	233.0695	220.0891	217.0363	224.7292	241.1064	261.7798	281.2098	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.4353	37.4353	37.4353	37.4353	37.4353	37.4353	37.4353	37.4353	37.4353	37.4353	37.4353	37.4353	(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)	-115.4823	-115.4823	-115.4823	-115.4823	-115.4823	-115.4823	-115.4823	-115.4823	-115.4823	-115.4823	-115.4823	-115.4823	(71)
Water heating gains (Table 5)	47.8815	46.3643	43.2138	38.9306	36.1499	32.2344	28.9064	33.1705	34.6855	39.1187	44.1245	46.3707	(72)
Total internal gains	434.6049	433.2080	418.0144	392.7517	365.6763	340.6609	325.0814	329.2252	342.7833	368.1960	397.4964	420.8425	(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
North					4.9200	10.6334	0.4600	0.0000			0.7700			18.5304 (74)
East					2.3100	19.6403	0.4600	0.0000			0.7700			16.0697 (76)
South					10.8500	46.7521	0.4600	0.0000			0.7700			179.6715 (78)
West					1.5300	19.6403	0.4600	0.0000			0.7700			10.6436 (80)
North					12.2300	10.6334	0.4300	0.0000			0.7700			43.0584 (74)
Solar gains	267.9735	464.2117	660.8888	870.4025	1028.0329	1045.5823	997.5363	875.0441	732.1091	519.4950	322.2580	228.5638	(83)	
Total gains	702.5784	897.4197	1078.9032	1263.1541	1393.7092	1386.2433	1322.6177	1204.2693	1074.8924	887.6911	719.7544	649.4064	(84)	

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	32.3384	32.4123	32.4851	32.8313	32.8969	33.2057	33.2057	33.2635	33.0861	32.8969	32.7644	32.6271	
alpha	3.1559	3.1608	3.1657	3.1888	3.1931	3.2137	3.2137	3.2176	3.2057	3.1931	3.1843	3.1751	
util living area	0.9882	0.9745	0.9466	0.8830	0.7695	0.6142	0.4751	0.5318	0.7533	0.9250	0.9790	0.9907	(86)
MIT	18.9108	19.2157	19.6538	20.1844	20.6131	20.8684	20.9571	20.9381	20.7345	20.1504	19.4241	18.8570	(87)
Th 2	19.9000	19.9022	19.9044	19.9147	19.9166	19.9256	19.9256	19.9272	19.9221	19.9166	19.9127	19.9086	(88)
util rest of house	0.9857	0.9693	0.9354	0.8582	0.7210	0.5348	0.3704	0.4247	0.6842	0.9037	0.9739	0.9888	(89)
MIT 2	17.9966	18.2999	18.7314	19.2479	19.6380	19.8524	19.9097	19.9024	19.7557	19.2290	18.5167	17.9494	(90)
Living area fraction	fLA = Living area / (4) =												0.1334 (91)
MIT	18.1186	18.4221	18.8545	19.3729	19.7681	19.9880	20.0495	20.0406	19.8863	19.3519	18.6378	18.0705	(92)
Temperature adjustment													0.0000
adjusted MIT	18.1186	18.4221	18.8545	19.3729	19.7681	19.9880	20.0495	20.0406	19.8863	19.3519	18.6378	18.0705	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	688.6090	861.4190	994.5761	1065.5146	994.5712	748.2673	506.7035	526.0041	732.6181	789.7725	694.9634	639.0854	(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	2151.6414	2100.6674	1914.9847	1606.2087	1234.9268	817.0243	523.0740	551.0971	880.6075	1339.5902	1773.1370	2140.6129	(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	1088.4961	832.7749	684.7840	389.2997	178.8246	0.0000	0.0000	0.0000	0.0000	409.0644	776.2850	1117.1365	(98)
Space heating													5476.6652 (98)
Space heating per m2	(98) / (4) =												43.0894 (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	1425.4054	1122.1277	1150.4519	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8320	0.8862	0.8573	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1185.9872	994.4064	986.2910	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1737.7870	1660.7498	1524.6159	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	397.2959	495.7595	400.5137	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												1293.5690	(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	99.3240	123.9399	100.1284	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												323.3923	(107)
Space cooling per m2												2.5444	(108)
Energy for space heating												43.0894	(99)
Energy for space cooling												2.5444	(108)
Total												45.6338	(109)
Dwelling Fabric Energy Efficiency (DFEE)												45.6	(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	63.5500 (1b)	x 2.5400 (2b)	= 161.4170 (1b) - (3b)
First floor	63.5500 (1c)	x 2.6100 (2c)	= 165.8655 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	127.1000		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 327.2825 (5)
Dwelling volume			

2. Ventilation rate

					main heating	+	secondary heating	+	other	=	total	m3 per hour
Number of chimneys					0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues					0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans											4 * 10 =	40.0000 (7a)
Number of passive vents											0 * 10 =	0.0000 (7b)
Number of flueless gas fires											0 * 40 =	0.0000 (7c)
												Air changes per hour
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =										40.0000 / (5) =	0.1222 (8)
Pressure test											Yes	
Measured/design AP50											5.0000	
Infiltration rate											0.3722 (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) =	0.3722 (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	0.4746	0.4653	0.4560	0.4094	0.4001	0.3536	0.3536	0.3443	0.3722	0.4001	0.4187	0.4374 (22b)
Effective ac	0.6126	0.6082	0.6040	0.5838	0.5801	0.5625	0.5625	0.5593	0.5693	0.5801	0.5877	0.5956 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opaque door			2.1500	1.0000	2.1500		(26)					
TER Opening Type (Uw = 1.40)			29.6300	1.3258	39.2822		(27)					
FP McCann System			63.5500	0.1300	8.2615		(28a)					
100mm Knauf Supafil 34	166.0400	31.7800	134.2600	0.1800	24.1668		(29a)					
Plane Ceiling-500mm Loft Roll	63.5500		63.5500	0.1300	8.2615		(30)					
Total net area of external elements Aum(A, m2)			293.1400				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	82.1220		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							12.9667 (36)					
Total fabric heat loss						(33) + (36) =	95.0887 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 66.1641	Feb 65.6918	Mar 65.2289	Apr 63.0545	May 62.6477	Jun 60.7539	Jul 60.7539	Aug 60.4032	Sep 61.4834	Oct 62.6477	Nov 63.4707	Dec 64.3311 (38)
Heat transfer coeff	161.2528	160.7805	160.3176	158.1432	157.7364	155.8426	155.8426	155.4919	156.5721	157.7364	158.5594	159.4198 (39)
Average = Sum(39)m / 12 =												158.1413 (39)
HLP	Jan 1.2687	Feb 1.2650	Mar 1.2614	Apr 1.2442	May 1.2410	Jun 1.2261	Jul 1.2261	Aug 1.2234	Sep 1.2319	Oct 1.2410	Nov 1.2475	Dec 1.2543 (40)
HLP (average)												1.2442 (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												2.8871 (42)
Average daily hot water use (litres/day)												102.7676 (43)
Daily hot water use	Jan 113.0443	Feb 108.9336	Mar 104.8229	Apr 100.7122	May 96.6015	Jun 92.4908	Jul 92.4908	Aug 96.6015	Sep 100.7122	Oct 104.8229	Nov 108.9336	Dec 113.0443 (44)
Energy conte	167.6415	146.6203	151.2990	131.9062	126.5671	109.2178	101.2063	116.1358	117.5228	136.9615	149.5042	162.3518 (45)
Energy content (annual)												Total = Sum(45)m = 1616.9343 (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	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Heat gains from water heating, kWh/month	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
	35.6238	31.1568	32.1510	28.0301	26.8955	23.2088	21.5063	24.6788	24.9736	29.1043	31.7696	34.4998	(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	144.3528	144.3528	144.3528	144.3528	144.3528	144.3528	144.3528	144.3528	144.3528	144.3528	144.3528	144.3528	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	26.2273	23.2948	18.9446	14.3423	10.7210	9.0512	9.7801	12.7125	17.0627	21.6651	25.2863	26.9562	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	294.1903	297.2430	289.5501	273.1729	252.4995	233.0695	220.0891	217.0363	224.7292	241.1064	261.7798	281.2098	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.4353	37.4353	37.4353	37.4353	37.4353	37.4353	37.4353	37.4353	37.4353	37.4353	37.4353	37.4353	(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)	-115.4823	-115.4823	-115.4823	-115.4823	-115.4823	-115.4823	-115.4823	-115.4823	-115.4823	-115.4823	-115.4823	-115.4823	(71)
Water heating gains (Table 5)	47.8815	46.3643	43.2138	38.9306	36.1499	32.2344	28.9064	33.1705	34.6855	39.1187	44.1245	46.3707	(72)
Total internal gains	434.6049	433.2080	418.0144	392.7517	365.6763	340.6609	325.0814	329.2252	342.7833	368.1960	397.4964	420.8425	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	FF	Access factor Table 6d	Gains W
North	15.9600	10.6334	0.6300		0.7000	0.7700	51.8653 (74)
East	2.1500	19.6403	0.6300		0.7000	0.7700	12.9050 (76)
South	10.1000	46.7521	0.6300		0.7000	0.7700	144.3092 (78)
West	1.4200	19.6403	0.6300		0.7000	0.7700	8.5233 (80)

Solar gains	217.6027	377.3767	538.5145	711.4733	842.3922	857.6724	817.8930	716.0510	597.2787	422.6418	261.7566	185.5554	(83)
Total gains	652.2076	810.5847	956.5289	1104.2250	1208.0685	1198.3333	1142.9744	1045.2762	940.0620	790.8379	659.2531	606.3980	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	54.7363	54.8971	55.0556	55.8126	55.9566	56.6366	56.6366	56.7643	56.3727	55.9566	55.6661	55.3657	
alpha	4.6491	4.6598	4.6704	4.7208	4.7304	4.7758	4.7758	4.7843	4.7582	4.7304	4.7111	4.6910	
util living area	0.9990	0.9969	0.9906	0.9670	0.8951	0.7434	0.5779	0.6447	0.8784	0.9833	0.9976	0.9993	(86)
MIT	19.5235	19.7114	20.0027	20.3856	20.7197	20.9224	20.9816	20.9698	20.8147	20.3729	19.8774	19.4973	(87)
Th 2	19.8654	19.8684	19.8712	19.8848	19.8873	19.8991	19.8991	19.9013	19.8946	19.8873	19.8822	19.8768	(88)
util rest of house	0.9986	0.9958	0.9871	0.9536	0.8518	0.6482	0.4443	0.5096	0.8113	0.9743	0.9966	0.9990	(89)
MIT 2	18.5211	18.7108	19.0025	19.3878	19.6966	19.8634	19.8946	19.8927	19.7893	19.3826	18.8877	18.5038	(90)
Living area fraction									fLA = Living area / (4) =			0.1334	(91)
MIT	18.6548	18.8443	19.1360	19.5209	19.8331	20.0047	20.0396	20.0365	19.9262	19.5147	19.0198	18.6364	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6548	18.8443	19.1360	19.5209	19.8331	20.0047	20.0396	20.0365	19.9262	19.5147	19.0198	18.6364	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	650.9091	806.0511	941.1350	1046.7851	1026.0579	788.8408	528.2872	551.3101	764.9093	767.2259	656.2405	605.5411	(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	2314.7600	2241.9703	2025.7745	1679.6267	1282.8918	842.2787	536.0379	565.4420	912.2129	1406.1750	1889.9936	2301.4485	(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	1237.9051	964.9377	806.9718	455.6460	191.0844	0.0000	0.0000	0.0000	0.0000	475.3781	888.3022	1261.7551	(98)
Space heating												6281.9804	(98)
Space heating per m2										(98) / (4) =		49.4255	(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	1464.9203	1153.2351	1181.7383	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8413	0.9067	0.8744	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1232.4095	1045.6183	1033.3010	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1518.1520	1450.7771	1338.7798	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	205.7346	301.4382	227.2763	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											734.4490 (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	51.4336	75.3595	56.8191	0.0000	0.0000	0.0000 (107)
Space cooling											183.6122 (107)
Space cooling per m2											1.4446 (108)
Energy for space heating											49.4255 (99)
Energy for space cooling											1.4446 (108)
Total											50.8701 (109)
Target Fabric Energy Efficiency (TFEE)											58.5 (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	63.5500 (1b)	x 2.5400 (2b)	= 161.4170 (1b) - (3b)
First floor	63.5500 (1c)	x 2.6100 (2c)	= 165.8655 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	127.1000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 327.2825 (5)

2. Ventilation rate

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

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Window (Uw = 1.20)			19.6100	1.1450	22.4542		(27)					
French Door (Uw = 1.40)			12.2300	1.3258	16.2140		(27)					
Front Door			2.1500	1.0000	2.1500		(26)					
FP McCann System			63.5500	0.1100	6.9905	75.0000	4766.2500 (28a)					
100mm Knauf Supafil 34	166.0400	33.9900	132.0500	0.2500	33.0125	52.8000	6972.2400 (29a)					
Plane Ceiling-500mm Loft Roll	63.5500		63.5500	0.0900	5.7195	9.0000	571.9500 (30)					
Total net area of external elements Aum(A, m2)			293.1400				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	86.5407		(33)					
1F Timber			113.4200			9.0000	1020.7800 (32c)					
GF Masonry			77.8800			39.0000	3037.3200 (32c)					
GF Timber			34.3900			9.0000	309.5100 (32c)					
Internal Floor			63.5500			13.8000	876.9900 (32d)					
Internal Ceiling			63.5500			9.0000	571.9500 (32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	18126.9900 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							142.6199 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.0208 (36)					
Total fabric heat loss						(33) + (36) =	92.5615 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 54.0016	Feb 54.0016	Mar 54.0016	Apr 54.0016	May 54.0016	Jun 54.0016	Jul 54.0016	Aug 54.0016	Sep 54.0016	Oct 54.0016	Nov 54.0016	Dec 54.0016 (38)
Heat transfer coeff	146.5631	146.5631	146.5631	146.5631	146.5631	146.5631	146.5631	146.5631	146.5631	146.5631	146.5631	146.5631 (39)
Average = Sum(39)m / 12 =												146.5631 (39)
HLP	Jan 1.1531	Feb 1.1531	Mar 1.1531	Apr 1.1531	May 1.1531	Jun 1.1531	Jul 1.1531	Aug 1.1531	Sep 1.1531	Oct 1.1531	Nov 1.1531	Dec 1.1531 (40)
HLP (average)												1.1531 (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												2.8871 (42)
Average daily hot water use (litres/day)												102.7676 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Daily hot water use	113.0443	108.9336	104.8229	100.7122	96.6015	92.4908	92.4908	96.6015	100.7122	104.8229	108.9336	113.0443 (44)
Energy conte	167.6415	146.6203	151.2990	131.9062	126.5671	109.2178	101.2063	116.1358	117.5228	136.9615	149.5042	162.3518 (45)
Energy content (annual)										Total = Sum (45)m =		1616.9343 (45)
Distribution loss (46)m = 0.15 x (45)m	25.1462	21.9930	22.6949	19.7859	18.9851	16.3827	15.1810	17.4204	17.6284	20.5442	22.4256	24.3528 (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	14.1589	12.7772	14.1197	13.6294	14.0500	13.5552	13.9812	14.0258	13.5949	14.0853	13.6716	14.1462 (61)
Total heat required for water heating calculated for each month	181.8004	159.3975	165.4187	145.5355	140.6171	122.7730	115.1876	130.1616	131.1176	151.0467	163.1758	176.4980 (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	181.8004	159.3975	165.4187	145.5355	140.6171	122.7730	115.1876	130.1616	131.1176	151.0467	163.1758	176.4980 (64)
RHI water heating demand										Total per year (kWh/year) = Sum (64)m =		1782.7297 (64)
Heat gains from water heating, kWh/month	59.2805	51.9456	53.8369	47.2661	45.5961	39.7037	37.1464	42.1216	42.4750	49.0610	53.1280	57.5185 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	173.2234	173.2234	173.2234	173.2234	173.2234	173.2234	173.2234	173.2234	173.2234	173.2234	173.2234	173.2234 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	65.5682	58.2371	47.3616	35.8558	26.8026	22.6279	24.4502	31.7813	42.6568	54.1627	63.2158	67.3905 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	439.0899	443.6463	432.1644	407.7207	376.8650	347.8649	328.4911	323.9347	335.4167	359.8603	390.7161	419.7161 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.2094	55.2094	55.2094	55.2094	55.2094	55.2094	55.2094	55.2094	55.2094	55.2094	55.2094	55.2094 (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)	-115.4823	-115.4823	-115.4823	-115.4823	-115.4823	-115.4823	-115.4823	-115.4823	-115.4823	-115.4823	-115.4823	-115.4823 (71)
Water heating gains (Table 5)	79.6781	77.2999	72.3614	65.6474	61.2850	55.1441	49.9280	56.6150	58.9931	65.9422	73.7889	77.3099 (72)
Total internal gains	700.2868	695.1339	667.8379	625.1744	580.9031	541.5874	518.8199	528.2817	553.0172	595.9157	643.6714	680.3671 (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
North				4.9200	11.9814		0.4600		0.0000		0.7700		20.8796 (74)
East				2.3100	22.3313		0.4600		0.0000		0.7700		18.2715 (76)
South				10.8500	50.9848		0.4600		0.0000		0.7700		195.9382 (78)
West				1.5300	22.3313		0.4600		0.0000		0.7700		12.1019 (80)
North				12.2300	11.9814		0.4300		0.0000		0.7700		48.5171 (74)
Solar gains	295.7084	461.8301	652.7427	892.3490	1032.0608	1125.3730	1061.2661	948.3920	785.9961	552.6784	364.4663	249.7076	(83)
Total gains	995.9952	1156.9640	1320.5805	1517.5234	1612.9639	1666.9604	1580.0859	1476.6736	1339.0132	1148.5941	1008.1376	930.0747	(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	34.3557	34.3557	34.3557	34.3557	34.3557	34.3557	34.3557	34.3557	34.3557	34.3557	34.3557	34.3557
Feb	3.2904	3.2904	3.2904	3.2904	3.2904	3.2904	3.2904	3.2904	3.2904	3.2904	3.2904	3.2904
alpha	0.9641	0.9427	0.8950	0.7929	0.6337	0.4226	0.2841	0.3126	0.5742	0.8313	0.9380	0.9702 (86)
util living area	19.4685	19.6961	20.0930	20.5264	20.8319	20.9683	20.9940	20.9917	20.9093	20.5273	19.9272	19.4037 (87)
MIT	19.9577	19.9577	19.9577	19.9577	19.9577	19.9577	19.9577	19.9577	19.9577	19.9577	19.9577	19.9577 (88)
Th 2	0.9571	0.9319	0.8752	0.7557	0.5724	0.3409	0.1902	0.2131	0.4897	0.7910	0.9241	0.9642 (89)
util rest of house	17.9532	18.2776	18.8366	19.4217	19.7998	19.9383	19.9560	19.9551	19.8896	19.4396	18.6135	17.8607 (90)
MIT 2	18.1554	18.4669	19.0043	19.5691	19.9375	20.0757	20.0945	20.0934	20.0257	19.5847	18.7888	18.0666 (92)
Living area fraction									fLA = Living area / (4) =			0.1334 (91)
MIT												-0.1500
Temperature adjustment	18.0054	18.3169	18.8543	19.4191	19.7875	19.9257	19.9445	19.9434	19.8757	19.4347	18.6388	17.9166 (93)
adjusted MIT												

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9387	0.9093	0.8493	0.7337	0.5616	0.3383	0.1890	0.2117	0.4826	0.7668	0.9005	0.9475 (94)
Ext temp.	934.9503	1052.0147	1121.5961	1113.4250	905.8852	563.8698	298.6213	312.6283	646.1509	880.7608	907.8460	881.2056 (95)
Heat loss rate W	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)
Month fracti	1891.4575	1863.8264	1678.7741	1395.1537	994.7969	575.3655	299.6439	314.1495	685.2804	1148.2827	1559.2604	1878.4375 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
	711.6413	545.5375	414.5405	202.8446	66.1504	0.0000	0.0000	0.0000	0.0000	199.0363	469.0184	741.9405 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF HEAT DEMAND 09 Jan 2014

Space heating
RHI space heating demand

3350.7095 (98)
3351 (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	63.5500 (1b)	x 2.5400 (2b)	= 161.4170 (1b) - (3b)
First floor	63.5500 (1c)	x 2.6100 (2c)	= 165.8655 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	127.1000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 327.2825 (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					
	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)					
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)					
Adj infilt rate																	
	0.2556	0.2506	0.2456	0.2206	0.2155	0.1905	0.1905	0.1855	0.2005	0.2155	0.2256	0.2356 (22b)					
Mechanical extract ventilation - decentralised																	
If mechanical ventilation:															0.5000 (23a)		
Effective ac	0.5056	0.5006	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)					

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Window (Uw = 1.20)			19.6100	1.1450	22.4542		(27)					
French Door (Uw = 1.40)			12.2300	1.3258	16.2140		(27)					
Front Door			2.1500	1.0000	2.1500		(26)					
FP McCann System			63.5500	0.1100	6.9905	75.0000	4766.2500 (28a)					
100mm Knauf Supafil 34	166.0400	33.9900	132.0500	0.2500	33.0125	52.8000	6972.2400 (29a)					
Plane Ceiling-500mm Loft Roll	63.5500		63.5500	0.0900	5.7195	9.0000	571.9500 (30)					
Total net area of external elements Aum(A, m2)			293.1400				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	86.5407		(33)					
1F Timber			113.4200			9.0000	1020.7800 (32c)					
GF Masonry			77.8800			39.0000	3037.3200 (32c)					
GF Timber			34.3900			9.0000	309.5100 (32c)					
Internal Floor			63.5500			13.8000	876.9900 (32d)					
Internal Ceiling			63.5500			9.0000	571.9500 (32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	18126.9900 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							142.6199 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.0208 (36)					
Total fabric heat loss						(33) + (36) =	92.5615 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 54.6105	Feb 54.0691	Mar 54.0016	Apr 54.0016	May 54.0016	Jun 54.0016	Jul 54.0016	Aug 54.0016	Sep 54.0016	Oct 54.0016	Nov 54.0016	Dec 54.0016 (38)
Heat transfer coeff	147.1720	146.6306	146.5631	146.5631	146.5631	146.5631	146.5631	146.5631	146.5631	146.5631	146.5631	146.5631 (39)
Average = Sum(39)m / 12 =												146.6195 (39)
HLP	Jan 1.1579	Feb 1.1537	Mar 1.1531	Apr 1.1531	May 1.1531	Jun 1.1531	Jul 1.1531	Aug 1.1531	Sep 1.1531	Oct 1.1531	Nov 1.1531	Dec 1.1531 (40)
HLP (average)												1.1536 (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												2.8871 (42)
Average daily hot water use (litres/day)												102.7676 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Daily hot water use	113.0443	108.9336	104.8229	100.7122	96.6015	92.4908	92.4908	96.6015	100.7122	104.8229	108.9336	113.0443 (44)
Energy conte	167.6415	146.6203	151.2990	131.9062	126.5671	109.2178	101.2063	116.1358	117.5228	136.9615	149.5042	162.3518 (45)
Energy content (annual)										Total = Sum (45)m =		1616.9343 (45)
Distribution loss (46)m = 0.15 x (45)m	25.1462	21.9930	22.6949	19.7859	18.9851	16.3827	15.1810	17.4204	17.6284	20.5442	22.4256	24.3528 (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	14.1589	12.7772	14.1197	13.6294	14.0500	13.5552	13.9812	14.0258	13.5949	14.0853	13.6716	14.1462 (61)
Total heat required for water heating calculated for each month												
WWHRS	181.8004	159.3975	165.4187	145.5355	140.6171	122.7730	115.1876	130.1616	131.1176	151.0467	163.1758	176.4980 (62)
Total of WWHRS savings	-59.9595	-52.7585	-53.8459	-44.2906	-41.1183	-33.9161	-28.6962	-34.7472	-35.7645	-44.2208	-51.2358	-57.9563 eq. (G10)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	121.8409	106.6390	111.5728	101.2450	99.4988	88.8569	86.4914	95.4144	95.3531	106.8260	111.9400	118.5418 (64)
Heat gains from water heating, kWh/month	59.2805	51.9456	53.8369	47.2661	45.5961	39.7037	37.1464	42.1216	42.4750	49.0610	53.1280	57.5185 (65)
Total per year (kWh/year) = Sum (64)m =												1244.2200 (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	173.2234	173.2234	173.2234	173.2234	173.2234	173.2234	173.2234	173.2234	173.2234	173.2234	173.2234	173.2234 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	65.5682	58.2371	47.3616	35.8558	26.8026	22.6279	24.4502	31.7813	42.6568	54.1627	63.2158	67.3905 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	439.0899	443.6463	432.1644	407.7207	376.8650	347.8649	328.4911	323.9347	335.4167	359.8603	390.7161	419.7161 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.2094	55.2094	55.2094	55.2094	55.2094	55.2094	55.2094	55.2094	55.2094	55.2094	55.2094	55.2094 (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)	-115.4823	-115.4823	-115.4823	-115.4823	-115.4823	-115.4823	-115.4823	-115.4823	-115.4823	-115.4823	-115.4823	-115.4823 (71)
Water heating gains (Table 5)	79.6781	77.2999	72.3614	65.6474	61.2850	55.1441	49.9280	56.6150	58.9931	65.9422	73.7889	77.3099 (72)
Total internal gains	700.2868	695.1339	667.8379	625.1744	580.9031	541.5874	518.8199	528.2817	553.0172	595.9157	643.6714	680.3671 (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
North					4.9200	10.6334		0.4600	0.0000	0.7700		18.5304 (74)
East					2.3100	19.6403		0.4600	0.0000	0.7700		16.0697 (76)
South					10.8500	46.7521		0.4600	0.0000	0.7700		179.6715 (78)
West					1.5300	19.6403		0.4600	0.0000	0.7700		10.6436 (80)
North					12.2300	10.6334		0.4300	0.0000	0.7700		43.0584 (74)

Solar gains	267.9735	464.2117	660.8888	870.4025	1028.0329	1045.5823	997.5363	875.0441	732.1091	519.4950	322.2580	228.5638 (83)
Total gains	968.2603	1159.3456	1328.7267	1495.5769	1608.9360	1587.1698	1516.3562	1403.3258	1285.1262	1115.4108	965.9293	908.9309 (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	34.2135	34.3399	34.3557	34.3557	34.3557	34.3557	34.3557	34.3557	34.3557	34.3557	34.3557	34.3557
alpha	3.2809	3.2893	3.2904	3.2904	3.2904	3.2904	3.2904	3.2904	3.2904	3.2904	3.2904	3.2904
util living area	0.9709	0.9485	0.9078	0.8276	0.6998	0.5432	0.4102	0.4570	0.6683	0.8699	0.9530	0.9759 (86)
MIT	19.3057	19.5905	19.9727	20.4011	20.7350	20.9151	20.9745	20.9633	20.8295	20.3808	19.7517	19.2391 (87)
Th 2	19.9538	19.9572	19.9577	19.9577	19.9577	19.9577	19.9577	19.9577	19.9577	19.9577	19.9577	19.9577 (88)
util rest of house	0.9654	0.9391	0.8910	0.7967	0.6487	0.4688	0.3191	0.3624	0.5966	0.8391	0.9427	0.9713 (89)
MIT 2	17.7153	18.1252	18.6668	19.2552	19.6849	19.8903	19.9442	19.9367	19.8073	19.2446	18.3632	17.6219 (90)
Living area fraction									fLA = Living area / (4) =			0.1334 (91)
MIT	17.9276	18.3208	18.8410	19.4081	19.8250	20.0270	20.0816	20.0737	19.9437	19.3962	18.5484	17.8377 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.7776	18.1708	18.6910	19.2581	19.6750	19.8770	19.9316	19.9237	19.7937	19.2462	18.3984	17.6877 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9490	0.9175	0.8655	0.7726	0.6334	0.4627	0.3167	0.3592	0.5841	0.8133	0.9215	0.9565 (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 (95)
Heat loss rate W	1983.5181	1945.8987	1786.7572	1518.1109	1168.8405	773.4161	488.2953	516.4473	834.4880	1267.2203	1655.9347	1976.7952 (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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Space heating	792.1250	592.8709	473.7106	261.0688	111.3925	0.0000	0.0000	0.0000	0.0000	267.9081	551.3911	823.8782 (98)
Space heating per m2												3874.3453 (98)
											(98) / (4) =	30.4827 (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												4281.0445 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	792.1250	592.8709	473.7106	261.0688	111.3925	0.0000	0.0000	0.0000	0.0000	267.9081	551.3911	823.8782 (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)	875.2763	655.1060	523.4371	288.4738	123.0857	0.0000	0.0000	0.0000	0.0000	296.0310	609.2720	910.3626 (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	121.8409	106.6390	111.5728	101.2450	99.4988	88.8569	86.4914	95.4144	95.3531	106.8260	111.9400	118.5418 (64)
Efficiency of water heater	90.0599	89.9971	89.8720	89.5824	88.9615	87.3000	87.3000	87.3000	87.3000	89.5641	89.9436	87.3000 (216)
Fuel for water heating, kWh/month	135.2887	118.4916	124.1464	113.0188	111.8448	101.7834	99.0737	109.2948	109.2247	119.2732	124.4557	131.5893 (219)
Water heating fuel used												1397.4851 (219)
Annual totals kWh/year												
Space heating fuel - main system												4281.0445 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
(MEV)Decentralised, Database: total watage = 8.4890, total flow = 37.0000, SFP = 0.2294)												
mechanical ventilation fans (SFP = 0.2294)												91.6088 (230a)
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												166.6088 (231)
Electricity for lighting (calculated in Appendix L)												463.1819 (232)
Total delivered energy for all uses												6308.3204 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	4281.0445	3.4800	148.9803 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1397.4851	3.4800	48.6325 (247)
Mechanical ventilation fans	91.6088	13.1900	12.0832 (249)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	463.1819	13.1900	61.0937 (250)
Additional standing charges			120.0000 (251)
Total energy cost			400.6822 (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] =	0.9778 (257)
SAP value		86.3591
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	4281.0445	0.2160	924.7056 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1397.4851	0.2160	301.8568 (264)
Space and water heating			1226.5624 (265)
Pumps and fans	166.6088	0.5190	86.4700 (267)
Energy for lighting	463.1819	0.5190	240.3914 (268)
Total kg/year			1553.4238 (272)
CO2 emissions per m2			12.2200 (273)
EI value			87.9048
EI rating			88 (274)
EI band			B

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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	$3.48 / 0.8894 = 3.913$, stars = 5
Water heating environmental impact	$0.216 / 0.8894 = 0.2429$, 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	63.5500 (1b)	x 2.5400 (2b)	= 161.4170 (1b) - (3b)
First floor	63.5500 (1c)	x 2.6100 (2c)	= 165.8655 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	127.1000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 327.2825 (5)

2. Ventilation rate

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

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Window (Uw = 1.20)			19.6100	1.1450	22.4542		(27)					
French Door (Uw = 1.40)			12.2300	1.3258	16.2140		(27)					
Front Door			2.1500	1.0000	2.1500		(26)					
FP McCann System			63.5500	0.1100	6.9905	75.0000	4766.2500 (28a)					
100mm Knauf Supafil 34	166.0400	33.9900	132.0500	0.2500	33.0125	52.8000	6972.2400 (29a)					
Plane Ceiling-500mm Loft Roll	63.5500		63.5500	0.0900	5.7195	9.0000	571.9500 (30)					
Total net area of external elements Aum(A, m2)			293.1400				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	86.5407		(33)					
1F Timber			113.4200			9.0000	1020.7800 (32c)					
GF Masonry			77.8800			39.0000	3037.3200 (32c)					
GF Timber			34.3900			9.0000	309.5100 (32c)					
Internal Floor			63.5500			13.8000	876.9900 (32d)					
Internal Ceiling			63.5500			9.0000	571.9500 (32e)					
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		18126.9900 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							142.6199 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.0208 (36)					
Total fabric heat loss						(33) + (36) =	92.5615 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 54.0016	Feb 54.0016	Mar 54.0016	Apr 54.0016	May 54.0016	Jun 54.0016	Jul 54.0016	Aug 54.0016	Sep 54.0016	Oct 54.0016	Nov 54.0016	Dec 54.0016 (38)
Heat transfer coeff	146.5631	146.5631	146.5631	146.5631	146.5631	146.5631	146.5631	146.5631	146.5631	146.5631	146.5631	146.5631 (39)
Average = Sum(39)m / 12 =												146.5631 (39)
HLP	Jan 1.1531	Feb 1.1531	Mar 1.1531	Apr 1.1531	May 1.1531	Jun 1.1531	Jul 1.1531	Aug 1.1531	Sep 1.1531	Oct 1.1531	Nov 1.1531	Dec 1.1531 (40)
HLP (average)												1.1531 (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												2.8871 (42)
Average daily hot water use (litres/day)												102.7676 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

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Daily hot water use	113.0443	108.9336	104.8229	100.7122	96.6015	92.4908	92.4908	96.6015	100.7122	104.8229	108.9336	113.0443 (44)
Energy conte	167.6415	146.6203	151.2990	131.9062	126.5671	109.2178	101.2063	116.1358	117.5228	136.9615	149.5042	162.3518 (45)
Energy content (annual)										Total = Sum (45)m =		1616.9343 (45)
Distribution loss (46)m = 0.15 x (45)m	25.1462	21.9930	22.6949	19.7859	18.9851	16.3827	15.1810	17.4204	17.6284	20.5442	22.4256	24.3528 (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	14.1589	12.7772	14.1197	13.6294	14.0500	13.5552	13.9812	14.0258	13.5949	14.0853	13.6716	14.1462 (61)
Total heat required for water heating calculated for each month												
WWHRS	181.8004	159.3975	165.4187	145.5355	140.6171	122.7730	115.1876	130.1616	131.1176	151.0467	163.1758	176.4980 (62)
Total of WWHRS savings	-59.9595	-52.7585	-53.8459	-44.2906	-41.1183	-33.9161	-28.6962	-34.7472	-35.7645	-44.2208	-51.2358	-57.9563 eq. (G10)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	121.8409	106.6390	111.5728	101.2450	99.4988	88.8569	86.4914	95.4144	95.3531	106.8260	111.9400	118.5418 (64)
Heat gains from water heating, kWh/month	59.2805	51.9456	53.8369	47.2661	45.5961	39.7037	37.1464	42.1216	42.4750	49.0610	53.1280	57.5185 (65)
Total per year (kWh/year) = Sum (64)m =												1244.2200 (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	173.2234	173.2234	173.2234	173.2234	173.2234	173.2234	173.2234	173.2234	173.2234	173.2234	173.2234	173.2234 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	65.5682	58.2371	47.3616	35.8558	26.8026	22.6279	24.4502	31.7813	42.6568	54.1627	63.2158	67.3905 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	439.0899	443.6463	432.1644	407.7207	376.8650	347.8649	328.4911	323.9347	335.4167	359.8603	390.7161	419.7161 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.2094	55.2094	55.2094	55.2094	55.2094	55.2094	55.2094	55.2094	55.2094	55.2094	55.2094	55.2094 (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)	-115.4823	-115.4823	-115.4823	-115.4823	-115.4823	-115.4823	-115.4823	-115.4823	-115.4823	-115.4823	-115.4823	-115.4823 (71)
Water heating gains (Table 5)	79.6781	77.2999	72.3614	65.6474	61.2850	55.1441	49.9280	56.6150	58.9931	65.9422	73.7889	77.3099 (72)
Total internal gains	700.2868	695.1339	667.8379	625.1744	580.9031	541.5874	518.8199	528.2817	553.0172	595.9157	643.6714	680.3671 (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
North					4.9200	11.9814		0.4600	0.0000	0.7700		20.8796 (74)
East					2.3100	22.3313		0.4600	0.0000	0.7700		18.2715 (76)
South					10.8500	50.9848		0.4600	0.0000	0.7700		195.9382 (78)
West					1.5300	22.3313		0.4600	0.0000	0.7700		12.1019 (80)
North					12.2300	11.9814		0.4300	0.0000	0.7700		48.5171 (74)

Solar gains	295.7084	461.8301	652.7427	892.3490	1032.0608	1125.3730	1061.2661	948.3920	785.9961	552.6784	364.4663	249.7076 (83)
Total gains	995.9952	1156.9640	1320.5805	1517.5234	1612.9639	1666.9604	1580.0859	1476.6736	1339.0132	1148.5941	1008.1376	930.0747 (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	34.3557	34.3557	34.3557	34.3557	34.3557	34.3557	34.3557	34.3557	34.3557	34.3557	34.3557	34.3557
alpha	3.2904	3.2904	3.2904	3.2904	3.2904	3.2904	3.2904	3.2904	3.2904	3.2904	3.2904	3.2904
util living area	0.9641	0.9427	0.8950	0.7929	0.6337	0.4226	0.2841	0.3126	0.5742	0.8313	0.9380	0.9702 (86)
MIT	19.4685	19.6961	20.0930	20.5264	20.8319	20.9683	20.9940	20.9917	20.9093	20.5273	19.9272	19.4037 (87)
Th 2	19.9577	19.9577	19.9577	19.9577	19.9577	19.9577	19.9577	19.9577	19.9577	19.9577	19.9577	19.9577 (88)
util rest of house	0.9571	0.9319	0.8752	0.7557	0.5724	0.3409	0.1902	0.2131	0.4897	0.7910	0.9241	0.9642 (89)
MIT 2	17.9532	18.2776	18.8366	19.4217	19.7998	19.9383	19.9560	19.9551	19.8896	19.4396	18.6135	17.8607 (90)
Living area fraction									fLA = Living area / (4) =			0.1334 (91)
MIT	18.1554	18.4669	19.0043	19.5691	19.9375	20.0757	20.0945	20.0934	20.0257	19.5847	18.7888	18.0666 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.0054	18.3169	18.8543	19.4191	19.7875	19.9257	19.9445	19.9434	19.8757	19.4347	18.6388	17.9166 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	934.9503	1052.0147	1121.5961	1113.4250	905.8852	563.8698	298.6213	312.6283	646.1509	880.7608	907.8460	881.2056 (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	1891.4575	1863.8264	1678.7741	1395.1537	994.7969	575.3655	299.6439	314.1495	685.2804	1148.2827	1559.2604	1878.4375 (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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711.6413	545.5375	414.5405	202.8446	66.1504	0.0000	0.0000	0.0000	0.0000	199.0363	469.0184	741.9405 (98)
Space heating											3350.7095 (98)
Space heating per m2									(98) / (4) =		26.3628 (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												3702.4414 (211)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	711.6413	545.5375	414.5405	202.8446	66.1504	0.0000	0.0000	0.0000	0.0000	199.0363	469.0184	741.9405 (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)	786.3440	602.8039	458.0557	224.1377	73.0943	0.0000	0.0000	0.0000	0.0000	219.9297	518.2523	819.8238 (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	121.8409	106.6390	111.5728	101.2450	99.4988	88.8569	86.4914	95.4144	95.3531	106.8260	111.9400	118.5418 (64)
Efficiency of water heater (217)m	90.0177	89.9608	89.8019	89.4088	88.5504	87.3000	87.3000	87.3000	87.3000	89.3560	89.8653	87.3000 (216)
Fuel for water heating, kWh/month	135.3522	118.5394	124.2432	113.2382	112.3641	101.7834	99.0737	109.2948	109.2247	119.5509	124.5642	131.6468 (219)
Water heating fuel used												1398.8757 (219)
Annual totals kWh/year												
Space heating fuel - main system												3702.4414 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
(MEV)Decentralised, Database: total watage = 8.4890, total flow = 37.0000, SFP = 0.2294)												
mechanical ventilation fans (SFP = 0.2294)												91.6088 (230a)
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												166.6088 (231)
Electricity for lighting (calculated in Appendix L)												463.1819 (232)
Total delivered energy for all uses												5731.1079 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3702.4414	3.9200	145.1357 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1398.8757	3.9200	54.8359 (247)
Mechanical ventilation fans	91.6088	16.9600	15.5369 (249)
Pumps and fans for heating	75.0000	16.9600	12.7200 (249)
Energy for lighting	463.1819	16.9600	78.5556 (250)
Additional standing charges			88.0000 (251)
Total energy cost			394.7841 (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	3702.4414	0.2160	799.7274 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1398.8757	0.2160	302.1572 (264)
Space and water heating			1101.8845 (265)
Pumps and fans	166.6088	0.5190	86.4700 (267)
Energy for lighting	463.1819	0.5190	240.3914 (268)
Total kg/year			1428.7459 (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	3702.4414	1.2200	4516.9786 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1398.8757	1.2200	1706.6284 (264)
Space and water heating			6223.6070 (265)
Pumps and fans	166.6088	3.0700	511.4892 (267)
Energy for lighting	463.1819	3.0700	1421.9684 (268)
Primary energy kWh/year			8157.0645 (272)
Primary energy kWh/m2/year			64.1783 (273)

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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	+ 7.8	-£ 309	-947 kg (66.3%)

Measures omitted - SAP change or cost saving too small:	SAP change	Cost change	CO2 change
N Solar water heating	+ 0.7	-£ 21	-138 kg (9.7%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar photovoltaic panels	£309 7.45 kg/m ²	A 94	A 95
Total Savings	£309 7.45 kg/m ²		
Potential energy efficiency rating:		A 94	
Potential environmental impact rating:			A 95

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

Typical heating and lighting costs of this home (per year, Thames Valley):			
	Current	Potential	Saving
Electricity	£107	£107	£0
Mains gas	£288	£288	£0
Space heating	£261	£261	£0
Water heating	£55	£55	£0
Lighting	£79	£79	£0
Generated (PV)	-£0	-£309	£309
Total cost of fuels	£395	£86	£309
Total cost of uses	£395	£86	£309
Delivered energy	45 kWh/m ²	31 kWh/m ²	14 kWh/m ²
Carbon dioxide emissions	1.4 tonnes	0.5 tonnes	0.9 tonnes
CO2 emissions per m ²	11 kg/m ²	4 kg/m ²	7 kg/m ²
Primary energy	64 kWh/m ²	20 kWh/m ²	44 kWh/m ²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	63.5500 (1b)	x 2.5400 (2b)	= 161.4170 (1b) - (3b)
First floor	63.5500 (1c)	x 2.6100 (2c)	= 165.8655 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	127.1000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 327.2825 (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					
	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)					
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)					
Adj infilt rate																	
	0.2556	0.2506	0.2456	0.2206	0.2155	0.1905	0.1905	0.1855	0.2005	0.2155	0.2256	0.2356 (22b)					
Mechanical extract ventilation - decentralised																	
If mechanical ventilation:															0.5000 (23a)		
Effective ac	0.5056	0.5006	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)					

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Window (Uw = 1.20)			19.6100	1.1450	22.4542		(27)					
French Door (Uw = 1.40)			12.2300	1.3258	16.2140		(27)					
Front Door			2.1500	1.0000	2.1500		(26)					
FP McCann System			63.5500	0.1100	6.9905	75.0000	4766.2500 (28a)					
100mm Knauf Supafil 34	166.0400	33.9900	132.0500	0.2500	33.0125	52.8000	6972.2400 (29a)					
Plane Ceiling-500mm Loft Roll	63.5500		63.5500	0.0900	5.7195	9.0000	571.9500 (30)					
Total net area of external elements Aum(A, m2)			293.1400				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	86.5407		(33)					
1F Timber			113.4200			9.0000	1020.7800 (32c)					
GF Masonry			77.8800			39.0000	3037.3200 (32c)					
GF Timber			34.3900			9.0000	309.5100 (32c)					
Internal Floor			63.5500			13.8000	876.9900 (32d)					
Internal Ceiling			63.5500			9.0000	571.9500 (32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	18126.9900 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							142.6199 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.0208 (36)					
Total fabric heat loss						(33) + (36) =	92.5615 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 54.6105	Feb 54.0691	Mar 54.0016	Apr 54.0016	May 54.0016	Jun 54.0016	Jul 54.0016	Aug 54.0016	Sep 54.0016	Oct 54.0016	Nov 54.0016	Dec 54.0016 (38)
Heat transfer coeff	147.1720	146.6306	146.5631	146.5631	146.5631	146.5631	146.5631	146.5631	146.5631	146.5631	146.5631	146.5631 (39)
Average = Sum(39)m / 12 =												146.6195 (39)
HLP	Jan 1.1579	Feb 1.1537	Mar 1.1531	Apr 1.1531	May 1.1531	Jun 1.1531	Jul 1.1531	Aug 1.1531	Sep 1.1531	Oct 1.1531	Nov 1.1531	Dec 1.1531 (40)
HLP (average)												1.1536 (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												2.8871 (42)
Average daily hot water use (litres/day)												102.7676 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

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Daily hot water use	113.0443	108.9336	104.8229	100.7122	96.6015	92.4908	92.4908	96.6015	100.7122	104.8229	108.9336	113.0443 (44)
Energy conte	167.6415	146.6203	151.2990	131.9062	126.5671	109.2178	101.2063	116.1358	117.5228	136.9615	149.5042	162.3518 (45)
Energy content (annual)										Total = Sum (45)m =		1616.9343 (45)
Distribution loss (46)m = 0.15 x (45)m	25.1462	21.9930	22.6949	19.7859	18.9851	16.3827	15.1810	17.4204	17.6284	20.5442	22.4256	24.3528 (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	14.1589	12.7772	14.1197	13.6294	14.0500	13.5552	13.9812	14.0258	13.5949	14.0853	13.6716	14.1462 (61)
Total heat required for water heating calculated for each month												
WWHRS	181.8004	159.3975	165.4187	145.5355	140.6171	122.7730	115.1876	130.1616	131.1176	151.0467	163.1758	176.4980 (62)
Total of WWHRS savings	-59.9595	-52.7585	-53.8459	-44.2906	-41.1183	-33.9161	-28.6962	-34.7472	-35.7645	-44.2208	-51.2358	-57.9563 eq. (G10)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	121.8409	106.6390	111.5728	101.2450	99.4988	88.8569	86.4914	95.4144	95.3531	106.8260	111.9400	118.5418 (64)
Heat gains from water heating, kWh/month	59.2805	51.9456	53.8369	47.2661	45.5961	39.7037	37.1464	42.1216	42.4750	49.0610	53.1280	57.5185 (65)
Total per year (kWh/year) = Sum (64)m =												1244.2200 (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	173.2234	173.2234	173.2234	173.2234	173.2234	173.2234	173.2234	173.2234	173.2234	173.2234	173.2234	173.2234 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	65.5682	58.2371	47.3616	35.8558	26.8026	22.6279	24.4502	31.7813	42.6568	54.1627	63.2158	67.3905 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	439.0899	443.6463	432.1644	407.7207	376.8650	347.8649	328.4911	323.9347	335.4167	359.8603	390.7161	419.7161 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.2094	55.2094	55.2094	55.2094	55.2094	55.2094	55.2094	55.2094	55.2094	55.2094	55.2094	55.2094 (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)	-115.4823	-115.4823	-115.4823	-115.4823	-115.4823	-115.4823	-115.4823	-115.4823	-115.4823	-115.4823	-115.4823	-115.4823 (71)
Water heating gains (Table 5)	79.6781	77.2999	72.3614	65.6474	61.2850	55.1441	49.9280	56.6150	58.9931	65.9422	73.7889	77.3099 (72)
Total internal gains	700.2868	695.1339	667.8379	625.1744	580.9031	541.5874	518.8199	528.2817	553.0172	595.9157	643.6714	680.3671 (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
North					4.9200	10.6334	0.4600	0.0000			0.7700	18.5304 (74)
East					2.3100	19.6403	0.4600	0.0000			0.7700	16.0697 (76)
South					10.8500	46.7521	0.4600	0.0000			0.7700	179.6715 (78)
West					1.5300	19.6403	0.4600	0.0000			0.7700	10.6436 (80)
North					12.2300	10.6334	0.4300	0.0000			0.7700	43.0584 (74)

Solar gains	267.9735	464.2117	660.8888	870.4025	1028.0329	1045.5823	997.5363	875.0441	732.1091	519.4950	322.2580	228.5638 (83)
Total gains	968.2603	1159.3456	1328.7267	1495.5769	1608.9360	1587.1698	1516.3562	1403.3258	1285.1262	1115.4108	965.9293	908.9309 (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	34.2135	34.3399	34.3557	34.3557	34.3557	34.3557	34.3557	34.3557	34.3557	34.3557	34.3557	34.3557
alpha	3.2809	3.2893	3.2904	3.2904	3.2904	3.2904	3.2904	3.2904	3.2904	3.2904	3.2904	3.2904
util living area	0.9709	0.9485	0.9078	0.8276	0.6998	0.5432	0.4102	0.4570	0.6683	0.8699	0.9530	0.9759 (86)
MIT	19.3057	19.5905	19.9727	20.4011	20.7350	20.9151	20.9745	20.9633	20.8295	20.3808	19.7517	19.2391 (87)
Th 2	19.9538	19.9572	19.9577	19.9577	19.9577	19.9577	19.9577	19.9577	19.9577	19.9577	19.9577	19.9577 (88)
util rest of house	0.9654	0.9391	0.8910	0.7967	0.6487	0.4688	0.3191	0.3624	0.5966	0.8391	0.9427	0.9713 (89)
MIT 2	17.7153	18.1252	18.6668	19.2552	19.6849	19.8903	19.9442	19.9367	19.8073	19.2446	18.3632	17.6219 (90)
Living area fraction									fLA = Living area / (4) =			0.1334 (91)
MIT	17.9276	18.3208	18.8410	19.4081	19.8250	20.0270	20.0816	20.0737	19.9437	19.3962	18.5484	17.8377 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.7776	18.1708	18.6910	19.2581	19.6750	19.8770	19.9316	19.9237	19.7937	19.2462	18.3984	17.6877 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9490	0.9175	0.8655	0.7726	0.6334	0.4627	0.3167	0.3592	0.5841	0.8133	0.9215	0.9565 (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 (95)
Heat loss rate W	1983.5181	1945.8987	1786.7572	1518.1109	1168.8405	773.4161	488.2953	516.4473	834.4880	1267.2203	1655.9347	1976.7952 (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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Space heating	792.1250	592.8709	473.7106	261.0688	111.3925	0.0000	0.0000	0.0000	0.0000	267.9081	551.3911	823.8782 (98)
Space heating per m2												3874.3453 (98)
												(98) / (4) = 30.4827 (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												4281.0445 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	792.1250	592.8709	473.7106	261.0688	111.3925	0.0000	0.0000	0.0000	0.0000	267.9081	551.3911	823.8782 (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)	875.2763	655.1060	523.4371	288.4738	123.0857	0.0000	0.0000	0.0000	0.0000	296.0310	609.2720	910.3626 (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	121.8409	106.6390	111.5728	101.2450	99.4988	88.8569	86.4914	95.4144	95.3531	106.8260	111.9400	118.5418 (64)
Efficiency of water heater	90.0599	89.9971	89.8720	89.5824	88.9615	87.3000	87.3000	87.3000	87.3000	89.5641	89.9436	87.3000 (216)
Fuel for water heating, kWh/month	135.2887	118.4916	124.1464	113.0188	111.8448	101.7834	99.0737	109.2948	109.2247	119.2732	124.4557	131.5893 (219)
Water heating fuel used												1397.4851 (219)
Annual totals kWh/year												
Space heating fuel - main system												4281.0445 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
(MEV)Decentralised, Database: total watage = 8.4890, total flow = 37.0000, SFP = 0.2294)												
mechanical ventilation fans (SFP = 0.2294)												91.6088 (230a)
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												166.6088 (231)
Electricity for lighting (calculated in Appendix L)												463.1819 (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												4581.0810 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	4281.0445	3.4800	148.9803 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1397.4851	3.4800	48.6325 (247)
Mechanical ventilation fans	91.6088	13.1900	12.0832 (249)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	463.1819	13.1900	61.0937 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-1727.2394	13.1900	-227.8229 (252)
Total energy cost			172.8594 (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] =	0.4219 (257)
SAP value		94.1151
SAP rating (Section 12)		94 (258)
SAP band		A

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	4281.0445	0.2160	924.7056 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1397.4851	0.2160	301.8568 (264)
Space and water heating			1226.5624 (265)
Pumps and fans	166.6088	0.5190	86.4700 (267)
Energy for lighting	463.1819	0.5190	240.3914 (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

656.9865 (272)
5.1700 (273)
94.8846
95 (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	63.5500 (1b)	x 2.5400 (2b)	= 161.4170 (1b) - (3b)
First floor	63.5500 (1c)	x 2.6100 (2c)	= 165.8655 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	127.1000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 327.2825 (5)

2. Ventilation rate

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

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Window (Uw = 1.20)			19.6100	1.1450	22.4542		(27)					
French Door (Uw = 1.40)			12.2300	1.3258	16.2140		(27)					
Front Door			2.1500	1.0000	2.1500		(26)					
FP McCann System			63.5500	0.1100	6.9905	75.0000	4766.2500 (28a)					
100mm Knauf Supafil 34	166.0400	33.9900	132.0500	0.2500	33.0125	52.8000	6972.2400 (29a)					
Plane Ceiling-500mm Loft Roll	63.5500		63.5500	0.0900	5.7195	9.0000	571.9500 (30)					
Total net area of external elements Aum(A, m2)			293.1400				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	86.5407		(33)					
1F Timber			113.4200			9.0000	1020.7800 (32c)					
GF Masonry			77.8800			39.0000	3037.3200 (32c)					
GF Timber			34.3900			9.0000	309.5100 (32c)					
Internal Floor			63.5500			13.8000	876.9900 (32d)					
Internal Ceiling			63.5500			9.0000	571.9500 (32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	18126.9900 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							142.6199 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.0208 (36)					
Total fabric heat loss						(33) + (36) =	92.5615 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 54.0016	Feb 54.0016	Mar 54.0016	Apr 54.0016	May 54.0016	Jun 54.0016	Jul 54.0016	Aug 54.0016	Sep 54.0016	Oct 54.0016	Nov 54.0016	Dec 54.0016 (38)
Heat transfer coeff	146.5631	146.5631	146.5631	146.5631	146.5631	146.5631	146.5631	146.5631	146.5631	146.5631	146.5631	146.5631 (39)
Average = Sum(39)m / 12 =												146.5631 (39)
HLP	Jan 1.1531	Feb 1.1531	Mar 1.1531	Apr 1.1531	May 1.1531	Jun 1.1531	Jul 1.1531	Aug 1.1531	Sep 1.1531	Oct 1.1531	Nov 1.1531	Dec 1.1531 (40)
HLP (average)												1.1531 (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												2.8871 (42)
Average daily hot water use (litres/day)												102.7676 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Daily hot water use	113.0443	108.9336	104.8229	100.7122	96.6015	92.4908	92.4908	96.6015	100.7122	104.8229	108.9336	113.0443 (44)
Energy conte	167.6415	146.6203	151.2990	131.9062	126.5671	109.2178	101.2063	116.1358	117.5228	136.9615	149.5042	162.3518 (45)
Energy content (annual)										Total =	Sum (45)m =	1616.9343 (45)
Distribution loss (46)m = 0.15 x (45)m	25.1462	21.9930	22.6949	19.7859	18.9851	16.3827	15.1810	17.4204	17.6284	20.5442	22.4256	24.3528 (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	14.1589	12.7772	14.1197	13.6294	14.0500	13.5552	13.9812	14.0258	13.5949	14.0853	13.6716	14.1462 (61)
Total heat required for water heating calculated for each month	181.8004	159.3975	165.4187	145.5355	140.6171	122.7730	115.1876	130.1616	131.1176	151.0467	163.1758	176.4980 (62)
WWHRS	-59.9595	-52.7585	-53.8459	-44.2906	-41.1183	-33.9161	-28.6962	-34.7472	-35.7645	-44.2208	-51.2358	-57.9563 eq. (G10)
Total of WWHRS savings												-538.5096
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	121.8409	106.6390	111.5728	101.2450	99.4988	88.8569	86.4914	95.4144	95.3531	106.8260	111.9400	118.5418 (64)
Total per year (kWh/year) = Sum (64)m =												1244.2200 (64)
Heat gains from water heating, kWh/month	59.2805	51.9456	53.8369	47.2661	45.5961	39.7037	37.1464	42.1216	42.4750	49.0610	53.1280	57.5185 (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	173.2234	173.2234	173.2234	173.2234	173.2234	173.2234	173.2234	173.2234	173.2234	173.2234	173.2234	173.2234 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	65.5682	58.2371	47.3616	35.8558	26.8026	22.6279	24.4502	31.7813	42.6568	54.1627	63.2158	67.3905 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	439.0899	443.6463	432.1644	407.7207	376.8650	347.8649	328.4911	323.9347	335.4167	359.8603	390.7161	419.7161 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.2094	55.2094	55.2094	55.2094	55.2094	55.2094	55.2094	55.2094	55.2094	55.2094	55.2094	55.2094 (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)	-115.4823	-115.4823	-115.4823	-115.4823	-115.4823	-115.4823	-115.4823	-115.4823	-115.4823	-115.4823	-115.4823	-115.4823 (71)
Water heating gains (Table 5)	79.6781	77.2999	72.3614	65.6474	61.2850	55.1441	49.9280	56.6150	58.9931	65.9422	73.7889	77.3099 (72)
Total internal gains	700.2868	695.1339	667.8379	625.1744	580.9031	541.5874	518.8199	528.2817	553.0172	595.9157	643.6714	680.3671 (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
North					4.9200	11.9814		0.4600	0.0000	0.7700		20.8796 (74)
East					2.3100	22.3313		0.4600	0.0000	0.7700		18.2715 (76)
South					10.8500	50.9848		0.4600	0.0000	0.7700		195.9382 (78)
West					1.5300	22.3313		0.4600	0.0000	0.7700		12.1019 (80)
North					12.2300	11.9814		0.4300	0.0000	0.7700		48.5171 (74)

Solar gains	295.7084	461.8301	652.7427	892.3490	1032.0608	1125.3730	1061.2661	948.3920	785.9961	552.6784	364.4663	249.7076 (83)
Total gains	995.9952	1156.9640	1320.5805	1517.5234	1612.9639	1666.9604	1580.0859	1476.6736	1339.0132	1148.5941	1008.1376	930.0747 (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	34.3557	34.3557	34.3557	34.3557	34.3557	34.3557	34.3557	34.3557	34.3557	34.3557	34.3557	34.3557
alpha	3.2904	3.2904	3.2904	3.2904	3.2904	3.2904	3.2904	3.2904	3.2904	3.2904	3.2904	3.2904
util living area	0.9641	0.9427	0.8950	0.7929	0.6337	0.4226	0.2841	0.3126	0.5742	0.8313	0.9380	0.9702 (86)
MIT	19.4685	19.6961	20.0930	20.5264	20.8319	20.9683	20.9940	20.9917	20.9093	20.5273	19.9272	19.4037 (87)
Th 2	19.9577	19.9577	19.9577	19.9577	19.9577	19.9577	19.9577	19.9577	19.9577	19.9577	19.9577	19.9577 (88)
util rest of house	0.9571	0.9319	0.8752	0.7557	0.5724	0.3409	0.1902	0.2131	0.4897	0.7910	0.9241	0.9642 (89)
MIT 2	17.9532	18.2776	18.8366	19.4217	19.7998	19.9383	19.9560	19.9551	19.8896	19.4396	18.6135	17.8607 (90)
Living area fraction									fLA =	Living area / (4) =		0.1334 (91)
MIT	18.1554	18.4669	19.0043	19.5691	19.9375	20.0757	20.0945	20.0934	20.0257	19.5847	18.7888	18.0666 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.0054	18.3169	18.8543	19.4191	19.7875	19.9257	19.9445	19.9434	19.8757	19.4347	18.6388	17.9166 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	934.9503	1052.0147	1121.5961	1113.4250	905.8852	563.8698	298.6213	312.6283	646.1509	880.7608	907.8460	881.2056 (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	1891.4575	1863.8264	1678.7741	1395.1537	994.7969	575.3655	299.6439	314.1495	685.2804	1148.2827	1559.2604	1878.4375 (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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Space heating	711.6413	545.5375	414.5405	202.8446	66.1504	0.0000	0.0000	0.0000	0.0000	199.0363	469.0184	741.9405 (98)
Space heating per m2												3350.7095 (98)
											(98) / (4) =	26.3628 (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												3702.4414 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	711.6413	545.5375	414.5405	202.8446	66.1504	0.0000	0.0000	0.0000	0.0000	199.0363	469.0184	741.9405 (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)	786.3440	602.8039	458.0557	224.1377	73.0943	0.0000	0.0000	0.0000	0.0000	219.9297	518.2523	819.8238 (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	121.8409	106.6390	111.5728	101.2450	99.4988	88.8569	86.4914	95.4144	95.3531	106.8260	111.9400	118.5418 (64)
Efficiency of water heater	90.0177	89.9608	89.8019	89.4088	88.5504	87.3000	87.3000	87.3000	87.3000	89.3560	89.8653	87.3000 (216)
Fuel for water heating, kWh/month	135.3522	118.5394	124.2432	113.2382	112.3641	101.7834	99.0737	109.2948	109.2247	119.5509	124.5642	131.6468 (219)
Water heating fuel used												1398.8757 (219)
Annual totals kWh/year												
Space heating fuel - main system												3702.4414 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
(MEV)Decentralised, Database: total watage = 8.4890, total flow = 37.0000, SFP = 0.2294)												
mechanical ventilation fans (SFP = 0.2294)												91.6088 (230a)
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												166.6088 (231)
Electricity for lighting (calculated in Appendix L)												463.1819 (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												3906.9483 (238)

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

	Fuel	Fuel price	Fuel cost
	kWh/year	p/kWh	£/year
Space heating - main system 1	3702.4414	3.9200	145.1357 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1398.8757	3.9200	54.8359 (247)
Mechanical ventilation fans	91.6088	16.9600	15.5369 (249)
Pumps and fans for heating	75.0000	16.9600	12.7200 (249)
Energy for lighting	463.1819	16.9600	78.5556 (250)
Additional standing charges			88.0000 (251)
Energy saving/generation technologies			
PV Unit	-1824.1596	16.9600	-309.3775 (252)
Total energy cost			85.4067 (255)

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

	Energy	Emission factor	Emissions
	kWh/year	kg CO2/kWh	kg CO2/year
Space heating - main system 1	3702.4414	0.2160	799.7274 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1398.8757	0.2160	302.1572 (264)
Space and water heating			1101.8845 (265)
Pumps and fans	166.6088	0.5190	86.4700 (267)
Energy for lighting	463.1819	0.5190	240.3914 (268)
Energy saving/generation technologies			
PV Unit	-1824.1596	0.5190	-946.7389 (269)
Total kg/year			482.0071 (272)

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

	Energy	Primary energy factor	Primary energy
	kWh/year	kg CO2/kWh	kWh/year
Space heating - main system 1	3702.4414	1.2200	4516.9786 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)

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Calculation Type: New Build (As Designed)

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

Water heating (other fuel)	1398.8757	1.2200	1706.6284 (264)
Space and water heating			6223.6070 (265)
Pumps and fans	166.6088	3.0700	511.4892 (267)
Energy for lighting	463.1819	3.0700	1421.9684 (268)
Energy saving/generation technologies			
PV Unit	-1824.1596	3.0700	-5600.1701 (269)
Primary energy kWh/year			2556.8944 (272)
Primary energy kWh/m2/year			20.1172 (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	142.6 (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	432.01 (P1)
Transmission heat loss coefficient	92.56 (37)
Summer heat loss coefficient	524.57 (P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
North	0.000	1.000	None
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
North	1.000	0.90	1.000	0.900 (P8)
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
North	4.9200	81.1852	0.4600	0.0000	0.9000	165.3645
East	2.3100	117.5071	0.4600	0.0000	0.9000	112.3767
South	10.8500	112.2060	0.4600	0.0000	0.9000	504.0181
West	1.5300	117.5071	0.4600	0.0000	0.9000	74.4313
North	12.2300	81.1852	0.4300	0.0000	0.9000	384.2502
total:						1240.4409

	Jun	Jul	Aug	
Solar gains	1315	1240	1109	(P4)
Internal gains	539	516	525	
Total summer gains	1854	1756	1634	(P5)
Summer gain/loss ratio	3.53	3.35	3.11	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 142.6)	1.00	1.00	1.00	
Threshold temperature	20.54	22.25	21.92	(P7)
Likelihood of high internal temperature	Slight	Medium	Slight	
Assessment of likelihood of high internal temperature:	Medium			