

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property Reference	Asher End/Semi			Issued on Date	15/12/2022
Assessment Reference	Asher End/Semi	Prop Type Ref	Asher		
Property	3 Bed, WC, B, 2 Storey				
SAP Rating	86 B	DER	13.02	TER	16.92
Environmental	90 B	% DER<TER	23.04		
CO ₂ Emissions (t/year)	1.02	DFEE	37.22	TFEE	48.28
General Requirements Compliance	Pass	% DFEE<TFEE	22.90		
Assessor Details	Mr. Christopher MacDougall, Chris MacDougall, Tel: 02032 902 902, chris.macdougall@aessc.co.uk			Assessor ID	Q920-0001
Client					

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

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DWELLING AS DESIGNED

Semi-Detached House, total floor area 95 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 16.92 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 13.02 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)48.3 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)37.2 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.25 (max. 0.30)	0.25 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.11 (max. 0.25)	0.11 (max. 0.70)	OK
Roof	0.09 (max. 0.20)	0.09 (max. 0.35)	OK
Openings	1.21 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

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

4 Heating efficiency

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

Secondary heating system:

None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls: Time and temperature zone control OK

Hot water controls:

No cylinder

Boiler interlock

Yes

OK

7 Low energy lights

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

8 Mechanical ventilation

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

9 Summertime temperature

Overheating risk (Thames Valley): Slight OK

Based on:

Overshading: Average
Windows facing North East: 4.88 m², No overhang
Windows facing South West: 9.04 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

10 Key features

Party wall U-value 0.00 W/m²K
Roof U-value 0.09 W/m²K
Floor U-value 0.11 W/m²K
Door U-value 1.00 W/m²K
Window U-value 0.90 W/m²K
Thermal bridging y-value 0.024 W/m²K

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	47.3200 (1b)	x 2.3100 (2b)	= 109.3092 (1b) - (3b)
First floor	47.3200 (1c)	x 2.6100 (2c)	= 123.5052 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	94.6400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 232.8144 (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) =											Air changes per hour		
Pressure test											0.0000 / (5) =		0.0000 (8)
Measured/design AP50											Yes		
Infiltration rate											4.0100		
Number of sides sheltered											0.2005 (18)		
											1 (19)		
Shelter factor											(20) = 1 - [0.075 x (19)] =		0.9250 (20)
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =		0.1855 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind factor	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)	
Adj infilt rate	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)	
	0.2365	0.2318	0.2272	0.2040	0.1994	0.1762	0.1762	0.1716	0.1855	0.1994	0.2086	0.2179 (22b)	
Mechanical extract ventilation - decentralised													
If mechanical ventilation:													0.5000 (23a)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)	

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Solid Door			2.1500	1.0000	2.1500		(26)					
Window (Uw = 1.20)			10.5900	1.1450	12.1260		(27)					
French Door (Uw = 1.40)			3.3300	1.3258	4.4148		(27)					
FP McCann System			47.3200	0.1100	5.2052	75.0000	3549.0000 (28a)					
100mm Knauf Supafil 34	97.3200	16.0700	81.2500	0.2500	20.3125	52.8000	4290.0000 (29a)					
Plane Ceiling-500mm Loft Roll	47.3200		47.3200	0.0900	4.2588	9.0000	425.8800 (30)					
Total net area of external elements Aum(A, m2)			191.9600				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	48.4672		(33)					
E-WM-30			39.9000	0.0000	0.0000	45.0000	1795.5000 (32)					
Timber GF			47.2400			9.0000	425.1600 (32c)					
Timber 1F			96.0800			9.0000	864.7200 (32c)					
AAC GF			50.8200			39.0000	1981.9800 (32c)					
Internal Floor			47.3200			12.6000	596.2320 (32d)					
Internal Ceiling			47.3200			9.0000	425.8800 (32e)					
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		14354.3520 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							151.6732 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.5631 (36)					
Total fabric heat loss						(33) + (36) =	53.0304 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 38.4144	Feb 38.4144	Mar 38.4144	Apr 38.4144	May 38.4144	Jun 38.4144	Jul 38.4144	Aug 38.4144	Sep 38.4144	Oct 38.4144	Nov 38.4144	Dec 38.4144 (38)
Heat transfer coeff	91.4447	91.4447	91.4447	91.4447	91.4447	91.4447	91.4447	91.4447	91.4447	91.4447	91.4447	91.4447 (39)
Average = Sum(39)m / 12 =												91.4447 (39)
HLP	Jan 0.9662	Feb 0.9662	Mar 0.9662	Apr 0.9662	May 0.9662	Jun 0.9662	Jul 0.9662	Aug 0.9662	Sep 0.9662	Oct 0.9662	Nov 0.9662	Dec 0.9662 (40)
HLP (average)												0.9662 (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	2.6841 (42)
Average daily hot water use (litres/day)	97.9464 (43)

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.7411	103.8232	99.9053	95.9875	92.0696	88.1518	88.1518	92.0696	95.9875	99.9053	103.8232	107.7411	(44)
Energy conte	159.7769	139.7419	144.2011	125.7180	120.6294	104.0940	96.4584	110.6874	112.0094	130.5362	142.4904	154.7354	(45)
Energy content (annual)										Total =	Sum (45)m =	1541.0786	(45)
Distribution loss (46)m = 0.15 x (45)m	23.9665	20.9613	21.6302	18.8577	18.0944	15.6141	14.4688	16.6031	16.8014	19.5804	21.3736	23.2103	(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	14.1400	12.7607	14.1023	13.6024	14.0231	13.5330	13.9606	14.0011	13.5708	14.0696	13.6548	14.1279	(61)
Total heat required for water heating calculated for each month	173.9169	152.5025	158.3034	139.3204	134.6525	117.6271	110.4191	124.6886	125.5802	144.6057	156.1452	168.8633	(62)
WWHRS	-53.3282	-46.9221	-47.8901	-39.4020	-36.5853	-30.1808	-25.5427	-30.9264	-31.8287	-39.3470	-45.5787	-51.5443	eq. (G10)
Total of WWHRS savings												-479.0762	
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	120.5887	105.5804	110.4134	99.9185	98.0673	87.4462	84.8764	93.7622	93.7515	105.2587	110.5665	117.3190	(64)
Heat gains from water heating, kWh/month	56.6608	49.6543	51.4724	45.2018	43.6151	37.9945	35.5626	40.3039	40.6358	46.9207	50.7918	54.9815	(65)
Total per year (kWh/year) =										Sum (64)m =		1227.5488	(64)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	134.2030	134.2030	134.2030	134.2030	134.2030	134.2030	134.2030	134.2030	134.2030	134.2030	134.2030	134.2030	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	23.4082	20.7910	16.9083	12.8007	9.5687	8.0783	8.7289	11.3461	15.2287	19.3364	22.5684	24.0588	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	247.3602	249.9270	243.4587	229.6884	212.3059	195.9688	185.0546	182.4878	188.9561	202.7264	220.1089	236.4460	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.4203	36.4203	36.4203	36.4203	36.4203	36.4203	36.4203	36.4203	36.4203	36.4203	36.4203	36.4203	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-107.3624	-107.3624	-107.3624	-107.3624	-107.3624	-107.3624	-107.3624	-107.3624	-107.3624	-107.3624	-107.3624	-107.3624	(71)
Water heating gains (Table 5)	76.1570	73.8904	69.1834	62.7803	58.6224	52.7702	47.7992	54.1719	56.4387	63.0654	70.5441	73.8999	(72)
Total internal gains	413.1863	410.8692	395.8113	371.5303	346.7579	323.0781	307.8435	314.2666	326.8844	351.3890	379.4823	400.6655	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c		Access factor Table 6d		Gains W	
Northeast				4.8800	11.2829	0.4600	0.0000		0.7700		19.5025 (75)	
Southwest				5.7100	36.7938	0.4600	0.0000		0.7700		74.4149 (79)	
Southwest				3.3300	36.7938	0.4300	0.0000		0.7700		40.5675 (79)	
Solar gains	134.4849	235.5555	339.5039	449.5026	529.8050	537.5531	513.4398	451.7603	377.3185	264.9783	162.2616	114.3277 (83)
Total gains	547.6712	646.4247	735.3152	821.0330	876.5629	860.6312	821.2833	766.0269	704.2029	616.3674	541.7439	514.9932 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
tau	43.6036	43.6036	43.6036	43.6036	43.6036	43.6036	43.6036	43.6036	43.6036	43.6036	43.6036	43.6036	
alpha	3.9069	3.9069	3.9069	3.9069	3.9069	3.9069	3.9069	3.9069	3.9069	3.9069	3.9069	3.9069	
util living area	0.9883	0.9771	0.9529	0.8954	0.7840	0.6232	0.4740	0.5240	0.7504	0.9266	0.9792	0.9907 (86)	
MIT	19.5077	19.7276	20.0536	20.4379	20.7529	20.9260	20.9803	20.9709	20.8447	20.4250	19.8790	19.4469 (87)	
Th 2	20.1116	20.1116	20.1116	20.1116	20.1116	20.1116	20.1116	20.1116	20.1116	20.1116	20.1116	20.1116 (88)	
util rest of house	0.9859	0.9726	0.9434	0.8740	0.7412	0.5533	0.3849	0.4326	0.6881	0.9070	0.9743	0.9888 (89)	
MIT 2	18.1031	18.4215	18.8900	19.4295	19.8467	20.0499	20.1004	20.0938	19.9671	19.4226	18.6439	18.0147 (90)	
Living area fraction	18.2992	18.6038	19.0524	19.5703	19.9732	20.1722	20.2232	20.2162	20.0896	19.5625	18.8163	18.2146 (91)	
MIT	18.2992	18.6038	19.0524	19.5703	19.9732	20.1722	20.2232	20.2162	20.0896	19.5625	18.8163	18.2146 (92)	
Temperature adjustment												-0.1500	
adjusted MIT	18.1492	18.4538	18.9024	19.4203	19.8232	20.0222	20.0732	20.0662	19.9396	19.4125	18.6663	18.0646 (93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9782	0.9608	0.9265	0.8540	0.7257	0.5458	0.3809	0.4277	0.6746	0.8872	0.9629	0.9822	(94)
Useful gains	535.7224	621.0708	681.3014	701.1734	636.1026	469.7087	312.8021	327.6560	475.0433	546.8585	521.6317	505.8297	(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	1266.4351	1239.4241	1134.1322	962.0234	742.8233	495.8275	317.6068	335.2579	534.0024	805.8601	1057.6743	1267.8471	(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	543.6503	415.5334	336.9061	187.8120	79.4002	0.0000	0.0000	0.0000	0.0000	192.6972	385.9507	566.9410	(98)

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Space heating 2708.8909 (98)
 Space heating per m2 (98) / (4) = 28.6231 (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													2993.2496 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	543.6503	415.5334	336.9061	187.8120	79.4002	0.0000	0.0000	0.0000	0.0000	192.6972	385.9507	566.9410	(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)	600.7185	459.1530	372.2720	207.5271	87.7351	0.0000	0.0000	0.0000	0.0000	212.9251	426.4648	626.4541	(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	120.5887	105.5804	110.4134	99.9185	98.0673	87.4462	84.8764	93.7622	93.7515	105.2587	110.5665	117.3190	(64)
Efficiency of water heater	89.9017	89.8329	89.6885	89.3625	88.7033	87.3000	87.3000	87.3000	87.3000	89.3431	89.7673	87.3000	(216)
(217)m	89.9017	89.8329	89.6885	89.3625	88.7033	87.3000	87.3000	87.3000	87.3000	89.3431	89.7673	89.9348	(217)
Fuel for water heating, kWh/month	134.1338	117.5299	123.1076	111.8125	110.5566	100.1675	97.2238	107.4023	107.3900	117.8141	123.1702	130.4490	(219)
Water heating fuel used												1380.7572	(219)
Annual totals kWh/year													
Space heating fuel - main system												2993.2496	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 6.6170, total flow = 29.0000, SFP = 0.2282)													
mechanical ventilation fans (SFP = 0.2282)													64.8086 (230a)
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													139.8086 (231)
Electricity for lighting (calculated in Appendix L)													413.3962 (232)
Total delivered energy for all uses													4927.2117 (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	2993.2496	0.2160	646.5419	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1380.7572	0.2160	298.2436	(264)
Space and water heating			944.7855	(265)
Pumps and fans	139.8086	0.5190	72.5607	(267)
Energy for lighting	413.3962	0.5190	214.5527	(268)
Total CO2, kg/year			1231.8988	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.0200	(273)

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

DER	13.0200	ZC1
Total Floor Area	94.6400	TFA
Assumed number of occupants	2.6841	N
CO2 emission factor in Table 12 for electricity displaced from grid	0.5190	EF
CO2 emissions from appliances, equation (L14)	15.4882	ZC2
CO2 emissions from cooking, equation (L16)	1.9381	ZC3
Total CO2 emissions	30.4463	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	30.4463	ZC8

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	47.3200 (1b)	x 2.3100 (2b)	= 109.3092 (1b) - (3b)
First floor	47.3200 (1c)	x 2.6100 (2c)	= 123.5052 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	94.6400		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 232.8144 (5)
Dwelling volume			

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																3 * 10 =	30.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =				30.0000	/ (5) =	0.1289 (8)	
Pressure test										Yes							
Measured/design AP50										5.0000							
Infiltration rate										0.3789 (18)							
Number of sides sheltered										1 (19)							
Shelter factor										(20) = 1 - [0.075 x (19)] =				0.9250 (20)			
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =				0.3504 (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	0.4468	0.4381	0.4293	0.3855	0.3767	0.3329	0.3329	0.3242	0.3504	0.3767	0.3942	0.4118	(22b)				
Effective ac	0.5998	0.5959	0.5921	0.5743	0.5710	0.5554	0.5554	0.5525	0.5614	0.5710	0.5777	0.5848	(25)				

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opaque door			2.1500	1.0000	2.1500		(26)					
TER Opening Type (Uw = 1.40)			13.9200	1.3258	18.4545		(27)					
FP McCann System			47.3200	0.1300	6.1516		(28a)					
100mm Knauf Supafil 34	97.3200	16.0700	81.2500	0.1800	14.6250		(29a)					
Plane Ceiling-500mm Loft Roll	47.3200		47.3200	0.1300	6.1516		(30)					
Total net area of external elements Aum(A, m2)			191.9600				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	47.5327		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.5851 (36)					
Total fabric heat loss						(33) + (36) =	57.1178 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 46.0836	Feb 45.7858	Mar 45.4939	Apr 44.1228	May 43.8663	Jun 42.6721	Jul 42.6721	Aug 42.4510	Sep 43.1321	Oct 43.8663	Nov 44.3852	Dec 44.9277 (38)
Heat transfer coeff	103.2014	102.9036	102.6117	101.2406	100.9841	99.7899	99.7899	99.5688	100.2499	100.9841	101.5031	102.0456 (39)
Average = Sum(39)m / 12 =												101.2394 (39)
HLP	Jan 1.0905	Feb 1.0873	Mar 1.0842	Apr 1.0697	May 1.0670	Jun 1.0544	Jul 1.0544	Aug 1.0521	Sep 1.0593	Oct 1.0670	Nov 1.0725	Dec 1.0783 (40)
HLP (average)												1.0697 (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												2.6841 (42)
Average daily hot water use (litres/day)												97.9464 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	107.7411	103.8232	99.9053	95.9875	92.0696	88.1518	88.1518	92.0696	95.9875	99.9053	103.8232	107.7411 (44)
Energy conte	159.7769	139.7419	144.2011	125.7180	120.6294	104.0940	96.4584	110.6874	112.0094	130.5362	142.4904	154.7354 (45)
Energy content (annual)											Total = Sum(45)m =	1541.0786 (45)
Distribution loss	(46)m = 0.15 x (45)m											
	23.9665	20.9613	21.6302	18.8577	18.0944	15.6141	14.4688	16.6031	16.8014	19.5804	21.3736	23.2103 (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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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	50.9107	47.3363	46.9177	43.4721	44.9212	46.9177	47.3363	50.9107	49.3151	50.9589 (61)
Solar input	210.7358	185.7693	195.1118	173.0543	167.5471	147.5661	141.3796	157.6051	159.3457	181.4468	191.8055	205.6943 (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	210.7358	185.7693	195.1118	173.0543	167.5471	147.5661	141.3796	157.6051	159.3457	181.4468	191.8055	205.6943 (64)
	65.8655	57.9710	60.6745	53.6353	51.8387	45.4793	43.3027	48.5330	49.0772	56.1309	59.7068	64.1892 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	134.2030	134.2030	134.2030	134.2030	134.2030	134.2030	134.2030	134.2030	134.2030	134.2030	134.2030	134.2030	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	23.4082	20.7910	16.9083	12.8007	9.5687	8.0783	8.7289	11.3461	15.2287	19.3364	22.5684	24.0588	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	247.3602	249.9270	243.4587	229.6884	212.3059	195.9688	185.0546	182.4878	188.9561	202.7264	220.1089	236.4460	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.4203	36.4203	36.4203	36.4203	36.4203	36.4203	36.4203	36.4203	36.4203	36.4203	36.4203	36.4203	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-107.3624	-107.3624	-107.3624	-107.3624	-107.3624	-107.3624	-107.3624	-107.3624	-107.3624	-107.3624	-107.3624	-107.3624	(71)
Water heating gains (Table 5)	88.5290	86.2664	81.5518	74.4935	69.6757	63.1657	58.2026	65.2325	68.1628	75.4448	82.9262	86.2759	(72)
Total internal gains	425.5582	423.2452	408.1797	383.2435	357.8111	333.4736	318.2469	325.3273	338.6085	363.7684	391.8643	413.0415	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
Northeast					4.8800	11.2829	0.6300	0.7000	0.7700		16.8273 (75)	
Southwest					9.0400	36.7938	0.6300	0.7000	0.7700		101.6518 (79)	
Solar gains	118.4791	207.4031	298.6243	394.8947	465.0285	471.6566	450.5695	396.7191	331.7230	233.2276	142.9286	100.7348 (83)
Total gains	544.0373	630.6484	706.8040	778.1381	822.8396	805.1302	768.8165	722.0464	670.3315	596.9960	534.7929	513.7763 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	63.6834	63.8677	64.0494	64.9168	65.0817	65.8606	65.8606	66.0068	65.5584	65.0817	64.7490	64.4048	
alpha	5.2456	5.2578	5.2700	5.3278	5.3388	5.3907	5.3907	5.4005	5.3706	5.3388	5.3166	5.2937	
util living area	0.9984	0.9961	0.9895	0.9655	0.8923	0.7323	0.5588	0.6133	0.8560	0.9782	0.9964	0.9988	(86)
MIT	19.8159	19.9675	20.2081	20.5230	20.7935	20.9505	20.9905	20.9847	20.8810	20.5302	20.1162	19.7922	(87)
Th 2	20.0086	20.0112	20.0137	20.0256	20.0278	20.0382	20.0382	20.0402	20.0342	20.0278	20.0233	20.0186	(88)
util rest of house	0.9978	0.9948	0.9857	0.9523	0.8513	0.6455	0.4431	0.4959	0.7887	0.9674	0.9950	0.9984	(89)
MIT 2	18.4242	18.6474	18.9988	19.4573	19.8205	20.0043	20.0346	20.0336	19.9364	19.4752	18.8739	18.3968	(90)
Living area fraction	18.6185	18.8317	19.1676	19.6060	19.9563	20.1364	20.1680	20.1664	20.0682	19.6224	19.0473	18.5916	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6185	18.8317	19.1676	19.6060	19.9563	20.1364	20.1680	20.1664	20.0682	19.6224	19.0473	18.5916	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9966	0.9925	0.9812	0.9450	0.8477	0.6551	0.4592	0.5120	0.7915	0.9613	0.9928	0.9975	(94)
Ext temp.	542.2145	625.9123	693.5076	735.3287	697.5517	527.4525	353.0142	369.6929	530.5514	573.8690	530.9232	512.4887	(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	1477.6858	1433.6184	1299.8407	1083.8827	833.7545	552.4740	356.0510	375.0131	598.3149	911.1234	1212.6905	1468.5981	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating per m2	695.9906	542.7784	451.1118	250.9588	101.3349	0.0000	0.0000	0.0000	0.0000	250.9173	490.8725	711.3454	(98)
												3495.3099	(98)
												36.9327	(99)

8c. Space cooling requirement

Not applicable

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

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Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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													3742.3018 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	695.9906	542.7784	451.1118	250.9588	101.3349	0.0000	0.0000	0.0000	0.0000	250.9173	490.8725	711.3454	(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)	745.1720	581.1332	482.9891	268.6925	108.4956	0.0000	0.0000	0.0000	0.0000	268.6481	525.5594	761.6118	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	210.7358	185.7693	195.1118	173.0543	167.5471	147.5661	141.3796	157.6051	159.3457	181.4468	191.8055	205.6943	(64)
Efficiency of water heater (217)m	87.8324	87.5908	87.0926	85.9860	83.8298	80.3000	80.3000	80.3000	80.3000	85.8675	87.3144	87.9196	(216)
Fuel for water heating, kWh/month	239.9294	212.0876	224.0280	201.2588	199.8658	183.7685	176.0643	196.2704	198.4380	211.3102	219.6722	233.9573	(219)
Water heating fuel used												2496.6505	(219)
Annual totals kWh/year													
Space heating fuel - main system												3742.3018	(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)												413.3962	(232)
Total delivered energy for all uses												6727.3485	(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	3742.3018	0.2160	808.3372 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2496.6505	0.2160	539.2765 (264)
Space and water heating			1347.6137 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	413.3962	0.5190	214.5527 (268)
Total CO2, kg/m2/year			1601.0913 (272)
Emissions per m2 for space and water heating			14.2394 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.2670 (272b)
Emissions per m2 for pumps and fans			0.4113 (272c)
Target Carbon Dioxide Emission Rate (TER) = (14.2394 * 1.00) + 2.2670 + 0.4113, rounded to 2 d.p.			16.9200 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	47.3200 (1b)	x 2.3100 (2b)	= 109.3092 (1b) - (3b)
First floor	47.3200 (1c)	x 2.6100 (2c)	= 123.5052 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	94.6400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 232.8144 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1289 (8)
Pressure test					Yes
Measured/design AP50					4.0100
Infiltration rate					0.3294 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3047 (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	0.3884	0.3808	0.3732	0.3351	0.3275	0.2894	0.2894	0.2818	0.3047	0.3275	0.3427	0.3580 (22b)
Effective ac	0.5754	0.5725	0.5696	0.5562	0.5536	0.5419	0.5419	0.5397	0.5464	0.5536	0.5587	0.5641 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid Door			2.1500	1.0000	2.1500		(26)
Window (Uw = 1.20)			10.5900	1.1450	12.1260		(27)
French Door (Uw = 1.40)			3.3300	1.3258	4.4148		(27)
FP McCann System			47.3200	0.1100	5.2052	75.0000	3549.0000 (28a)
100mm Knauf Supafil 34	97.3200	16.0700	81.2500	0.2500	20.3125	52.8000	4290.0000 (29a)
Plane Ceiling-500mm Loft Roll	47.3200		47.3200	0.0900	4.2588	9.0000	425.8800 (30)
Total net area of external elements Aum(A, m ²)			191.9600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	48.4672		(33)
E-WM-30			39.9000	0.0000	0.0000	45.0000	1795.5000 (32)
Timber GF			47.2400			9.0000	425.1600 (32c)
Timber 1F			96.0800			9.0000	864.7200 (32c)
AAC GF			50.8200			39.0000	1981.9800 (32c)
Internal Floor			47.3200			12.6000	596.2320 (32d)
Internal Ceiling			47.3200			9.0000	425.8800 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	14354.3520 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							151.6732 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.5631 (36)
Total fabric heat loss						(33) + (36) =	53.0304 (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	44.2105	43.9854	43.7648	42.7286	42.5347	41.6322	41.6322	41.4651	41.9798	42.5347	42.9269	43.3669 (38)
Heat transfer coeff	97.2408	97.0158	96.7951	95.7589	95.5651	94.6626	94.6626	94.4954	95.0102	95.5651	95.9573	96.3673 (39)
Average = Sum(39)m / 12 =												95.7580 (39)
HLP	1.0275	1.0251	1.0228	1.0118	1.0098	1.0002	1.0002	0.9985	1.0039	1.0098	1.0139	1.0183 (40)
HLP (average)												1.0118 (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												2.6841 (42)
Average daily hot water use (litres/day)												97.9464 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	107.7411	103.8232	99.9053	95.9875	92.0696	88.1518	88.1518	92.0696	95.9875	99.9053	103.8232	107.7411 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Energy conte	159.7769	139.7419	144.2011	125.7180	120.6294	104.0940	96.4584	110.6874	112.0094	130.5362	142.4904	154.7354 (45)
Energy content (annual)										Total =	Sum (45)m =	1541.0786 (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	33.9526	29.6952	30.6427	26.7151	25.6338	22.1200	20.4974	23.5211	23.8020	27.7389	30.2792	32.8813 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	134.2030	134.2030	134.2030	134.2030	134.2030	134.2030	134.2030	134.2030	134.2030	134.2030	134.2030	134.2030 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	23.4082	20.7910	16.9083	12.8007	9.5687	8.0783	8.7289	11.3461	15.2287	19.3364	22.5684	24.0588 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	247.3602	249.9270	243.4587	229.6884	212.3059	195.9688	185.0546	182.4878	188.9561	202.7264	220.1089	236.4460 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.4203	36.4203	36.4203	36.4203	36.4203	36.4203	36.4203	36.4203	36.4203	36.4203	36.4203	36.4203 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-107.3624	-107.3624	-107.3624	-107.3624	-107.3624	-107.3624	-107.3624	-107.3624	-107.3624	-107.3624	-107.3624	-107.3624 (71)
Water heating gains (Table 5)	45.6352	44.1892	41.1865	37.1043	34.4540	30.7222	27.5503	31.6144	33.0583	37.2835	42.0545	44.1953 (72)
Total internal gains	379.6645	378.1680	364.8144	342.8543	319.5894	298.0302	284.5947	288.7091	300.5040	322.6071	347.9926	367.9609 (73)

6. Solar gains

[Jan]			Area m2		Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
Northeast			4.8800		11.2829		0.4600		0.0000		0.7700		19.5025 (75)
Southwest			5.7100		36.7938		0.4600		0.0000		0.7700		74.4149 (79)
Southwest			3.3300		36.7938		0.4300		0.0000		0.7700		40.5675 (79)
Solar gains	134.4849	235.5555	339.5039	449.5026	529.8050	537.5531	513.4398	451.7603	377.3185	264.9783	162.2616	114.3277	(83)
Total gains	514.1494	613.7235	704.3183	792.3569	849.3945	835.5833	798.0344	740.4694	677.8226	587.5855	510.2542	482.2886	(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	41.0046	41.0997	41.1934	41.6391	41.7236	42.1214	42.1214	42.1959	41.9673	41.7236	41.5531	41.3763
alpha	3.7336	3.7400	3.7462	3.7759	3.7816	3.8081	3.8081	3.8131	3.7978	3.7816	3.7702	3.7584
util living area	0.9906	0.9813	0.9609	0.9101	0.8084	0.6506	0.5000	0.5526	0.7782	0.9390	0.9833	0.9926 (86)
MIT	19.3411	19.5707	19.9170	20.3459	20.6977	20.9067	20.9737	20.9617	20.8081	20.3388	19.7570	19.2986 (87)
Th 2	20.0605	20.0625	20.0644	20.0735	20.0752	20.0831	20.0831	20.0846	20.0801	20.0752	20.0718	20.0682 (88)
util rest of house	0.9887	0.9775	0.9526	0.8904	0.7667	0.5785	0.4047	0.4558	0.7168	0.9217	0.9793	0.9910 (89)
MIT 2	18.5361	18.7652	19.1076	19.5288	19.8522	20.0296	20.0730	20.0686	19.9567	19.5309	18.9587	18.4997 (90)
Living area fraction	18.6485	18.8776	19.2206	19.6429	19.9702	20.1520	20.1987	20.1933	20.0756	19.6437	19.0702	18.6112 (92)
Temperature adjustment	18.6485	18.8776	19.2206	19.6429	19.9702	20.1520	20.1987	20.1933	20.0756	19.6437	19.0702	18.6112 (93)
adjusted MIT	18.6485	18.8776	19.2206	19.6429	19.9702	20.1520	20.1987	20.1933	20.0756	19.6437	19.0702	18.6112 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9847	0.9711	0.9432	0.8797	0.7615	0.5842	0.4171	0.4679	0.7164	0.9116	0.9734	0.9877 (94)
Ext temp.	506.2688	595.9873	664.3075	697.0192	646.7867	488.1872	332.8993	346.4514	485.6075	535.6568	496.6635	476.3381 (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	1395.2574	1356.0475	1231.2887	1028.7239	790.3433	525.5700	340.6625	358.4465	567.7406	864.2599	1148.6239	1388.7658 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating per m2	661.4075	510.7605	421.8340	238.8274	106.8061	0.0000	0.0000	0.0000	0.0000	244.4807	469.4115	678.8462 (98)
												3332.3738 (98)
												35.2111 (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												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	889.8280	700.5029	718.1652	0.0000	0.0000	0.0000	0.0000 (100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.8608	0.9133	0.8915	0.0000	0.0000	0.0000	0.0000 (101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	765.9474	639.7717	640.2437	0.0000	0.0000	0.0000	0.0000 (102)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1079.1870	1033.1674	967.8506	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	225.5326	292.6864	243.7396	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction									FC = cooled area / (4) =			761.9585 (104)
Intermittency factor (Table 10b)												1.0000 (105)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	56.3831	73.1716	60.9349	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling per m2												190.4896 (107)
Energy for space heating												2.0128 (108)
Energy for space cooling												35.2111 (99)
Total												2.0128 (108)
Dwelling Fabric Energy Efficiency (DFEE)												37.2238 (109)
												37.2 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	47.3200 (1b)	x 2.3100 (2b)	= 109.3092 (1b) - (3b)
First floor	47.3200 (1c)	x 2.6100 (2c)	= 123.5052 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	94.6400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 232.8144 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1289 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3789 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3504 (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	0.4468	0.4381	0.4293	0.3855	0.3767	0.3329	0.3329	0.3242	0.3504	0.3767	0.3942	0.4118 (22b)
Effective ac	0.5998	0.5959	0.5921	0.5743	0.5710	0.5554	0.5554	0.5525	0.5614	0.5710	0.5777	0.5848 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			2.1500	1.0000	2.1500		(26)
TER Opening Type (Uw = 1.40)			13.9200	1.3258	18.4545		(27)
FP McCann System			47.3200	0.1300	6.1516		(28a)
100mm Knauf Supafil 34	97.3200	16.0700	81.2500	0.1800	14.6250		(29a)
Plane Ceiling-500mm Loft Roll	47.3200		47.3200	0.1300	6.1516		(30)
Total net area of external elements Aum(A, m ²)			191.9600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	47.5327		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.5851 (36)
Total fabric heat loss						(33) + (36) =	57.1178 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	46.0836	45.7858	45.4939	44.1228	43.8663	42.6721	42.6721	42.4510	43.1321	43.8663	44.3852	44.9277 (38)
Average = Sum(39)m / 12 =	103.2014	102.9036	102.6117	101.2406	100.9841	99.7899	99.7899	99.5688	100.2499	100.9841	101.5031	102.0456 (39)
												101.2394 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.0905	1.0873	1.0842	1.0697	1.0670	1.0544	1.0544	1.0521	1.0593	1.0670	1.0725	1.0783 (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												2.6841 (42)
Average daily hot water use (litres/day)												97.9464 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	107.7411	103.8232	99.9053	95.9875	92.0696	88.1518	88.1518	92.0696	95.9875	99.9053	103.8232	107.7411 (44)
Energy conte	159.7769	139.7419	144.2011	125.7180	120.6294	104.0940	96.4584	110.6874	112.0094	130.5362	142.4904	154.7354 (45)
Energy content (annual)										Total = Sum(45)m =		1541.0786 (45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (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 (59)
	33.9526	29.6952	30.6427	26.7151	25.6338	22.1200	20.4974	23.5211	23.8020	27.7389	30.2792	32.8813 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	134.2030	134.2030	134.2030	134.2030	134.2030	134.2030	134.2030	134.2030	134.2030	134.2030	134.2030	134.2030	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	23.4082	20.7910	16.9083	12.8007	9.5687	8.0783	8.7289	11.3461	15.2287	19.3364	22.5684	24.0588	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	247.3602	249.9270	243.4587	229.6884	212.3059	195.9688	185.0546	182.4878	188.9561	202.7264	220.1089	236.4460	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.4203	36.4203	36.4203	36.4203	36.4203	36.4203	36.4203	36.4203	36.4203	36.4203	36.4203	36.4203	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-107.3624	-107.3624	-107.3624	-107.3624	-107.3624	-107.3624	-107.3624	-107.3624	-107.3624	-107.3624	-107.3624	-107.3624	(71)
Water heating gains (Table 5)	45.6352	44.1892	41.1865	37.1043	34.4540	30.7222	27.5503	31.6144	33.0583	37.2835	42.0545	44.1953	(72)
Total internal gains	379.6645	378.1680	364.8144	342.8543	319.5894	298.0302	284.5947	288.7091	300.5040	322.6071	347.9926	367.9609	(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
Northeast												4.8800	11.2829	0.6300	0.7000	0.7700	16.8273	(75)
Southwest												9.0400	36.7938	0.6300	0.7000	0.7700	101.6518	(79)
Solar gains	118.4791	207.4031	298.6243	394.8947	465.0285	471.6566	450.5695	396.7191	331.7230	233.2276	142.9286	100.7348	(83)					
Total gains	498.1436	585.5712	663.4387	737.7489	784.6179	769.6868	735.1642	685.4282	632.2270	555.8347	490.9212	468.6957	(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	63.6834	63.8677	64.0494	64.9168	65.0817	65.8606	65.8606	66.0068	65.5584	65.0817	64.7490	64.4048	
alpha	5.2456	5.2578	5.2700	5.3278	5.3388	5.3907	5.3907	5.4005	5.3706	5.3388	5.3166	5.2937	
util living area	0.9989	0.9973	0.9921	0.9722	0.9073	0.7556	0.5817	0.6410	0.8783	0.9840	0.9976	0.9992	(86)
MIT	19.7702	19.9231	20.1667	20.4886	20.7710	20.9424	20.9885	20.9812	20.8624	20.4929	20.0728	19.7471	(87)
Th 2	20.0086	20.0112	20.0137	20.0256	20.0278	20.0382	20.0382	20.0402	20.0342	20.0278	20.0233	20.0186	(88)
util rest of house	0.9986	0.9963	0.9892	0.9611	0.8699	0.6697	0.4626	0.5207	0.8163	0.9757	0.9966	0.9990	(89)
MIT 2	18.8813	19.0359	19.2801	19.6054	19.8682	20.0107	20.0352	20.0345	19.9547	19.6150	19.1955	18.8663	(90)
Living area fraction	19.0054	19.1598	19.4039	19.7287	19.9942	20.1408	20.1682	20.1667	20.0814	19.7375	19.3179	18.9893	(92)
MIT	19.0054	19.1598	19.4039	19.7287	19.9942	20.1408	20.1682	20.1667	20.0814	19.7375	19.3179	18.9893	(93)
Temperature adjustment												0.0000	
adjusted MIT	19.0054	19.1598	19.4039	19.7287	19.9942	20.1408	20.1682	20.1667	20.0814	19.7375	19.3179	18.9893	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	497.1728	582.7521	654.6486	705.9077	681.3666	523.1384	352.3509	368.3594	518.3548	540.4532	488.7651	468.0331	(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	1517.6141	1467.3811	1324.0884	1096.3002	837.5871	552.9115	356.0740	375.0427	599.6334	922.7452	1240.1562	1509.1811	(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	759.2083	594.4707	498.0632	281.0826	116.2281	0.0000	0.0000	0.0000	0.0000	284.4252	541.0016	774.6141	(98)
Space heating												3849.0938	(98)
Space heating per m2												40.6709	(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	938.0255	738.4456	756.7229	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8700	0.9309	0.9081	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	816.1002	687.4374	687.1690	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1002.1652	959.6827	903.5167	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	133.9668	202.5505	160.9627	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												497.4799	(104)
Cooled fraction												1.0000	(105)

$$fC = \text{cooled area} / (4) =$$

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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	33.4917	50.6376	40.2407	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling											124.3700 (107)
Space cooling per m2											1.3141 (108)
Energy for space heating											40.6709 (99)
Energy for space cooling											1.3141 (108)
Total											41.9850 (109)
Target Fabric Energy Efficiency (TFEE)											48.3 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	47.3200 (1b)	x 2.3100 (2b)	= 109.3092 (1b) - (3b)
First floor	47.3200 (1c)	x 2.6100 (2c)	= 123.5052 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	94.6400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 232.8144 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																0 * 10 =	0.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =					Air changes per hour		
Pressure test															0.0000 / (5) =		0.0000 (8)
Measured/design AP50															Yes		
Infiltration rate															4.0100		
Number of sides sheltered															0.2005 (18)		
															1 (19)		
Shelter factor										(20) = 1 - [0.075 x (19)] =					0.9250 (20)		
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =					0.1855 (21)		
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)					
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)					
Adj infilt rate																	
	0.1947	0.1855	0.1855	0.1716	0.1716	0.1530	0.1576	0.1484	0.1530	0.1623	0.1623	0.1762 (22b)					
Mechanical extract ventilation - decentralised																	
If mechanical ventilation:															0.5000 (23a)		
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)					

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Solid Door			2.1500	1.0000	2.1500		(26)					
Window (Uw = 1.20)			10.5900	1.1450	12.1260		(27)					
French Door (Uw = 1.40)			3.3300	1.3258	4.4148		(27)					
FP McCann System			47.3200	0.1100	5.2052	75.0000	3549.0000 (28a)					
100mm Knauf Supafil 34	97.3200	16.0700	81.2500	0.2500	20.3125	52.8000	4290.0000 (29a)					
Plane Ceiling-500mm Loft Roll	47.3200		47.3200	0.0900	4.2588	9.0000	425.8800 (30)					
Total net area of external elements Aum(A, m2)			191.9600				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	48.4672		(33)					
E-WM-30			39.9000	0.0000	0.0000	45.0000	1795.5000 (32)					
Timber GF			47.2400			9.0000	425.1600 (32c)					
Timber 1F			96.0800			9.0000	864.7200 (32c)					
AAC GF			50.8200			39.0000	1981.9800 (32c)					
Internal Floor			47.3200			12.6000	596.2320 (32d)					
Internal Ceiling			47.3200			9.0000	425.8800 (32e)					
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		14354.3520 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							151.6732 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.5631 (36)					
Total fabric heat loss						(33) + (36) =	53.0304 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 38.4144	Feb 38.4144	Mar 38.4144	Apr 38.4144	May 38.4144	Jun 38.4144	Jul 38.4144	Aug 38.4144	Sep 38.4144	Oct 38.4144	Nov 38.4144	Dec 38.4144 (38)
Heat transfer coeff	91.4447	91.4447	91.4447	91.4447	91.4447	91.4447	91.4447	91.4447	91.4447	91.4447	91.4447	91.4447 (39)
Average = Sum(39)m / 12 =												91.4447 (39)
HLP	Jan 0.9662	Feb 0.9662	Mar 0.9662	Apr 0.9662	May 0.9662	Jun 0.9662	Jul 0.9662	Aug 0.9662	Sep 0.9662	Oct 0.9662	Nov 0.9662	Dec 0.9662 (40)
HLP (average)												0.9662 (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	2.6841 (42)
Average daily hot water use (litres/day)	97.9464 (43)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.7411	103.8232	99.9053	95.9875	92.0696	88.1518	88.1518	92.0696	95.9875	99.9053	103.8232	107.7411	(44)
Energy conte	159.7769	139.7419	144.2011	125.7180	120.6294	104.0940	96.4584	110.6874	112.0094	130.5362	142.4904	154.7354	(45)
Energy content (annual)	Total = Sum(45)m = 1541.0786												(45)
Distribution loss (46)m = 0.15 x (45)m	23.9665	20.9613	21.6302	18.8577	18.0944	15.6141	14.4688	16.6031	16.8014	19.5804	21.3736	23.2103	(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	14.1400	12.7607	14.1023	13.6024	14.0231	13.5330	13.9606	14.0011	13.5708	14.0696	13.6548	14.1279	(61)
Total heat required for water heating calculated for each month	173.9169	152.5025	158.3034	139.3204	134.6525	117.6271	110.4191	124.6886	125.5802	144.6057	156.1452	168.8633	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Solar input (sum of months) = Sum(63)m =	0.0000												(63)
Output from w/h	173.9169	152.5025	158.3034	139.3204	134.6525	117.6271	110.4191	124.6886	125.5802	144.6057	156.1452	168.8633	(64)
RHI water heating demand	Total per year (kWh/year) = Sum(64)m = 1706.6250												(64)
Heat gains from water heating, kWh/month	56.6608	49.6543	51.4724	45.2018	43.6151	37.9945	35.5626	40.3039	40.6358	46.9207	50.7918	54.9815	(65)
	1707												(65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	161.0436	161.0436	161.0436	161.0436	161.0436	161.0436	161.0436	161.0436	161.0436	161.0436	161.0436	161.0436	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	58.5205	51.9774	42.2709	32.0018	23.9217	20.1957	21.8222	28.3653	38.0718	48.3409	56.4210	60.1470	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	369.1943	373.0253	363.3711	342.8185	316.8745	292.4907	276.2009	272.3698	282.0240	302.5767	328.5207	352.9044	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.7884	53.7884	53.7884	53.7884	53.7884	53.7884	53.7884	53.7884	53.7884	53.7884	53.7884	53.7884	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-107.3624	-107.3624	-107.3624	-107.3624	-107.3624	-107.3624	-107.3624	-107.3624	-107.3624	-107.3624	-107.3624	-107.3624	(71)
Water heating gains (Table 5)	76.1570	73.8904	69.1834	62.7803	58.6224	52.7702	47.7992	54.1719	56.4387	63.0654	70.5441	73.8999	(72)
Total internal gains	614.3414	609.3627	585.2950	548.0702	509.8882	475.9262	456.2919	465.3766	487.0041	524.4526	565.9554	597.4209	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
Northeast				4.8800	12.9236		0.4600		0.0000		0.7700		22.3383 (75)
Southwest				5.7100	40.4699		0.4600		0.0000		0.7700		81.8497 (79)
Southwest				3.3300	40.4699		0.4300		0.0000		0.7700		44.6206 (79)
Solar gains	148.8086	234.9268	335.8196	460.8246	531.3594	577.8552	545.6164	489.3854	405.4534	282.5224	184.0077	125.2459	(83)
Total gains	763.1500	844.2895	921.1146	1008.8948	1041.2475	1053.7814	1001.9082	954.7620	892.4575	806.9750	749.9632	722.6668	(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	43.6036	43.6036	43.6036	43.6036	43.6036	43.6036	43.6036	43.6036	43.6036	43.6036	43.6036	43.6036	
alpha	3.9069	3.9069	3.9069	3.9069	3.9069	3.9069	3.9069	3.9069	3.9069	3.9069	3.9069	3.9069	
util living area	0.9600	0.9409	0.8959	0.7986	0.6387	0.4243	0.2815	0.3044	0.5601	0.8205	0.9319	0.9661 (86)	
MIT	19.9082	20.0709	20.3666	20.6832	20.8992	20.9847	20.9978	20.9970	20.9538	20.7012	20.2584	19.8560 (87)	
Th 2	20.1116	20.1116	20.1116	20.1116	20.1116	20.1116	20.1116	20.1116	20.1116	20.1116	20.1116	20.1116 (88)	
util rest of house	0.9525	0.9302	0.8771	0.7643	0.5832	0.3527	0.2015	0.2209	0.4856	0.7816	0.9174	0.9597 (89)	
MIT 2	18.6799	18.9108	19.3257	19.7509	20.0160	20.1019	20.1109	20.1106	20.0765	19.7843	19.1815	18.6058 (90)	
Living area fraction	fLA = Living area / (4) =												0.1396 (91)
MIT	18.8513	19.0728	19.4710	19.8810	20.1393	20.2252	20.2347	20.2343	20.1990	19.9123	19.3319	18.7803 (92)	
Temperature adjustment													-0.1500
adjusted MIT	18.7013	18.9228	19.3210	19.7310	19.9893	20.0752	20.0847	20.0843	20.0490	19.7623	19.1819	18.6303 (93)	

8. Space heating requirement

Utilisation	0.9369	0.9122	0.8573	0.7479	0.5751	0.3497	0.1991	0.2183	0.4800	0.7640	0.8984	0.9452	(94)
Useful gains	715.0282	770.1729	789.6484	754.5972	598.7899	368.4769	199.4826	208.4545	428.4189	616.5534	673.7766	683.0591	(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	1243.7681	1218.2969	1090.1140	898.9974	639.1359	372.6521	199.7765	208.8855	443.4138	746.3964	1022.5218	1237.2737	(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	393.3825	301.1393	223.5464	103.9682	30.0174	0.0000	0.0000	0.0000	0.0000	96.6031	251.0966	412.3357	(98)
Space heating	1812.0891												(98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF HEAT DEMAND 09 Jan 2014

RHI space heating demand

1812 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	47.3200 (1b)	x 2.3100 (2b)	= 109.3092 (1b) - (3b)
First floor	47.3200 (1c)	x 2.6100 (2c)	= 123.5052 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	94.6400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 232.8144 (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) =											Air changes per hour		
Pressure test											0.0000 / (5) =		0.0000 (8)
Measured/design AP50											Yes		
Infiltration rate											4.0100		
Number of sides sheltered											0.2005 (18)		
											1 (19)		
Shelter factor											(20) = 1 - [0.075 x (19)] =		0.9250 (20)
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =		0.1855 (21)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)	
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)	
Adj infilt rate													
	0.2365	0.2318	0.2272	0.2040	0.1994	0.1762	0.1762	0.1716	0.1855	0.1994	0.2086	0.2179 (22b)	
Mechanical extract ventilation - decentralised													
If mechanical ventilation:												0.5000 (23a)	
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)	

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Solid Door			2.1500	1.0000	2.1500		(26)					
Window (Uw = 1.20)			10.5900	1.1450	12.1260		(27)					
French Door (Uw = 1.40)			3.3300	1.3258	4.4148		(27)					
FP McCann System			47.3200	0.1100	5.2052	75.0000	3549.0000 (28a)					
100mm Knauf Supafil 34	97.3200	16.0700	81.2500	0.2500	20.3125	52.8000	4290.0000 (29a)					
Plane Ceiling-500mm Loft Roll	47.3200		47.3200	0.0900	4.2588	9.0000	425.8800 (30)					
Total net area of external elements Aum(A, m2)			191.9600				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	48.4672		(33)					
E-WM-30			39.9000	0.0000	0.0000	45.0000	1795.5000 (32)					
Timber GF			47.2400			9.0000	425.1600 (32c)					
Timber 1F			96.0800			9.0000	864.7200 (32c)					
AAC GF			50.8200			39.0000	1981.9800 (32c)					
Internal Floor			47.3200			12.6000	596.2320 (32d)					
Internal Ceiling			47.3200			9.0000	425.8800 (32e)					
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		14354.3520 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							151.6732 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.5631 (36)					
Total fabric heat loss						(33) + (36) =	53.0304 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 38.4144	Feb 38.4144	Mar 38.4144	Apr 38.4144	May 38.4144	Jun 38.4144	Jul 38.4144	Aug 38.4144	Sep 38.4144	Oct 38.4144	Nov 38.4144	Dec 38.4144 (38)
Heat transfer coeff	91.4447	91.4447	91.4447	91.4447	91.4447	91.4447	91.4447	91.4447	91.4447	91.4447	91.4447	91.4447 (39)
Average = Sum(39)m / 12 =												91.4447 (39)
HLP	Jan 0.9662	Feb 0.9662	Mar 0.9662	Apr 0.9662	May 0.9662	Jun 0.9662	Jul 0.9662	Aug 0.9662	Sep 0.9662	Oct 0.9662	Nov 0.9662	Dec 0.9662 (40)
HLP (average)												0.9662 (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	2.6841 (42)
Average daily hot water use (litres/day)	97.9464 (43)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.7411	103.8232	99.9053	95.9875	92.0696	88.1518	88.1518	92.0696	95.9875	99.9053	103.8232	107.7411	(44)
Energy conte	159.7769	139.7419	144.2011	125.7180	120.6294	104.0940	96.4584	110.6874	112.0094	130.5362	142.4904	154.7354	(45)
Energy content (annual)										Total =	Sum (45)m =	1541.0786	(45)
Distribution loss (46)m = 0.15 x (45)m	23.9665	20.9613	21.6302	18.8577	18.0944	15.6141	14.4688	16.6031	16.8014	19.5804	21.3736	23.2103	(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	14.1400	12.7607	14.1023	13.6024	14.0231	13.5330	13.9606	14.0011	13.5708	14.0696	13.6548	14.1279	(61)
Total heat required for water heating calculated for each month	173.9169	152.5025	158.3034	139.3204	134.6525	117.6271	110.4191	124.6886	125.5802	144.6057	156.1452	168.8633	(62)
WWHRS	-53.3282	-46.9221	-47.8901	-39.4020	-36.5853	-30.1808	-25.5427	-30.9264	-31.8287	-39.3470	-45.5787	-51.5443	eq. (G10)
Total of WWHRS savings												-479.0762	
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	120.5887	105.5804	110.4134	99.9185	98.0673	87.4462	84.8764	93.7622	93.7515	105.2587	110.5665	117.3190	(64)
Heat gains from water heating, kWh/month	56.6608	49.6543	51.4724	45.2018	43.6151	37.9945	35.5626	40.3039	40.6358	46.9207	50.7918	54.9815	(65)
										Total per year (kWh/year) =	Sum (64)m =	1227.5488	(64)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	161.0436	161.0436	161.0436	161.0436	161.0436	161.0436	161.0436	161.0436	161.0436	161.0436	161.0436	161.0436	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	58.5205	51.9774	42.2709	32.0018	23.9217	20.1957	21.8222	28.3653	38.0718	48.3409	56.4210	60.1470	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	369.1943	373.0253	363.3711	342.8185	316.8745	292.4907	276.2009	272.3698	282.0240	302.5767	328.5207	352.9044	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.7884	53.7884	53.7884	53.7884	53.7884	53.7884	53.7884	53.7884	53.7884	53.7884	53.7884	53.7884	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-107.3624	-107.3624	-107.3624	-107.3624	-107.3624	-107.3624	-107.3624	-107.3624	-107.3624	-107.3624	-107.3624	-107.3624	(71)
Water heating gains (Table 5)	76.1570	73.8904	69.1834	62.7803	58.6224	52.7702	47.7992	54.1719	56.4387	63.0654	70.5441	73.8999	(72)
Total internal gains	614.3414	609.3627	585.2950	548.0702	509.8882	475.9262	456.2919	465.3766	487.0041	524.4526	565.9554	597.4209	(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	
				4.8800	11.2829	0.4600	0.0000		0.7700		19.5025 (75)	
				5.7100	36.7938	0.4600	0.0000		0.7700		74.4149 (79)	
				3.3300	36.7938	0.4300	0.0000		0.7700		40.5675 (79)	
Solar gains	134.4849	235.5555	339.5039	449.5026	529.8050	537.5531	513.4398	451.7603	377.3185	264.9783	162.2616	114.3277 (83)
Total gains	748.8263	844.9182	924.7989	997.5729	1039.6932	1013.4793	969.7316	917.1369	864.3226	789.4309	728.2170	711.7486 (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	43.6036	43.6036	43.6036	43.6036	43.6036	43.6036	43.6036	43.6036	43.6036	43.6036	43.6036	43.6036
alpha	3.9069	3.9069	3.9069	3.9069	3.9069	3.9069	3.9069	3.9069	3.9069	3.9069	3.9069	3.9069
util living area	0.9675	0.9479	0.9107	0.8353	0.7096	0.5468	0.4070	0.4466	0.6567	0.8630	0.9482	0.9728 (86)
MIT	19.7851	19.9838	20.2678	20.5864	20.8295	20.9530	20.9884	20.9832	20.9041	20.5917	20.1212	19.7227 (87)
Th 2	20.1116	20.1116	20.1116	20.1116	20.1116	20.1116	20.1116	20.1116	20.1116	20.1116	20.1116	20.1116 (88)
util rest of house	0.9616	0.9387	0.8951	0.8069	0.6630	0.4804	0.3282	0.3652	0.5917	0.8329	0.9374	0.9678 (89)
MIT 2	18.5025	18.7861	19.1872	19.6233	19.9345	20.0737	20.1052	20.1017	20.0266	19.6409	18.9871	18.4129 (90)
Living area fraction	18.6815	18.9533	19.3380	19.7577	20.0594	20.1964	20.2285	20.2248	20.1491	19.7736	19.1454	18.5957 (91)
MIT	18.6815	18.9533	19.3380	19.7577	20.0594	20.1964	20.2285	20.2248	20.1491	19.7736	19.1454	18.5957 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.5315	18.8033	19.1880	19.6077	19.9094	20.0464	20.0785	20.0748	19.9991	19.6236	18.9954	18.4457 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9475	0.9215	0.8754	0.7887	0.6516	0.4754	0.3252	0.3618	0.5828	0.8134	0.9199	0.9549	(94)
Useful gains	709.5229	778.5583	809.5714	786.8103	677.4213	481.7651	315.3309	331.7950	503.7667	642.1555	669.8863	679.6586	(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	1301.3973	1271.3810	1160.2532	979.1644	750.7097	498.0458	318.0876	336.0391	539.4430	825.1645	1087.7707	1302.6963	(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	440.3546	331.1769	260.9072	138.4950	54.5266	0.0000	0.0000	0.0000	0.0000	136.1587	300.8768	463.5401	(98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Space heating 2126.0358 (98)
 Space heating per m2 (98) / (4) = 22.4645 (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													2349.2108 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	440.3546	331.1769	260.9072	138.4950	54.5266	0.0000	0.0000	0.0000	0.0000	136.1587	300.8768	463.5401	(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)	486.5796	365.9413	288.2953	153.0331	60.2503	0.0000	0.0000	0.0000	0.0000	150.4516	332.4606	512.1990	(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	120.5887	105.5804	110.4134	99.9185	98.0673	87.4462	84.8764	93.7622	93.7515	105.2587	110.5665	117.3190	(64)
Efficiency of water heater	89.7924	89.7051	89.5242	89.1308	88.4171	87.3000	87.3000	87.3000	87.3000	89.0764	89.6172	87.3000	(216)
(217)m	89.7924	89.7051	89.5242	89.1308	88.4171	87.3000	87.3000	87.3000	87.3000	89.0764	89.6172	89.8349	(217)
Fuel for water heating, kWh/month	134.2971	117.6972	123.3335	112.1032	110.9143	100.1675	97.2238	107.4023	107.3900	118.1668	123.3764	130.5940	(219)
Water heating fuel used												1382.6662	(219)
Annual totals kWh/year													
Space heating fuel - main system												2349.2108	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 6.6170, total flow = 29.0000, SFP = 0.2282)													
mechanical ventilation fans (SFP = 0.2282)												64.8086	(230a)
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												139.8086	(231)
Electricity for lighting (calculated in Appendix L)												413.3962	(232)
Total delivered energy for all uses												4285.0819	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2349.2108	3.4800	81.7525	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1382.6662	3.4800	48.1168	(247)
Mechanical ventilation fans	64.8086	13.1900	8.5483	(249)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	413.3962	13.1900	54.5270	(250)
Additional standing charges			120.0000	(251)
Total energy cost			322.8370	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.4200	(256)
Energy cost factor (ECF)	0.9710	(257)
SAP value	86.4544	
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	2349.2108	0.2160	507.4295	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1382.6662	0.2160	298.6559	(264)
Space and water heating			806.0854	(265)
Pumps and fans	139.8086	0.5190	72.5607	(267)
Energy for lighting	413.3962	0.5190	214.5527	(268)
Total kg/year			1093.1988	(272)
CO2 emissions per m2			11.5500	(273)
EI value			89.5096	
EI rating			90	(274)
EI band			B	

Calculation of stars for heating and DHW

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

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	$3.48 / 0.8869 = 3.924$, stars = 5
Water heating environmental impact	$0.216 / 0.8869 = 0.2435$, stars = 5

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	47.3200 (1b)	x 2.3100 (2b)	= 109.3092 (1b) - (3b)
First floor	47.3200 (1c)	x 2.6100 (2c)	= 123.5052 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	94.6400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 232.8144 (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) =																Air changes per hour							
Pressure test																0.0000 / (5) =		0.0000 (8)					
Measured/design AP50																Yes							
Infiltration rate																4.0100							
Number of sides sheltered																0.2005 (18)							
																1 (19)							
Shelter factor																(20) = 1 - [0.075 x (19)] =		0.9250 (20)					
Infiltration rate adjusted to include shelter factor																(21) = (18) x (20) =		0.1855 (21)					
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec											
	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)											
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)											
Adj infilt rate																							
	0.1947	0.1855	0.1855	0.1716	0.1716	0.1530	0.1576	0.1484	0.1530	0.1623	0.1623	0.1762 (22b)											
Mechanical extract ventilation - decentralised																							
If mechanical ventilation:																		0.5000 (23a)					
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)											

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Solid Door			2.1500	1.0000	2.1500		(26)					
Window (Uw = 1.20)			10.5900	1.1450	12.1260		(27)					
French Door (Uw = 1.40)			3.3300	1.3258	4.4148		(27)					
FP McCann System			47.3200	0.1100	5.2052	75.0000	3549.0000 (28a)					
100mm Knauf Supafil 34	97.3200	16.0700	81.2500	0.2500	20.3125	52.8000	4290.0000 (29a)					
Plane Ceiling-500mm Loft Roll	47.3200		47.3200	0.0900	4.2588	9.0000	425.8800 (30)					
Total net area of external elements Aum(A, m2)			191.9600				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	48.4672		(33)					
E-WM-30			39.9000	0.0000	0.0000	45.0000	1795.5000 (32)					
Timber GF			47.2400			9.0000	425.1600 (32c)					
Timber 1F			96.0800			9.0000	864.7200 (32c)					
AAC GF			50.8200			39.0000	1981.9800 (32c)					
Internal Floor			47.3200			12.6000	596.2320 (32d)					
Internal Ceiling			47.3200			9.0000	425.8800 (32e)					
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		14354.3520 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							151.6732 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.5631 (36)					
Total fabric heat loss						(33) + (36) =	53.0304 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 38.4144	Feb 38.4144	Mar 38.4144	Apr 38.4144	May 38.4144	Jun 38.4144	Jul 38.4144	Aug 38.4144	Sep 38.4144	Oct 38.4144	Nov 38.4144	Dec 38.4144 (38)
Heat transfer coeff	91.4447	91.4447	91.4447	91.4447	91.4447	91.4447	91.4447	91.4447	91.4447	91.4447	91.4447	91.4447 (39)
Average = Sum(39)m / 12 =												91.4447 (39)
HLP	Jan 0.9662	Feb 0.9662	Mar 0.9662	Apr 0.9662	May 0.9662	Jun 0.9662	Jul 0.9662	Aug 0.9662	Sep 0.9662	Oct 0.9662	Nov 0.9662	Dec 0.9662 (40)
HLP (average)												0.9662 (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	2.6841 (42)
Average daily hot water use (litres/day)	97.9464 (43)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.7411	103.8232	99.9053	95.9875	92.0696	88.1518	88.1518	92.0696	95.9875	99.9053	103.8232	107.7411	(44)
Energy conte	159.7769	139.7419	144.2011	125.7180	120.6294	104.0940	96.4584	110.6874	112.0094	130.5362	142.4904	154.7354	(45)
Energy content (annual)	Total = Sum (45)m = 1541.0786												(45)
Distribution loss (46)m = 0.15 x (45)m	23.9665	20.9613	21.6302	18.8577	18.0944	15.6141	14.4688	16.6031	16.8014	19.5804	21.3736	23.2103	(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	14.1400	12.7607	14.1023	13.6024	14.0231	13.5330	13.9606	14.0011	13.5708	14.0696	13.6548	14.1279	(61)
Total heat required for water heating calculated for each month	173.9169	152.5025	158.3034	139.3204	134.6525	117.6271	110.4191	124.6886	125.5802	144.6057	156.1452	168.8633	(62)
WWHRS	-53.3282	-46.9221	-47.8901	-39.4020	-36.5853	-30.1808	-25.5427	-30.9264	-31.8287	-39.3470	-45.5787	-51.5443	eq. (G10)
Total of WWHRS savings	-479.0762												
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	120.5887	105.5804	110.4134	99.9185	98.0673	87.4462	84.8764	93.7622	93.7515	105.2587	110.5665	117.3190	(64)
Heat gains from water heating, kWh/month	56.6608	49.6543	51.4724	45.2018	43.6151	37.9945	35.5626	40.3039	40.6358	46.9207	50.7918	54.9815	(65)
Total per year (kWh/year) = Sum (64)m = 1227.5488												(64)	

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	161.0436	161.0436	161.0436	161.0436	161.0436	161.0436	161.0436	161.0436	161.0436	161.0436	161.0436	161.0436	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	58.5205	51.9774	42.2709	32.0018	23.9217	20.1957	21.8222	28.3653	38.0718	48.3409	56.4210	60.1470	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	369.1943	373.0253	363.3711	342.8185	316.8745	292.4907	276.2009	272.3698	282.0240	302.5767	328.5207	352.9044	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.7884	53.7884	53.7884	53.7884	53.7884	53.7884	53.7884	53.7884	53.7884	53.7884	53.7884	53.7884	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-107.3624	-107.3624	-107.3624	-107.3624	-107.3624	-107.3624	-107.3624	-107.3624	-107.3624	-107.3624	-107.3624	-107.3624	(71)
Water heating gains (Table 5)	76.1570	73.8904	69.1834	62.7803	58.6224	52.7702	47.7992	54.1719	56.4387	63.0654	70.5441	73.8999	(72)
Total internal gains	614.3414	609.3627	585.2950	548.0702	509.8882	475.9262	456.2919	465.3766	487.0041	524.4526	565.9554	597.4209	(73)

6. Solar gains

[Jan]			Area m2		Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
Northeast			4.8800		12.9236		0.4600		0.0000		0.7700		22.3383 (75)
Southwest			5.7100		40.4699		0.4600		0.0000		0.7700		81.8497 (79)
Southwest			3.3300		40.4699		0.4300		0.0000		0.7700		44.6206 (79)
Solar gains	148.8086	234.9268	335.8196	460.8246	531.3594	577.8552	545.6164	489.3854	405.4534	282.5224	184.0077	125.2459	(83)
Total gains	763.1500	844.2895	921.1146	1008.8948	1041.2475	1053.7814	1001.9082	954.7620	892.4575	806.9750	749.9632	722.6668	(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	43.6036	43.6036	43.6036	43.6036	43.6036	43.6036	43.6036	43.6036	43.6036	43.6036	43.6036	43.6036
alpha	3.9069	3.9069	3.9069	3.9069	3.9069	3.9069	3.9069	3.9069	3.9069	3.9069	3.9069	3.9069
util living area	0.9600	0.9409	0.8959	0.7986	0.6387	0.4243	0.2815	0.3044	0.5601	0.8205	0.9319	0.9661 (86)
MIT	19.9082	20.0709	20.3666	20.6832	20.8992	20.9847	20.9978	20.9970	20.9538	20.7012	20.2584	19.8560 (87)
Th 2	20.1116	20.1116	20.1116	20.1116	20.1116	20.1116	20.1116	20.1116	20.1116	20.1116	20.1116	20.1116 (88)
util rest of house	0.9525	0.9302	0.8771	0.7643	0.5832	0.3527	0.2015	0.2209	0.4856	0.7816	0.9174	0.9597 (89)
MIT 2	18.6799	18.9108	19.3257	19.7509	20.0160	20.1019	20.1109	20.1106	20.0765	19.7843	19.1815	18.6058 (90)
Living area fraction	18.8513	19.0728	19.4710	19.8810	20.1393	20.2252	20.2347	20.2343	20.1990	19.9123	19.3319	18.7803 (91)
MIT	18.8513	19.0728	19.4710	19.8810	20.1393	20.2252	20.2347	20.2343	20.1990	19.9123	19.3319	18.7803 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.7013	18.9228	19.3210	19.7310	19.9893	20.0752	20.0847	20.0843	20.0490	19.7623	19.1819	18.6303 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9369	0.9122	0.8573	0.7479	0.5751	0.3497	0.1991	0.2183	0.4800	0.7640	0.8984	0.9452	(94)
Useful gains	715.0282	770.1729	789.6484	754.5972	598.7899	368.4769	199.4826	208.4545	428.4189	616.5534	673.7766	683.0591	(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	1243.7681	1218.2969	1090.1140	898.9974	639.1359	372.6521	199.7765	208.8855	443.4138	746.3964	1022.5218	1237.2737	(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	393.3825	301.1393	223.5464	103.9682	30.0174	0.0000	0.0000	0.0000	0.0000	96.6031	251.0966	412.3357	(98)

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

Space heating 1812.0891 (98)
 Space heating per m2 (98) / (4) = 19.1472 (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													2002.3084 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	393.3825	301.1393	223.5464	103.9682	30.0174	0.0000	0.0000	0.0000	0.0000	96.6031	251.0966	412.3357	(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)	434.6768	332.7506	247.0126	114.8820	33.1684	0.0000	0.0000	0.0000	0.0000	106.7438	277.4548	455.6195	(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	120.5887	105.5804	110.4134	99.9185	98.0673	87.4462	84.8764	93.7622	93.7515	105.2587	110.5665	117.3190	(64)
Efficiency of water heater	89.7283	89.6470	89.4164	88.9030	88.0295	87.3000	87.3000	87.3000	87.3000	88.8027	89.4971	89.7711	(216)
Fuel for water heating, kWh/month	134.3931	117.7735	123.4823	112.3904	111.4028	100.1675	97.2238	107.4023	107.3900	118.5310	123.5420	130.6868	(217)
Water heating fuel used												1384.3856	(219)
Annual totals kWh/year													
Space heating fuel - main system												2002.3084	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 6.6170, total flow = 29.0000, SFP = 0.2282)													
mechanical ventilation fans (SFP = 0.2282)													64.8086 (230a)
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													139.8086 (231)
Electricity for lighting (calculated in Appendix L)													413.3962 (232)
Total delivered energy for all uses													3939.8989 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2002.3084	3.9200	78.4905	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1384.3856	3.9200	54.2679	(247)
Mechanical ventilation fans	64.8086	16.9600	10.9915	(249)
Pumps and fans for heating	75.0000	16.9600	12.7200	(249)
Energy for lighting	413.3962	16.9600	70.1120	(250)
Additional standing charges			88.0000	(251)
Total energy cost			314.5820	(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	2002.3084	0.2160	432.4986	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1384.3856	0.2160	299.0273	(264)
Space and water heating			731.5259	(265)
Pumps and fans	139.8086	0.5190	72.5607	(267)
Energy for lighting	413.3962	0.5190	214.5527	(268)
Total kg/year			1018.6392	(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	2002.3084	1.2200	2442.8162	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1384.3856	1.2200	1688.9505	(264)
Space and water heating			4131.7667	(265)
Pumps and fans	139.8086	3.0700	429.2125	(267)
Energy for lighting	413.3962	3.0700	1269.1265	(268)
Primary energy kWh/year			5830.1057	(272)
Primary energy kWh/m2/year			61.6030	(273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 86
Current environmental impact rating: B 90

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

Recommended measures:	SAP change	Cost change	CO2 change
U Solar photovoltaic panels	+ 9.6	-£ 309	-947 kg (92.9%)
Measures omitted - SAP change or cost saving too small:			
N Solar water heating	+ 0.8	-£ 21	-138 kg (13.6%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar photovoltaic panels	£309	10.00 kg/m²	A 96 A 98
Total Savings	£309	10.00 kg/m²	
Potential energy efficiency rating:		A 96	
Potential environmental impact rating:			A 98

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

Typical heating and lighting costs of this home (per year, Thames Valley):			
	Current	Potential	Saving
Electricity	£94	£94	£0
Mains gas	£221	£221	£0
Space heating	£190	£190	£0
Water heating	£54	£54	£0
Lighting	£70	£70	£0
Generated (PV)	-£0	-£309	£309
Total cost of fuels	£315	£6	£309
Total cost of uses	£314	£5	£309
Delivered energy	42 kWh/m²	22 kWh/m²	19 kWh/m²
Carbon dioxide emissions	1.0 tonnes	0.1 tonnes	0.9 tonnes
CO2 emissions per m²	11 kg/m²	1 kg/m²	10 kg/m²
Primary energy	62 kWh/m²	2 kWh/m²	59 kWh/m²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	47.3200 (1b)	x 2.3100 (2b)	= 109.3092 (1b) - (3b)
First floor	47.3200 (1c)	x 2.6100 (2c)	= 123.5052 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	94.6400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 232.8144 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																0 * 10 =	0.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =				0.0000 / (5) =		0.0000 (8)	
Pressure test														Yes			
Measured/design AP50														4.0100			
Infiltration rate														0.2005 (18)			
Number of sides sheltered														1 (19)			
Shelter factor										(20) = 1 - [0.075 x (19)] =				0.9250 (20)			
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =				0.1855 (21)			
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)					
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)					
Adj infilt rate																	
	0.2365	0.2318	0.2272	0.2040	0.1994	0.1762	0.1762	0.1716	0.1855	0.1994	0.2086	0.2179 (22b)					
Mechanical extract ventilation - decentralised																	
If mechanical ventilation:																0.5000 (23a)	
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)					

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Solid Door			2.1500	1.0000	2.1500		(26)					
Window (Uw = 1.20)			10.5900	1.1450	12.1260		(27)					
French Door (Uw = 1.40)			3.3300	1.3258	4.4148		(27)					
FP McCann System			47.3200	0.1100	5.2052	75.0000	3549.0000 (28a)					
100mm Knauf Supafil 34	97.3200	16.0700	81.2500	0.2500	20.3125	52.8000	4290.0000 (29a)					
Plane Ceiling-500mm Loft Roll	47.3200		47.3200	0.0900	4.2588	9.0000	425.8800 (30)					
Total net area of external elements Aum(A, m2)			191.9600				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	48.4672		(33)					
E-WM-30			39.9000	0.0000	0.0000	45.0000	1795.5000 (32)					
Timber GF			47.2400			9.0000	425.1600 (32c)					
Timber 1F			96.0800			9.0000	864.7200 (32c)					
AAC GF			50.8200			39.0000	1981.9800 (32c)					
Internal Floor			47.3200			12.6000	596.2320 (32d)					
Internal Ceiling			47.3200			9.0000	425.8800 (32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	14354.3520 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							151.6732 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.5631 (36)					
Total fabric heat loss						(33) + (36) =	53.0304 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 38.4144	Feb 38.4144	Mar 38.4144	Apr 38.4144	May 38.4144	Jun 38.4144	Jul 38.4144	Aug 38.4144	Sep 38.4144	Oct 38.4144	Nov 38.4144	Dec 38.4144 (38)
Heat transfer coeff	91.4447	91.4447	91.4447	91.4447	91.4447	91.4447	91.4447	91.4447	91.4447	91.4447	91.4447	91.4447 (39)
Average = Sum(39)m / 12 =												91.4447 (39)
HLP	Jan 0.9662	Feb 0.9662	Mar 0.9662	Apr 0.9662	May 0.9662	Jun 0.9662	Jul 0.9662	Aug 0.9662	Sep 0.9662	Oct 0.9662	Nov 0.9662	Dec 0.9662 (40)
HLP (average)												0.9662 (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	2.6841 (42)
Average daily hot water use (litres/day)	97.9464 (43)

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Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.7411	103.8232	99.9053	95.9875	92.0696	88.1518	88.1518	92.0696	95.9875	99.9053	103.8232	107.7411	(44)
Energy conte	159.7769	139.7419	144.2011	125.7180	120.6294	104.0940	96.4584	110.6874	112.0094	130.5362	142.4904	154.7354	(45)
Energy content (annual)	Total = Sum (45)m = 1541.0786												(45)
Distribution loss (46)m = 0.15 x (45)m	23.9665	20.9613	21.6302	18.8577	18.0944	15.6141	14.4688	16.6031	16.8014	19.5804	21.3736	23.2103	(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	14.1400	12.7607	14.1023	13.6024	14.0231	13.5330	13.9606	14.0011	13.5708	14.0696	13.6548	14.1279	(61)
Total heat required for water heating calculated for each month	173.9169	152.5025	158.3034	139.3204	134.6525	117.6271	110.4191	124.6886	125.5802	144.6057	156.1452	168.8633	(62)
WWHRS	-53.3282	-46.9221	-47.8901	-39.4020	-36.5853	-30.1808	-25.5427	-30.9264	-31.8287	-39.3470	-45.5787	-51.5443	eq. (G10)
Total of WWHRS savings	-479.0762												
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	120.5887	105.5804	110.4134	99.9185	98.0673	87.4462	84.8764	93.7622	93.7515	105.2587	110.5665	117.3190	(64)
Heat gains from water heating, kWh/month	56.6608	49.6543	51.4724	45.2018	43.6151	37.9945	35.5626	40.3039	40.6358	46.9207	50.7918	54.9815	(65)
Total per year (kWh/year) = Sum (64)m =	1227.5488												(64)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	161.0436	161.0436	161.0436	161.0436	161.0436	161.0436	161.0436	161.0436	161.0436	161.0436	161.0436	161.0436	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	58.5205	51.9774	42.2709	32.0018	23.9217	20.1957	21.8222	28.3653	38.0718	48.3409	56.4210	60.1470	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	369.1943	373.0253	363.3711	342.8185	316.8745	292.4907	276.2009	272.3698	282.0240	302.5767	328.5207	352.9044	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.7884	53.7884	53.7884	53.7884	53.7884	53.7884	53.7884	53.7884	53.7884	53.7884	53.7884	53.7884	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-107.3624	-107.3624	-107.3624	-107.3624	-107.3624	-107.3624	-107.3624	-107.3624	-107.3624	-107.3624	-107.3624	-107.3624	(71)
Water heating gains (Table 5)	76.1570	73.8904	69.1834	62.7803	58.6224	52.7702	47.7992	54.1719	56.4387	63.0654	70.5441	73.8999	(72)
Total internal gains	614.3414	609.3627	585.2950	548.0702	509.8882	475.9262	456.2919	465.3766	487.0041	524.4526	565.9554	597.4209	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
Northeast				4.8800	11.2829		0.4600		0.0000		0.7700		19.5025 (75)
Southwest				5.7100	36.7938		0.4600		0.0000		0.7700		74.4149 (79)
Southwest				3.3300	36.7938		0.4300		0.0000		0.7700		40.5675 (79)
Solar gains	134.4849	235.5555	339.5039	449.5026	529.8050	537.5531	513.4398	451.7603	377.3185	264.9783	162.2616	114.3277	(83)
Total gains	748.8263	844.9182	924.7989	997.5729	1039.6932	1013.4793	969.7316	917.1369	864.3226	789.4309	728.2170	711.7486	(84)

7. Mean internal temperature (heating season)

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	43.6036	43.6036	43.6036	43.6036	43.6036	43.6036	43.6036	43.6036	43.6036	43.6036	43.6036	43.6036	
alpha	3.9069	3.9069	3.9069	3.9069	3.9069	3.9069	3.9069	3.9069	3.9069	3.9069	3.9069	3.9069	
util living area	0.9675	0.9479	0.9107	0.8353	0.7096	0.5468	0.4070	0.4466	0.6567	0.8630	0.9482	0.9728	(86)
MIT	19.7851	19.9838	20.2678	20.5864	20.8295	20.9530	20.9884	20.9832	20.9041	20.5917	20.1212	19.7227	(87)
Th 2	20.1116	20.1116	20.1116	20.1116	20.1116	20.1116	20.1116	20.1116	20.1116	20.1116	20.1116	20.1116	(88)
util rest of house	0.9616	0.9387	0.8951	0.8069	0.6630	0.4804	0.3282	0.3652	0.5917	0.8329	0.9374	0.9678	(89)
MIT 2	18.5025	18.7861	19.1872	19.6233	19.9345	20.0737	20.1052	20.1017	20.0266	19.6409	18.9871	18.4129	(90)
Living area fraction	18.6815	18.9533	19.3380	19.7577	20.0594	20.1964	20.2285	20.2248	20.1491	19.7736	19.1454	18.5957	(91)
MIT	18.6815	18.9533	19.3380	19.7577	20.0594	20.1964	20.2285	20.2248	20.1491	19.7736	19.1454	18.5957	(92)
Temperature adjustment	18.5315	18.8033	19.1880	19.6077	19.9094	20.0464	20.0785	20.0748	19.9991	19.6236	18.9954	-0.1500	
adjusted MIT	18.5315	18.8033	19.1880	19.6077	19.9094	20.0464	20.0785	20.0748	19.9991	19.6236	18.9954	18.4457	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	709.5229	778.5583	809.5714	786.8103	677.4213	481.7651	315.3309	331.7950	503.7667	642.1555	669.8863	679.6586	(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	1301.3973	1271.3810	1160.2532	979.1644	750.7097	498.0458	318.0876	336.0391	539.4430	825.1645	1087.7707	1302.6963	(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	440.3546	331.1769	260.9072	138.4950	54.5266	0.0000	0.0000	0.0000	0.0000	136.1587	300.8768	463.5401	(98)

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Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Space heating 2126.0358 (98)
 Space heating per m2 (98) / (4) = 22.4645 (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													2349.2108 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	440.3546	331.1769	260.9072	138.4950	54.5266	0.0000	0.0000	0.0000	0.0000	136.1587	300.8768	463.5401	(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)	486.5796	365.9413	288.2953	153.0331	60.2503	0.0000	0.0000	0.0000	0.0000	150.4516	332.4606	512.1990	(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	120.5887	105.5804	110.4134	99.9185	98.0673	87.4462	84.8764	93.7622	93.7515	105.2587	110.5665	117.3190	(64)
Efficiency of water heater (217)m	89.7924	89.7051	89.5242	89.1308	88.4171	87.3000	87.3000	87.3000	87.3000	89.0764	89.6172	89.8349	(216)
Fuel for water heating, kWh/month	134.2971	117.6972	123.3335	112.1032	110.9143	100.1675	97.2238	107.4023	107.3900	118.1668	123.3764	130.5940	(219)
Water heating fuel used												1382.6662	(219)
Annual totals kWh/year													
Space heating fuel - main system												2349.2108	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 6.6170, total flow = 29.0000, SFP = 0.2282)													
mechanical ventilation fans (SFP = 0.2282)												64.8086	(230a)
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												139.8086	(231)
Electricity for lighting (calculated in Appendix L)												413.3962	(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												2557.8425	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2349.2108	3.4800	81.7525 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1382.6662	3.4800	48.1168 (247)
Mechanical ventilation fans	64.8086	13.1900	8.5483 (249)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	413.3962	13.1900	54.5270 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-1727.2394	13.1900	-227.8229 (252)
Total energy cost			95.0142 (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] = 0.2858 (257)
SAP value	96.0134
SAP rating (Section 12)	96 (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	2349.2108	0.2160	507.4295 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1382.6662	0.2160	298.6559 (264)
Space and water heating			806.0854 (265)
Pumps and fans	139.8086	0.5190	72.5607 (267)
Energy for lighting	413.3962	0.5190	214.5527 (268)
Energy saving/generation technologies			
PV Unit	-1727.2394	0.5190	-896.4372 (269)
Total kg/year			196.7615 (272)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

CO2 emissions per m2	2.0800 (273)
EI value	98.1119
EI rating	98 (274)
EI band	A

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	47.3200 (1b)	x 2.3100 (2b)	= 109.3092 (1b) - (3b)
First floor	47.3200 (1c)	x 2.6100 (2c)	= 123.5052 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	94.6400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 232.8144 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																0 * 10 =	0.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =					0.0000 / (5) =	0.0000 (8)	
Pressure test															Yes		
Measured/design AP50															4.0100		
Infiltration rate															0.2005 (18)		
Number of sides sheltered															1 (19)		
Shelter factor										(20) = 1 - [0.075 x (19)] =					0.9250 (20)		
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =					0.1855 (21)		
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)					
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)					
Adj infilt rate																	
	0.1947	0.1855	0.1855	0.1716	0.1716	0.1530	0.1576	0.1484	0.1530	0.1623	0.1623	0.1762 (22b)					
Mechanical extract ventilation - decentralised																	
If mechanical ventilation:															0.5000 (23a)		
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)					

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Solid Door			2.1500	1.0000	2.1500		(26)					
Window (Uw = 1.20)			10.5900	1.1450	12.1260		(27)					
French Door (Uw = 1.40)			3.3300	1.3258	4.4148		(27)					
FP McCann System			47.3200	0.1100	5.2052	75.0000	3549.0000 (28a)					
100mm Knauf Supafil 34	97.3200	16.0700	81.2500	0.2500	20.3125	52.8000	4290.0000 (29a)					
Plane Ceiling-500mm Loft Roll	47.3200		47.3200	0.0900	4.2588	9.0000	425.8800 (30)					
Total net area of external elements Aum(A, m2)			191.9600				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	48.4672		(33)					
E-WM-30			39.9000	0.0000	0.0000	45.0000	1795.5000 (32)					
Timber GF			47.2400			9.0000	425.1600 (32c)					
Timber 1F			96.0800			9.0000	864.7200 (32c)					
AAC GF			50.8200			39.0000	1981.9800 (32c)					
Internal Floor			47.3200			12.6000	596.2320 (32d)					
Internal Ceiling			47.3200			9.0000	425.8800 (32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	14354.3520 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							151.6732 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.5631 (36)					
Total fabric heat loss						(33) + (36) =	53.0304 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 38.4144	Feb 38.4144	Mar 38.4144	Apr 38.4144	May 38.4144	Jun 38.4144	Jul 38.4144	Aug 38.4144	Sep 38.4144	Oct 38.4144	Nov 38.4144	Dec 38.4144 (38)
Heat transfer coeff	91.4447	91.4447	91.4447	91.4447	91.4447	91.4447	91.4447	91.4447	91.4447	91.4447	91.4447	91.4447 (39)
Average = Sum(39)m / 12 =												91.4447 (39)
HLP	Jan 0.9662	Feb 0.9662	Mar 0.9662	Apr 0.9662	May 0.9662	Jun 0.9662	Jul 0.9662	Aug 0.9662	Sep 0.9662	Oct 0.9662	Nov 0.9662	Dec 0.9662 (40)
HLP (average)												0.9662 (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	2.6841 (42)
Average daily hot water use (litres/day)	97.9464 (43)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.7411	103.8232	99.9053	95.9875	92.0696	88.1518	88.1518	92.0696	95.9875	99.9053	103.8232	107.7411	(44)
Energy conte	159.7769	139.7419	144.2011	125.7180	120.6294	104.0940	96.4584	110.6874	112.0094	130.5362	142.4904	154.7354	(45)
Energy content (annual)	Total = Sum (45)m = 1541.0786												(45)
Distribution loss (46)m = 0.15 x (45)m	23.9665	20.9613	21.6302	18.8577	18.0944	15.6141	14.4688	16.6031	16.8014	19.5804	21.3736	23.2103	(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	14.1400	12.7607	14.1023	13.6024	14.0231	13.5330	13.9606	14.0011	13.5708	14.0696	13.6548	14.1279	(61)
Total heat required for water heating calculated for each month	173.9169	152.5025	158.3034	139.3204	134.6525	117.6271	110.4191	124.6886	125.5802	144.6057	156.1452	168.8633	(62)
WWHRS	-53.3282	-46.9221	-47.8901	-39.4020	-36.5853	-30.1808	-25.5427	-30.9264	-31.8287	-39.3470	-45.5787	-51.5443	eq. (G10)
Total of WWHRS savings	-479.0762												
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	120.5887	105.5804	110.4134	99.9185	98.0673	87.4462	84.8764	93.7622	93.7515	105.2587	110.5665	117.3190	(64)
Heat gains from water heating, kWh/month	56.6608	49.6543	51.4724	45.2018	43.6151	37.9945	35.5626	40.3039	40.6358	46.9207	50.7918	54.9815	(65)
Total per year (kWh/year) = Sum (64)m =	1227.5488												(64)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	161.0436	161.0436	161.0436	161.0436	161.0436	161.0436	161.0436	161.0436	161.0436	161.0436	161.0436	161.0436	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	58.5205	51.9774	42.2709	32.0018	23.9217	20.1957	21.8222	28.3653	38.0718	48.3409	56.4210	60.1470	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	369.1943	373.0253	363.3711	342.8185	316.8745	292.4907	276.2009	272.3698	282.0240	302.5767	328.5207	352.9044	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.7884	53.7884	53.7884	53.7884	53.7884	53.7884	53.7884	53.7884	53.7884	53.7884	53.7884	53.7884	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-107.3624	-107.3624	-107.3624	-107.3624	-107.3624	-107.3624	-107.3624	-107.3624	-107.3624	-107.3624	-107.3624	-107.3624	(71)
Water heating gains (Table 5)	76.1570	73.8904	69.1834	62.7803	58.6224	52.7702	47.7992	54.1719	56.4387	63.0654	70.5441	73.8999	(72)
Total internal gains	614.3414	609.3627	585.2950	548.0702	509.8882	475.9262	456.2919	465.3766	487.0041	524.4526	565.9554	597.4209	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
Northeast				4.8800	12.9236	0.4600	0.0000	0.7700	22.3383 (75)			
Southwest				5.7100	40.4699	0.4600	0.0000	0.7700	81.8497 (79)			
Southwest				3.3300	40.4699	0.4300	0.0000	0.7700	44.6206 (79)			
Solar gains	148.8086	234.9268	335.8196	460.8246	531.3594	577.8552	545.6164	489.3854	405.4534	282.5224	184.0077	125.2459 (83)
Total gains	763.1500	844.2895	921.1146	1008.8948	1041.2475	1053.7814	1001.9082	954.7620	892.4575	806.9750	749.9632	722.6668 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
tau	43.6036	43.6036	43.6036	43.6036	43.6036	43.6036	43.6036	43.6036	43.6036	43.6036	43.6036	43.6036	
alpha	3.9069	3.9069	3.9069	3.9069	3.9069	3.9069	3.9069	3.9069	3.9069	3.9069	3.9069	3.9069	
util living area	0.9600	0.9409	0.8959	0.7986	0.6387	0.4243	0.2815	0.3044	0.5601	0.8205	0.9319	0.9661	(86)
MIT	19.9082	20.0709	20.3666	20.6832	20.8992	20.9847	20.9978	20.9970	20.9538	20.7012	20.2584	19.8560	(87)
Th 2	20.1116	20.1116	20.1116	20.1116	20.1116	20.1116	20.1116	20.1116	20.1116	20.1116	20.1116	20.1116	(88)
util rest of house	0.9525	0.9302	0.8771	0.7643	0.5832	0.3527	0.2015	0.2209	0.4856	0.7816	0.9174	0.9597	(89)
MIT 2	18.6799	18.9108	19.3257	19.7509	20.0160	20.1019	20.1109	20.1106	20.0765	19.7843	19.1815	18.6058	(90)
Living area fraction	18.8513	19.0728	19.4710	19.8810	20.1393	20.2252	20.2347	20.2343	20.1990	19.9123	19.3319	18.7803	(91)
MIT	18.8513	19.0728	19.4710	19.8810	20.1393	20.2252	20.2347	20.2343	20.1990	19.9123	19.3319	18.7803	(92)
Temperature adjustment													-0.1500
adjusted MIT	18.7013	18.9228	19.3210	19.7310	19.9893	20.0752	20.0847	20.0843	20.0490	19.7623	19.1819	18.6303	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9369	0.9122	0.8573	0.7479	0.5751	0.3497	0.1991	0.2183	0.4800	0.7640	0.8984	0.9452	(94)
Useful gains	715.0282	770.1729	789.6484	754.5972	598.7899	368.4769	199.4826	208.4545	428.4189	616.5534	673.7766	683.0591	(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	1243.7681	1218.2969	1090.1140	898.9974	639.1359	372.6521	199.7765	208.8855	443.4138	746.3964	1022.5218	1237.2737	(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	393.3825	301.1393	223.5464	103.9682	30.0174	0.0000	0.0000	0.0000	0.0000	96.6031	251.0966	412.3357	(98)

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Space heating 1812.0891 (98)
 Space heating per m2 (98) / (4) = 19.1472 (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													2002.3084 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	393.3825	301.1393	223.5464	103.9682	30.0174	0.0000	0.0000	0.0000	0.0000	96.6031	251.0966	412.3357	(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)	434.6768	332.7506	247.0126	114.8820	33.1684	0.0000	0.0000	0.0000	0.0000	106.7438	277.4548	455.6195	(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	120.5887	105.5804	110.4134	99.9185	98.0673	87.4462	84.8764	93.7622	93.7515	105.2587	110.5665	117.3190	(64)
Efficiency of water heater (217)m	89.7283	89.6470	89.4164	88.9030	88.0295	87.3000	87.3000	87.3000	87.3000	88.8027	89.4971	89.7711	(216)
Fuel for water heating, kWh/month	134.3931	117.7735	123.4823	112.3904	111.4028	100.1675	97.2238	107.4023	107.3900	118.5310	123.5420	130.6868	(219)
Water heating fuel used												1384.3856	(219)
Annual totals kWh/year													
Space heating fuel - main system												2002.3084	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 6.6170, total flow = 29.0000, SFP = 0.2282)													
mechanical ventilation fans (SFP = 0.2282)												64.8086	(230a)
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												139.8086	(231)
Electricity for lighting (calculated in Appendix L)												413.3962	(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												2115.7393	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2002.3084	3.9200	78.4905 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1384.3856	3.9200	54.2679 (247)
Mechanical ventilation fans	64.8086	16.9600	10.9915 (249)
Pumps and fans for heating	75.0000	16.9600	12.7200 (249)
Energy for lighting	413.3962	16.9600	70.1120 (250)
Additional standing charges			88.0000 (251)
Energy saving/generation technologies			
PV Unit	-1824.1596	16.9600	-309.3775 (252)
Total energy cost			5.2045 (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	2002.3084	0.2160	432.4986 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1384.3856	0.2160	299.0273 (264)
Space and water heating			731.5259 (265)
Pumps and fans	139.8086	0.5190	72.5607 (267)
Energy for lighting	413.3962	0.5190	214.5527 (268)
Energy saving/generation technologies			
PV Unit	-1824.1596	0.5190	-946.7389 (269)
Total kg/year			71.9004 (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	2002.3084	1.2200	2442.8162 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1384.3856	1.2200	1688.9505 (264)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Space and water heating			4131.7667 (265)
Pumps and fans	139.8086	3.0700	429.2125 (267)
Energy for lighting	413.3962	3.0700	1269.1265 (268)
Energy saving/generation technologies			
PV Unit	-1824.1596	3.0700	-5600.1701 (269)
Primary energy kWh/year			229.9356 (272)
Primary energy kWh/m2/year			2.4296 (273)

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

Overheating Calculation Input Data

Dwelling type	SemiDetached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Thames Valley
Front of dwelling faces	North East
Overshading	Average or unknown
Thermal mass parameter	151.7 (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	307.32 (P1)
Transmission heat loss coefficient	53.03 (37)
Summer heat loss coefficient	360.35 (P2)

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

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

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North East	4.8800	98.8453	0.4600	0.0000	0.9000	199.6991
South West	5.7100	119.9223	0.4600	0.0000	0.9000	283.4892
South West	3.3300	119.9223	0.4300	0.0000	0.9000	154.5451
total:						637.7334

	Jun	Jul	Aug	
Solar gains	675	638	572	(P3/P4)
Internal gains	473	453	462	
Total summer gains	1148	1091	1034	(P5)
Summer gain/loss ratio	3.19	3.03	2.87	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 151.7)	0.94	0.94	0.94	
Threshold temperature	20.13	21.87	21.61	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	
Assessment of likelihood of high internal temperature:	Slight			