

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property Reference	Asher End/Semi (ASHP + PV)				Issued on Date	15/12/2022
Assessment Reference	Asher End/Semi (ASHP + PV)	Prop Type Ref	Asher			
Property	3 Bed, WC, B, 2 Storey					
SAP Rating	93 A	DER	8.22	TER	24.27	
Environmental	94 A	% DER<TER	66.14			
CO ₂ Emissions (t/year)	0.57	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						

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

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:Electricity

Fuel factor:1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER) 24.27 kgCO₂/m²

Dwelling Carbon Dioxide Emission Rate (DER) 8.22 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: Heat pump with radiators or underfloor - Electric
Vaillant aroTHERM 8kW VWL 85/3 A 230v

Secondary heating system: None

5 Cylinder insulation

Hot water storage Measured cylinder loss: 1.56 kWh/day
Permitted by DBSCG 2.24 OK
Primary pipework insulated: Yes OK

6 Controls

Space heating controls: Time and temperature zone control OK

Hot water controls:

Cylinderstat OK
Independent timer for DHW OK

7 Low energy lights

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

8 Mechanical ventilation

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

9 Summertime temperature

Overheating risk (Thames Valley): Medium OK

Based on:

Overshading: Average
Windows facing North East: 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
Photovoltaic array 1.20 kW

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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							
	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 DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 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 content (annual)	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)
Distribution loss	Total = Sum(45)m = 1541.0786 (45)												
	(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:													
Store volume													200.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.5600 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													0.8424 (55)
Total storage loss													
	26.1144	23.5872	26.1144	25.2720	26.1144	25.2720	26.1144	26.1144	25.2720	26.1144	25.2720	26.1144	(56)
If cylinder contains dedicated solar storage													
	26.1144	23.5872	26.1144	25.2720	26.1144	25.2720	26.1144	26.1144	25.2720	26.1144	25.2720	26.1144	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month													
	209.1537	184.3403	193.5779	173.5020	170.0662	151.8780	145.8352	160.0642	159.7934	179.9130	190.2744	204.1122	(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	155.8254	137.4182	145.6878	134.1000	133.4210	121.6972	120.2926	129.1379	127.9647	140.5660	144.6957	152.5679	(64)
													Total per year (kWh/year) = Sum(64)m = 1643.3744 (64)
Heat gains from water heating, kWh/month													
	92.6273	82.1429	87.4483	80.0284	79.6107	72.8385	71.5739	76.3050	75.4703	82.9047	85.6053	90.9510	(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)	124.4990	122.2365	117.5380	111.1506	107.0037	101.1645	96.2014	102.5605	104.8199	111.4311	118.8962	122.2459	(72)
Total internal gains	458.5283	456.2153	441.1660	416.9006	392.1391	368.4725	353.2458	359.6553	372.2656	396.7547	424.8344	446.0116	(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	593.0132	691.7708	780.6698	866.4033	921.9442	906.0256	866.6856	811.4156	749.5841	661.7330	587.0960	560.3393 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)

Utilisation factor for gains for living area, nil,m (see Table 9a)													21.0000 (85)
	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	0.9847	0.9716	0.9439	0.8806	0.7629	0.5990	0.4515	0.4984	0.7227	0.9113	0.9731	0.9876	(86)
Tweekday	18.1966	18.5094	18.9668	19.4852	19.8751	20.0584	20.1022	20.0968	19.9878	19.4870	18.7322	18.1096	
Tweekend	20.0771	20.2170	20.4236	20.6639	20.8561	20.9584	20.9892	20.9841	20.9126	20.6595	20.3152	20.0382	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
MIT	19.5756	19.7889	20.1104	20.4751	20.7778	20.9360	20.9834	20.9755	20.8636	20.4745	19.9308	19.5156	(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													
	0.9816	0.9661	0.9330	0.8572	0.7186	0.5298	0.3657	0.4101	0.6589	0.8887	0.9669	0.9851	(89)
Tweekday	18.1966	18.5094	18.9668	19.4852	19.8751	20.0584	20.1022	20.0968	19.9878	19.4870	18.7322	18.1096	
Tweekend	18.1966	18.5094	18.9668	19.4852	19.8751	20.0584	20.1022	20.0968	19.9878	19.4870	18.7322	18.1096	
MIT 2	18.1966	18.5094	18.9668	19.4852	19.8751	20.0584	20.1022	20.0968	19.9878	19.4870	18.7322	18.1096	(90)
Living area fraction									fLA = Living area / (4) =			0.1396	(91)
MIT	18.3891	18.6880	19.1264	19.6234	20.0011	20.1809	20.2252	20.2195	20.1100	19.6249	18.8995	18.3058	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3891	18.6880	19.1264	19.6234	20.0011	20.1809	20.2252	20.2195	20.1100	19.6249	18.8995	18.3058	(93)

8. Space heating requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9734	0.9543	0.9178	0.8423	0.7126	0.5355	0.3769	0.4212	0.6588	0.8736	0.9555	0.9779	(94)
Useful gains	577.2209	660.1913	716.4606	729.7901	657.0135	485.1724	326.6722	341.7645	493.8046	578.1071	560.9496	547.9352	(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													
	1288.3760	1260.8358	1154.6192	980.5974	759.0955	510.3469	331.5074	349.2713	549.5860	825.2762	1079.0044	1289.9025	(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													
	529.0993	403.6331	325.9900	180.5813	75.9490	0.0000	0.0000	0.0000	0.0000	183.8938	372.9994	552.0237	(98)
Space heating													2624.1696 (98)
Space heating per m2											(98) / (4) =	27.7279	(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 %)													251.3853	(206)
Efficiency of secondary/supplementary heating system, %													100.0000	(208)
Space heating requirement													1043.8833	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	529.0993	403.6331	325.9900	180.5813	75.9490	0.0000	0.0000	0.0000	0.0000	183.8938	372.9994	552.0237	(98)	
Space heating efficiency (main heating system 1)	251.3853	251.3853	251.3853	251.3853	251.3853	0.0000	0.0000	0.0000	0.0000	251.3853	251.3853	251.3853	(210)	
Space heating fuel (main heating system)	210.4734	160.5635	129.6774	71.8345	30.2122	0.0000	0.0000	0.0000	0.0000	73.1522	148.3776	219.5926	(211)	
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)	
Water heating														
Water heating requirement	155.8254	137.4182	145.6878	134.1000	133.4210	121.6972	120.2926	129.1379	127.9647	140.5660	144.6957	152.5679	(64)	
Efficiency of water heater													170.2800	(216)
(217)m	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	(217)	
Fuel for water heating, kWh/month	91.5113	80.7013	85.5578	78.7527	78.3539	71.4689	70.6440	75.8385	75.1496	82.5499	84.9752	89.5982	(219)	
Water heating fuel used													965.1012	(219)
Annual totals kWh/year														
Space heating fuel - main system													1043.8833	(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)
Total electricity for the above, kWh/year													64.8086	(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 * 1.20 * 1029 * 1.00) =										-988.0192			-988.0192	(233)
Total delivered energy for all uses													1499.1702	(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	1043.8833	0.5190	541.7754	(261)
Space heating - secondary	0.0000	0.5190	0.0000	(263)
Water heating (other fuel)	965.1012	0.5190	500.8875	(264)
Space and water heating			1042.6630	(265)
Pumps and fans	64.8086	0.5190	33.6357	(267)
Energy for lighting	413.3962	0.5190	214.5527	(268)
Energy saving/generation technologies				
PV Unit	-988.0192	0.5190	-512.7820	(269)
Total CO2, kg/year			778.0693	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			8.2200	(273)

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

DER		8.2200	ZC1
Total Floor Area		94.6400	
Assumed number of occupants		2.6841	
CO2 emission factor in Table 12 for electricity displaced from grid		0.5190	
CO2 emissions from appliances, equation (L14)		15.4882	ZC2
CO2 emissions from cooking, equation (L16)		1.9381	ZC3
Total CO2 emissions		25.6463	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		25.6463	ZC8

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	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 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											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:												
Store volume												200.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.6525 (48)
Temperature factor from Table 2b												0.5400 (49)

Enter (49) or (54) in (55)												0.8924 (55)
Total storage loss	27.6637	24.9865	27.6637	26.7713	27.6637	26.7713	27.6637	27.6637	26.7713	27.6637	26.7713	27.6637 (56)
If cylinder contains dedicated solar storage	27.6637	24.9865	27.6637	26.7713	27.6637	26.7713	27.6637	27.6637	26.7713	27.6637	26.7713	27.6637 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	210.7030	185.7396	195.1272	175.0013	171.5555	153.3773	147.3845	161.6135	161.2927	181.4622	191.7737	205.6615 (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	210.7030	185.7396	195.1272	175.0013	171.5555	153.3773	147.3845	161.6135	161.2927	181.4622	191.7737	205.6615 (64)
	Total per year (kWh/year) = Sum(64)m = 2140.6920 (64)											
Heat gains from water heating, kWh/month	93.8667	83.2624	88.6877	81.2279	80.8501	74.0379	72.8133	77.5444	76.6698	84.1441	86.8047	92.1904 (65)

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)	126.1649	123.9023	119.2039	112.8165	108.6695	102.8304	97.8673	104.2264	106.4858	113.0970	120.5621	123.9118	(72)
Total internal gains	463.1941	460.8812	445.8318	421.5665	396.8050	373.1384	357.9117	364.3212	376.9315	401.4206	429.5003	450.6774	(73)

[Jan]	Area	Solar flux	g	FF	Access	Gains
	m2	Table 6a	Specific data	Specific data	factor	W
		W/m2	or Table 6b	or Table 6c	Table 6d	
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)

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3568.3700 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	672.5792	522.1439	429.6507	233.4780	90.3912	0.0000	0.0000	0.0000	0.0000	231.6884	468.7173	687.7773	(98)
Space heating efficiency (main heating system 1)	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)
Space heating fuel (main heating system)	719.3361	558.4426	459.5194	249.7091	96.6751	0.0000	0.0000	0.0000	0.0000	247.7951	501.3019	735.5907	(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	210.7030	185.7396	195.1272	175.0013	171.5555	153.3773	147.3845	161.6135	161.2927	181.4622	191.7737	205.6615	(64)
Efficiency of water heater (217)m	87.6950	87.4242	86.8625	85.5836	83.1942	79.8000	79.8000	79.8000	79.8000	85.4667	87.1087	87.7903	(216)
Fuel for water heating, kWh/month	240.2678	212.4579	224.6392	204.4798	206.2108	192.2022	184.6923	202.5232	202.1212	212.3193	220.1545	234.2643	(219)
Water heating fuel used												2536.3326	(219)
Annual totals kWh/year													
Space heating fuel - main system												3568.3700	(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												6593.0988	(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	3568.3700	0.2160	770.7679 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2536.3326	0.2160	547.8478 (264)
Space and water heating			1318.6158 (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			1572.0934 (272)
Emissions per m2 for space and water heating			13.9330 (272a)
Fuel factor (electricity)			1.5500
Emissions per m2 for lighting			2.2670 (272b)
Emissions per m2 for pumps and fans			0.4113 (272c)
Target Carbon Dioxide Emission Rate (TER) = (13.9330 * 1.55) + 2.2670 + 0.4113, rounded to 2 d.p.			24.2700 (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)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	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)
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	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	0.0000 (57)
Heat gains from water heating, kWh/month	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
	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	0.6300	0.7000	0.7700		16.8273		
Southwest				9.0400	36.7938	0.6300	0.7000	0.7700		101.6518 (75)		
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									fLA = Living area / (4) =			0.1396	(91)
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	(92)
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 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 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 content (annual)	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)
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:													
Store volume													200.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.5600 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													0.8424 (55)
Total storage loss													
26.1144	23.5872	26.1144	25.2720	26.1144	25.2720	26.1144	26.1144	25.2720	26.1144	25.2720	26.1144	25.2720	(56)
If cylinder contains dedicated solar storage													
26.1144	23.5872	26.1144	25.2720	26.1144	25.2720	26.1144	26.1144	25.2720	26.1144	25.2720	26.1144	25.2720	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month													
209.1537	184.3403	193.5779	173.5020	170.0062	151.8780	145.8352	160.0642	159.7934	179.9130	190.2744	204.1122	204.1122	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Output from w/h	209.1537	184.3403	193.5779	173.5020	170.0062	151.8780	145.8352	160.0642	159.7934	179.9130	190.2744	204.1122	(64)
RHI water heating demand													
Heat gains from water heating, kWh/month	92.6273	82.1429	87.4483	80.0284	79.6107	72.8385	71.5739	76.3050	75.4703	82.9047	85.6053	90.9510	(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	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	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	53.7884	(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	-107.3624	(71)
Water heating gains (Table 5)													
124.4990	122.2365	117.5380	111.1506	107.0037	101.1645	96.2014	102.5605	104.8199	111.4311	118.8962	122.2459	122.2459	(72)
Total internal gains	659.6834	654.7088	630.6497	593.4405	555.2694	521.3206	501.6941	510.7652	532.3854	569.8183	611.3075	642.7669	(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	808.4920	889.6356	966.4693	1054.2651	1086.6288	1099.1758	1047.3105	1000.1506	937.8387	852.3406	795.3152	768.0129 (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	0.9525	0.9316	0.8828	0.7808	0.6185	0.4080	0.2695	0.2909	0.5373	0.7996	0.9200	0.9592 (86)
Tweekday	18.7601	18.9834	19.3825	19.7834	20.0268	20.1032	20.1110	20.1107	20.0815	19.8194	19.2497	18.6886
Tweekend	20.3308	20.4330	20.6179	20.8123	20.9418	20.9914	20.9988	20.9983	20.9741	20.8257	20.5528	20.2982
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	0	0	0	0	0	0	0	0	0	0	0	0
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0
MIT	19.9672	20.1229	20.4103	20.7069	20.9102	20.9868	20.9981	20.9974	20.9596	20.7311	20.3017	19.9168 (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												
	0.9439	0.9196	0.8625	0.7453	0.5633	0.3386	0.1928	0.2110	0.4645	0.7586	0.9037	0.9516 (89)
Tweekday	18.7601	18.9834	19.3825	19.7834	20.0268	20.1032	20.1110	20.1107	20.0815	19.8194	19.2497	18.6886
Tweekend	18.7601	18.9834	19.3825	19.7834	20.0268	20.1032	20.1110	20.1107	20.0815	19.8194	19.2497	18.6886
MIT 2	18.7601	18.9834	19.3825	19.7834	20.0268	20.1032	20.1110	20.1107	20.0815	19.8194	19.2497	18.6886 (90)
Living area fraction									fLA = Living area / (4) =			0.1396 (91)
MIT	18.9286	19.1424	19.5259	19.9123	20.1501	20.2266	20.2348	20.2345	20.2041	19.9467	19.3965	18.8600 (92)
Temperature adjustment												0.0000
adjusted MIT	18.9286	19.1424	19.5259	19.9123	20.1501	20.2266	20.2348	20.2345	20.2041	19.9467	19.3965	18.8600 (93)

8. Space heating requirement

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	
Utilisation	0.9293	0.9036	0.8470	0.7366	0.5658	0.3478	0.2035	0.2221	0.4723	0.7501	0.8878	0.9379	(94)
Useful gains	751.3330	803.9074	818.5823	776.5929	614.8252	382.2486	213.1650	222.1315	442.9657	639.3395	706.1170	720.2947	(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													
Month fracti	1264.5490	1238.3826	1108.8531	915.5707	653.8426	386.4960	213.5055	222.6204	457.5969	763.2575	1042.1493	1258.2831	(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)
RHI space heating demand	381.8327	291.9673	215.9615	100.0640	29.0290	0.0000	0.0000	0.0000	0.0000	92.1950	241.9432	400.2634	(98)
												1753.2561	(98)
												1753	(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) =											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)

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:													
Store volume												200.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5600	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8424	(55)
Total storage loss													
	26.1144	23.5872	26.1144	25.2720	26.1144	25.2720	26.1144	26.1144	25.2720	26.1144	25.2720	26.1144	(56)
If cylinder contains dedicated solar storage													
	26.1144	23.5872	26.1144	25.2720	26.1144	25.2720	26.1144	26.1144	25.2720	26.1144	25.2720	26.1144	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month													
	209.1537	184.3403	193.5779	173.5020	170.0062	151.8780	145.8352	160.0642	159.7934	179.9130	190.2744	204.1122	(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													
	155.8254	137.4182	145.6878	134.1000	133.4210	121.6972	120.2926	129.1379	127.9647	140.5660	144.6957	152.5679	(64)
Heat gains from water heating, kWh/month													
	92.6273	82.1429	87.4483	80.0284	79.6107	72.8385	71.5739	76.3050	75.4703	82.9047	85.6053	90.9510	(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	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)													
	124.4990	122.2365	117.5380	111.1506	107.0037	101.1645	96.2014	102.5605	104.8199	111.4311	118.8962	122.2459	(72)
Total internal gains													
	659.6834	654.7088	630.6497	593.4405	555.2694	521.3206	501.6941	510.7652	532.3854	569.8183	611.3075	642.7669	(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			794.1683	890.2643	970.1536	1042.9431	1085.0745	1058.8737	1015.1339	962.5255	909.7039	834.7966	773.5691	757.0946 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains for living area, nil,m (see Table 9a)													21.0000 (85)
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	0.9611	0.9395	0.8990	0.8190	0.6900	0.5269	0.3899	0.4272	0.6326	0.8446	0.9384	0.9670	(86)
Tweekday	18.5861	18.8615	19.2489	19.6637	19.9528	20.0785	20.1061	20.1032	20.0380	19.6865	19.0618	18.4989	
Tweekend	20.2526	20.3778	20.5560	20.7532	20.9004	20.9733	20.9935	20.9907	20.9457	20.7593	20.4665	20.2131	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
MIT	19.8465	20.0375	20.3148	20.6146	20.8463	20.9590	20.9900	20.9857	20.9152	20.6285	20.1670	19.7856	(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													
	0.9542	0.9291	0.8819	0.7893	0.6429	0.4619	0.3139	0.3487	0.5678	0.8122	0.9260	0.9611	(89)
Tweekday	18.5861	18.8615	19.2489	19.6637	19.9528	20.0785	20.1061	20.1032	20.0380	19.6865	19.0618	18.4989	
Tweekend	18.5861	18.8615	19.2489	19.6637	19.9528	20.0785	20.1061	20.1032	20.0380	19.6865	19.0618	18.4989	
MIT 2	18.5861	18.8615	19.2489	19.6637	19.9528	20.0785	20.1061	20.1032	20.0380	19.6865	19.0618	18.4989	(90)
Living area fraction													
fLA = Living area / (4) =												0.1396	(91)
MIT	18.7620	19.0256	19.3977	19.7964	20.0775	20.2014	20.2295	20.2264	20.1604	19.8180	19.2161	18.6785	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7620	19.0256	19.3977	19.7964	20.0775	20.2014	20.2295	20.2264	20.1604	19.8180	19.2161	18.6785	(93)

8. Space heating requirement

Regs Region: England
Elmhurst Energy Systems
SAP2012 Calculator (Design
System) version 4.14r19

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

Space heating - secondary	0.0000	0.5190	0.0000 (263)
Water heating (other fuel)	965.1012	0.5190	500.8875 (264)
Space and water heating			926.1564 (265)
Pumps and fans	64.8086	0.5190	33.6357 (267)
Energy for lighting	413.3962	0.5190	214.5527 (268)
Energy saving/generation technologies			
PV Unit	-988.0192	0.5190	-512.7820 (269)
Total kg/year			661.5627 (272)
CO2 emissions per m2			6.9900 (273)
EI value			93.6516
EI rating			94 (274)
EI band			A

----- Calculation of stars for heating and DHW

Main heating energy efficiency	$13.19 \times (1 + 0.29 \times 0.00) / 2.5139 = 5.247$, stars = 4
Main heating environmental impact	$0.519 \times (1 + 0.29 \times 0.00) / 2.5139 = 0.2065$, stars = 5
Water heating energy efficiency	$13.19 / 1.7028 = 7.746$, stars = 3
Water heating environmental impact	$0.519 / 1.7028 = 0.3048$, 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) =											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 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:													
Store volume													200.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.5600 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													0.8424 (55)
Total storage loss	26.1144	23.5872	26.1144	25.2720	26.1144	25.2720	26.1144	26.1144	25.2720	26.1144	25.2720	26.1144	(56)
If cylinder contains dedicated solar storage	26.1144	23.5872	26.1144	25.2720	26.1144	25.2720	26.1144	26.1144	25.2720	26.1144	25.2720	26.1144	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month	209.1537	184.3403	193.5779	173.5020	170.0062	151.8780	145.8352	160.0642	159.7934	179.9130	190.2744	204.1122	(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	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	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	155.8254	137.4182	145.6878	134.1000	133.4210	121.6972	120.2926	129.1379	127.9647	140.5660	144.6957	152.5679	(64)
Heat gains from water heating, kWh/month	92.6273	82.1429	87.4483	80.0284	79.6107	72.8385	71.5739	76.3050	75.4703	82.9047	85.6053	90.9510	(65)
Total per year (kWh/year) = Sum (64)m = 1643.3744													(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	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)	124.4990	122.2365	117.5380	111.1506	107.0037	101.1645	96.2014	102.5605	104.8199	111.4311	118.8962	122.2459	(72)
Total internal gains	659.6834	654.7088	630.6497	593.4405	555.2694	521.3206	501.6941	510.7652	532.3854	569.8183	611.3075	642.7669	(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	808.4920	889.6356	966.4693	1054.2651	1086.6288	1099.1758	1047.3105	1000.1506	937.8387	852.3406	795.3152	768.0129 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains for living area, nil,m (see Table 9a)	43.6036	43.6036	43.6036	43.6036	43.6036	43.6036	43.6036	43.6036	43.6036	43.6036	43.6036	43.6036	21.0000 (85)
tau	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	0.9525	0.9316	0.8828	0.7808	0.6185	0.4080	0.2695	0.2909	0.5373	0.7996	0.9200	0.9592	(86)
Tweekday	18.7601	18.9834	19.3825	19.7834	20.0268	20.1032	20.1110	20.1107	20.0815	19.8194	19.2497	18.6886	
Tweekend	20.3308	20.4330	20.6179	20.8123	20.9418	20.9914	20.9988	20.9983	20.9741	20.8257	20.5528	20.2982	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
MIT	19.9672	20.1229	20.4103	20.7069	20.9102	20.9868	20.9981	20.9974	20.9596	20.7311	20.3017	19.9168	(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	0.9439	0.9196	0.8625	0.7453	0.5633	0.3386	0.1928	0.2110	0.4645	0.7586	0.9037	0.9516	(89)
Tweekday	18.7601	18.9834	19.3825	19.7834	20.0268	20.1032	20.1110	20.1107	20.0815	19.8194	19.2497	18.6886	
Tweekend	18.7601	18.9834	19.3825	19.7834	20.0268	20.1032	20.1110	20.1107	20.0815	19.8194	19.2497	18.6886	
MIT 2	18.7601	18.9834	19.3825	19.7834	20.0268	20.1032	20.1110	20.1107	20.0815	19.8194	19.2497	18.6886	(90)
Living area fraction	fLA = Living area / (4) =												0.1396 (91)
MIT	18.9286	19.1424	19.5259	19.9123	20.1501	20.2266	20.2348	20.2345	20.2041	19.9467	19.3965	18.8600	(92)
Temperature adjustment													0.0000
adjusted MIT	18.9286	19.1424	19.5259	19.9123	20.1501	20.2266	20.2348	20.2345	20.2041	19.9467	19.3965	18.8600	(93)

8. Space heating requirement

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	
Utilisation	0.9293	0.9036	0.8470	0.7366	0.5658	0.3478	0.2035	0.2221	0.4723	0.7501	0.8878	0.9379	(94)
Useful gains	751.3330	803.9074	818.5823	776.5929	614.8252	382.2486	213.1650	222.1315	442.9657	639.3395	706.1170	720.2947	(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													
	1264.5490	1238.3826	1108.8531	915.5707	653.8426	386.4960	213.5055	222.6204	457.5969	763.2575	1042.1493	1258.2831	(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													
	381.8327	291.9673	215.9615	100.0640	29.0290	0.0000	0.0000	0.0000	0.0000	92.1950	241.9432	400.2634	(98)
Space heating													
Space heating per m2													
											(98) / (4) =	18.5255	(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 %)													251.3853	(206)
Efficiency of secondary/supplementary heating system, %													100.0000	(208)
Space heating requirement													697.4377	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	381.8327	291.9673	215.9615	100.0640	29.0290	0.0000	0.0000	0.0000	0.0000	92.1950	241.9432	400.2634	(98)	
Space heating efficiency (main heating system 1)	251.3853	251.3853	251.3853	251.3853	251.3853	0.0000	0.0000	0.0000	0.0000	251.3853	251.3853	251.3853	(210)	
Space heating fuel (main heating system)	151.8914	116.1433	85.9085	39.8050	11.5476	0.0000	0.0000	0.0000	0.0000	36.6748	96.2440	159.2231	(211)	
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)	
Water heating														
Water heating requirement	155.8254	137.4182	145.6878	134.1000	133.4210	121.6972	120.2926	129.1379	127.9647	140.5660	144.6957	152.5679	(64)	
Efficiency of water heater													170.2800	(216)
(217)m	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	(217)	
Fuel for water heating, kWh/month	91.5113	80.7013	85.5578	78.7527	78.3539	71.4689	70.6440	75.8385	75.1496	82.5499	84.9752	89.5982	(219)	
Water heating fuel used													965.1012	(219)
Annual totals kWh/year														
Space heating fuel - main system													697.4377	(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)
Total electricity for the above, kWh/year													64.8086	(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 * 1.20 * 1090 * 1.00) =										-1046.8728		-1046.8728	(233)	
Total delivered energy for all uses												1093.8710	(238)	

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	697.4377	16.9600	118.2854 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	965.1012	16.9600	163.6812 (247)
Mechanical ventilation fans	64.8086	16.9600	10.9915 (249)
Pumps and fans for heating	0.0000	0.0000	0.0000 (249)
Energy for lighting	413.3962	16.9600	70.1120 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit	-1046.8728	16.9600	-177.5496 (252)
Total energy cost			185.5205 (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	697.4377	0.5190	361.9702	(261)
Space heating - secondary	0.0000	0.5190	0.0000	(263)
Water heating (other fuel)	965.1012	0.5190	500.8875	(264)
Space and water heating			862.8577	(265)
Pumps and fans	64.8086	0.5190	33.6357	(267)
Energy for lighting	413.3962	0.5190	214.5527	(268)
Energy saving/generation technologies				
PV Unit	-1046.8728	0.5190	-543.3270	(269)
Total kg/year			567.7191	(272)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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	697.4377	3.0700	2141.1338 (261)
Space heating - secondary	0.0000	3.0700	0.0000 (263)
Water heating (other fuel)	965.1012	3.0700	2962.8607 (264)
Space and water heating			5103.9945 (265)
Pumps and fans	64.8086	3.0700	198.9625 (267)
Energy for lighting	413.3962	3.0700	1269.1265 (268)
Energy saving/generation technologies			
PV Unit	-1046.8728	3.0700	-3213.8994 (269)
Primary energy kWh/year			3358.1841 (272)
Primary energy kWh/m2/year			35.4838 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: A 93
Current environmental impact rating: A 94

(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	Recommended
O	Not considered
P	Not considered
R	Not considered
S	Not considered
T	Not considered
U Solar photovoltaic panels	Already installed
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
N Solar water heating	+ 2.1	-£ 65	-200 kg (35.3%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£65	2.11 kg/m²	A 95
Total Savings	£65	2.11 kg/m²	A 96

Potential energy efficiency rating: A 95
Potential environmental impact rating: A 96

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 £363	Potential £298	Saving £65
Electricity			
Space heating	£129	£129	-£0
Water heating	£164	£98	£66
Lighting	£70	£70	£0
Generated (PV)	-£178	-£178	£0
Total cost of fuels	£185	£120	£65
Total cost of uses	£185	£119	£66
Delivered energy	12 kWh/m²	7 kWh/m²	4 kWh/m²
Carbon dioxide emissions	0.6 tonnes	0.4 tonnes	0.2 tonnes
CO2 emissions per m²	6 kg/m²	4 kg/m²	2 kg/m²
Primary energy	35 kWh/m²	23 kWh/m²	13 kWh/m²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

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

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
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 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:													
Store volume												200.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5600	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8424	(55)
Total storage loss													
	26.1144	23.5872	26.1144	25.2720	26.1144	25.2720	26.1144	26.1144	25.2720	26.1144	25.2720	26.1144	(56)
If cylinder contains dedicated solar storage													
	26.1144	23.5872	26.1144	25.2720	26.1144	25.2720	26.1144	26.1144	25.2720	26.1144	25.2720	26.1144	(57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month	209.1537	184.3403	192.1822	166.7484	157.2119	139.2713	132.8083	147.9678	154.3905	178.5172	190.2744	204.1122	(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	
Aperture area of solar collector												3.0000	(H1)
Zero-loss collector efficiency												0.7000	(H2)
Collector heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0050	(H3a)
Collector effective heat loss coefficient												1.8063	(H3b)
Collector performance ratio												2.5804	(H4)
Annual solar radiation per m2												1079.5246	(H5)
Overshading factor												0.8000	(H6)
Solar energy available												1813.6014	(H7)
Adjustment factor for showers												1.0000	(H7a)
Solar-to-load ratio												1.7077	(H8)
Utilisation factor												0.4432	(H9)
Collector performance factor												0.8793	(H10)
Dedicated solar storage volume												75.0000	(H11)
Effective solar volume												75.0000	(H13)
Daily hot water demand												97.9464	(H14)
Volume ratio Veff/V												0.7657	(H15)
Solar storage volume factor												0.9466	(H16)
Solar input												-669.0569	(H17)
Solar input	-19.4013	-32.3752	-55.1387	-73.8967	-91.2932	-89.7557	-88.5696	-77.3837	-60.6069	-41.3874	-23.0128	-16.2356	(63)
Output from w/h												-669.0569	(63)
	136.4241	105.0430	89.1534	53.4497	29.3335	19.3347	18.6960	39.6577	61.9548	97.7828	121.6830	136.3323	(64)
Heat gains from water heating, kWh/month	92.6273	82.1429	86.3317	74.6256	69.3753	62.7531	61.1523	66.6279	71.1480	81.7881	85.6053	90.9510	(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	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)	124.4990	122.2365	116.0372	103.6466	93.2463	87.1571	82.1940	89.5536	98.8167	109.9303	118.8962	122.2459	(72)
Total internal gains	659.6834	654.7088	629.1489	585.9365	541.5121	507.3131	487.6866	497.7583	526.3822	568.3175	611.3075	642.7669	(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	794.1683	890.2643	968.6528	1035.4391	1071.3171	1044.8662	1001.1264	949.5186	903.7007	833.2958	773.5691		757.0946 (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	0.9611	0.9395	0.8994	0.8217	0.6959	0.5329	0.3950	0.4326	0.6357	0.8452	0.9384	0.9670	(86)	
Tweekday	18.5861	18.8615	19.2469	19.6573	19.9475	20.0771	20.1059	20.1028	20.0366	19.6850	19.0618	18.4989		
Tweekend	20.2526	20.3778	20.5551	20.7499	20.8973	20.9722	20.9932	20.9903	20.9447	20.7586	20.4665	20.2131		

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	0	0	0	0	0	0	0	0	0	0	0	0	0
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0	0
MIT	19.8465	20.0375	20.3133	20.6094	20.8415	20.9573	20.9896	20.9850	20.9137	20.6274	20.1670	19.7856	(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													
	0.9542	0.9291	0.8824	0.7922	0.6489	0.4675	0.3182	0.3533	0.5709	0.8129	0.9260	0.9611	(89)
Tweekday	18.5861	18.8615	19.2469	19.6573	19.9475	20.0771	20.1059	20.1028	20.0366	19.6850	19.0618	18.4989	
Tweekend	18.5861	18.8615	19.2469	19.6573	19.9475	20.0771	20.1059	20.1028	20.0366	19.6850	19.0618	18.4989	
MIT 2	18.5861	18.8615	19.2469	19.6573	19.9475	20.0771	20.1059	20.1028	20.0366	19.6850	19.0618	18.4989	(90)
Living area fraction									fLA = Living area / (4) =				0.1396 (91)
MIT	18.7620	19.0256	19.3958	19.7902	20.0723	20.2000	20.2292	20.2260	20.1590	19.8166	19.2161	18.6785	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7620	19.0256	19.3958	19.7902	20.0723	20.2000	20.2292	20.2260	20.1590	19.8166	19.2161	18.6785	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9407	0.9135	0.8663	0.7804	0.6467	0.4742	0.3285	0.3637	0.5745	0.8007	0.9105	0.9485	(94)
Useful gains	747.0452	813.2314	839.1060	808.0572	692.8086	495.4859	328.8890	345.3610	519.2015	667.2189	704.3221	718.0694	(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													
	1322.4767	1291.7157	1179.2523	995.8495	765.5996	512.0863	331.8714	349.8640	554.0631	842.8068	1107.9495	1323.9837	(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													
	428.1211	321.5415	253.0688	135.2105	54.1565	0.0000	0.0000	0.0000	0.0000	130.6374	290.6117	450.8003	(98)
Space heating													2064.1477 (98)
Space heating per m2													(98) / (4) = 21.8105 (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 %)													251.3853 (206)
Efficiency of secondary/supplementary heating system, %													100.0000 (208)
Space heating requirement													821.1091 (211)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	428.1211	321.5415	253.0688	135.2105	54.1565	0.0000	0.0000	0.0000	0.0000	130.6374	290.6117	450.8003	(98)
Space heating efficiency (main heating system 1)	251.3853	251.3853	251.3853	251.3853	251.3853	0.0000	0.0000	0.0000	0.0000	251.3853	251.3853	251.3853	(210)
Space heating fuel (main heating system)	170.3047	127.9078	100.6697	53.7861	21.5432	0.0000	0.0000	0.0000	0.0000	51.9670	115.6041	179.3264	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	136.4241	105.0430	89.1534	53.4497	29.3335	19.3347	18.6960	39.6577	61.9548	97.7828	121.6830	136.3323	(64)
Efficiency of water heater	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	(216)
(217)m	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	(217)
Fuel for water heating, kWh/month	80.1175	61.6884	52.3569	31.3893	17.2266	11.3547	10.9796	23.2897	36.3841	57.4247	71.4605	80.0636	(219)
Water heating fuel used												533.7357	(219)
Annual totals kWh/year													
Space heating fuel - main system												821.1091	(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)
pump for solar water heating													50.0000 (230g)
Total electricity for the above, kWh/year													114.8086 (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 * 1.20 * 1029 * 1.00) =										-988.0192		-988.0192	(233)
Total delivered energy for all uses												895.0304	(238)

10a. Fuel costs - using Table 12 prices

	Fuel	Fuel price	Fuel cost	
	kWh/year	p/kWh	£/year	
Space heating - main system 1	821.1091	13.1900	108.3043	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	533.7357	13.1900	70.3997	(247)
Mechanical ventilation fans	64.8086	13.1900	8.5483	(249)
Pumps and fans for heating	0.0000	0.0000	0.0000	(249)
Pump for solar water heating	50.0000	13.1900	6.5950	(249)
Energy for lighting	413.3962	13.1900	54.5270	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit	-988.0192	13.1900	-130.3197	(252)
Total energy cost			118.0545	(255)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	0.3551 (257)
SAP value		95.0467
SAP rating (Section 12)		95 (258)
SAP band		A

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	821.1091	0.5190	426.1556 (261)
Space heating - secondary	0.0000	0.5190	0.0000 (263)
Water heating (other fuel)	533.7357	0.5190	277.0088 (264)
Space and water heating			703.1644 (265)
Pumps and fans	114.8086	0.5190	59.5857 (267)
Energy for lighting	413.3962	0.5190	214.5527 (268)
Energy saving/generation technologies			
PV Unit	-988.0192	0.5190	-512.7820 (269)
Total kg/year			464.5208 (272)
CO2 emissions per m2			4.9100 (273)
EI value			95.5424
EI rating			96 (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:													
Store volume												200.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5600	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8424	(55)
Total storage loss	26.1144	23.5872	26.1144	25.2720	26.1144	25.2720	26.1144	26.1144	25.2720	26.1144	25.2720	26.1144	(56)
If cylinder contains dedicated solar storage	26.1144	23.5872	26.1144	25.2720	26.1144	25.2720	26.1144	26.1144	25.2720	26.1144	25.2720	26.1144	(57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month	209.1537	184.3403	192.1822	166.7484	157.2119	139.2713	132.8083	147.9678	154.3905	178.5172	190.2744	204.1122	(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	
Aperture area of solar collector												3.0000	(H1)
Zero-loss collector efficiency												0.7000	(H2)
Collector heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0050	(H3a)
Collector effective heat loss coefficient												1.8063	(H3b)
Collector performance ratio												2.5804	(H4)
Annual solar radiation per m2												1140.0998	(H5)
Overshading factor												0.8000	(H6)
Solar energy available												1915.3676	(H7)
Adjustment factor for showers												1.0000	(H7a)
Solar-to-load ratio												1.8035	(H8)
Utilisation factor												0.4256	(H9)
Collector performance factor												0.8793	(H10)
Dedicated solar storage volume												75.0000	(H11)
Effective solar volume												75.0000	(H13)
Daily hot water demand												97.9464	(H14)
Volume ratio Veff/V												0.7657	(H15)
Solar storage volume factor												0.9466	(H16)
Solar input												-678.5481	(H17)
Solar input	-20.8854	-31.3907	-52.8659	-73.0768	-88.0090	-92.6257	-90.4016	-80.7292	-63.0094	-42.8641	-25.3867	-17.3037	(63)
Output from w/h	134.9401	106.0275	91.4262	54.2696	32.6176	16.4648	16.8640	36.3123	59.5524	96.3061	119.3090	135.2642	(64)
Heat gains from water heating, kWh/month	92.6273	82.1429	86.3317	74.6256	69.3753	62.7531	61.1523	66.6279	71.1480	81.7881	85.6053	90.9510	(65)
Total per year (kWh/year) = Sum (64)m =													
899.3539 (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	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)	124.4990	122.2365	116.0372	103.6466	93.2463	87.1571	82.1940	89.5536	98.8167	109.9303	118.8962	122.2459	(72)
Total internal gains	659.6834	654.7088	629.1489	585.9365	541.5121	507.3131	487.6866	497.7583	526.3822	568.3175	611.3075	642.7669	(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	808.4920	889.6356	964.9685	1046.7611	1072.8715	1085.1683	1033.3030	987.1437	931.8355	850.8398	795.3152	768.0129 (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	0.9525	0.9316	0.8832	0.7838	0.6245	0.4129	0.2731	0.2946	0.5402	0.8003	0.9200	0.9592	(86)
Tweekday	18.7601	18.9834	19.3807	19.7782	20.0237	20.1029	20.1109	20.1107	20.0809	19.8183	19.2497	18.6886	
Tweekend	20.3308	20.4330	20.6170	20.8096	20.9398	20.9910	20.9987	20.9983	20.9736	20.8251	20.5528	20.2982	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	0	0	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0	0	
MIT	19.9672	20.1229	20.4089	20.7027	20.9071	20.9862	20.9980	20.9973	20.9588	20.7301	20.3017	19.9168	(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														
	0.9439	0.9196	0.8629	0.7484	0.5692	0.3429	0.1954	0.2137	0.4672	0.7593	0.9037	0.9516	(89)	
Tweekday	18.7601	18.9834	19.3807	19.7782	20.0237	20.1029	20.1109	20.1107	20.0809	19.8183	19.2497	18.6886		
Tweekend	18.7601	18.9834	19.3807	19.7782	20.0237	20.1029	20.1109	20.1107	20.0809	19.8183	19.2497	18.6886		
MIT 2	18.7601	18.9834	19.3807	19.7782	20.0237	20.1029	20.1109	20.1107	20.0809	19.8183	19.2497	18.6886	(90)	
Living area fraction									fLA = Living area / (4) =				0.1396	(91)
MIT	18.9286	19.1424	19.5242	19.9073	20.1470	20.2262	20.2348	20.2344	20.2035	19.9456	19.3965	18.8600	(92)	
Temperature adjustment												0.0000		
adjusted MIT	18.9286	19.1424	19.5242	19.9073	20.1470	20.2262	20.2348	20.2344	20.2035	19.9456	19.3965	18.8600	(93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9293	0.9036	0.8475	0.7396	0.5715	0.3520	0.2063	0.2250	0.4750	0.7508	0.8878	0.9379	(94)
Useful gains	751.3330	803.9074	817.7719	774.1436	613.1754	382.0253	213.1443	222.1030	442.6216	638.8187	706.1170	720.2947	(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													
	1264.5490	1238.3826	1108.6928	915.1113	653.5577	386.4595	213.5020	222.6156	457.5393	763.1595	1042.1493	1258.2831	(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													
	381.8327	291.9673	216.4452	101.4968	30.0445	0.0000	0.0000	0.0000	0.0000	92.5096	241.9432	400.2634	(98)
Space heating												1756.5027	(98)
Space heating per m2										(98) / (4) =		18.5598	(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 %)													251.3853	(206)
Efficiency of secondary/supplementary heating system, %													100.0000	(208)
Space heating requirement													698.7292	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	381.8327	291.9673	216.4452	101.4968	30.0445	0.0000	0.0000	0.0000	0.0000	92.5096	241.9432	400.2634	(98)	
Space heating efficiency (main heating system 1)	251.3853	251.3853	251.3853	251.3853	251.3853	0.0000	0.0000	0.0000	0.0000	251.3853	251.3853	251.3853	(210)	
Space heating fuel (main heating system)	151.8914	116.1433	86.1010	40.3750	11.9516	0.0000	0.0000	0.0000	0.0000	36.7999	96.2440	159.2231	(211)	
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)	
Water heating														
Water heating requirement	134.9401	106.0275	91.4262	54.2696	32.6176	16.4648	16.8640	36.3123	59.5524	96.3061	119.3090	135.2642	(64)	
Efficiency of water heater	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	(216)	
(217)m	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	170.2800	(217)	
Fuel for water heating, kWh/month	79.2460	62.2666	53.6917	31.8708	19.1553	9.6692	9.9037	21.3250	34.9732	56.5575	70.0664	79.4364	(219)	
Water heating fuel used												528.1618	(219)	
Annual totals kWh/year														
Space heating fuel - main system												698.7292	(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)
pump for solar water heating													50.0000	(230g)
Total electricity for the above, kWh/year													114.8086	(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 * 1.20 * 1090 * 1.00) =									-1046.8728			-1046.8728	(233)	
Total delivered energy for all uses												708.2231	(238)	

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

	Fuel	Fuel price	Fuel cost	
	kWh/year	p/kWh	£/year	
Space heating - main system 1	698.7292	16.9600	118.5045	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	528.1618	16.9600	89.5762	(247)
Mechanical ventilation fans	64.8086	16.9600	10.9915	(249)
Pumps and fans for heating	0.0000	0.0000	0.0000	(249)
Pump for solar water heating	50.0000	16.9600	8.4800	(249)
Energy for lighting	413.3962	16.9600	70.1120	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit	-1046.8728	16.9600	-177.5496	(252)
Total energy cost			120.1146	(255)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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	698.7292	0.5190	362.6404 (261)
Space heating - secondary	0.0000	0.5190	0.0000 (263)
Water heating (other fuel)	528.1618	0.5190	274.1160 (264)
Space and water heating			636.7564 (265)
Pumps and fans	114.8086	0.5190	59.5857 (267)
Energy for lighting	413.3962	0.5190	214.5527 (268)
Energy saving/generation technologies			
PV Unit	-1046.8728	0.5190	-543.3270 (269)
Total kg/year			367.5678 (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	698.7292	3.0700	2145.0986 (261)
Space heating - secondary	0.0000	3.0700	0.0000 (263)
Water heating (other fuel)	528.1618	3.0700	1621.4566 (264)
Space and water heating			3766.5552 (265)
Pumps and fans	114.8086	3.0700	352.4625 (267)
Energy for lighting	413.3962	3.0700	1269.1265 (268)
Energy saving/generation technologies			
PV Unit	-1046.8728	3.0700	-3213.8994 (269)
Primary energy kWh/year			2174.2448 (272)
Primary energy kWh/m2/year			22.9738 (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	521	502	511	
Total summer gains	1197	1139	1083	(P5)
Summer gain/loss ratio	3.32	3.16	3.00	(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	20.26	22.00	21.74	(P7)
Likelihood of high internal temperature	Not significant	Medium	Slight	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

Assessment of likelihood of high internal temperature:

Medium