

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



Property Reference	4907-0015-3817-129			Issued on Date	15/03/2018
Assessment Reference	As Built	Prop Type Ref	SHL3W - Semi (Op)		
Property	37, Appleby Drive, Botley, SOUTHAMPTON, SO32 2GE				
SAP Rating	88 B	DER	13.34	TER	17.82
Environmental	89 B	% DER<TER	25.12		
CO ₂ Emissions (t/year)	0.91	DFEE	48.88	TFEE	53.49
General Requirements Compliance	Pass	% DFEE<TFEE	8.63		
Assessor Details	Mr. Fraser Browning, Fraser Browning, Tel: 01884 242050, Fraser.browning@aessc.co.uk			Assessor ID	T511-0001
Client					

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

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DWELLING AS BUILT

Semi-Detached House, total floor area 93 m²

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

1a TER and DER

Fuel for main heating:Mains gas

Fuel factor:1.00 (mains gas)

Target Carbon Dioxide Emission Rate (TER) 17.82 kgCO₂/m²

Dwelling Carbon Dioxide Emission Rate (DER) 13.34 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)53.5 kWh/m²/yr

Dwelling Fabric Energy Efficiency (DFEE)48.9 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.25 (max. 0.30)	0.30 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.14 (max. 0.25)	0.14 (max. 0.70)	OK
Roof	0.13 (max. 0.20)	0.13 (max. 0.35)	OK
Openings	1.35 (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: 4.25 (measured in this dwelling)
Maximum 10.0 OK

4 Heating efficiency

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

Data from database

Potterton Promax Ultra Combi 28 ErP

Combi boiler

Efficiency: 89.1% SEDBUK2009

Minimum: 88.0% OK

Secondary heating system:

None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls: Time and temperature zone control OK

Hot water controls:

No cylinder

Boiler interlock

Yes

OK

7 Low energy lights

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

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Southern England): Slight OK

Based on:

Overshading:

Average

Windows facing North East: 6.06 m², No overhang

Windows facing South East: 6.69 m², No overhang

Windows facing North West: 5.40 m², No overhang

Air change rate: 4.00 ach

Blinds/curtains: None

10 Key features

Party wall U-value 0.00 W/m²K

Door U-value 0.90 W/m²K

Photovoltaic array 1.35 kW

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (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	46.5100 (1b)	x 2.3100 (2b)	= 107.4381 (1b) - (3b)
First floor	46.5100 (1c)	x 2.4700 (2c)	= 114.8797 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.0200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 222.3178 (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) = 0.1349 (8)
Pressure test					Yes
Measured/design AP50					4.2500
Infiltration rate					0.3474 (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) =	0.3214 (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	0.4098	0.4017	0.3937	0.3535	0.3455	0.3053	0.3053	0.2973	0.3214	0.3455	0.3616	0.3776 (22b)
Effective ac	0.5840	0.5807	0.5775	0.5625	0.5597	0.5466	0.5466	0.5442	0.5516	0.5597	0.5654	0.5713 (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 FD			2.1500	0.9000	1.9350		(26)
Windows (Uw = 1.40)			18.1500	1.3258	24.0625		(27)
Jet Floor Lo			46.5100	0.1400	6.5114	75.0000	3488.2500 (28a)
100mm Knauf Supafil	92.6400	20.3000	72.3400	0.2500	18.0850	60.0000	4340.4000 (29a)
E-WM-28	5.0600		5.0600	0.3000	1.5180	110.0000	556.6000 (29a)
Plane	46.5100		46.5100	0.1300	6.0463	9.0000	418.5900 (30)
Total net area of external elements Aum(A, m ²)			190.7200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	58.1582		(33)
E-WM-28			36.8400	0.0000	0.0000	110.0000	4052.4000 (32)
GF - Timber			32.2000			9.0000	289.8000 (32c)
GF - Masonry			49.1100			39.0000	1915.2900 (32c)
1F - Timber			91.8600			9.0000	826.7400 (32c)
Internal Floor 1			46.5100			18.0000	837.1800 (32d)
Internal Ceiling			46.5100			18.0000	837.1800 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	17562.4300 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							188.8027 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							13.1822 (36)
Total fabric heat loss						(33) + (36) =	71.3404 (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	42.8417	42.6025	42.3681	41.2669	41.0609	40.1019	40.1019	39.9243	40.4713	41.0609	41.4777	41.9134 (38)
Heat transfer coeff	114.1820	113.9429	113.7084	112.6073	112.4013	111.4422	111.4422	111.2646	111.8117	112.4013	112.8181	113.2538 (39)
Average = Sum(39)m / 12 =												112.6063 (39)
HLP	1.2275	1.2249	1.2224	1.2106	1.2084	1.1980	1.1980	1.1961	1.2020	1.2084	1.2128	1.2175 (40)
HLP (average)												1.2106 (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												2.6648 (42)
Average daily hot water use (litres/day)												97.4900 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	107.2390	103.3394	99.4398	95.5402	91.6406	87.7410	87.7410	91.6406	95.5402	99.4398	103.3394	107.2390 (44)

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Energy conte	159.0323	139.0907	143.5291	125.1322	120.0673	103.6090	96.0089	110.1716	111.4874	129.9279	141.8264	154.0143 (45)
Energy content (annual)										Total = Sum (45)m =		1533.8973 (45)
Distribution loss (46)m = 0.15 x (45)m												
	23.8548	20.8636	21.5294	18.7698	18.0101	15.5413	14.4013	16.5257	16.7231	19.4892	21.2740	23.1021 (46)
Water storage loss:												
Total storage loss												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	21.8495	19.7150	21.7777	20.9935	21.6339	20.8675	21.5204	21.5940	20.9362	21.7182	21.0915	21.8274 (61)
Total heat required for water heating calculated for each month												
Solar input	180.8818	158.8057	165.3069	146.1257	141.7012	124.4764	117.5293	131.7656	132.4236	151.6461	162.9180	175.8417 (62)
	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								Solar input (sum of months) = Sum (63)m =				0.0000 (63)
	180.8818	158.8057	165.3069	146.1257	141.7012	124.4764	117.5293	131.7656	132.4236	151.6461	162.9180	175.8417 (64)
Heat gains from water heating, kWh/month								Total per year (kWh/year) = Sum (64)m =				1789.4221 (64)
	58.3406	51.1764	53.1679	46.8548	45.3309	39.6669	37.3031	42.0306	42.3036	48.6306	52.4302	56.6666 (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	133.2421	133.2421	133.2421	133.2421	133.2421	133.2421	133.2421	133.2421	133.2421	133.2421	133.2421	133.2421 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	22.0140	19.5526	15.9013	12.0383	8.9988	7.5971	8.2090	10.6703	14.3217	18.1847	21.2242	22.6258 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	244.5253	247.0628	240.6686	227.0561	209.8728	193.7229	182.9338	180.3964	186.7906	200.4031	217.5864	233.7362 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	36.3242	36.3242	36.3242	36.3242	36.3242	36.3242	36.3242	36.3242	36.3242	36.3242	36.3242	36.3242 (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)												
	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937 (71)
Water heating gains (Table 5)												
	78.4148	76.1554	71.4622	65.0762	60.9286	55.0928	50.1385	56.4927	58.7550	65.3637	72.8197	76.1648 (72)
Total internal gains												
	410.9268	408.7434	394.0047	370.1432	345.7728	322.3855	307.2540	313.5321	325.8400	349.9241	377.6029	398.4995 (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				6.0600	11.2829	0.6200	0.7000	0.7700	20.5645 (75)			
Southeast				6.6900	36.7938	0.6200	0.7000	0.7700	74.0328 (77)			
Northwest				5.4000	11.2829	0.6200	0.7000	0.7700	18.3248 (81)			
Solar gains	112.9221	205.2655	315.1643	448.0144	554.3064	573.3879	543.1981	460.3695	360.6139	236.1132	137.6070	95.1156 (83)
Total gains	523.8489	614.0089	709.1689	818.1576	900.0792	895.7734	850.4521	773.9016	686.4538	586.0373	515.2099	493.6151 (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	42.7252	42.8149	42.9032	43.3227	43.4021	43.7756	43.7756	43.8455	43.6310	43.4021	43.2418	43.0754
alpha	3.8483	3.8543	3.8602	3.8882	3.8935	3.9184	3.9184	3.9230	3.9087	3.8935	3.8828	3.8717
util living area												
	0.9950	0.9902	0.9777	0.9401	0.8505	0.6976	0.5463	0.6105	0.8400	0.9649	0.9910	0.9960 (86)
MIT	19.2952	19.4901	19.8232	20.2671	20.6543	20.8906	20.9682	20.9512	20.7588	20.2543	19.6946	19.2601 (87)
Th 2	19.8981	19.9001	19.9021	19.9116	19.9133	19.9216	19.9216	19.9231	19.9184	19.9133	19.9097	19.9060 (88)
util rest of house												
	0.9936	0.9875	0.9714	0.9223	0.8056	0.6109	0.4257	0.4885	0.7744	0.9512	0.9882	0.9949 (89)
MIT 2	17.6266	17.9117	18.3956	19.0335	19.5549	19.8384	19.9068	19.8979	19.7027	19.0276	18.2174	17.5805 (90)
Living area fraction												
	fLA = Living area / (4) =											0.1824 (91)
MIT	17.9310	18.1996	18.6561	19.2586	19.7554	20.0304	20.1004	20.0900	19.8954	19.2514	18.4869	17.8869 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.7810	18.0496	18.5061	19.1086	19.6054	19.8804	19.9504	19.9400	19.7454	19.1014	18.3369	17.7369 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9895	0.9808	0.9600	0.9052	0.7905	0.6072	0.4291	0.4906	0.7616	0.9366	0.9818	0.9915 (94)
Useful gains	518.3608	602.2149	680.7996	740.5781	711.5119	543.9044	364.9045	379.6994	522.8089	548.8654	505.8229	489.4388 (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												
	1539.2863	1498.3066	1365.1901	1149.5587	888.5795	588.4548	373.3746	393.8797	631.2214	955.5680	1267.7280	1533.1035 (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												
	759.5686	602.1736	509.1865	294.4660	131.7382	0.0000	0.0000	0.0000	0.0000	302.5868	548.5717	776.4866 (98)
Space heating												3924.7779 (98)
Space heating per m ²												(98) / (4) = 42.1928 (99)

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8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												90.0000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												4360.8644 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	759.5686	602.1736	509.1865	294.4660	131.7382	0.0000	0.0000	0.0000	0.0000	302.5868	548.5717	776.4866 (98)
Space heating efficiency (main heating system 1)	90.0000	90.0000	90.0000	90.0000	90.0000	0.0000	0.0000	0.0000	0.0000	90.0000	90.0000	90.0000 (210)
Space heating fuel (main heating system)	843.9651	669.0818	565.7628	327.1845	146.3758	0.0000	0.0000	0.0000	0.0000	336.2075	609.5241	862.7629 (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	180.8818	158.8057	165.3069	146.1257	141.7012	124.4764	117.5293	131.7656	132.4236	151.6461	162.9180	175.8417 (64)
Efficiency of water heater (217)m	89.3459	89.2908	89.1682	88.8780	88.2591	86.7000	86.7000	86.7000	86.7000	88.8707	89.2224	86.7000 (216)
Fuel for water heating, kWh/month	202.4511	177.8523	185.3877	164.4115	160.5513	143.5715	135.5586	151.9788	152.7377	170.6368	182.5977	196.7528 (219)
Water heating fuel used												2024.4878 (219)
Annual totals kWh/year												
Space heating fuel - main system												4360.8644 (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)												388.7741 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 1.35 * 677 * 1.00) =												-730.6252 (233)
Total delivered energy for all uses												6118.5011 (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	4360.8644	0.2160	941.9467 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2024.4878	0.2160	437.2894 (264)
Space and water heating			1379.2361 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	388.7741	0.5190	201.7738 (268)
Energy saving/generation technologies			
PV Unit	-730.6252	0.5190	-379.1945 (269)
Total CO2, kg/year			1240.7404 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.3400 (273)

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

DER			13.3400 ZC1
Total Floor Area	TFA		93.0200
Assumed number of occupants	N		2.6648
CO2 emission factor in Table 12 for electricity displaced from grid	EF		0.5190
CO2 emissions from appliances, equation (L14)			15.5774 ZC2
CO2 emissions from cooking, equation (L16)			1.9668 ZC3
Total CO2 emissions			30.8842 ZC4
Residual CO2 emissions offset from biofuel CHP			0.0000 ZC5
Additional allowable electricity generation, kWh/m²/year			0.0000 ZC6
Resulting CO2 emissions offset from additional allowable electricity generation			0.0000 ZC7
Net CO2 emissions			30.8842 ZC8

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
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1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	46.5100 (1b)	x 2.3100 (2b)	= 107.4381 (1b) - (3b)
First floor	46.5100 (1c)	x 2.4700 (2c)	= 114.8797 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.0200		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 222.3178 (5)
Dwelling volume			

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																3 * 10 =	30.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000	/ (5) =	0.1349 (8)
Pressure test										Yes							
Measured/design AP50										5.0000							
Infiltration rate										0.3849 (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) =					0.3561 (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	0.4540	0.4451	0.4362	0.3917	0.3828	0.3383	0.3383	0.3294	0.3561	0.3828	0.4006	0.4184	(22b)				
Effective ac	0.6031	0.5991	0.5951	0.5767	0.5733	0.5572	0.5572	0.5542	0.5634	0.5733	0.5802	0.5875	(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)			18.1500	1.3258	24.0625			(27)					
Jet Floor Lo			46.5100	0.1300	6.0463			(28a)					
100mm Knauf Supafil	92.6400	20.3000	72.3400	0.1800	13.0212			(29a)					
E-WM-28	5.0600		5.0600	0.1800	0.9108			(29a)					
Plane	46.5100		46.5100	0.1300	6.0463			(30)					
Total net area of external elements Aum(A, m2)			190.7200					(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	52.2371		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							12.9953	(36)					
Total fabric heat loss						(33) + (36) =	65.2324	(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 44.2430	Feb 43.9494	Mar 43.6616	Apr 42.3100	May 42.0571	Jun 40.8798	Jul 40.8798	Aug 40.6618	Sep 41.3333	Oct 42.0571	Nov 42.5687	Dec 43.1035	(38)
Heat transfer coeff	109.4754	109.1818	108.8940	107.5424	107.2895	106.1122	106.1122	105.8942	106.5657	107.2895	107.8011	108.3359	(39)
Average = Sum(39)m / 12 =												107.5412	(39)
HLP	Jan 1.1769	Feb 1.1737	Mar 1.1707	Apr 1.1561	May 1.1534	Jun 1.1407	Jul 1.1407	Aug 1.1384	Sep 1.1456	Oct 1.1534	Nov 1.1589	Dec 1.1647	(40)
HLP (average)												1.1561	(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												2.6648 (42)
Average daily hot water use (litres/day)												97.4900 (43)
Daily hot water use	Jan 107.2390	Feb 103.3394	Mar 99.4398	Apr 95.5402	May 91.6406	Jun 87.7410	Jul 87.7410	Aug 91.6406	Sep 95.5402	Oct 99.4398	Nov 103.3394	Dec 107.2390 (44)
Energy conte	159.0323	139.0907	143.5291	125.1322	120.0673	103.6090	96.0089	110.1716	111.4874	129.9279	141.8264	154.0143 (45)
Energy content (annual)										Total = Sum(45)m =		1533.8973 (45)
Distribution loss (46)m = 0.15 x (45)m	23.8548	20.8636	21.5294	18.7698	18.0101	15.5413	14.4013	16.5257	16.7231	19.4892	21.2740	23.1021 (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)

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.6734	47.1157	46.6990	43.2695	44.7119	46.6990	47.1157	50.6734	49.3151	50.9589	(61)	
Total heat required for water heating calculated for each month	209.9912	185.1181	194.2026	172.2479	166.7663	146.8785	140.7208	156.8707	158.6032	180.6013	191.1415	204.9732	(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	209.9912	185.1181	194.2026	172.2479	166.7663	146.8785	140.7208	Solar input (sum of months) = Sum (63)m =					0.0000 (63)	
Heat gains from water heating, kWh/month	65.6180	57.7545	60.3918	53.3854	51.5971	45.2674	43.1009	48.3068	48.8485	55.8694	59.4861	63.9495	(65)	
	209.9912	185.1181	194.2026	172.2479	166.7663	146.8785	140.7208	156.8707	158.6032	180.6013	191.1415	204.9732	(64)	
	Total per year (kWh/year) = Sum (64)m =											2108.1153 (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	133.2421	133.2421	133.2421	133.2421	133.2421	133.2421	133.2421	133.2421	133.2421	133.2421	133.2421	133.2421	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	22.0140	19.5526	15.9013	12.0383	8.9988	7.5971	8.2090	10.6703	14.3217	18.1847	21.2242	22.6258	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	244.5253	247.0628	240.6686	227.0561	209.8728	193.7229	182.9338	180.3964	186.7906	200.4031	217.5864	233.7362	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.3242	36.3242	36.3242	36.3242	36.3242	36.3242	36.3242	36.3242	36.3242	36.3242	36.3242	36.3242	(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)	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	(71)
Water heating gains (Table 5)	88.1962	85.9442	81.1718	74.1464	69.3510	62.8713	57.9314	64.9285	67.8451	75.0932	82.6195	85.9536	(72)
Total internal gains	420.7082	418.5322	403.7142	379.2134	354.1952	330.1640	315.0468	321.9679	334.9301	359.6536	387.4027	408.2883	(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				6.0600	11.2829	0.6300	0.7000	0.7700	20.8962 (75)			
Southeast				6.6900	36.7938	0.6300	0.7000	0.7700	75.2269 (77)			
Northwest				5.4000	11.2829	0.6300	0.7000	0.7700	18.6204 (81)			
Solar gains	114.7434	208.5762	320.2476	455.2404	563.2469	582.6361	551.9594	467.7948	366.4302	239.9215	139.8265	96.6497 (83)
Total gains	535.4516	627.1084	723.9618	834.4538	917.4420	912.8001	867.0062	789.7627	701.3603	599.5752	527.2292	504.9380 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.0062	59.1648	59.3212	60.0668	60.2084	60.8763	60.8763	61.0017	60.6173	60.2084	59.9226	59.6268	
alpha	4.9337	4.9443	4.9547	5.0045	5.0139	5.0584	5.0584	5.0668	5.0412	5.0139	4.9948	4.9751	
util living area	0.9983	0.9961	0.9885	0.9583	0.8667	0.6928	0.5274	0.5952	0.8535	0.9789	0.9965	0.9988	(86)
MIT	19.7002	19.8608	20.1316	20.4941	20.7955	20.9527	20.9903	20.9828	20.8619	20.4664	20.0192	19.6751	(87)
Th 2	19.9385	19.9411	19.9436	19.9553	19.9575	19.9677	19.9677	19.9696	19.9637	19.9575	19.9530	19.9484	(88)
util rest of house	0.9978	0.9947	0.9843	0.9424	0.8188	0.6011	0.4094	0.4726	0.7829	0.9682	0.9950	0.9984	(89)
MIT 2	18.2054	18.4415	18.8367	19.3607	19.7584	19.9367	19.9642	19.9625	19.8516	19.3317	18.6819	18.1756	(90)
Living area fraction	18.4781	18.7005	19.0730	19.5675	19.9476	20.1221	20.1514	20.1487	20.0359	19.5387	18.9259	18.4492	(91)
MIT	18.4781	18.7005	19.0730	19.5675	19.9476	20.1221	20.1514	20.1487	20.0359	19.5387	18.9259	18.4492	(92)
Temperature adjustment	18.4781	18.7005	19.0730	19.5675	19.9476	20.1221	20.1514	20.1487	20.0359	19.5387	18.9259	18.4492	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9966	0.9923	0.9795	0.9349	0.8183	0.6157	0.4310	0.4949	0.7886	0.9622	0.9928	0.9974	(94)
Ext temp.	533.6094	622.2815	709.1121	780.1721	750.7405	562.0424	373.6742	390.8165	553.1026	576.9053	523.4526	503.6283	(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	1552.1519	1506.7588	1369.1195	1147.2083	884.8778	585.9597	376.8425	396.9608	632.5606	959.0252	1274.8423	1543.6996	(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	757.7955	594.3688	491.0455	264.2661	99.7982	0.0000	0.0000	0.0000	0.0000	284.2971	541.0006	773.8131	(98)
Space heating per m2												3806.3849	(98)
												40.9201	(99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.4000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													4075.3586 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	757.7955	594.3688	491.0455	264.2661	99.7982	0.0000	0.0000	0.0000	0.0000	284.2971	541.0006	773.8131	(98)
Space heating efficiency (main heating system 1)	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)	811.3443	636.3691	525.7446	282.9402	106.8503	0.0000	0.0000	0.0000	0.0000	304.3867	579.2298	828.4937	(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	209.9912	185.1181	194.2026	172.2479	166.7663	146.8785	140.7208	156.8707	158.6032	180.6013	191.1415	204.9732	(64)
Efficiency of water heater (217)m	87.9984	87.7780	87.2885	86.1254	83.8055	80.3000	80.3000	80.3000	80.3000	86.1887	87.5259	88.0800	(216)
Fuel for water heating, kWh/month	238.6308	210.8935	222.4836	199.9966	198.9922	182.9122	175.2438	195.3558	197.5133	209.5418	218.3828	232.7126	(219)
Water heating fuel used												2482.6589	(219)
Annual totals kWh/year													
Space heating fuel - main system												4075.3586	(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)												388.7741	(232)
Total delivered energy for all uses												7021.7916	(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	4075.3586	0.2160	880.2775 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2482.6589	0.2160	536.2543 (264)
Space and water heating			1416.5318 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	388.7741	0.5190	201.7738 (268)
Total CO2, kg/m2/year			1657.2305 (272)
Emissions per m2 for space and water heating			15.2282 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.1691 (272b)
Emissions per m2 for pumps and fans			0.4185 (272c)
Target Carbon Dioxide Emission Rate (TER) = (15.2282 * 1.00) + 2.1691 + 0.4185, rounded to 2 d.p.			17.8200 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (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	46.5100 (1b)	x 2.3100 (2b)	= 107.4381 (1b) - (3b)
First floor	46.5100 (1c)	x 2.4700 (2c)	= 114.8797 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.0200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 222.3178 (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) = 0.1349 (8)
Pressure test					Yes
Measured/design AP50					4.2500
Infiltration rate					0.3474 (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) =	0.3214 (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	0.4098	0.4017	0.3937	0.3535	0.3455	0.3053	0.3053	0.2973	0.3214	0.3455	0.3616	0.3776 (22b)
Effective ac	0.5840	0.5807	0.5775	0.5625	0.5597	0.5466	0.5466	0.5442	0.5516	0.5597	0.5654	0.5713 (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 FD			2.1500	0.9000	1.9350		(26)
Windows (Uw = 1.40)			18.1500	1.3258	24.0625		(27)
Jet Floor Lo			46.5100	0.1400	6.5114	75.0000	3488.2500 (28a)
100mm Knauf Supafil	92.6400	20.3000	72.3400	0.2500	18.0850	60.0000	4340.4000 (29a)
E-WM-28	5.0600		5.0600	0.3000	1.5180	110.0000	556.6000 (29a)
Plane	46.5100		46.5100	0.1300	6.0463	9.0000	418.5900 (30)
Total net area of external elements Aum(A, m ²)			190.7200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	58.1582		(33)
E-WM-28			36.8400	0.0000	0.0000	110.0000	4052.4000 (32)
GF - Timber			32.2000			9.0000	289.8000 (32c)
GF - Masonry			49.1100			39.0000	1915.2900 (32c)
1F - Timber			91.8600			9.0000	826.7400 (32c)
Internal Floor 1			46.5100			18.0000	837.1800 (32d)
Internal Ceiling			46.5100			9.0000	418.5900 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	17143.8400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							184.3027 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							13.1822 (36)
Total fabric heat loss						(33) + (36) =	71.3404 (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	42.8417	42.6025	42.3681	41.2669	41.0609	40.1019	40.1019	39.9243	40.4713	41.0609	41.4777	41.9134 (38)
Heat transfer coeff	114.1820	113.9429	113.7084	112.6073	112.4013	111.4422	111.4422	111.2646	111.8117	112.4013	112.8181	113.2538 (39)
Average = Sum(39)m / 12 =												112.6063 (39)
HLP	1.2275	1.2249	1.2224	1.2106	1.2084	1.1980	1.1980	1.1961	1.2020	1.2084	1.2128	1.2175 (40)
HLP (average)												1.2106 (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												2.6648 (42)
Average daily hot water use (litres/day)												97.4900 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	107.2390	103.3394	99.4398	95.5402	91.6406	87.7410	87.7410	91.6406	95.5402	99.4398	103.3394	107.2390 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Energy conte	159.0323	139.0907	143.5291	125.1322	120.0673	103.6090	96.0089	110.1716	111.4874	129.9279	141.8264	154.0143 (45)
Energy content (annual)	Total = Sum(45)m = 1533.8973 (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	33.7944	29.5568	30.4999	26.5906	25.5143	22.0169	20.4019	23.4115	23.6911	27.6097	30.1381	32.7280 (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	133.2421	133.2421	133.2421	133.2421	133.2421	133.2421	133.2421	133.2421	133.2421	133.2421	133.2421	133.2421	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	22.0140	19.5526	15.9013	12.0383	8.9988	7.5971	8.2090	10.6703	14.3217	18.1847	21.2242	22.6258	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	244.5253	247.0628	240.6686	227.0561	209.8728	193.7229	182.9338	180.3964	186.7906	200.4031	217.5864	233.7362	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.3242	36.3242	36.3242	36.3242	36.3242	36.3242	36.3242	36.3242	36.3242	36.3242	36.3242	36.3242	(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)	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	(71)
Water heating gains (Table 5)	45.4225	43.9833	40.9945	36.9314	34.2934	30.5790	27.4219	31.4670	32.9043	37.1098	41.8585	43.9893	(72)
Total internal gains	374.9345	373.5713	360.5370	338.9984	316.1376	294.8717	281.5373	285.5064	296.9892	318.6702	343.6417	363.3240	(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	6.0600	11.2829	0.6200	0.7000	0.7700	20.5645 (75)
Southeast	6.6900	36.7938	0.6200	0.7000	0.7700	74.0328 (77)
Northwest	5.4000	11.2829	0.6200	0.7000	0.7700	18.3248 (81)

Solar gains	112.9221	205.2655	315.1643	448.0144	554.3064	573.3879	543.1981	460.3695	360.6139	236.1132	137.6070	95.1156 (83)
Total gains	487.8566	578.8368	675.7013	787.0128	870.4440	868.2596	824.7355	745.8759	657.6031	554.7834	481.2487	458.4396 (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	41.7069	41.7944	41.8806	42.2901	42.3676	42.7322	42.7322	42.8005	42.5911	42.3676	42.2111	42.0487
alpha	3.7805	3.7863	3.7920	3.8193	3.8245	3.8488	3.8488	3.8534	3.8394	3.8245	3.8141	3.8032
util living area	0.9957	0.9913	0.9797	0.9441	0.8584	0.7095	0.5591	0.6261	0.8515	0.9688	0.9923	0.9966 (86)
MIT	19.2207	19.4206	19.7630	20.2213	20.6251	20.8775	20.9632	20.9435	20.7336	20.2059	19.6299	19.1857 (87)
Th 2	19.8981	19.9001	19.9021	19.9116	19.9133	19.9216	19.9216	19.9231	19.9184	19.9133	19.9097	19.9060 (88)
util rest of house	0.9946	0.9890	0.9740	0.9275	0.8154	0.6238	0.4373	0.5037	0.7891	0.9565	0.9899	0.9957 (89)
MIT 2	18.2756	18.4761	18.8168	19.2706	19.6449	19.8567	19.9095	19.9025	19.7526	19.2642	18.6927	18.2467 (90)
Living area fraction	fLA = Living area / (4) = 0.1824 (91)											
MIT	18.4480	18.6484	18.9894	19.4440	19.8237	20.0429	20.1018	20.0924	19.9315	19.4360	18.8637	18.4180 (92)
Temperature adjustment	0.0000											
adjusted MIT	18.4480	18.6484	18.9894	19.4440	19.8237	20.0429	20.1018	20.0924	19.9315	19.4360	18.8637	18.4180 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9924	0.9853	0.9677	0.9187	0.8113	0.6344	0.4588	0.5245	0.7900	0.9493	0.9866	0.9940 (94)
Useful gains	484.1606	570.3483	653.8964	723.0217	706.1516	550.8039	378.3882	391.2115	519.4908	526.6833	474.7956	455.6744 (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	1615.4506	1566.5291	1420.1549	1187.3327	913.1168	606.5745	390.2434	410.8364	652.0347	993.1800	1327.1580	1610.2402 (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	841.6798	669.4335	570.0963	334.3039	153.9821	0.0000	0.0000	0.0000	0.0000	347.0736	613.7009	858.9969 (98)
Space heating												4389.2670 (99)
Space heating per m2										(98) / (4) =		47.1863 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000
Heat loss rate W												

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Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	1047.5571	824.6726	845.6113	0.0000	0.0000	0.0000	0.0000 (100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.8180	0.8808	0.8454	0.0000	0.0000	0.0000	0.0000 (101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	856.9532	726.3349	714.9166	0.0000	0.0000	0.0000	0.0000 (102)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1115.8549	1062.8375	972.4362	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	186.4092	250.3580	191.5946	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction									FC = cooled area / (4) =			628.3618 (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	46.6023	62.5895	47.8986	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling per m2												157.0904 (107)
Energy for space heating												1.6888 (108)
Energy for space cooling												47.1863 (99)
Total												1.6888 (108)
Dwelling Fabric Energy Efficiency (DFEE)												48.8751 (109)
												48.9 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (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	46.5100 (1b)	x 2.3100 (2b)	= 107.4381 (1b) - (3b)
First floor	46.5100 (1c)	x 2.4700 (2c)	= 114.8797 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.0200		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 222.3178 (5)
Dwelling volume			

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																3 * 10 =	30.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =										30.0000 / (5) =							0.1349 (8)
Pressure test										Yes							
Measured/design AP50																	5.0000
Infiltration rate																	0.3849 (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) =							0.3561 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
Wind factor	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)				
Adj infilt rate	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)				
	0.4540	0.4451	0.4362	0.3917	0.3828	0.3383	0.3383	0.3294	0.3561	0.3828	0.4006	0.4184	(22b)				
Effective ac	0.6031	0.5991	0.5951	0.5767	0.5733	0.5572	0.5572	0.5542	0.5634	0.5733	0.5802	0.5875	(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)			18.1500	1.3258	24.0625			(27)					
Jet Floor Lo			46.5100	0.1300	6.0463			(28a)					
100mm Knauf Supafil	92.6400	20.3000	72.3400	0.1800	13.0212			(29a)					
E-WM-28	5.0600		5.0600	0.1800	0.9108			(29a)					
Plane	46.5100		46.5100	0.1300	6.0463			(30)					
Total net area of external elements Aum(A, m2)			190.7200					(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	52.2371		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							12.9953	(36)					
Total fabric heat loss						(33) + (36) =	65.2324	(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 44.2430	Feb 43.9494	Mar 43.6616	Apr 42.3100	May 42.0571	Jun 40.8798	Jul 40.8798	Aug 40.6618	Sep 41.3333	Oct 42.0571	Nov 42.5687	Dec 43.1035	(38)
Heat transfer coeff	109.4754	109.1818	108.8940	107.5424	107.2895	106.1122	106.1122	105.8942	106.5657	107.2895	107.8011	108.3359	(39)
Average = Sum(39)m / 12 =												107.5412	(39)
HLP	Jan 1.1769	Feb 1.1737	Mar 1.1707	Apr 1.1561	May 1.1534	Jun 1.1407	Jul 1.1407	Aug 1.1384	Sep 1.1456	Oct 1.1534	Nov 1.1589	Dec 1.1647	(40)
HLP (average)												1.1561	(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												2.6648 (42)
Average daily hot water use (litres/day)												97.4900 (43)
Daily hot water use	Jan 107.2390	Feb 103.3394	Mar 99.4398	Apr 95.5402	May 91.6406	Jun 87.7410	Jul 87.7410	Aug 91.6406	Sep 95.5402	Oct 99.4398	Nov 103.3394	Dec 107.2390 (44)
Energy conte	159.0323	139.0907	143.5291	125.1322	120.0673	103.6090	96.0089	110.1716	111.4874	129.9279	141.8264	154.0143 (45)
Energy content (annual)										Total = Sum(45)m =		1533.8973 (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)

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If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month	33.7944	29.5568	30.4999	26.5906	25.5143	22.0169	20.4019	23.4115	23.6911	27.6097	30.1381	(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	133.2421	133.2421	133.2421	133.2421	133.2421	133.2421	133.2421	133.2421	133.2421	133.2421	133.2421	133.2421	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	22.0140	19.5526	15.9013	12.0383	8.9988	7.5971	8.2090	10.6703	14.3217	18.1847	21.2242	22.6258	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	244.5253	247.0628	240.6686	227.0561	209.8728	193.7229	182.9338	180.3964	186.7906	200.4031	217.5864	233.7362	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.3242	36.3242	36.3242	36.3242	36.3242	36.3242	36.3242	36.3242	36.3242	36.3242	36.3242	36.3242	(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)	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	(71)
Water heating gains (Table 5)	45.4225	43.9833	40.9945	36.9314	34.2934	30.5790	27.4219	31.4670	32.9043	37.1098	41.8585	43.9893	(72)
Total internal gains	374.9345	373.5713	360.5370	338.9984	316.1376	294.8717	281.5373	285.5064	296.9892	318.6702	343.6417	363.3240	(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	6.0600	11.2829	0.6300	0.7000	0.7700	20.8962	(75)
Southeast	6.6900	36.7938	0.6300	0.7000	0.7700	75.2269	(77)
Northwest	5.4000	11.2829	0.6300	0.7000	0.7700	18.6204	(81)

Solar gains	114.7434	208.5762	320.2476	455.2404	563.2469	582.6361	551.9594	467.7948	366.4302	239.9215	139.8265	96.6497	(83)
Total gains	489.6779	582.1475	680.7846	794.2388	879.3845	877.5078	833.4967	753.3012	663.4194	558.5917	483.4682	459.9737	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
tau	59.0062	59.1648	59.3212	60.0668	60.2084	60.8763	60.8763	61.0017	60.6173	60.2084	59.9226	59.6268		
alpha	4.9337	4.9443	4.9547	5.0045	5.0139	5.0584	5.0584	5.0668	5.0412	5.0139	4.9948	4.9751		
util living area	0.9989	0.9972	0.9911	0.9653	0.8816	0.7132	0.5466	0.6196	0.8743	0.9842	0.9976	0.9992	(86)	
MIT	19.6546	19.8164	20.0905	20.4608	20.7755	20.9461	20.9886	20.9794	20.8431	20.4289	19.9758	19.6301	(87)	
Th 2	19.9385	19.9411	19.9436	19.9553	19.9575	19.9677	19.9677	19.9696	19.9637	19.9575	19.9530	19.9484	(88)	
util rest of house	0.9985	0.9962	0.9878	0.9516	0.8368	0.6215	0.4253	0.4941	0.8085	0.9758	0.9966	0.9989	(89)	
MIT 2	18.7097	18.8732	19.1475	19.5185	19.8060	19.9432	19.9648	19.9637	19.8743	19.4945	19.0420	18.6931	(90)	
Living area fraction														
MIT	18.8821	19.0452	19.3195	19.6904	19.9829	20.1262	20.1516	20.1490	20.0511	19.6649	19.2124	18.8640	(91)	
Temperature adjustment														
adjusted MIT	18.8821	19.0452	19.3195	19.6904	19.9829	20.1262	20.1516	20.1490	20.0511	19.6649	19.2124	18.8640	(93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	488.6800	579.2245	670.7057	752.3594	736.9813	558.6618	373.1124	389.5313	540.7586	543.3011	481.3329	459.2875	(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	1596.3769	1544.4027	1395.9703	1160.4254	888.6680	586.3940	376.8681	396.9988	634.1802	972.5709	1305.7285	1588.6415	(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	824.1265	648.5997	539.5969	293.8075	112.8549	0.0000	0.0000	0.0000	0.0000	319.3768	593.5648	840.2394	(98)
Space heating												4172.1664	(98)
Space heating per m2												44.8524	(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	997.4549	785.2305	804.7961	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8813	0.9349	0.9058	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	879.0982	734.1329	728.9994	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1126.6645	1073.0780	981.1151	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	178.2477	252.1752	187.5741	0.0000	0.0000	0.0000	0.0000	(104)

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Space cooling											617.9970 (104)
Cooled fraction											1.0000 (105)
Intermittency factor (Table 10b)											
	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh											
	0.0000	0.0000	0.0000	0.0000	0.0000	44.5619	63.0438	46.8935	0.0000	0.0000	0.0000 (107)
Space cooling											154.4993 (107)
Space cooling per m2											1.6609 (108)
Energy for space heating											44.8524 (99)
Energy for space cooling											1.6609 (108)
Total											46.5133 (109)
Target Fabric Energy Efficiency (TFEE)											53.5 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (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	46.5100 (1b)	x 2.3100 (2b)	= 107.4381 (1b) - (3b)
First floor	46.5100 (1c)	x 2.4700 (2c)	= 114.8797 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.0200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 222.3178 (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) = 0.1349 (8)
Pressure test					Yes
Measured/design AP50					4.2500
Infiltration rate					0.3474 (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)	=	0.3214 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000 (22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250 (22a)
Adj infilt rate	0.3375	0.3133	0.3214	0.3053	0.3053	0.2973	0.2892	0.2812	0.2732	0.2973	0.2812	0.2973 (22b)
Effective ac	0.5569	0.5491	0.5516	0.5466	0.5466	0.5442	0.5418	0.5395	0.5373	0.5442	0.5395	0.5442 (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 FD			2.1500	0.9000	1.9350		(26)
Windows (Uw = 1.40)			18.1500	1.3258	24.0625		(27)
Jet Floor Lo			46.5100	0.1400	6.5114	75.0000	3488.2500 (28a)
100mm Knauf Supafil	92.6400	20.3000	72.3400	0.2500	18.0850	60.0000	4340.4000 (29a)
E-WM-28	5.0600		5.0600	0.3000	1.5180	110.0000	556.6000 (29a)
Plane	46.5100		46.5100	0.1300	6.0463	9.0000	418.5900 (30)
Total net area of external elements Aum(A, m ²)			190.7200				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		58.1582		(33)
E-WM-28			36.8400	0.0000	0.0000	110.0000	4052.4000 (32)
GF - Timber			32.2000			9.0000	289.8000 (32c)
GF - Masonry			49.1100			39.0000	1915.2900 (32c)
1F - Timber			91.8600			9.0000	826.7400 (32c)
Internal Floor 1			46.5100			18.0000	837.1800 (32d)
Internal Ceiling			46.5100			18.0000	837.1800 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	17562.4300 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							188.8027 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							13.1822 (36)
Total fabric heat loss						(33) + (36) =	71.3404 (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	40.8596	40.2842	40.4713	40.1019	40.1019	39.9243	39.7514	39.5833	39.4199	39.9243	39.5833	39.9243 (38)
Heat transfer coeff	112.2000	111.6246	111.8117	111.4422	111.4422	111.2646	111.0918	110.9236	110.7603	111.2646	110.9236	111.2646 (39)
Average = Sum(39)m / 12 =												111.3345 (39)
HLP	1.2062	1.2000	1.2020	1.1980	1.1980	1.1961	1.1943	1.1925	1.1907	1.1961	1.1925	1.1961 (40)
HLP (average)												1.1969 (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												2.6648 (42)
Average daily hot water use (litres/day)												97.4900 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	107.2390	103.3394	99.4398	95.5402	91.6406	87.7410	87.7410	91.6406	95.5402	99.4398	103.3394	107.2390 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Energy content (annual)	159.0323	139.0907	143.5291	125.1322	120.0673	103.6090	96.0089	110.1716	111.4874	129.9279	141.8264	154.0143 (45)
Distribution loss (46)m = 0.15 x (45)m	23.8548	20.8636	21.5294	18.7698	18.0101	15.5413	14.4013	16.5257	16.7231	19.4892	21.2740	1533.8973 (45)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	21.8495	19.7150	21.7777	20.9935	21.6339	20.8675	21.5204	21.5940	20.9362	21.7182	21.0915	21.8274 (61)
Total heat required for water heating calculated for each month	180.8818	158.8057	165.3069	146.1257	141.7012	124.4764	117.5293	131.7656	132.4236	151.6461	162.9180	175.8417 (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	180.8818	158.8057	165.3069	146.1257	141.7012	124.4764	117.5293	131.7656	132.4236	151.6461	162.9180	175.8417 (64)
RHI water heating demand	58.3406	51.1764	53.1679	46.8548	45.3309	39.6669	37.3031	42.0306	42.3036	48.6306	52.4302	56.6666 (65)
Heat gains from water heating, kWh/month												
Total per year (kWh/year) = Sum(64)m =												1789 (64)

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

Metabolic gains (Table 5), Watts												
(66)m	159.8905	159.8905	159.8905	159.8905	159.8905	159.8905	159.8905	159.8905	159.8905	159.8905	159.8905	159.8905 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	55.0350	48.8816	39.7532	30.0957	22.4969	18.9928	20.5224	26.6758	35.8042	45.4617	53.0605	56.5646 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	364.9632	368.7504	359.2068	338.8897	313.2430	289.1387	273.0356	269.2484	278.7920	299.1091	324.7558	348.8601 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.6539	53.6539	53.6539	53.6539	53.6539	53.6539	53.6539	53.6539	53.6539	53.6539	53.6539	53.6539 (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)	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937 (71)
Water heating gains (Table 5)	78.4148	76.1554	71.4622	65.0762	60.9286	55.0928	50.1385	56.4927	58.7550	65.3637	72.8197	76.1648 (72)
Total internal gains	608.3638	603.7381	580.3729	544.0123	506.6192	473.1751	453.6473	462.3677	483.3020	519.8852	560.5867	591.5402 (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				6.0600	14.6176		0.6200	0.7000		0.7700	26.6424 (75)	
Southeast				6.6900	45.1778		0.6200	0.7000		0.7700	90.9022 (77)	
Northwest				5.4000	14.6176		0.6200	0.7000		0.7700	23.7407 (81)	
Solar gains	141.2853	219.6165	342.3631	492.5935	580.4721	652.3410	613.1530	531.9426	414.8848	273.2848	171.8324	116.8447 (83)
Total gains	749.6491	823.3546	922.7360	1036.6058	1087.0913	1125.5161	1066.8003	994.3102	898.1867	793.1700	732.4191	708.3849 (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	43.4800	43.7041	43.6310	43.7756	43.7756	43.8455	43.9137	43.9803	44.0452	43.8455	43.9803	43.8455
alpha	3.8987	3.9136	3.9087	3.9184	3.9184	3.9230	3.9276	3.9320	3.9363	3.9230	3.9320	3.9230
util living area	0.9808	0.9717	0.9438	0.8715	0.7385	0.5359	0.3990	0.4256	0.6868	0.8959	0.9653	0.9836 (86)
MIT	19.6758	19.8210	20.1407	20.5316	20.8212	20.9616	20.9906	20.9883	20.8996	20.5570	20.0748	19.6576 (87)
Th 2	19.9150	19.9200	19.9184	19.9216	19.9216	19.9231	19.9246	19.9260	19.9274	19.9231	19.9260	19.9231 (88)
util rest of house	0.9759	0.9647	0.9295	0.8393	0.6765	0.4453	0.2924	0.3130	0.5987	0.8612	0.9550	0.9794 (89)
MIT 2	18.1894	18.4013	18.8551	19.3930	19.7553	19.8991	19.9213	19.9218	19.8525	19.4418	18.7736	18.1690 (90)
Living area fraction	18.4606	18.6603	19.0896	19.6007	19.9497	20.0929	20.1164	20.1164	20.0435	19.6453	19.0110	18.4406 (92)
MIT	18.4606	18.6603	19.0896	19.6007	19.9497	20.0929	20.1164	20.1164	20.0435	19.6453	19.0110	18.4406 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.3106	18.5103	18.9396	19.4507	19.7997	19.9429	19.9664	19.9664	19.8935	19.4953	18.8610	18.2906 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9657	0.9521	0.9129	0.8226	0.6687	0.4470	0.2967	0.3173	0.5956	0.8442	0.9410	0.9702 (94)
Ext temp.	723.9299	783.9358	842.3528	852.7412	726.9645	503.1331	316.4894	315.5000	534.9751	669.5642	689.1758	687.2547 (95)
Heat loss rate W	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000 (96)
Month fracti	1504.6646	1474.5902	1334.9881	1108.9317	813.4984	516.5940	318.4299	317.9525	575.2349	900.7175	1215.8346	1478.7712 (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	580.8666	464.1197	366.5206	184.4571	64.3812	0.0000	0.0000	0.0000	0.0000	171.9780	379.1943	588.8883 (98)
RHI space heating demand												2800.4059 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF HEAT DEMAND 09 Jan 2014

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (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	46.5100 (1b)	x 2.3100 (2b)	= 107.4381 (1b) - (3b)
First floor	46.5100 (1c)	x 2.4700 (2c)	= 114.8797 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.0200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 222.3178 (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) = 0.1349 (8)
Pressure test					Yes
Measured/design AP50					4.2500
Infiltration rate					0.3474 (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) =	0.3214 (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	0.4098	0.4017	0.3937	0.3535	0.3455	0.3053	0.3053	0.2973	0.3214	0.3455	0.3616	0.3776 (22b)
Effective ac	0.5840	0.5807	0.5775	0.5625	0.5597	0.5466	0.5466	0.5442	0.5516	0.5597	0.5654	0.5713 (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 FD			2.1500	0.9000	1.9350		(26)
Windows (Uw = 1.40)			18.1500	1.3258	24.0625		(27)
Jet Floor Lo			46.5100	0.1400	6.5114	75.0000	3488.2500 (28a)
100mm Knauf Supafil	92.6400	20.3000	72.3400	0.2500	18.0850	60.0000	4340.4000 (29a)
E-WM-28	5.0600		5.0600	0.3000	1.5180	110.0000	556.6000 (29a)
Plane	46.5100		46.5100	0.1300	6.0463	9.0000	418.5900 (30)
Total net area of external elements Aum(A, m ²)			190.7200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	58.1582		(33)
E-WM-28			36.8400	0.0000	0.0000	110.0000	4052.4000 (32)
GF - Timber			32.2000			9.0000	289.8000 (32c)
GF - Masonry			49.1100			39.0000	1915.2900 (32c)
1F - Timber			91.8600			9.0000	826.7400 (32c)
Internal Floor 1			46.5100			18.0000	837.1800 (32d)
Internal Ceiling			46.5100			18.0000	837.1800 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	17562.4300 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							188.8027 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							13.1822 (36)
Total fabric heat loss						(33) + (36) =	71.3404 (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	42.8417	42.6025	42.3681	41.2669	41.0609	40.1019	40.1019	39.9243	40.4713	41.0609	41.4777	41.9134 (38)
Heat transfer coeff	114.1820	113.9429	113.7084	112.6073	112.4013	111.4422	111.4422	111.2646	111.8117	112.4013	112.8181	113.2538 (39)
Average = Sum(39)m / 12 =												112.6063 (39)
HLP	1.2275	1.2249	1.2224	1.2106	1.2084	1.1980	1.1980	1.1961	1.2020	1.2084	1.2128	1.2175 (40)
HLP (average)												1.2106 (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												2.6648 (42)
Average daily hot water use (litres/day)												97.4900 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	107.2390	103.3394	99.4398	95.5402	91.6406	87.7410	87.7410	91.6406	95.5402	99.4398	103.3394	107.2390 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Energy conte	159.0323	139.0907	143.5291	125.1322	120.0673	103.6090	96.0089	110.1716	111.4874	129.9279	141.8264	154.0143 (45)
Energy content (annual)	Total = Sum (45)m =											1533.8973 (45)
Distribution loss (46)m = 0.15 x (45)m	23.8548	20.8636	21.5294	18.7698	18.0101	15.5413	14.4013	16.5257	16.7231	19.4892	21.2740	23.1021 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	21.8495	19.7150	21.7777	20.9935	21.6339	20.8675	21.5204	21.5940	20.9362	21.7182	21.0915	21.8274 (61)
Total heat required for water heating calculated for each month	180.8818	158.8057	165.3069	146.1257	141.7012	124.4764	117.5293	131.7656	132.4236	151.6461	162.9180	175.8417 (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	180.8818	158.8057	165.3069	146.1257	141.7012	124.4764	117.5293	131.7656	132.4236	151.6461	162.9180	175.8417 (64)
Heat gains from water heating, kWh/month	58.3406	51.1764	53.1679	46.8548	45.3309	39.6669	37.3031	42.0306	42.3036	48.6306	52.4302	56.6666 (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	159.8905	159.8905	159.8905	159.8905	159.8905	159.8905	159.8905	159.8905	159.8905	159.8905	159.8905	159.8905 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	55.0350	48.8816	39.7532	30.0957	22.4969	18.9928	20.5224	26.6758	35.8042	45.4617	53.0605	56.5646 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	364.9632	368.7504	359.2068	338.8897	313.2430	289.1387	273.0356	269.2484	278.7920	299.1091	324.7558	348.8601 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.6539	53.6539	53.6539	53.6539	53.6539	53.6539	53.6539	53.6539	53.6539	53.6539	53.6539	53.6539 (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)	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937 (71)
Water heating gains (Table 5)	78.4148	76.1554	71.4622	65.0762	60.9286	55.0928	50.1385	56.4927	58.7550	65.3637	72.8197	76.1648 (72)
Total internal gains	608.3638	603.7381	580.3729	544.0123	506.6192	473.1751	453.6473	462.3677	483.3020	519.8852	560.5867	591.5402 (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				6.0600	11.2829		0.6200	0.7000	0.7700		20.5645 (75)	
Southeast				6.6900	36.7938		0.6200	0.7000	0.7700		74.0328 (77)	
Northwest				5.4000	11.2829		0.6200	0.7000	0.7700		18.3248 (81)	
Solar gains	112.9221	205.2655	315.1643	448.0144	554.3064	573.3879	543.1981	460.3695	360.6139	236.1132	137.6070	95.1156 (83)
Total gains	721.2858	809.0036	895.5372	992.0267	1060.9256	1046.5630	996.8454	922.7371	843.9158	755.9984	698.1937	686.6558 (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	42.7252	42.8149	42.9032	43.3227	43.4021	43.7756	43.7756	43.8455	43.6310	43.4021	43.2418	43.0754
alpha	3.8483	3.8543	3.8602	3.8882	3.8935	3.9184	3.9184	3.9230	3.9087	3.8935	3.8828	3.8717
util living area	0.9851	0.9757	0.9543	0.8995	0.7897	0.6246	0.4759	0.5288	0.7591	0.9266	0.9756	0.9876 (86)
MIT	19.5281	19.7134	20.0218	20.4193	20.7436	20.9262	20.9803	20.9704	20.8381	20.4211	19.9051	19.4900 (87)
Th 2	19.8981	19.9001	19.9021	19.9116	19.9133	19.9216	19.9216	19.9231	19.9184	19.9133	19.9097	19.9060 (88)
util rest of house	0.9814	0.9697	0.9427	0.8735	0.7370	0.5384	0.3665	0.4162	0.6823	0.9018	0.9684	0.9844 (89)
MIT 2	17.9642	18.2329	18.6759	19.2361	19.6576	19.8679	19.9128	19.9086	19.7829	19.2526	18.5194	17.9143 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	18.2495	18.5030	18.9214	19.4519	19.8557	20.0610	20.1075	20.1023	19.9754	19.4658	18.7722	18.2018 (92)
Temperature adjustment												
adjusted MIT	18.0995	18.3530	18.7714	19.3019	19.7057	19.9110	19.9575	19.9523	19.8254	19.3158	18.6222	18.0518 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9726	0.9579	0.9269	0.8557	0.7256	0.5375	0.3703	0.4194	0.6748	0.8842	0.9565	0.9766 (94)
Useful gains	701.5034	774.9404	830.0437	848.8986	769.7958	562.5350	369.1046	387.0041	569.4761	668.4453	667.8029	670.6125 (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	1575.6587	1532.8728	1395.3647	1171.3329	899.8565	591.8695	374.1713	395.2504	640.1695	979.6678	1299.9129	1568.7670 (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	650.3715	509.3305	420.5989	232.1527	96.7652	0.0000	0.0000	0.0000	0.0000	231.5495	455.1192	668.2270 (98)
Space heating												3264.1145 (98)
Space heating per m2											(98) / (4) =	35.0905 (99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.0000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3626.7938 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	650.3715	509.3305	420.5989	232.1527	96.7652	0.0000	0.0000	0.0000	0.0000	231.5495	455.1192	668.2270	(98)
Space heating efficiency (main heating system 1)	90.0000	90.0000	90.0000	90.0000	90.0000	0.0000	0.0000	0.0000	0.0000	90.0000	90.0000	90.0000	(210)
Space heating fuel (main heating system)	722.6350	565.9228	467.3321	257.9474	107.5169	0.0000	0.0000	0.0000	0.0000	257.2772	505.6880	742.4744	(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	180.8818	158.8057	165.3069	146.1257	141.7012	124.4764	117.5293	131.7656	132.4236	151.6461	162.9180	175.8417	(64)
Efficiency of water heater (217)m	89.2607	89.1931	89.0438	88.6959	88.0095	86.7000	86.7000	86.7000	86.7000	88.6645	89.1060	86.7000	(216)
Fuel for water heating, kWh/month	202.6444	178.0471	185.6468	164.7491	161.0068	143.5715	135.5586	151.9788	152.7377	171.0337	182.8362	196.9289	(219)
Water heating fuel used												2026.7396	(219)
Annual totals kWh/year													
Space heating fuel - main system												3626.7938	(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)												388.7741	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.35 * 677 * 1.00) =										-730.6252		-730.6252	(233)
Total delivered energy for all uses												5386.6824	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3626.7938	3.4800	126.2124	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	2026.7396	3.4800	70.5305	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	388.7741	13.1900	51.2793	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-730.6252	13.1900	-96.3695	(252)
Total energy cost			281.5453	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.8568 (257)
SAP value	88.0483	
SAP rating (Section 12)	88	(258)
SAP band	B	

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3626.7938	0.2160	783.3875	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2026.7396	0.2160	437.7758	(264)
Space and water heating			1221.1632	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	388.7741	0.5190	201.7738	(268)
Energy saving/generation technologies				
PV Unit	-730.6252	0.5190	-379.1945	(269)
Total kg/year			1082.6675	(272)
CO2 emissions per m2			11.6400	(273)
EI value			89.4887	
EI rating			89	(274)
EI band			B	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

Calculation of stars for heating and DHW

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9000 = 3.867$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9000 = 0.2400$, stars = 4
Water heating energy efficiency	$3.48 / 0.8817 = 3.947$, stars = 4
Water heating environmental impact	$0.216 / 0.8817 = 0.2450$, stars = 4

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

SAP 2012 WORKSHEET FOR New Build (As Built) (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	46.5100 (1b)	x 2.3100 (2b)	= 107.4381 (1b) - (3b)
First floor	46.5100 (1c)	x 2.4700 (2c)	= 114.8797 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.0200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 222.3178 (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) = 0.1349 (8)
Pressure test					Yes
Measured/design AP50					4.2500
Infiltration rate					0.3474 (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)	=	0.3214 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000 (22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250 (22a)
Adj infilt rate	0.3375	0.3133	0.3214	0.3053	0.3053	0.2973	0.2892	0.2812	0.2732	0.2973	0.2812	0.2973 (22b)
Effective ac	0.5569	0.5491	0.5516	0.5466	0.5466	0.5442	0.5418	0.5395	0.5373	0.5442	0.5395	0.5442 (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 FD			2.1500	0.9000	1.9350		(26)
Windows (Uw = 1.40)			18.1500	1.3258	24.0625		(27)
Jet Floor Lo			46.5100	0.1400	6.5114	75.0000	3488.2500 (28a)
100mm Knauf Supafil	92.6400	20.3000	72.3400	0.2500	18.0850	60.0000	4340.4000 (29a)
E-WM-28	5.0600		5.0600	0.3000	1.5180	110.0000	556.6000 (29a)
Plane	46.5100		46.5100	0.1300	6.0463	9.0000	418.5900 (30)
Total net area of external elements Aum(A, m ²)			190.7200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	58.1582		(33)
E-WM-28			36.8400	0.0000	0.0000	110.0000	4052.4000 (32)
GF - Timber			32.2000			9.0000	289.8000 (32c)
GF - Masonry			49.1100			39.0000	1915.2900 (32c)
1F - Timber			91.8600			9.0000	826.7400 (32c)
Internal Floor 1			46.5100			18.0000	837.1800 (32d)
Internal Ceiling			46.5100			18.0000	837.1800 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	17562.4300 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							188.8027 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							13.1822 (36)
Total fabric heat loss						(33) + (36) =	71.3404 (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	40.8596	40.2842	40.4713	40.1019	40.1019	39.9243	39.7514	39.5833	39.4199	39.9243	39.5833	39.9243 (38)
Heat transfer coeff	112.2000	111.6246	111.8117	111.4422	111.4422	111.2646	111.0918	110.9236	110.7603	111.2646	110.9236	111.2646 (39)
Average = Sum(39)m / 12 =												111.3345 (39)
HLP	1.2062	1.2000	1.2020	1.1980	1.1980	1.1961	1.1943	1.1925	1.1907	1.1961	1.1925	1.1961 (40)
HLP (average)												1.1969 (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												2.6648 (42)
Average daily hot water use (litres/day)												97.4900 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	107.2390	103.3394	99.4398	95.5402	91.6406	87.7410	87.7410	91.6406	95.5402	99.4398	103.3394	107.2390 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Energy conte	159.0323	139.0907	143.5291	125.1322	120.0673	103.6090	96.0089	110.1716	111.4874	129.9279	141.8264	154.0143 (45)
Energy content (annual)	Total = Sum (45)m =											1533.8973 (45)
Distribution loss (46)m = 0.15 x (45)m	23.8548	20.8636	21.5294	18.7698	18.0101	15.5413	14.4013	16.5257	16.7231	19.4892	21.2740	23.1021 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	21.8495	19.7150	21.7777	20.9935	21.6339	20.8675	21.5204	21.5940	20.9362	21.7182	21.0915	21.8274 (61)
Total heat required for water heating calculated for each month	180.8818	158.8057	165.3069	146.1257	141.7012	124.4764	117.5293	131.7656	132.4236	151.6461	162.9180	175.8417 (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	180.8818	158.8057	165.3069	146.1257	141.7012	124.4764	117.5293	131.7656	132.4236	151.6461	162.9180	175.8417 (64)
Heat gains from water heating, kWh/month	58.3406	51.1764	53.1679	46.8548	45.3309	39.6669	37.3031	42.0306	42.3036	48.6306	52.4302	56.6666 (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	159.8905	159.8905	159.8905	159.8905	159.8905	159.8905	159.8905	159.8905	159.8905	159.8905	159.8905	159.8905 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	55.0350	48.8816	39.7532	30.0957	22.4969	18.9928	20.5224	26.6758	35.8042	45.4617	53.0605	56.5646 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	364.9632	368.7504	359.2068	338.8897	313.2430	289.1387	273.0356	269.2484	278.7920	299.1091	324.7558	348.8601 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.6539	53.6539	53.6539	53.6539	53.6539	53.6539	53.6539	53.6539	53.6539	53.6539	53.6539	53.6539 (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)	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937 (71)
Water heating gains (Table 5)	78.4148	76.1554	71.4622	65.0762	60.9286	55.0928	50.1385	56.4927	58.7550	65.3637	72.8197	76.1648 (72)
Total internal gains	608.3638	603.7381	580.3729	544.0123	506.6192	473.1751	453.6473	462.3677	483.3020	519.8852	560.5867	591.5402 (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				6.0600	14.6176	0.6200	0.7000	0.7700	26.6424 (75)			
Southeast				6.6900	45.1778	0.6200	0.7000	0.7700	90.9022 (77)			
Northwest				5.4000	14.6176	0.6200	0.7000	0.7700	23.7407 (81)			
Solar gains	141.2853	219.6165	342.3631	492.5935	580.4721	652.3410	613.1530	531.9426	414.8848	273.2848	171.8324	116.8447 (83)
Total gains	749.6491	823.3546	922.7360	1036.6058	1087.0913	1125.5161	1066.8003	994.3102	898.1867	793.1700	732.4191	708.3849 (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	43.4800	43.7041	43.6310	43.7756	43.7756	43.8455	43.9137	43.9803	44.0452	43.8455	43.9803	43.8455
alpha	3.8987	3.9136	3.9087	3.9184	3.9184	3.9230	3.9276	3.9320	3.9363	3.9230	3.9320	3.9230
util living area	0.9808	0.9717	0.9438	0.8715	0.7385	0.5359	0.3990	0.4256	0.6868	0.8959	0.9653	0.9836 (86)
MIT	19.6758	19.8210	20.1407	20.5316	20.8212	20.9616	20.9906	20.9883	20.8996	20.5570	20.0748	19.6576 (87)
Th 2	19.9150	19.9200	19.9184	19.9216	19.9216	19.9231	19.9246	19.9260	19.9274	19.9231	19.9260	19.9231 (88)
util rest of house	0.9759	0.9647	0.9295	0.8393	0.6765	0.4453	0.2924	0.3130	0.5987	0.8612	0.9550	0.9794 (89)
MIT 2	18.1894	18.4013	18.8551	19.3930	19.7553	19.8991	19.9213	19.9218	19.8525	19.4418	18.7736	18.1690 (90)
Living area fraction	fLA = Living area / (4) =											0.1824 (91)
MIT	18.4606	18.6603	19.0896	19.6007	19.9497	20.0929	20.1164	20.1164	20.0435	19.6453	19.0110	18.4406 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.3106	18.5103	18.9396	19.4507	19.7997	19.9429	19.9664	19.9664	19.8935	19.4953	18.8610	18.2906 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9657	0.9521	0.9129	0.8226	0.6687	0.4470	0.2967	0.3173	0.5956	0.8442	0.9410	0.9702 (94)
Ext temp.	723.9299	783.9358	842.3528	852.7412	726.9645	503.1331	316.4894	315.5000	534.9751	669.5642	689.1758	687.2547 (95)
Heat loss rate W	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000 (96)
Month fracti	1504.6646	1474.5902	1334.9881	1108.9317	813.4984	516.5940	318.4299	317.9525	575.2349	900.7175	1215.8346	1478.7712 (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	580.8666	464.1197	366.5206	184.4571	64.3812	0.0000	0.0000	0.0000	0.0000	171.9780	379.1943	588.8883 (98)
Space heating per m2	(98) / (4) =											30.1054 (99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												90.0000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3111.5622	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	580.8666	464.1197	366.5206	184.4571	64.3812	0.0000	0.0000	0.0000	0.0000	171.9780	379.1943	588.8883	(98)
Space heating efficiency (main heating system 1)	90.0000	90.0000	90.0000	90.0000	90.0000	0.0000	0.0000	0.0000	0.0000	90.0000	90.0000	90.0000	(210)
Space heating fuel (main heating system)	645.4073	515.6886	407.2452	204.9524	71.5347	0.0000	0.0000	0.0000	0.0000	191.0867	421.3270	654.3203	(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	180.8818	158.8057	165.3069	146.1257	141.7012	124.4764	117.5293	131.7656	132.4236	151.6461	162.9180	175.8417	(64)
Efficiency of water heater (217)m	89.1939	89.1351	88.9477	88.5109	87.7046	86.7000	86.7000	86.7000	86.7000	88.4229	88.9822	86.7000	(216)
Fuel for water heating, kWh/month	202.7963	178.1629	185.8473	165.0935	161.5663	143.5715	135.5586	151.9788	152.7377	171.5009	183.0906	197.0897	(219)
Water heating fuel used												2028.9942	(219)
Annual totals kWh/year													
Space heating fuel - main system												3111.5622	(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)												388.7741	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.35 * 781 * 1.00) =										-843.1056		-843.1056	(233)
Total delivered energy for all uses												4761.2249	(238)

10a. Fuel costs - using BEDF prices (445)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3111.5622	3.9300	122.2844	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	2028.9942	3.9300	79.7395	(247)
Pumps and fans for heating	75.0000	17.5600	13.1700	(249)
Energy for lighting	388.7741	17.5600	68.2687	(250)
Additional standing charges			88.0000	(251)
Energy saving/generation technologies				
PV Unit	-843.1056	17.5600	-148.0493	(252)
Total energy cost			223.4133	(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	3111.5622	0.2160	672.0974	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2028.9942	0.2160	438.2627	(264)
Space and water heating			1110.3602	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	388.7741	0.5190	201.7738	(268)
Energy saving/generation technologies				
PV Unit	-843.1056	0.5190	-437.5718	(269)
Total kg/year			913.4872	(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	3111.5622	1.2200	3796.1058	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2028.9942	1.2200	2475.3729	(264)
Space and water heating			6271.4788	(265)
Pumps and fans	75.0000	3.0700	230.2500	(267)
Energy for lighting	388.7741	3.0700	1193.5366	(268)
Energy saving/generation technologies				
PV Unit	-843.1056	3.0700	-2588.3342	(269)
Primary energy kWh/year			5106.9312	(272)
Primary energy kWh/m2/year			54.9014	(273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 88
Current environmental impact rating: B 89

(For testing purposes):

A	Not considered
B	Not considered
C	Not considered
D	Not considered
E Low energy lighting	Already installed
F	Not considered
G	Not considered
H	Not considered
I	Not considered
J	Not considered
K	Not considered
M	Not considered
N Solar water heating	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	+ 1.2	-£ 31	-195 kg (21.4%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£31 2.10 kg/m²	B 89	B 91
Total Savings	£31 2.10 kg/m²		
Potential energy efficiency rating:		B 89	
Potential environmental impact rating:			B 91

Fuel prices for cost data on this page from database revision number 445 TEST (30 Jul 2019)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Southern England):

	Current	Potential	Saving
Electricity	£81	£90	-£9
Mains gas	£290	£250	£40
Space heating	£223	£223	£0
Water heating	£80	£48	£31
Lighting	£68	£68	£0
Generated (PV)	-£148	-£148	£0
Total cost of fuels	£223	£192	£31
Total cost of uses	£223	£191	£31
Delivered energy	51 kWh/m²	41 kWh/m²	10 kWh/m²
Carbon dioxide emissions	0.9 tonnes	0.7 tonnes	0.2 tonnes
CO2 emissions per m²	10 kg/m²	8 kg/m²	2 kg/m²
Primary energy	55 kWh/m²	43 kWh/m²	12 kWh/m²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (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	46.5100 (1b)	x 2.3100 (2b)	= 107.4381 (1b) - (3b)
First floor	46.5100 (1c)	x 2.4700 (2c)	= 114.8797 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.0200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 222.3178 (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) = 0.1349 (8)
Pressure test					Yes
Measured/design AP50					4.2500
Infiltration rate					0.3474 (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) =	0.3214 (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	0.4098	0.4017	0.3937	0.3535	0.3455	0.3053	0.3053	0.2973	0.3214	0.3455	0.3616	0.3776 (22b)
Effective ac	0.5840	0.5807	0.5775	0.5625	0.5597	0.5466	0.5466	0.5442	0.5516	0.5597	0.5654	0.5713 (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 FD			2.1500	0.9000	1.9350		(26)
Windows (Uw = 1.40)			18.1500	1.3258	24.0625		(27)
Jet Floor Lo			46.5100	0.1400	6.5114	75.0000	3488.2500 (28a)
100mm Knauf Supafil	92.6400	20.3000	72.3400	0.2500	18.0850	60.0000	4340.4000 (29a)
E-WM-28	5.0600		5.0600	0.3000	1.5180	110.0000	556.6000 (29a)
Plane	46.5100		46.5100	0.1300	6.0463	9.0000	418.5900 (30)
Total net area of external elements Aum(A, m ²)			190.7200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	58.1582		(33)
E-WM-28			36.8400	0.0000	0.0000	110.0000	4052.4000 (32)
GF - Timber			32.2000			9.0000	289.8000 (32c)
GF - Masonry			49.1100			39.0000	1915.2900 (32c)
1F - Timber			91.8600			9.0000	826.7400 (32c)
Internal Floor 1			46.5100			18.0000	837.1800 (32d)
Internal Ceiling			46.5100			18.0000	837.1800 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	17562.4300 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							188.8027 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							13.1822 (36)
Total fabric heat loss						(33) + (36) =	71.3404 (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	42.8417	42.6025	42.3681	41.2669	41.0609	40.1019	40.1019	39.9243	40.4713	41.0609	41.4777	41.9134 (38)
Heat transfer coeff	114.1820	113.9429	113.7084	112.6073	112.4013	111.4422	111.4422	111.2646	111.8117	112.4013	112.8181	113.2538 (39)
Average = Sum(39)m / 12 =												112.6063 (39)
HLP	1.2275	1.2249	1.2224	1.2106	1.2084	1.1980	1.1980	1.1961	1.2020	1.2084	1.2128	1.2175 (40)
HLP (average)												1.2106 (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												2.6648 (42)
Average daily hot water use (litres/day)												97.4900 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	107.2390	103.3394	99.4398	95.5402	91.6406	87.7410	87.7410	91.6406	95.5402	99.4398	103.3394	107.2390 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Energy content (annual)	159.0323	139.0907	143.5291	125.1322	120.0673	103.6090	96.0089	110.1716	111.4874	129.9279	141.8264	154.0143 (45)
Distribution loss (46)m = 0.15 x (45)m	23.8548	20.8636	21.5294	18.7698	18.0101	15.5413	14.4013	16.5257	16.7231	19.4892	21.2740	1533.8973 (45)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	21.8495	19.7150	21.7777	20.9935	21.6339	20.8675	21.5204	21.5940	20.9362	21.7182	21.0915	21.8274 (61)
Total heat required for water heating calculated for each month	180.8818	158.8057	165.3069	146.1257	141.7012	124.4764	117.5293	131.7656	132.4236	151.6461	162.9180	175.8417 (62)
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												1.1823 (H8)
Utilisation factor												0.5708 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												97.4900 (H14)
Volume ratio Veff/V												0.7693 (H15)
Solar storage volume factor												0.9475 (H16)
Solar input												-862.4655 (H17)
Solar input	-25.0098	-41.7341	-71.0780	-95.2585	-117.6839	-115.7020	-114.1730	-99.7535	-78.1270	-53.3515	-29.6652	-20.9289 (63)
Solar input (sum of months) = Sum (63)m =												-862.4655 (63)
Output from w/h	155.8720	117.0716	94.2289	50.8672	24.0173	8.7744	3.3564	32.0121	54.2966	98.2946	133.2528	154.9128 (64)
Total per year (kWh/year) = Sum (64)m =												926.9566 (64)
Heat gains from water heating, kWh/month	58.3406	51.1764	53.1679	46.8548	45.3309	39.6669	37.3031	42.0306	42.3036	48.6306	52.4302	56.6666 (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	159.8905	159.8905	159.8905	159.8905	159.8905	159.8905	159.8905	159.8905	159.8905	159.8905	159.8905	159.8905	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	55.0350	48.8816	39.7532	30.0957	22.4969	18.9928	20.5224	26.6758	35.8042	45.4617	53.0605	56.5646	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	364.9632	368.7504	359.2068	338.8897	313.2430	289.1387	273.0356	269.2484	278.7920	299.1091	324.7558	348.8601	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.6539	53.6539	53.6539	53.6539	53.6539	53.6539	53.6539	53.6539	53.6539	53.6539	53.6539	53.6539	(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)	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	(71)
Water heating gains (Table 5)	78.4148	76.1554	71.4622	65.0762	60.9286	55.0928	50.1385	56.4927	58.7550	65.3637	72.8197	76.1648	(72)
Total internal gains	608.3638	603.7381	580.3729	544.0123	506.6192	473.1751	453.6473	462.3677	483.3020	519.8852	560.5867	591.5402	(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				6.0600	11.2829		0.6200		0.7000		0.7700		20.5645 (75)
Southeast				6.6900	36.7938		0.6200		0.7000		0.7700		74.0328 (77)
Northwest				5.4000	11.2829		0.6200		0.7000		0.7700		18.3248 (81)
Solar gains	112.9221	205.2655	315.1643	448.0144	554.3064	573.3879	543.1981	460.3695	360.6139	236.1132	137.6070		95.1156 (83)
Total gains	721.2858	809.0036	895.5372	992.0267	1060.9256	1046.5630	996.8454	922.7371	843.9158	755.9984	698.1937		686.6558 (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	42.7252	42.8149	42.9032	43.3227	43.4021	43.7756	43.7756	43.8455	43.6310	43.4021	43.2418	43.0754
alpha	3.8483	3.8543	3.8602	3.8882	3.8935	3.9184	3.9184	3.9230	3.9087	3.8935	3.8828	3.8717
util living area	0.9851	0.9757	0.9543	0.8995	0.7897	0.6246	0.4759	0.5288	0.7591	0.9266	0.9756	0.9876 (86)
MIT	19.5281	19.7134	20.0218	20.4193	20.7436	20.9262	20.9803	20.9704	20.8381	20.4211	19.9051	19.4900 (87)
Th 2	19.8981	19.9001	19.9021	19.9116	19.9133	19.9216	19.9216	19.9231	19.9184	19.9133	19.9097	19.9060 (88)
util rest of house	0.9814	0.9697	0.9427	0.8735	0.7370	0.5384	0.3665	0.4162	0.6823	0.9018	0.9684	0.9844 (89)
MIT 2	17.9642	18.2329	18.6759	19.2361	19.6576	19.8679	19.9128	19.9086	19.7829	19.2526	18.5194	17.9143 (90)
Living area fraction									fLA = Living area / (4) =			0.1824 (91)
MIT	18.2495	18.5030	18.9214	19.4519	19.8557	20.0610	20.1075	20.1023	19.9754	19.4658	18.7722	18.2018 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.0995	18.3530	18.7714	19.3019	19.7057	19.9110	19.9575	19.9523	19.8254	19.3158	18.6222	18.0518 (93)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9726	0.9579	0.9269	0.8557	0.7256	0.5375	0.3703	0.4194	0.6748	0.8842	0.9565	0.9766	(94)
Useful gains	701.5034	774.9404	830.0437	848.8986	769.7958	562.5350	369.1046	387.0041	569.4761	668.4453	667.8029	670.6125	(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	1575.6587	1532.8728	1395.3647	1171.3329	899.8565	591.8695	374.1713	395.2504	640.1695	979.6678	1299.9129	1568.7670	(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	650.3715	509.3305	420.5989	232.1527	96.7652	0.0000	0.0000	0.0000	0.0000	231.5495	455.1192	668.2270	(98)
Space heating												3264.1145	(98)
Space heating per m2											(98) / (4) =	35.0905	(99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.0000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3626.7938 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	650.3715	509.3305	420.5989	232.1527	96.7652	0.0000	0.0000	0.0000	0.0000	231.5495	455.1192	668.2270	(98)
Space heating efficiency (main heating system 1)	90.0000	90.0000	90.0000	90.0000	90.0000	0.0000	0.0000	0.0000	0.0000	90.0000	90.0000	90.0000	(210)
Space heating fuel (main heating system)	722.6350	565.9228	467.3321	257.9474	107.5169	0.0000	0.0000	0.0000	0.0000	257.2772	505.6880	742.4744	(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	155.8720	117.0716	94.2289	50.8672	24.0173	8.7744	3.3564	32.0121	54.2966	98.2946	133.2528	154.9128	(64)
Efficiency of water heater	89.3426	89.3643	89.3773	89.3885	89.3239	86.7000	86.7000	86.7000	86.7000	88.9906	89.2308	86.7000	(216)
(217)m	89.3426	89.3643	89.3773	89.3885	89.3239	86.7000	86.7000	86.7000	86.7000	88.9906	89.2308	89.3599	(217)
Fuel for water heating, kWh/month	174.4656	131.0049	105.4281	56.9057	26.8879	10.1204	3.8712	36.9229	62.6259	110.4550	149.3349	173.3583	(219)
Water heating fuel used												1041.3808	(219)
Annual totals kWh/year													
Space heating fuel - main system												3626.7938	(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)
pump for solar water heating												50.0000	(230g)
Total electricity for the above, kWh/year												125.0000	(231)
Electricity for lighting (calculated in Appendix L)												388.7741	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.35 * 677 * 1.00) =										-730.6252		-730.6252	(233)
Total delivered energy for all uses												4451.3236	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3626.7938	3.4800	126.2124	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1041.3808	3.4800	36.2401	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Pump for solar water heating	50.0000	13.1900	6.5950	(249)
Energy for lighting	388.7741	13.1900	51.2793	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-730.6252	13.1900	-96.3695	(252)
Total energy cost			253.8498	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):			0.4200 (256)
Energy cost factor (ECF)		[(255) x (256)] / [(4) + 45.0] =	0.7725 (257)
SAP value			89.2240
SAP rating (Section 12)			89 (258)
SAP band			B

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	3626.7938	0.2160	783.3875 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1041.3808	0.2160	224.9383 (264)
Space and water heating			1008.3257 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	388.7741	0.5190	201.7738 (268)
Energy saving/generation technologies			
PV Unit	-730.6252	0.5190	-379.1945 (269)
Total kg/year			895.7800 (272)
CO2 emissions per m2			9.6300 (273)
EI value			91.3031
EI rating			91 (274)
EI band			B

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

SAP 2012 WORKSHEET FOR New Build (As Built) (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	46.5100 (1b)	x 2.3100 (2b)	= 107.4381 (1b) - (3b)
First floor	46.5100 (1c)	x 2.4700 (2c)	= 114.8797 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.0200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 222.3178 (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) = 0.1349 (8)
Pressure test					Yes
Measured/design AP50					4.2500
Infiltration rate					0.3474 (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)	=	0.3214 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000 (22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250 (22a)
Adj infilt rate	0.3375	0.3133	0.3214	0.3053	0.3053	0.2973	0.2892	0.2812	0.2732	0.2973	0.2812	0.2973 (22b)
Effective ac	0.5569	0.5491	0.5516	0.5466	0.5466	0.5442	0.5418	0.5395	0.5373	0.5442	0.5395	0.5442 (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 FD			2.1500	0.9000	1.9350		(26)
Windows (Uw = 1.40)			18.1500	1.3258	24.0625		(27)
Jet Floor Lo			46.5100	0.1400	6.5114	75.0000	3488.2500 (28a)
100mm Knauf Supafil	92.6400	20.3000	72.3400	0.2500	18.0850	60.0000	4340.4000 (29a)
E-WM-28	5.0600		5.0600	0.3000	1.5180	110.0000	556.6000 (29a)
Plane	46.5100		46.5100	0.1300	6.0463	9.0000	418.5900 (30)
Total net area of external elements Aum(A, m ²)			190.7200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	58.1582		(33)
E-WM-28			36.8400	0.0000	0.0000	110.0000	4052.4000 (32)
GF - Timber			32.2000			9.0000	289.8000 (32c)
GF - Masonry			49.1100			39.0000	1915.2900 (32c)
1F - Timber			91.8600			9.0000	826.7400 (32c)
Internal Floor 1			46.5100			18.0000	837.1800 (32d)
Internal Ceiling			46.5100			18.0000	837.1800 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	17562.4300 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							188.8027 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							13.1822 (36)
Total fabric heat loss						(33) + (36) =	71.3404 (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	40.8596	40.2842	40.4713	40.1019	40.1019	39.9243	39.7514	39.5833	39.4199	39.9243	39.5833	39.9243 (38)
Heat transfer coeff	112.2000	111.6246	111.8117	111.4422	111.4422	111.2646	111.0918	110.9236	110.7603	111.2646	110.9236	111.2646 (39)
Average = Sum(39)m / 12 =												111.3345 (39)
HLP	1.2062	1.2000	1.2020	1.1980	1.1980	1.1961	1.1943	1.1925	1.1907	1.1961	1.1925	1.1961 (40)
HLP (average)												1.1969 (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												2.6648 (42)
Average daily hot water use (litres/day)												97.4900 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	107.2390	103.3394	99.4398	95.5402	91.6406	87.7410	87.7410	91.6406	95.5402	99.4398	103.3394	107.2390 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Energy content (annual)	159.0323	139.0907	143.5291	125.1322	120.0673	103.6090	96.0089	110.1716	111.4874	129.9279	141.8264	154.0143 (45)
Distribution loss (46)m = 0.15 x (45)m	23.8548	20.8636	21.5294	18.7698	18.0101	15.5413	14.4013	16.5257	16.7231	19.4892	21.2740	1533.8973 (45)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	21.8495	19.7150	21.7777	20.9935	21.6339	20.8675	21.5204	21.5940	20.9362	21.7182	21.0915	21.8274 (61)
Total heat required for water heating calculated for each month	180.8818	158.8057	165.3069	146.1257	141.7012	124.4764	117.5293	131.7656	132.4236	151.6461	162.9180	175.8417 (62)
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												1208.1510 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												2029.6937 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.3232 (H8)
Utilisation factor												0.5303 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												97.4900 (H14)
Volume ratio Veff/V												0.7693 (H15)
Solar storage volume factor												0.9475 (H16)
Solar input												-896.8358 (H17)
Solar input	-29.2570	-41.6015	-71.5030	-96.4741	-113.3147	-121.0380	-118.4925	-106.0544	-83.0333	-57.4064	-34.6033	-24.0577 (63)
Solar input (sum of months) = Sum (63)m =												-896.8358 (63)
Output from w/h	151.6249	117.2042	93.8039	49.6516	28.3865	3.4385	0.0000	25.7112	49.3903	94.2397	128.3147	151.7840 (64)
Total per year (kWh/year) = Sum (64)m =												893.5495 (64)
Heat gains from water heating, kWh/month	58.3406	51.1764	53.1679	46.8548	45.3309	39.6669	37.3031	42.0306	42.3036	48.6306	52.4302	56.6666 (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	159.8905	159.8905	159.8905	159.8905	159.8905	159.8905	159.8905	159.8905	159.8905	159.8905	159.8905	159.8905	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	55.0350	48.8816	39.7532	30.0957	22.4969	18.9928	20.5224	26.6758	35.8042	45.4617	53.0605	56.5646	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	364.9632	368.7504	359.2068	338.8897	313.2430	289.1387	273.0356	269.2484	278.7920	299.1091	324.7558	348.8601	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.6539	53.6539	53.6539	53.6539	53.6539	53.6539	53.6539	53.6539	53.6539	53.6539	53.6539	53.6539	(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)	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	-106.5937	(71)
Water heating gains (Table 5)	78.4148	76.1554	71.4622	65.0762	60.9286	55.0928	50.1385	56.4927	58.7550	65.3637	72.8197	76.1648	(72)
Total internal gains	608.3638	603.7381	580.3729	544.0123	506.6192	473.1751	453.6473	462.3677	483.3020	519.8852	560.5867	591.5402	(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				6.0600	14.6176		0.6200		0.7000		0.7700		26.6424 (75)
Southeast				6.6900	45.1778		0.6200		0.7000		0.7700		90.9022 (77)
Northwest				5.4000	14.6176		0.6200		0.7000		0.7700		23.7407 (81)
Solar gains	141.2853	219.6165	342.3631	492.5935	580.4721	652.3410	613.1530	531.9426	414.8848	273.2848	171.8324	116.8447	(83)
Total gains	749.6491	823.3546	922.7360	1036.6058	1087.0913	1125.5161	1066.8003	994.3102	898.1867	793.1700	732.4191	708.3849	(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	43.4800	43.7041	43.6310	43.7756	43.7756	43.8455	43.9137	43.9803	44.0452	43.8455	43.9803	43.8455
alpha	3.9987	3.9136	3.9087	3.9184	3.9184	3.9230	3.9276	3.9320	3.9363	3.9230	3.9320	3.9230
util living area	0.9808	0.9717	0.9438	0.8715	0.7385	0.5359	0.3990	0.4256	0.6868	0.8959	0.9653	0.9836 (86)
MIT	19.6758	19.8210	20.1407	20.5316	20.8212	20.9616	20.9906	20.9883	20.8996	20.5570	20.0748	19.6576 (87)
Th 2	19.9150	19.9200	19.9184	19.9216	19.9216	19.9231	19.9246	19.9260	19.9274	19.9231	19.9260	19.9231 (88)
util rest of house	0.9759	0.9647	0.9295	0.8393	0.6765	0.4453	0.2924	0.3130	0.5987	0.8612	0.9550	0.9794 (89)
MIT 2	18.1894	18.4013	18.8551	19.3930	19.7553	19.8991	19.9213	19.9218	19.8525	19.4418	18.7736	18.1690 (90)
Living area fraction									fLA = Living area / (4) =			0.1824 (91)
MIT	18.4606	18.6603	19.0896	19.6007	19.9497	20.0929	20.1164	20.1164	20.0435	19.6453	19.0110	18.4406 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.3106	18.5103	18.9396	19.4507	19.7997	19.9429	19.9664	19.9664	19.8935	19.4953	18.8610	18.2906 (93)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9657	0.9521	0.9129	0.8226	0.6687	0.4470	0.2967	0.3173	0.5956	0.8442	0.9410	0.9702	(94)
Useful gains	723.9299	783.9358	842.3528	852.7412	726.9645	503.1331	316.4894	315.5000	534.9751	669.5642	689.1758	687.2547	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W	1504.6646	1474.5902	1334.9881	1108.9317	813.4984	516.5940	318.4299	317.9525	575.2349	900.7175	1215.8346	1478.7712	(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	580.8666	464.1197	366.5206	184.4571	64.3812	0.0000	0.0000	0.0000	0.0000	171.9780	379.1943	588.8883	(98)
Space heating												2800.4059	(98)
Space heating per m2												30.1054	(99)
												(98) / (4) =	

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.0000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3111.5622 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	580.8666	464.1197	366.5206	184.4571	64.3812	0.0000	0.0000	0.0000	0.0000	171.9780	379.1943	588.8883	(98)
Space heating efficiency (main heating system 1)	90.0000	90.0000	90.0000	90.0000	90.0000	0.0000	0.0000	0.0000	0.0000	90.0000	90.0000	90.0000	(210)
Space heating fuel (main heating system)	645.4073	515.6886	407.2452	204.9524	71.5347	0.0000	0.0000	0.0000	0.0000	191.0867	421.3270	654.3203	(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	151.6249	117.2042	93.8039	49.6516	28.3865	3.4385	0.0000	25.7112	49.3903	94.2397	128.3147	151.7840	(64)
Efficiency of water heater	89.2964	89.3146	89.3073	89.2793	88.9638	86.7000	86.7000	86.7000	86.7000	88.8035	89.1422	86.7000	(216)
(217)m	89.2964	89.3146	89.3073	89.2793	88.9638	86.7000	86.7000	86.7000	86.7000	88.8035	89.1422	89.3034	(217)
Fuel for water heating, kWh/month	169.7994	131.2262	105.0349	55.6138	31.9079	3.9660	0.0000	29.6554	56.9670	106.1217	143.9439	169.9644	(219)
Water heating fuel used												1004.2005	(219)
Annual totals kWh/year													
Space heating fuel - main system												3111.5622	(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)
pump for solar water heating													50.0000 (230g)
Total electricity for the above, kWh/year													125.0000 (231)
Electricity for lighting (calculated in Appendix L)													388.7741 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.35 * 781 * 1.00) =										-843.1056		-843.1056	(233)
Total delivered energy for all uses												3786.4312	(238)

10a. Fuel costs - using BEDF prices (445)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3111.5622	3.9300	122.2844	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1004.2005	3.9300	39.4651	(247)
Pumps and fans for heating	75.0000	17.5600	13.1700	(249)
Pump for solar water heating	50.0000	17.5600	8.7800	(249)
Energy for lighting	388.7741	17.5600	68.2687	(250)
Additional standing charges			88.0000	(251)
Energy saving/generation technologies				
PV Unit	-843.1056	17.5600	-148.0493	(252)
Total energy cost			191.9189	(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	3111.5622	0.2160	672.0974	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1004.2005	0.2160	216.9073	(264)
Space and water heating			889.0047	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	388.7741	0.5190	201.7738	(268)
Energy saving/generation technologies				

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

PV Unit	-843.1056	0.5190	-437.5718 (269)
Total kg/year			718.0817 (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	3111.5622	1.2200	3796.1058 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1004.2005	1.2200	1225.1246 (264)
Space and water heating			5021.2305 (265)
Pumps and fans	125.0000	3.0700	383.7500 (267)
Energy for lighting	388.7741	3.0700	1193.5366 (268)
Energy saving/generation technologies			
PV Unit	-843.1056	3.0700	-2588.3342 (269)
Primary energy kWh/year			4010.1829 (272)
Primary energy kWh/m2/year			43.1110 (273)

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

Overheating Calculation Input Data

Dwelling type	SemiDetached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	North East
Overshading	Average or unknown
Thermal mass parameter	188.8 (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	293.46 (P1)
Transmission heat loss coefficient	71.34 (37)
Summer heat loss coefficient	364.80 (P2)

Overhangs

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

Solar shading

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

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North East	6.0600	106.0502	0.6200	0.7000	0.9000	225.9222
South East	6.6900	127.3119	0.6200	0.7000	0.9000	299.4124
North West	5.4000	106.0502	0.6200	0.7000	0.9000	201.3168
total:						726.6514

	Jun	Jul	Aug	
Solar gains	786	727	628	(P3)
Internal gains	470	451	459	
Total summer gains	1256	1177	1088	(P5)

Summer gain/loss ratio	3.44	3.23	2.98	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 188.8)	0.68	0.68	0.68	
Threshold temperature	19.52	21.21	20.96	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	

Assessment of likelihood of high internal temperature: Slight