

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



Property Reference	4907-0015-3817-163			Issued on Date	05/12/2019
Assessment Reference	As Built	Prop Type Ref	P306i - Det (As)		
Property	83, Appleby Drive, Botley, SOUTHAMPTON, SO32 2GE				
SAP Rating	87 B	DER	14.80	TER	18.84
Environmental	88 B	% DER<TER	21.43		
CO ₂ Emissions (t/year)	1.06	DFEE	51.23	TFEE	58.15
General Requirements Compliance	Pass	% DFEE<TFEE	11.90		
Assessor Details	Mr. Fraser Browning, Fraser Browning, Tel: 01884 242050, Fraser.browning@aessc.co.uk			Assessor ID	T511-0001
Client					

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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

DWELLING AS BUILT

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) 18.84 kgCO₂/m²

Dwelling Carbon Dioxide Emission Rate (DER) 14.80 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)58.2 kWh/m²/yr

Dwelling Fabric Energy Efficiency (DFEE)51.2 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.25 (max. 0.30)	0.25 (max. 0.70)	OK
Floor	0.15 (max. 0.25)	0.15 (max. 0.70)	OK
Roof	0.13 (max. 0.20)	0.20 (max. 0.35)	OK
Openings	1.34 (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:	4.45 (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 40 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: 0.68 m², No overhang

Windows facing East: 5.76 m², No overhang

Windows facing South East: 0.68 m², No overhang

Windows facing West: 7.97 m², No overhang

Air change rate: 4.00 ach

Blinds/curtains: None

10 Key features

Door U-value 0.90 W/m²K

Thermal bridging y-value 0.036 W/m²K

Photovoltaic array 0.81 kW

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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	46.7700 (1b)	x 2.3100 (2b)	= 108.0387 (1b) - (3b)
First floor	45.7700 (1c)	x 2.4800 (2c)	= 113.5096 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	92.5400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 221.5483 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.1805 (8)
Pressure test					Yes
Measured/design AP50					4.4500
Infiltration rate					0.4030 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.4030 (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	0.5139	0.5038	0.4937	0.4434	0.4333	0.3829	0.3829	0.3728	0.4030	0.4333	0.4534	0.4736 (22b)
Effective ac	0.6320	0.6269	0.6219	0.5983	0.5939	0.5733	0.5733	0.5695	0.5812	0.5939	0.6028	0.6121 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid Door			1.9600	0.9000	1.7640		(26)
Window (Uw = 1.40)			11.9400	1.3258	15.8295		(27)
French (Uw = 1.40)			3.1500	1.3258	4.1761		(27)
Half Glazed Door			1.8900	1.3000	2.4570		(26a)
Heat Loss Floor			46.7700	0.1500	7.0155	75.0000	3507.7500 (28a)
100mm Knauf Supafil	134.7300	18.9400	115.7900	0.2500	28.9475	52.8000	6113.7120 (29a)
External Plane Roof	45.7700		45.7700	0.1300	5.9501	9.0000	411.9300 (30)
Bay	1.0100		1.0100	0.2000	0.2020	9.0000	9.0900 (30)
Total net area of external elements Aum(A, m ²)			228.2800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	66.3418		(33)
GF Masonry			41.2600			39.0000	1609.1400 (32c)
GF Timber			34.3700			9.0000	309.3300 (32c)
1F Timber			81.4300			9.0000	732.8700 (32c)
1F Metal			34.9000			20.0000	698.0000 (32c)
Internal Floor			45.7700			18.0000	823.8600 (32d)
Internal Floor 1			45.7700			18.0000	823.8600 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	15039.5420 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							162.5194 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.1836 (36)
Total fabric heat loss						(33) + (36) =	74.5254 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	46.2090	45.8341	45.4667	43.7409	43.4180	41.9148	41.9148	41.6365	42.4938	43.4180	44.0712	44.7541 (38)
Heat transfer coeff	120.7343	120.3595	119.9920	118.2662	117.9433	116.4402	116.4402	116.1618	117.0192	117.9433	118.5965	119.2794 (39)
Average = Sum(39)m / 12 =												118.2647 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.3047	1.3006	1.2967	1.2780	1.2745	1.2583	1.2583	1.2553	1.2645	1.2745	1.2816	1.2890 (40)
HLP (average)												1.2780 (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												2.6589 (42)
Average daily hot water use (litres/day)												97.3492 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Daily hot water use	107.0842	103.1902	99.2962	95.4022	91.5083	87.6143	87.6143	91.5083	95.4022	99.2962	103.1902	107.0842 (44)
Energy conte	158.8027	138.8899	143.3219	124.9515	119.8939	103.4594	95.8703	110.0126	111.3265	129.7403	141.6217	153.7919 (45)
Energy content (annual)										Total = Sum (45)m =		1531.6825 (45)
Distribution loss (46)m = 0.15 x (45)m	23.8204	20.8335	21.4983	18.7427	17.9841	15.5189	14.3805	16.5019	16.6990	19.4610	21.2432	23.0688 (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	21.0464	18.9901	20.9755	20.2193	20.8354	20.0965	20.7248	20.7965	20.1634	20.9175	20.3157	21.0249 (61)
Total heat required for water heating calculated for each month												
Solar input	179.8492	157.8800	164.2974	145.1708	140.7293	123.5558	116.5951	130.8090	131.4899	150.6578	161.9373	174.8168 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Solar input (sum of months) = Sum (63)m =												0.0000 (63)
Output from w/h	179.8492	157.8800	164.2974	145.1708	140.7293	123.5558	116.5951	130.8090	131.4899	150.6578	161.9373	174.8168 (64)
Heat gains from water heating, kWh/month	58.0635	50.9284	52.8984	46.6012	45.0736	39.4244	37.0581	41.7783	42.0569	48.3680	52.1681	56.3920 (65)
Total per year (kWh/year) = Sum (64)m =												1777.7885 (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	132.9458	132.9458	132.9458	132.9458	132.9458	132.9458	132.9458	132.9458	132.9458	132.9458	132.9458	132.9458 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	22.5802	20.0555	16.3102	12.3479	9.2302	7.7925	8.4201	10.9448	14.6900	18.6524	21.7701	23.2078 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	243.6738	246.2024	239.8305	226.2654	209.1420	193.0483	182.2968	179.7682	186.1401	199.7052	216.8287	232.9223 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.2946	36.2946	36.2946	36.2946	36.2946	36.2946	36.2946	36.2946	36.2946	36.2946	36.2946	36.2946 (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)	-106.3566	-106.3566	-106.3566	-106.3566	-106.3566	-106.3566	-106.3566	-106.3566	-106.3566	-106.3566	-106.3566	-106.3566 (71)
Water heating gains (Table 5)	78.0424	75.7863	71.1000	64.7239	60.5828	54.7560	49.8092	56.1536	58.4124	65.0108	72.4557	75.7958 (72)
Total internal gains	410.1801	407.9280	393.1245	369.2209	344.8387	321.4806	306.4099	312.7503	325.1263	349.2521	376.9382	397.8095 (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				0.6800	11.2829	0.7100	0.7000		0.7700		2.6425 (75)	
East				5.7600	19.6403	0.7100	0.7000		0.7700		38.9636 (76)	
Southeast				0.6800	36.7938	0.7100	0.7000		0.7700		8.6173 (77)	
West				4.8200	19.6403	0.7100	0.7000		0.7700		32.6050 (80)	
West				3.1500	19.6403	0.7100	0.7000		0.7700		21.3082 (80)	
Solar gains	104.1367	201.7443	328.9873	477.1838	584.0710	597.9468	569.2258	489.1712	381.5517	238.3831	129.4531	85.9101 (83)
Total gains	514.3168	609.6723	722.1118	846.4048	928.9097	919.4274	875.6357	801.9216	706.6779	587.6352	506.3913	483.7196 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	34.6020	34.7098	34.8161	35.3241	35.4208	35.8781	35.8781	35.9641	35.7006	35.4208	35.2257	35.0241
alpha	3.3068	3.3140	3.3211	3.3549	3.3614	3.3919	3.3919	3.3976	3.3800	3.3614	3.3484	3.3349
util living area	0.9918	0.9851	0.9677	0.9219	0.8301	0.6855	0.5416	0.5991	0.8202	0.9543	0.9866	0.9934 (86)
MIT	18.9661	19.1925	19.5914	20.1156	20.5569	20.8430	20.9479	20.9263	20.6893	20.0942	19.4398	18.9350 (87)
Th 2	19.8372	19.8403	19.8435	19.8581	19.8609	19.8737	19.8737	19.8760	19.8687	19.8609	19.8553	19.8495 (88)
util rest of house	0.9899	0.9815	0.9597	0.9015	0.7842	0.5999	0.4203	0.4780	0.7537	0.9384	0.9828	0.9918 (89)
MIT 2	17.1340	17.4650	18.0439	18.7972	19.3945	19.7487	19.8473	19.8350	19.5843	18.7833	17.8364	17.0959 (90)
Living area fraction									fLA = Living area / (4) =			0.1961 (91)
MIT	17.4933	17.8038	18.3474	19.0558	19.6225	19.9633	20.0632	20.0491	19.8010	19.0404	18.1509	17.4566 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.3433	17.6538	18.1974	18.9058	19.4725	19.8133	19.9132	19.8991	19.6510	18.8904	18.0009	17.3066 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9832	0.9712	0.9434	0.8795	0.7656	0.5948	0.4249	0.4807	0.7382	0.9192	0.9732	0.9861 (94)
Useful gains	505.6879	592.1145	681.2298	744.4002	711.1699	546.8770	372.0270	385.4809	521.6437	540.1398	492.8053	476.9979 (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	1574.7780	1535.0382	1403.5982	1183.3473	916.7147	607.0401	385.7898	406.4583	649.5748	977.7983	1292.8077	1563.3497 (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	795.4030	633.6447	537.4421	316.0419	152.9253	0.0000	0.0000	0.0000	0.0000	325.6179	576.0018	808.2457 (98)
Space heating												4145.3224 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Space heating per m2 (98) / (4) = 44.7949 (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													4605.9138 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	795.4030	633.6447	537.4421	316.0419	152.9253	0.0000	0.0000	0.0000	0.0000	325.6179	576.0018	808.2457	(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)	883.7812	704.0497	597.1579	351.1577	169.9170	0.0000	0.0000	0.0000	0.0000	361.7976	640.0019	898.0508	(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	179.8492	157.8800	164.2974	145.1708	140.7293	123.5558	116.5951	130.8090	131.4899	150.6578	161.9373	174.8168	(64)
Efficiency of water heater (217)m	89.3727	89.3219	89.2051	88.9345	88.3877	86.7000	86.7000	86.7000	86.7000	88.9293	89.2545	86.7000	(216)
Fuel for water heating, kWh/month	201.2351	176.7540	184.1795	163.2333	159.2181	142.5096	134.4811	150.8755	151.6607	169.4131	181.4332	195.5557	(219)
Water heating fuel used												2010.5489	(219)
Annual totals kWh/year													
Space heating fuel - main system												4605.9138	(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)												398.7732	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 908 * 1.00) =										-588.2895		-588.2895	(233)
Total delivered energy for all uses												6501.9464	(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	4605.9138	0.2160	994.8774 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2010.5489	0.2160	434.2786 (264)
Space and water heating			1429.1560 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	398.7732	0.5190	206.9633 (268)
Energy saving/generation technologies			
PV Unit	-588.2895	0.5190	-305.3223 (269)
Total CO2, kg/year			1369.7220 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			14.8000 (273)

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

DER		14.8000	ZC1
Total Floor Area		92.5400	
Assumed number of occupants		2.6589	
CO2 emission factor in Table 12 for electricity displaced from grid		0.5190	
CO2 emissions from appliances, equation (L14)		15.6036	ZC2
CO2 emissions from cooking, equation (L16)		1.9755	ZC3
Total CO2 emissions		32.3791	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		32.3791	ZC8

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	46.7700 (1b)	x 2.3100 (2b)	= 108.0387 (1b) - (3b)
First floor	45.7700 (1c)	x 2.4800 (2c)	= 113.5096 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	92.5400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 221.5483 (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) = 0.1354 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3854 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3854 (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	0.4914	0.4818	0.4721	0.4240	0.4143	0.3661	0.3661	0.3565	0.3854	0.4143	0.4336	0.4529 (22b)
Effective ac	0.6207	0.6160	0.6115	0.5899	0.5858	0.5670	0.5670	0.5635	0.5743	0.5858	0.5940	0.6025 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			1.9600	1.0000	1.9600		(26)
TER Semi-glazed door			1.8900	1.2000	2.2680		(26a)
TER Opening Type (Uw = 1.40)			15.0900	1.3258	20.0057		(27)
Heat Loss Floor			46.7700	0.1300	6.0801		(28a)
100mm Knauf Supafil	134.7300	18.9400	115.7900	0.1800	20.8422		(29a)
External Plane Roof	45.7700		45.7700	0.1300	5.9501		(30)
Bay	1.0100		1.0100	0.1300	0.1313		(30)
Total net area of external elements Aum(A, m ²)			228.2800				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		57.2374		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							11.3958 (36)
Total fabric heat loss						(33) + (36) =	68.6332 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	45.3826	45.0398	44.7039	43.1258	42.8305	41.4560	41.4560	41.2015	41.9855	42.8305	43.4278	44.0523 (38)
Heat transfer coeff	114.0158	113.6730	113.3370	111.7590	111.4637	110.0892	110.0892	109.8347	110.6187	111.4637	112.0610	112.6854 (39)
Average = Sum(39)m / 12 =												111.7575 (39)
HLP	1.2321	1.2284	1.2247	1.2077	1.2045	1.1896	1.1896	1.1869	1.1954	1.2045	1.2109	1.2177 (40)
HLP (average)												1.2077 (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												2.6589 (42)
Average daily hot water use (litres/day)												97.3492 (43)
Daily hot water use	107.0842	103.1902	99.2962	95.4022	91.5083	87.6143	87.6143	91.5083	95.4022	99.2962	103.1902	107.0842 (44)
Energy conte	158.8027	138.8899	143.3219	124.9515	119.8939	103.4594	95.8703	110.0126	111.3265	129.7403	141.6217	153.7919 (45)
Energy content (annual)										Total = Sum(45)m =		1531.6825 (45)
Distribution loss (46)m = 0.15 x (45)m	23.8204	20.8335	21.4983	18.7427	17.9841	15.5189	14.3805	16.5019	16.6990	19.4610	21.2432	23.0688 (46)
Water storage loss:												
Total storage loss												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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 (56)
Combi loss	50.9589	46.0274	50.6003	47.0477	46.6316	43.2071	44.6473	46.6316	47.0477	50.6003	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month	209.7616	184.9173	193.9222	171.9992	166.5256	146.6664	140.5176	156.6442	158.3742	180.3405	190.9367	204.7508 (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	209.7616	184.9173	193.9222	171.9992	166.5256	146.6664	140.5176	156.6442	158.3742	180.3405	190.9367	204.7508 (64)
Heat gains from water heating, kWh/month	65.5416	57.6877	60.3046	53.3083	51.5226	45.2020	43.0387	48.2371	48.7780	55.7887	59.4180	63.8755 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(66)
(66)m	132.9458	132.9458	132.9458	132.9458	132.9458	132.9458	132.9458	132.9458	132.9458	132.9458	132.9458	132.9458	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	22.5802	20.0555	16.3102	12.3479	9.2302	7.7925	8.4201	10.9448	14.6900	18.6524	21.7701	23.2078	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	243.6738	246.2024	239.8305	226.2654	209.1420	193.0483	182.2968	179.7682	186.1401	199.7052	216.8287	232.9223	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.2946	36.2946	36.2946	36.2946	36.2946	36.2946	36.2946	36.2946	36.2946	36.2946	36.2946	36.2946	(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)	-106.3566	-106.3566	-106.3566	-106.3566	-106.3566	-106.3566	-106.3566	-106.3566	-106.3566	-106.3566	-106.3566	-106.3566	(71)
Water heating gains (Table 5)	88.0936	85.8448	81.0546	74.0393	69.2509	62.7806	57.8477	64.8348	67.7472	74.9848	82.5250	85.8542	(72)
Total internal gains	420.2313	417.9865	403.0790	378.5364	353.5068	329.5051	314.4483	321.4315	334.4611	359.2261	387.0074	407.8680	(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					0.6800	11.2829	0.6300	0.7000	0.7700		2.3448 (75)	
East					5.7600	19.6403	0.6300	0.7000	0.7700		34.5734 (76)	
Southeast					0.6800	36.7938	0.6300	0.7000	0.7700		7.6464 (77)	
West					7.9700	19.6403	0.6300	0.7000	0.7700		47.8385 (80)	
Solar gains	92.4030	179.0126	291.9183	423.4166	518.2602	530.5725	505.0877	434.0533	338.5599	211.5231	114.8668	76.2301 (83)
Total gains	512.6343	596.9990	694.9973	801.9530	871.7669	860.0776	819.5361	755.4848	673.0210	570.7492	501.8743	484.0981 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.3640	56.5340	56.7016	57.5022	57.6545	58.3744	58.3744	58.5096	58.0950	57.6545	57.3472	57.0294	
alpha	4.7576	4.7689	4.7801	4.8335	4.8436	4.8916	4.8916	4.9006	4.8730	4.8436	4.8231	4.8020	
util living area	0.9986	0.9968	0.9905	0.9658	0.8920	0.7384	0.5717	0.6348	0.8774	0.9833	0.9971	0.9989	(86)
MIT	19.6080	19.7642	20.0438	20.4198	20.7398	20.9300	20.9840	20.9741	20.8261	20.3991	19.9388	19.5869	(87)
Th 2	19.8944	19.8974	19.9003	19.9139	19.9164	19.9283	19.9283	19.9305	19.9237	19.9164	19.9113	19.9059	(88)
util rest of house	0.9981	0.9956	0.9869	0.9521	0.8486	0.6448	0.4422	0.5036	0.8111	0.9744	0.9959	0.9986	(89)
MIT 2	18.0398	18.2701	18.6789	19.2264	19.6574	19.8810	19.9224	19.9197	19.7787	19.2066	18.5355	18.0170	(90)
Living area fraction	18.3474	18.5631	18.9466	19.4605	19.8696	20.0867	20.1306	20.1265	19.9842	19.4405	18.8107	18.3249	(92)
Temperature adjustment	18.3474	18.5631	18.9466	19.4605	19.8696	20.0867	20.1306	20.1265	19.9842	19.4405	18.8107	18.3249	(93)
adjusted MIT	18.3474	18.5631	18.9466	19.4605	19.8696	20.0867	20.1306	20.1265	19.9842	19.4405	18.8107	18.3249	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	511.0889	593.1370	682.8358	757.5911	737.8865	567.5629	383.3021	399.7374	548.8962	552.9657	498.8578	482.9872	(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	1601.6216	1553.1274	1410.6656	1180.2281	910.6190	604.0306	388.6849	409.2977	650.8984	985.3897	1312.3164	1591.6713	(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	811.3563	645.1135	541.5054	304.2986	128.5130	0.0000	0.0000	0.0000	0.0000	321.7234	585.6902	824.8609	(98)
Space heating												4163.0614	(98)
Space heating per m2												44.9866	(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													4457.2392 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	811.3563	645.1135	541.5054	304.2986	128.5130	0.0000	0.0000	0.0000	0.0000	321.7234	585.6902	824.8609	(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)	868.6899	690.6997	579.7702	325.8015	137.5942	0.0000	0.0000	0.0000	0.0000	344.4576	627.0773	883.1488	(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	209.7616	184.9173	193.9222	171.9992	166.5256	146.6664	140.5176	156.6442	158.3742	180.3405	190.9367	204.7508	(64)
Efficiency of water heater (217)m	88.1231	87.9359	87.4980	86.4724	84.4077	80.3000	80.3000	80.3000	80.3000	86.4923	87.6884	88.1940	(216)
Fuel for water heating, kWh/month	238.0325	210.2864	221.6303	198.9065	197.2871	182.6481	174.9908	195.0737	197.2281	208.5047	217.7446	232.1595	(219)
Water heating fuel used												2474.4922	(219)
Annual totals kWh/year													
Space heating fuel - main system												4457.2392	(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)												398.7732	(232)
Total delivered energy for all uses												7405.5046	(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	4457.2392	0.2160	962.7637 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2474.4922	0.2160	534.4903 (264)
Space and water heating			1497.2540 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	398.7732	0.5190	206.9633 (268)
Total CO2, kg/m2/year			1743.1423 (272)
Emissions per m2 for space and water heating			16.1795 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.2365 (272b)
Emissions per m2 for pumps and fans			0.4206 (272c)
Target Carbon Dioxide Emission Rate (TER) = (16.1795 * 1.00) + 2.2365 + 0.4206, rounded to 2 d.p.			18.8400 (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	46.7700 (1b)	x 2.3100 (2b)	= 108.0387 (1b) - (3b)
First floor	45.7700 (1c)	x 2.4800 (2c)	= 113.5096 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	92.5400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 221.5483 (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) = 0.1354 (8)
Pressure test					Yes
Measured/design AP50					4.4500
Infiltration rate					0.3579 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3579 (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	0.4563	0.4474	0.4384	0.3937	0.3848	0.3400	0.3400	0.3311	0.3579	0.3848	0.4026	0.4205 (22b)
Effective ac	0.6041	0.6001	0.5961	0.5775	0.5740	0.5578	0.5578	0.5548	0.5641	0.5740	0.5811	0.5884 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid Door			1.9600	0.9000	1.7640		(26)
Window (Uw = 1.40)			11.9400	1.3258	15.8295		(27)
French (Uw = 1.40)			3.1500	1.3258	4.1761		(27)
Half Glazed Door			1.8900	1.3000	2.4570		(26a)
Heat Loss Floor			46.7700	0.1500	7.0155	75.0000	3507.7500 (28a)
100mm Knauf Supafil	134.7300	18.9400	115.7900	0.2500	28.9475	52.8000	6113.7120 (29a)
External Plane Roof	45.7700		45.7700	0.1300	5.9501	9.0000	411.9300 (30)
Bay	1.0100		1.0100	0.2000	0.2020	9.0000	9.0900 (30)
Total net area of external elements Aum(A, m ²)			228.2800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	66.3418		(33)
GF Masonry			41.2600			39.0000	1609.1400 (32c)
GF Timber			34.3700			9.0000	309.3300 (32c)
1F Timber			81.4300			9.0000	732.8700 (32c)
1F Metal			34.9000			20.0000	698.0000 (32c)
Internal Floor			45.7700			18.0000	823.8600 (32d)
Internal Floor 1			45.7700			9.0000	411.9300 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 14627.6120 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 158.0680 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 8.1836 (36)
Total fabric heat loss (33) + (36) = 74.5254 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	44.1679	43.8723	43.5825	42.2216	41.9670	40.7817	40.7817	40.5622	41.2382	41.9670	42.4821	43.0206 (38)
Heat transfer coeff	118.6932	118.3976	118.1079	116.7470	116.4923	115.3070	115.3070	115.0875	115.7636	116.4923	117.0074	117.5460 (39)
Average = Sum(39)m / 12 =												116.7457 (39)
HLP	1.2826	1.2794	1.2763	1.2616	1.2588	1.2460	1.2460	1.2437	1.2510	1.2588	1.2644	1.2702 (40)
HLP (average)												1.2616 (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												2.6589 (42)
Average daily hot water use (litres/day)												97.3492 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Daily hot water use	107.0842	103.1902	99.2962	95.4022	91.5083	87.6143	87.6143	91.5083	95.4022	99.2962	103.1902	107.0842 (44)
Energy conte	158.8027	138.8899	143.3219	124.9515	119.8939	103.4594	95.8703	110.0126	111.3265	129.7403	141.6217	153.7919 (45)
Energy content (annual)										Total =	Sum (45)m =	1531.6825 (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	33.7456	29.5141	30.4559	26.5522	25.4775	21.9851	20.3724	23.3777	23.6569	27.5698	30.0946	32.6808 (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	132.9458	132.9458	132.9458	132.9458	132.9458	132.9458	132.9458	132.9458	132.9458	132.9458	132.9458	132.9458 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	22.5802	20.0555	16.3102	12.3479	9.2302	7.7925	8.4201	10.9448	14.6900	18.6524	21.7701	23.2078 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	243.6738	246.2024	239.8305	226.2654	209.1420	193.0483	182.2968	179.7682	186.1401	199.7052	216.8287	232.9223 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.2946	36.2946	36.2946	36.2946	36.2946	36.2946	36.2946	36.2946	36.2946	36.2946	36.2946	36.2946 (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)	-106.3566	-106.3566	-106.3566	-106.3566	-106.3566	-106.3566	-106.3566	-106.3566	-106.3566	-106.3566	-106.3566	-106.3566 (71)
Water heating gains (Table 5)	45.3570	43.9198	40.9354	36.8780	34.2439	30.5349	27.3823	31.4216	32.8568	37.0562	41.7981	43.9258 (72)
Total internal gains	374.4947	373.0614	359.9598	338.3751	315.4998	294.2595	280.9829	285.0183	296.5707	318.2975	343.2805	362.9396 (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				0.6800	11.2829		0.7100		0.7000		0.7700		2.6425 (75)
East				5.7600	19.6403		0.7100		0.7000		0.7700		38.9636 (76)
Southeast				0.6800	36.7938		0.7100		0.7000		0.7700		8.6173 (77)
West				4.8200	19.6403		0.7100		0.7000		0.7700		32.6050 (80)
West				3.1500	19.6403		0.7100		0.7000		0.7700		21.3082 (80)
Solar gains	104.1367	201.7443	328.9873	477.1838	584.0710	597.9468	569.2258	489.1712	381.5517	238.3831	129.4531	85.9101	(83)
Total gains	478.6314	574.8057	688.9471	815.5589	899.5708	892.2062	850.2088	774.1895	678.1223	556.6806	472.7336	448.8497	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	34.2330	34.3185	34.4027	34.8037	34.8798	35.2383	35.2383	35.3055	35.0993	34.8798	34.7262	34.5671
alpha	3.2822	3.2879	3.2935	3.3202	3.3253	3.3492	3.3492	3.3537	3.3400	3.3253	3.3151	3.3045
util living area	0.9928	0.9864	0.9696	0.9248	0.8345	0.6924	0.5490	0.6091	0.8282	0.9578	0.9881	0.9942 (86)
MIT	18.9148	19.1454	19.5524	20.0842	20.5370	20.8321	20.9433	20.9192	20.6692	20.0558	19.3886	18.8785 (87)
Th 2	19.8545	19.8570	19.8595	19.8710	19.8732	19.8834	19.8834	19.8852	19.8795	19.8732	19.8688	19.8642 (88)
util rest of house	0.9912	0.9832	0.9621	0.9054	0.7901	0.6083	0.4284	0.4889	0.7644	0.9433	0.9848	0.9929 (89)
MIT 2	17.9563	18.1873	18.5914	19.1165	19.5373	19.7905	19.8632	19.8537	19.6693	19.1005	18.4393	17.9272 (90)
Living area fraction	0.9912	0.9832	0.9621	0.9054	0.7901	0.6083	0.4284	0.4889	0.7644	0.9433	0.9848	0.9929 (89)
MIT	18.1443	18.3752	18.7799	19.3063	19.7334	19.9948	20.0751	20.0626	19.8654	19.2879	18.6255	18.1137 (92)
Temperature adjustment	18.1443	18.3752	18.7799	19.3063	19.7334	19.9948	20.0751	20.0626	19.8654	19.2879	18.6255	18.1137 (93)
adjusted MIT	18.1443	18.3752	18.7799	19.3063	19.7334	19.9948	20.0751	20.0626	19.8654	19.2879	18.6255	18.1137 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	472.6826	561.8255	656.4590	728.6449	705.0406	550.9660	382.9742	394.6217	517.6955	519.5670	463.1242	444.2913 (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	1643.2252	1595.4328	1450.3508	1214.9059	935.8252	622.0587	400.7006	421.5251	667.4214	1012.0733	1348.5640	1635.5042 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	870.8837	694.5842	590.6555	350.1079	171.7037	0.0000	0.0000	0.0000	0.0000	366.4247	637.5166	886.2624 (98)
Space heating												4568.1387 (98)
Space heating per m2										(98) / (4) =		49.3639 (99)

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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	1083.8860	853.2719	874.6651	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7903	0.8547	0.8209	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	856.6489	729.3303	717.9698	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1143.8376	1092.6370	1005.6436	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	206.7759	270.3002	214.0293	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling													
Cooled fraction									fC = cooled area / (4) =			691.1053	(104)
Intermittency factor (Table 10b)												1.0000	(105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	51.6940	67.5750	53.5073	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling													
Space cooling per m2												172.7763	(107)
Energy for space heating												1.8670	(108)
Energy for space cooling												49.3639	(99)
Energy for space cooling												1.8670	(108)
Total												51.2310	(109)
Dwelling Fabric Energy Efficiency (DFEE)												51.2	(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	46.7700 (1b)	x 2.3100 (2b)	= 108.0387 (1b) - (3b)
First floor	45.7700 (1c)	x 2.4800 (2c)	= 113.5096 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	92.5400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 221.5483 (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) = 0.1354 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3854 (18)
Number of sides sheltered					0 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		1.0000 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3854 (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	0.4914	0.4818	0.4721	0.4240	0.4143	0.3661	0.3661	0.3565	0.3854	0.4143	0.4336	0.4529 (22b)
Effective ac	0.6207	0.6160	0.6115	0.5899	0.5858	0.5670	0.5670	0.5635	0.5743	0.5858	0.5940	0.6025 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			1.9600	1.0000	1.9600		(26)
TER Semi-glazed door			1.8900	1.2000	2.2680		(26a)
TER Opening Type (Uw = 1.40)			15.0900	1.3258	20.0057		(27)
Heat Loss Floor			46.7700	0.1300	6.0801		(28a)
100mm Knauf Supafil	134.7300	18.9400	115.7900	0.1800	20.8422		(29a)
External Plane Roof	45.7700		45.7700	0.1300	5.9501		(30)
Bay	1.0100		1.0100	0.1300	0.1313		(30)
Total net area of external elements Aum(A, m ²)			228.2800				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		57.2374		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							11.3958 (36)
Total fabric heat loss						(33) + (36) =	68.6332 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	45.3826	45.0398	44.7039	43.1258	42.8305	41.4560	41.4560	41.2015	41.9855	42.8305	43.4278	44.0523 (38)
Heat transfer coeff	114.0158	113.6730	113.3370	111.7590	111.4637	110.0892	110.0892	109.8347	110.6187	111.4637	112.0610	112.6854 (39)
Average = Sum(39)m / 12 =												111.7575 (39)
HLP	1.2321	1.2284	1.2247	1.2077	1.2045	1.1896	1.1896	1.1869	1.1954	1.2045	1.2109	1.2177 (40)
HLP (average)												1.2077 (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												2.6589 (42)
Average daily hot water use (litres/day)												97.3492 (43)
Daily hot water use	107.0842	103.1902	99.2962	95.4022	91.5083	87.6143	87.6143	91.5083	95.4022	99.2962	103.1902	107.0842 (44)
Energy conte	158.8027	138.8899	143.3219	124.9515	119.8939	103.4594	95.8703	110.0126	111.3265	129.7403	141.6217	153.7919 (45)
Energy content (annual)										Total = Sum(45)m =		1531.6825 (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												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Heat gains from water heating, kWh/month	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
	33.7456	29.5141	30.4559	26.5522	25.4775	21.9851	20.3724	23.3777	23.6569	27.5698	30.0946	32.6808 (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	132.9458	132.9458	132.9458	132.9458	132.9458	132.9458	132.9458	132.9458	132.9458	132.9458	132.9458	132.9458 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	22.5802	20.0555	16.3102	12.3479	9.2302	7.7925	8.4201	10.9448	14.6900	18.6524	21.7701	23.2078 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	243.6738	246.2024	239.8305	226.2654	209.1420	193.0483	182.2968	179.7682	186.1401	199.7052	216.8287	232.9223 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.2946	36.2946	36.2946	36.2946	36.2946	36.2946	36.2946	36.2946	36.2946	36.2946	36.2946	36.2946 (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)	-106.3566	-106.3566	-106.3566	-106.3566	-106.3566	-106.3566	-106.3566	-106.3566	-106.3566	-106.3566	-106.3566	-106.3566 (71)
Water heating gains (Table 5)	45.3570	43.9198	40.9354	36.8780	34.2439	30.5349	27.3823	31.4216	32.8568	37.0562	41.7981	43.9258 (72)
Total internal gains	374.4947	373.0614	359.9598	338.3751	315.4998	294.2595	280.9829	285.0183	296.5707	318.2975	343.2805	362.9396 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	FF	Access factor Table 6d	Gains W
Northeast	0.6800	11.2829	0.6300		0.7000	0.7700	2.3448 (75)
East	5.7600	19.6403	0.6300		0.7000	0.7700	34.5734 (76)
Southeast	0.6800	36.7938	0.6300		0.7000	0.7700	7.6464 (77)
West	7.9700	19.6403	0.6300		0.7000	0.7700	47.8385 (80)

Solar gains	92.4030	179.0126	291.9183	423.4166	518.2602	530.5725	505.0877	434.0533	338.5599	211.5231	114.8668	76.2301 (83)
Total gains	466.8977	552.0740	651.8781	761.7917	833.7600	824.8319	786.0707	719.0717	635.1306	529.8206	458.1474	439.1696 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	56.3640	56.5340	56.7016	57.5022	57.6545	58.3744	58.3744	58.5096	58.0950	57.6545	57.3472	57.0294
alpha	4.7576	4.7689	4.7801	4.8335	4.8436	4.8916	4.8916	4.9006	4.8730	4.8436	4.8231	4.8020
util living area	0.9991	0.9977	0.9927	0.9717	0.9053	0.7589	0.5927	0.6603	0.8962	0.9876	0.9981	0.9993 (86)
MIT	19.5625	19.7199	20.0025	20.3853	20.7168	20.9208	20.9814	20.9693	20.8046	20.3609	19.8955	19.5421 (87)
Th 2	19.8944	19.8974	19.9003	19.9139	19.9164	19.9283	19.9283	19.9305	19.9237	19.9164	19.9113	19.9059 (88)
util rest of house	0.9987	0.9969	0.9899	0.9601	0.8653	0.6664	0.4601	0.5269	0.8356	0.9808	0.9972	0.9991 (89)
MIT 2	18.5828	18.7422	19.0257	19.4122	19.7211	19.8911	19.9235	19.9215	19.8095	19.3951	18.9288	18.5715 (90)
Living area fraction									fLA = Living area / (4) =			0.1961 (91)
MIT	18.7750	18.9340	19.2173	19.6031	19.9164	20.0930	20.1310	20.1270	20.0046	19.5845	19.1184	18.7618 (92)
Temperature adjustment												0.0000
adjusted MIT	18.7750	18.9340	19.2173	19.6031	19.9164	20.0930	20.1310	20.1270	20.0046	19.5845	19.1184	18.7618 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9982	0.9958	0.9875	0.9558	0.8653	0.6821	0.4864	0.5532	0.8411	0.9779	0.9964	0.9987 (94)
Useful gains	466.0732	549.7791	643.7507	728.1262	721.4707	562.6105	382.3537	397.7921	534.2276	518.1125	456.4779	438.5960 (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	1650.3752	1595.2869	1441.3421	1196.1626	915.8295	604.7252	388.7263	409.3580	653.1630	1001.4472	1346.7982	1640.9075 (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	881.1207	702.5813	593.4080	336.9862	144.6029	0.0000	0.0000	0.0000	0.0000	359.6011	641.0307	894.5198 (98)
Space heating												4553.8505 (98)
Space heating per m2										(98) / (4) =		49.2095 (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	1034.8387	814.6603	834.7437	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8420	0.9080	0.8762	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	871.3353	739.7340	731.4398	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1065.0884	1017.6703	941.2201	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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	139.5022	206.7846	156.0765	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												502.3634 (104)
Cooled fraction									fC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)												
0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)	
Space cooling kWh												
0.0000	0.0000	0.0000	0.0000	0.0000	34.8756	51.6962	39.0191	0.0000	0.0000	0.0000	0.0000 (107)	
Space cooling												125.5909 (107)
Space cooling per m2												1.3572 (108)
Energy for space heating												49.2095 (99)
Energy for space cooling												1.3572 (108)
Total												50.5667 (109)
Target Fabric Energy Efficiency (TFEE)												58.2 (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	46.7700 (1b)	x 2.3100 (2b)	= 108.0387 (1b) - (3b)
First floor	45.7700 (1c)	x 2.4800 (2c)	= 113.5096 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	92.5400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 221.5483 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																4 * 10 =	40.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =										40.0000 / (5) =							0.1805 (8)
Pressure test										Yes							
Measured/design AP50																	4.4500
Infiltration rate																	0.4030 (18)
Number of sides sheltered																	0 (19)
Shelter factor										(20) = 1 - [0.075 x (19)] =							1.0000 (20)
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =							0.4030 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
Wind factor	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)				
Adj infilt rate	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)				
	0.4232	0.3930	0.4030	0.3829	0.3829	0.3728	0.3627	0.3527	0.3426	0.3728	0.3527	0.3728	(22b)				
Effective ac	0.5895	0.5772	0.5812	0.5733	0.5733	0.5695	0.5658	0.5622	0.5587	0.5695	0.5622	0.5695	(25)				

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K						
Solid Door			1.9600	0.9000	1.7640			(26)					
Window (Uw = 1.40)			11.9400	1.3258	15.8295			(27)					
French (Uw = 1.40)			3.1500	1.3258	4.1761			(27)					
Half Glazed Door			1.8900	1.3000	2.4570			(26a)					
Heat Loss Floor			46.7700	0.1500	7.0155	75.0000	3507.7500	(28a)					
100mm Knauf Supafil	134.7300	18.9400	115.7900	0.2500	28.9475	52.8000	6113.7120	(29a)					
External Plane Roof	45.7700		45.7700	0.1300	5.9501	9.0000	411.9300	(30)					
Bay	1.0100		1.0100	0.2000	0.2020	9.0000	9.0900	(30)					
Total net area of external elements Aum(A, m2)			228.2800					(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		66.3418			(33)					
GF Masonry			41.2600			39.0000	1609.1400	(32c)					
GF Timber			34.3700			9.0000	309.3300	(32c)					
1F Timber			81.4300			9.0000	732.8700	(32c)					
1F Metal			34.9000			20.0000	698.0000	(32c)					
Internal Floor			45.7700			18.0000	823.8600	(32d)					
Internal Floor 1			45.7700			18.0000	823.8600	(32e)					
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		15039.5420	(34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							162.5194	(35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.1836	(36)					
Total fabric heat loss						(33) + (36) =	74.5254	(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	43.1025	42.2006	42.4938	41.9148	41.9148	41.6365	41.3655	41.1020	40.8459	41.6365	41.1020	41.6365	(38)
Heat transfer coeff	117.6278	116.7260	117.0192	116.4402	116.4402	116.1618	115.8909	115.6274	115.3713	116.1618	115.6274	116.1618	(39)
Average = Sum(39)m / 12 =												116.2713	(39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2711	1.2614	1.2645	1.2583	1.2583	1.2553	1.2523	1.2495	1.2467	1.2553	1.2495	1.2553	(40)
HLP (average)												1.2564	(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												2.6589 (42)
Average daily hot water use (litres/day)												97.3492 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Daily hot water use	107.0842	103.1902	99.2962	95.4022	91.5083	87.6143	87.6143	91.5083	95.4022	99.2962	103.1902	107.0842 (44)
Energy conte	158.8027	138.8899	143.3219	124.9515	119.8939	103.4594	95.8703	110.0126	111.3265	129.7403	141.6217	153.7919 (45)
Energy content (annual)										Total = Sum (45)m =		1531.6825 (45)
Distribution loss (46)m = 0.15 x (45)m	23.8204	20.8335	21.4983	18.7427	17.9841	15.5189	14.3805	16.5019	16.6990	19.4610	21.2432	23.0688 (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	21.0464	18.9901	20.9755	20.2193	20.8354	20.0965	20.7248	20.7965	20.1634	20.9175	20.3157	21.0249 (61)
Total heat required for water heating calculated for each month	179.8492	157.8800	164.2974	145.1708	140.7293	123.5558	116.5951	130.8090	131.4899	150.6578	161.9373	174.8168 (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	179.8492	157.8800	164.2974	145.1708	140.7293	123.5558	116.5951	130.8090	131.4899	150.6578	161.9373	174.8168 (64)
RHI water heating demand												
Heat gains from water heating, kWh/month	58.0635	50.9284	52.8984	46.6012	45.0736	39.4244	37.0581	41.7783	42.0569	48.3680	52.1681	56.3920 (65)
												1778 (64)
												1777.7885 (64)

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

Metabolic gains (Table 5), Watts												
(66)m	159.5349	159.5349	159.5349	159.5349	159.5349	159.5349	159.5349	159.5349	159.5349	159.5349	159.5349	159.5349 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	56.4505	50.1388	40.7756	30.8698	23.0755	19.4813	21.0503	27.3619	36.7251	46.6310	54.4252	58.0194 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	363.6923	367.4663	357.9559	337.7096	312.1522	288.1318	272.0848	268.3108	277.8211	298.0675	323.6249	347.6452 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.6124	53.6124	53.6124	53.6124	53.6124	53.6124	53.6124	53.6124	53.6124	53.6124	53.6124	53.6124 (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)	-106.3566	-106.3566	-106.3566	-106.3566	-106.3566	-106.3566	-106.3566	-106.3566	-106.3566	-106.3566	-106.3566	-106.3566 (71)
Water heating gains (Table 5)	78.0424	75.7863	71.1000	64.7239	60.5828	54.7560	49.8092	56.1536	58.4124	65.0108	72.4557	75.7958 (72)
Total internal gains	607.9758	603.1821	579.6223	543.0939	505.6012	472.1599	452.7350	461.6170	482.7493	519.4999	560.2965	591.2511 (73)

6. Solar gains

[Jan]					Area	Solar flux		g	FF	Access		Gains
					m2	Table 6a		Specific data		factor		W
						W/m2		or Table 6b		Specific data	Table 6d	
										or Table 6c		
Northeast					0.6800	14.6176		0.7100		0.7000	0.7700	3.4235 (75)
East					5.7600	25.1925		0.7100		0.7000	0.7700	49.9786 (76)
Southeast					0.6800	45.1778		0.7100		0.7000	0.7700	10.5809 (77)
West					4.8200	25.1925		0.7100		0.7000	0.7700	41.8224 (80)
West					3.1500	25.1925		0.7100		0.7000	0.7700	27.3320 (80)

Solar gains	133.1375	219.5422	360.2956	524.0978	608.1362	675.6123	638.3866	563.2690	440.7991	279.7715	164.9897	107.9449 (83)
Total gains	741.1133	822.7244	939.9179	1067.1918	1113.7374	1147.7722	1091.1215	1024.8860	923.5484	799.2714	725.2862	699.1960 (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	35.5158	35.7902	35.7006	35.8781	35.8781	35.9641	36.0481	36.1303	36.2105	35.9641	36.1303	35.9641
alpha	3.3677	3.3860	3.3800	3.3919	3.3919	3.3976	3.4032	3.4087	3.4140	3.3976	3.4087	3.3976
util living area	0.9737	0.9623	0.9286	0.8510	0.7248	0.5355	0.4019	0.4246	0.6736	0.8812	0.9559	0.9772 (86)
MIT	19.4042	19.5795	19.9561	20.4115	20.7507	20.9352	20.9816	20.9784	20.8566	20.4385	19.8758	19.3936 (87)
Th 2	19.8635	19.8712	19.8687	19.8737	19.8737	19.8760	19.8784	19.8806	19.8828	19.8760	19.8806	19.8760 (88)
util rest of house	0.9678	0.9539	0.9125	0.8176	0.6636	0.4443	0.2918	0.3095	0.5868	0.8456	0.9443	0.9720 (89)
MIT 2	17.7840	18.0403	18.5741	19.2028	19.6346	19.8328	19.8712	19.8721	19.7705	19.2581	18.4766	17.7773 (90)
Living area fraction	18.1018	18.3422	18.8451	19.4398	19.8535	20.0490	20.0890	20.0890	19.9835	19.4896	18.7510	18.0943 (91)
MIT	18.1018	18.3422	18.8451	19.4398	19.8535	20.0490	20.0890	20.0890	19.9835	19.4896	18.7510	18.0943 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.9518	18.1922	18.6951	19.2898	19.7035	19.8990	19.9390	19.9390	19.8335	19.3396	18.6010	17.9443 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9536	0.9369	0.8910	0.7971	0.6533	0.4463	0.2980	0.3158	0.5825	0.8245	0.9260	0.9589 (94)
Ext temp.	706.6914	770.7783	837.4817	850.6259	727.6282	512.2207	325.1054	323.6363	538.0080	658.9596	671.5948	670.4656 (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	1535.2524	1504.8528	1368.5551	1139.9309	838.7810	534.2287	329.0106	328.2711	592.2555	922.2747	1237.3281	1503.6317 (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)
	616.4494	493.2981	395.1186	208.2996	82.6977	0.0000	0.0000	0.0000	0.0000	195.9064	407.3280	619.8755 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF HEAT DEMAND 09 Jan 2014

Space heating	3018.9734 (98)
RHI space heating demand	3019 (98)

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	46.7700 (1b)	x 2.3100 (2b)	= 108.0387 (1b) - (3b)
First floor	45.7700 (1c)	x 2.4800 (2c)	= 113.5096 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	92.5400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 221.5483 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																4 * 10 =	40.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =										40.0000 / (5) =							0.1805 (8)
Pressure test										Yes							
Measured/design AP50																	4.4500
Infiltration rate																	0.4030 (18)
Number of sides sheltered																	0 (19)
Shelter factor										(20) = 1 - [0.075 x (19)] =							1.0000 (20)
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =							0.4030 (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	0.5139	0.5038	0.4937	0.4434	0.4333	0.3829	0.3829	0.3728	0.4030	0.4333	0.4534	0.4736	(22b)				
Effective ac	0.6320	0.6269	0.6219	0.5983	0.5939	0.5733	0.5733	0.5695	0.5812	0.5939	0.6028	0.6121	(25)				

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K						
Solid Door			1.9600	0.9000	1.7640			(26)					
Window (Uw = 1.40)			11.9400	1.3258	15.8295			(27)					
French (Uw = 1.40)			3.1500	1.3258	4.1761			(27)					
Half Glazed Door			1.8900	1.3000	2.4570			(26a)					
Heat Loss Floor			46.7700	0.1500	7.0155	75.0000	3507.7500	(28a)					
100mm Knauf Supafil	134.7300	18.9400	115.7900	0.2500	28.9475	52.8000	6113.7120	(29a)					
External Plane Roof	45.7700		45.7700	0.1300	5.9501	9.0000	411.9300	(30)					
Bay	1.0100		1.0100	0.2000	0.2020	9.0000	9.0900	(30)					
Total net area of external elements Aum(A, m2)			228.2800					(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		66.3418			(33)					
GF Masonry			41.2600			39.0000	1609.1400	(32c)					
GF Timber			34.3700			9.0000	309.3300	(32c)					
1F Timber			81.4300			9.0000	732.8700	(32c)					
1F Metal			34.9000			20.0000	698.0000	(32c)					
Internal Floor			45.7700			18.0000	823.8600	(32d)					
Internal Floor 1			45.7700			18.0000	823.8600	(32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	15039.5420	(34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							162.5194	(35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.1836	(36)					
Total fabric heat loss						(33) + (36) =	74.5254	(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	46.2090	45.8341	45.4667	43.7409	43.4180	41.9148	41.9148	41.6365	42.4938	43.4180	44.0712	44.7541	(38)
Heat transfer coeff	120.7343	120.3595	119.9920	118.2662	117.9433	116.4402	116.4402	116.1618	117.0192	117.9433	118.5965	119.2794	(39)
Average = Sum(39)m / 12 =												118.2647	(39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3047	1.3006	1.2967	1.2780	1.2745	1.2583	1.2583	1.2553	1.2645	1.2745	1.2816	1.2890	(40)
HLP (average)												1.2780	(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											
2.6589 (42)											
Average daily hot water use (litres/day)											
97.3492 (43)											
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Daily hot water use	107.0842	103.1902	99.2962	95.4022	91.5083	87.6143	87.6143	91.5083	95.4022	99.2962	103.1902	107.0842 (44)
Energy conte	158.8027	138.8899	143.3219	124.9515	119.8939	103.4594	95.8703	110.0126	111.3265	129.7403	141.6217	153.7919 (45)
Energy content (annual)										Total = Sum (45)m =		1531.6825 (45)
Distribution loss (46)m = 0.15 x (45)m	23.8204	20.8335	21.4983	18.7427	17.9841	15.5189	14.3805	16.5019	16.6990	19.4610	21.2432	23.0688 (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	21.0464	18.9901	20.9755	20.2193	20.8354	20.0965	20.7248	20.7965	20.1634	20.9175	20.3157	21.0249 (61)
Total heat required for water heating calculated for each month	179.8492	157.8800	164.2974	145.1708	140.7293	123.5558	116.5951	130.8090	131.4899	150.6578	161.9373	174.8168 (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	179.8492	157.8800	164.2974	145.1708	140.7293	123.5558	116.5951	130.8090	131.4899	150.6578	161.9373	174.8168 (64)
Heat gains from water heating, kWh/month	58.0635	50.9284	52.8984	46.6012	45.0736	39.4244	37.0581	41.7783	42.0569	48.3680	52.1681	56.3920 (65)
										Total per year (kWh/year) = Sum (64)m =		1777.7885 (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	159.5349	159.5349	159.5349	159.5349	159.5349	159.5349	159.5349	159.5349	159.5349	159.5349	159.5349	159.5349 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	56.4505	50.1388	40.7756	30.8698	23.0755	19.4813	21.0503	27.3619	36.7251	46.6310	54.4252	58.0194 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	363.6923	367.4663	357.9559	337.7096	312.1522	288.1318	272.0848	268.3108	277.8211	298.0675	323.6249	347.6452 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.6124	53.6124	53.6124	53.6124	53.6124	53.6124	53.6124	53.6124	53.6124	53.6124	53.6124	53.6124 (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)	-106.3566	-106.3566	-106.3566	-106.3566	-106.3566	-106.3566	-106.3566	-106.3566	-106.3566	-106.3566	-106.3566	-106.3566 (71)
Water heating gains (Table 5)	78.0424	75.7863	71.1000	64.7239	60.5828	54.7560	49.8092	56.1536	58.4124	65.0108	72.4557	75.7958 (72)
Total internal gains	607.9758	603.1821	579.6223	543.0939	505.6012	472.1599	452.7350	461.6170	482.7493	519.4999	560.2965	591.2511 (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					0.6800	11.2829	0.7100	0.7000			0.7700			2.6425 (75)
East					5.7600	19.6403	0.7100	0.7000			0.7700			38.9636 (76)
Southeast					0.6800	36.7938	0.7100	0.7000			0.7700			8.6173 (77)
West					4.8200	19.6403	0.7100	0.7000			0.7700			32.6050 (80)
West					3.1500	19.6403	0.7100	0.7000			0.7700			21.3082 (80)
Solar gains	104.1367	201.7443	328.9873	477.1838	584.0710	597.9468	569.2258	489.1712	381.5517	238.3831	129.4531	85.9101	(83)	
Total gains	712.1125	804.9264	908.6096	1020.2778	1089.6722	1070.1067	1021.9608	950.7883	864.3009	757.8831	689.7496	677.1612	(84)	

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	34.6020	34.7098	34.8161	35.3241	35.4208	35.8781	35.8781	35.9641	35.7006	35.4208	35.2257	35.0241
alpha	3.3068	3.3140	3.3211	3.3549	3.3614	3.3919	3.3919	3.3976	3.3800	3.3614	3.3484	3.3349
util living area	0.9791	0.9675	0.9412	0.8803	0.7732	0.6185	0.4761	0.5243	0.7448	0.9137	0.9678	0.9821 (86)
MIT	19.2188	19.4333	19.8030	20.2758	20.6541	20.8862	20.9648	20.9510	20.7767	20.2734	19.6679	19.1851 (87)
Th 2	19.8372	19.8403	19.8435	19.8581	19.8609	19.8737	19.8737	19.8760	19.8687	19.8609	19.8553	19.8495 (88)
util rest of house	0.9744	0.9603	0.9279	0.8527	0.7208	0.5331	0.3646	0.4111	0.6689	0.8875	0.9594	0.9781 (89)
MIT 2	17.4994	17.8106	18.3413	19.0100	19.5080	19.7865	19.8566	19.8501	19.6751	19.0248	18.1628	17.4584 (90)
Living area fraction									fLA = Living area / (4) =			0.1961 (91)
MIT	17.8366	18.1288	18.6280	19.2583	19.7328	20.0022	20.0739	20.0660	19.8911	19.2697	18.4580	17.7970 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.6866	17.9788	18.4780	19.1083	19.5828	19.8522	19.9239	19.9160	19.7411	19.1197	18.3080	17.6470 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9617	0.9440	0.9070	0.8305	0.7062	0.5313	0.3699	0.4153	0.6590	0.8654	0.9432	0.9666 (94)
Useful gains	684.8151	759.8272	824.0792	847.3133	769.5185	568.5999	377.9840	394.9000	569.6048	655.9090	650.5984	654.5664 (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	1616.2244	1574.1609	1437.2597	1207.2928	929.7226	611.5656	387.0395	408.4270	660.1221	1004.8445	1329.2268	1603.9566 (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	692.9685	547.2322	456.2063	259.1852	119.1918	0.0000	0.0000	0.0000	0.0000	259.6080	488.6124	706.3463 (98)
Space heating												3529.3508 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Space heating per m2 (98) / (4) = 38.1387 (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													3921.5009 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	692.9685	547.2322	456.2063	259.1852	119.1918	0.0000	0.0000	0.0000	0.0000	259.6080	488.6124	706.3463	(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)	769.9650	608.0358	506.8959	287.9836	132.4353	0.0000	0.0000	0.0000	0.0000	288.4533	542.9027	784.8292	(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	179.8492	157.8800	164.2974	145.1708	140.7293	123.5558	116.5951	130.8090	131.4899	150.6578	161.9373	174.8168	(64)
Efficiency of water heater (217)m	89.2996	89.2395	89.1020	88.7867	88.1827	86.7000	86.7000	86.7000	86.7000	88.7594	89.1553	86.7000	(216)
Fuel for water heating, kWh/month	201.3997	176.9173	184.3925	163.5051	159.5883	142.5096	134.4811	150.8755	151.6607	169.7373	181.6351	195.7077	(219)
Water heating fuel used												2012.4099	(219)
Annual totals kWh/year													
Space heating fuel - main system												3921.5009	(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)												398.7732	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 908 * 1.00) =										-588.2895		-588.2895	(233)
Total delivered energy for all uses												5819.3944	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3921.5009	3.4800	136.4682 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2012.4099	3.4800	70.0319 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	398.7732	13.1900	52.5982 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-588.2895	13.1900	-77.5954 (252)
Total energy cost			311.3954 (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] =	0.9509 (257)
SAP value	86.7350	
SAP rating (Section 12)	87	(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	3921.5009	0.2160	847.0442 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2012.4099	0.2160	434.6805 (264)
Space and water heating			1281.7247 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	398.7732	0.5190	206.9633 (268)
Energy saving/generation technologies			
PV Unit	-588.2895	0.5190	-305.3223 (269)
Total kg/year			1222.2907 (272)
CO2 emissions per m2			13.2100 (273)
EI value			88.0917
EI rating			88 (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
Main heating environmental impact
Water heating energy efficiency
Water heating environmental impact

$3.48 \times (1 + 0.29 \times 0.00) / 0.9000 = 3.867$, stars = 4
 $0.216 \times (1 + 0.29 \times 0.00) / 0.9000 = 0.2400$, stars = 4
 $3.48 / 0.8822 = 3.945$, stars = 4
 $0.216 / 0.8822 = 0.2448$, 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	46.7700 (1b)	x 2.3100 (2b)	= 108.0387 (1b) - (3b)
First floor	45.7700 (1c)	x 2.4800 (2c)	= 113.5096 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	92.5400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 221.5483 (5)

2. Ventilation rate

										main heating	secondary heating	other	total	m3 per hour			
										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of chimneys										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of open flues										0	+	0	+	0	=	4 * 10 =	40.0000 (7a)
Number of intermittent fans																0 * 10 =	0.0000 (7b)
Number of passive vents																0 * 40 =	0.0000 (7c)
Number of flueless gas fires																	
										Air changes per hour							
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =				40.0000	/ (5) =	0.1805 (8)	
Pressure test										Yes							
Measured/design AP50										4.4500							
Infiltration rate										0.4030 (18)							
Number of sides sheltered										0 (19)							
Shelter factor										(20) = 1 - [0.075 x (19)] =				1.0000	(20)		
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =				0.4030	(21)		
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
	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	0.4232	0.3930	0.4030	0.3829	0.3829	0.3728	0.3627	0.3527	0.3426	0.3728	0.3527	0.3728	(22b)				
Effective ac	0.5895	0.5772	0.5812	0.5733	0.5733	0.5695	0.5658	0.5622	0.5587	0.5695	0.5622	0.5695	(25)				

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K						
Solid Door			1.9600	0.9000	1.7640			(26)					
Window (Uw = 1.40)			11.9400	1.3258	15.8295			(27)					
French (Uw = 1.40)			3.1500	1.3258	4.1761			(27)					
Half Glazed Door			1.8900	1.3000	2.4570			(26a)					
Heat Loss Floor			46.7700	0.1500	7.0155	75.0000	3507.7500	(28a)					
100mm Knauf Supafil	134.7300	18.9400	115.7900	0.2500	28.9475	52.8000	6113.7120	(29a)					
External Plane Roof	45.7700		45.7700	0.1300	5.9501	9.0000	411.9300	(30)					
Bay	1.0100		1.0100	0.2000	0.2020	9.0000	9.0900	(30)					
Total net area of external elements Aum(A, m2)			228.2800					(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	66.3418			(33)					
GF Masonry			41.2600			39.0000	1609.1400	(32c)					
GF Timber			34.3700			9.0000	309.3300	(32c)					
1F Timber			81.4300			9.0000	732.8700	(32c)					
1F Metal			34.9000			20.0000	698.0000	(32c)					
Internal Floor			45.7700			18.0000	823.8600	(32d)					
Internal Floor 1			45.7700			18.0000	823.8600	(32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	15039.5420	(34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							162.5194	(35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.1836	(36)					
Total fabric heat loss						(33) + (36) =	74.5254	(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	43.1025	42.2006	42.4938	41.9148	41.9148	41.6365	41.3655	41.1020	40.8459	41.6365	41.1020	41.6365	(38)
Heat transfer coeff	117.6278	116.7260	117.0192	116.4402	116.4402	116.1618	115.8909	115.6274	115.3713	116.1618	115.6274	116.1618	(39)
Average = Sum(39)m / 12 =												116.2713	(39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2711	1.2614	1.2645	1.2583	1.2583	1.2553	1.2523	1.2495	1.2467	1.2553	1.2495	1.2553	(40)
HLP (average)												1.2564	(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												2.6589 (42)
Average daily hot water use (litres/day)												97.3492 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Daily hot water use	107.0842	103.1902	99.2962	95.4022	91.5083	87.6143	87.6143	91.5083	95.4022	99.2962	103.1902	107.0842 (44)
Energy conte	158.8027	138.8899	143.3219	124.9515	119.8939	103.4594	95.8703	110.0126	111.3265	129.7403	141.6217	153.7919 (45)
Energy content (annual)										Total = Sum (45)m =		1531.6825 (45)
Distribution loss (46)m = 0.15 x (45)m	23.8204	20.8335	21.4983	18.7427	17.9841	15.5189	14.3805	16.5019	16.6990	19.4610	21.2432	23.0688 (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	21.0464	18.9901	20.9755	20.2193	20.8354	20.0965	20.7248	20.7965	20.1634	20.9175	20.3157	21.0249 (61)
Total heat required for water heating calculated for each month												
Solar input	179.8492	157.8800	164.2974	145.1708	140.7293	123.5558	116.5951	130.8090	131.4899	150.6578	161.9373	174.8168 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Solar input (sum of months) = Sum (63)m =												0.0000 (63)
Output from w/h	179.8492	157.8800	164.2974	145.1708	140.7293	123.5558	116.5951	130.8090	131.4899	150.6578	161.9373	174.8168 (64)
Heat gains from water heating, kWh/month	58.0635	50.9284	52.8984	46.6012	45.0736	39.4244	37.0581	41.7783	42.0569	48.3680	52.1681	56.3920 (65)
Total per year (kWh/year) = Sum (64)m =												1777.7885 (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	159.5349	159.5349	159.5349	159.5349	159.5349	159.5349	159.5349	159.5349	159.5349	159.5349	159.5349	159.5349 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	56.4505	50.1388	40.7756	30.8698	23.0755	19.4813	21.0503	27.3619	36.7251	46.6310	54.4252	58.0194 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	363.6923	367.4663	357.9559	337.7096	312.1522	288.1318	272.0848	268.3108	277.8211	298.0675	323.6249	347.6452 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.6124	53.6124	53.6124	53.6124	53.6124	53.6124	53.6124	53.6124	53.6124	53.6124	53.6124	53.6124 (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)	-106.3566	-106.3566	-106.3566	-106.3566	-106.3566	-106.3566	-106.3566	-106.3566	-106.3566	-106.3566	-106.3566	-106.3566 (71)
Water heating gains (Table 5)	78.0424	75.7863	71.1000	64.7239	60.5828	54.7560	49.8092	56.1536	58.4124	65.0108	72.4557	75.7958 (72)
Total internal gains	607.9758	603.1821	579.6223	543.0939	505.6012	472.1599	452.7350	461.6170	482.7493	519.4999	560.2965	591.2511 (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					0.6800	14.6176	0.7100	0.7000	0.7700		3.4235 (75)	
East					5.7600	25.1925	0.7100	0.7000	0.7700		49.9786 (76)	
Southeast					0.6800	45.1778	0.7100	0.7000	0.7700		10.5809 (77)	
West					4.8200	25.1925	0.7100	0.7000	0.7700		41.8224 (80)	
West					3.1500	25.1925	0.7100	0.7000	0.7700		27.3320 (80)	
Solar gains	133.1375	219.5422	360.2956	524.0978	608.1362	675.6123	638.3866	563.2690	440.7991	279.7715	164.9897	107.9449 (83)
Total gains	741.1133	822.7244	939.9179	1067.1918	1113.7374	1147.7722	1091.1215	1024.8860	923.5484	799.2714	725.2862	699.1960 (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	35.5158	35.7902	35.7006	35.8781	35.8781	35.9641	36.0481	36.1303	36.2105	35.9641	36.1303	35.9641
alpha	3.3677	3.3860	3.3800	3.3919	3.3919	3.3976	3.4032	3.4087	3.4140	3.3976	3.4087	3.3976
util living area	0.9737	0.9623	0.9286	0.8510	0.7248	0.5355	0.4019	0.4246	0.6736	0.8812	0.9559	0.9772 (86)
MIT	19.4042	19.5795	19.9561	20.4115	20.7507	20.9352	20.9816	20.9784	20.8566	20.4385	19.8758	19.3936 (87)
Th 2	19.8635	19.8712	19.8687	19.8737	19.8737	19.8760	19.8784	19.8806	19.8828	19.8760	19.8806	19.8760 (88)
util rest of house	0.9678	0.9539	0.9125	0.8176	0.6636	0.4443	0.2918	0.3095	0.5868	0.8456	0.9443	0.9720 (89)
MIT 2	17.7840	18.0403	18.5741	19.2028	19.6346	19.8328	19.8712	19.8721	19.7705	19.2581	18.4766	17.7773 (90)
Living area fraction									fLA = Living area / (4) =			0.1961 (91)
MIT	18.1018	18.3422	18.8451	19.4398	19.8535	20.0490	20.0890	20.0890	19.9835	19.4896	18.7510	18.0943 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.9518	18.1922	18.6951	19.2898	19.7035	19.8990	19.9390	19.9390	19.8335	19.3396	18.6010	17.9443 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9536	0.9369	0.8910	0.7971	0.6533	0.4463	0.2980	0.3158	0.5825	0.8245	0.9260	0.9589 (94)
Useful gains	706.6914	770.7783	837.4817	850.6259	727.6282	512.2207	325.1054	323.6363	538.0080	658.9596	671.5948	670.4656 (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	1535.2524	1504.8528	1368.5551	1139.9309	838.7810	534.2287	329.0106	328.2711	592.2555	922.2747	1237.3281	1503.6317 (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	616.4494	493.2981	395.1186	208.2996	82.6977	0.0000	0.0000	0.0000	0.0000	195.9064	407.3280	619.8755 (98)
Space heating												3018.9734 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Space heating per m2 (98) / (4) = 32.6234 (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													3354.4149 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	616.4494	493.2981	395.1186	208.2996	82.6977	0.0000	0.0000	0.0000	0.0000	195.9064	407.3280	619.8755	(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)	684.9438	548.1090	439.0207	231.4440	91.8863	0.0000	0.0000	0.0000	0.0000	217.6738	452.5867	688.7506	(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	179.8492	157.8800	164.2974	145.1708	140.7293	123.5558	116.5951	130.8090	131.4899	150.6578	161.9373	174.8168	(64)
Efficiency of water heater (217)m	89.2329	89.1770	89.0050	88.6148	87.8928	86.7000	86.7000	86.7000	86.7000	88.5351	89.0360	86.7000	(216)
Fuel for water heating, kWh/month	201.5503	177.0411	184.5934	163.8224	160.1146	142.5096	134.4811	150.8755	151.6607	170.1674	181.8786	195.8673	(219)
Water heating fuel used												2014.5619	(219)
Annual totals kWh/year													
Space heating fuel - main system												3354.4149	(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)												398.7732	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 1031 * 1.00) =										-668.0993		-668.0993	(233)
Total delivered energy for all uses												5174.6507	(238)

10a. Fuel costs - using BEDF prices (453)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3354.4149	3.9300	131.8285 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2014.5619	3.9300	79.1723 (247)
Pumps and fans for heating	75.0000	17.5600	13.1700 (249)
Energy for lighting	398.7732	17.5600	70.0246 (250)
Additional standing charges			88.0000 (251)
Energy saving/generation technologies			
PV Unit	-668.0993	17.5600	-117.3182 (252)
Total energy cost			264.8771 (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	3354.4149	0.2160	724.5536 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2014.5619	0.2160	435.1454 (264)
Space and water heating			1159.6990 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	398.7732	0.5190	206.9633 (268)
Energy saving/generation technologies			
PV Unit	-668.0993	0.5190	-346.7435 (269)
Total kg/year			1058.8438 (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	3354.4149	1.2200	4092.3861 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2014.5619	1.2200	2457.7656 (264)
Space and water heating			6550.1517 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	398.7732	3.0700	1224.2338 (268)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Energy saving/generation technologies			
PV Unit	-668.0993	3.0700	-2051.0649 (269)
Primary energy kWh/year			5953.5706 (272)
Primary energy kWh/m2/year			64.3351 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating:	B 87
Current environmental impact rating:	B 88

(For testing purposes):

A	Not considered
B	Not considered
C	Not considered
D	Not considered
E Low energy lighting	Already installed
F	Not considered
G	Not considered
H	Not considered
I	Not considered
J	Not considered
K	Not considered
M	Not considered
N Solar water heating	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 (18.4%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£31 2.11 kg/m²	B 88	B 90
Total Savings	£31 2.11 kg/m²		

Potential energy efficiency rating:	B 88
Potential environmental impact rating:	B 90

Fuel prices for cost data on this page from database revision number 453 TEST (27 Nov 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	£83	£92	-£9
Mains gas	£299	£259	£40
Space heating	£233	£233	£0
Water heating	£79	£48	£31
Lighting	£70	£70	£0
Generated (PV)	-£117	-£117	£0
Total cost of fuels	£265	£234	£31
Total cost of uses	£265	£234	£31
Delivered energy	56 kWh/m²	45 kWh/m²	11 kWh/m²
Carbon dioxide emissions	1.1 tonnes	0.9 tonnes	0.2 tonnes
CO2 emissions per m²	11 kg/m²	9 kg/m²	2 kg/m²
Primary energy	64 kWh/m²	53 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	46.7700 (1b)	x 2.3100 (2b)	= 108.0387 (1b) - (3b)
First floor	45.7700 (1c)	x 2.4800 (2c)	= 113.5096 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	92.5400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 221.5483 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.1805 (8)
Pressure test					Yes
Measured/design AP50					4.4500
Infiltration rate					0.4030 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.4030 (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	0.5139	0.5038	0.4937	0.4434	0.4333	0.3829	0.3829	0.3728	0.4030	0.4333	0.4534	0.4736 (22b)
Effective ac	0.6320	0.6269	0.6219	0.5983	0.5939	0.5733	0.5733	0.5695	0.5812	0.5939	0.6028	0.6121 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid Door			1.9600	0.9000	1.7640		(26)
Window (Uw = 1.40)			11.9400	1.3258	15.8295		(27)
French (Uw = 1.40)			3.1500	1.3258	4.1761		(27)
Half Glazed Door			1.8900	1.3000	2.4570		(26a)
Heat Loss Floor			46.7700	0.1500	7.0155	75.0000	3507.7500 (28a)
100mm Knauf Supafil	134.7300	18.9400	115.7900	0.2500	28.9475	52.8000	6113.7120 (29a)
External Plane Roof	45.7700		45.7700	0.1300	5.9501	9.0000	411.9300 (30)
Bay	1.0100		1.0100	0.2000	0.2020	9.0000	9.0900 (30)
Total net area of external elements Aum(A, m ²)			228.2800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	66.3418		(33)
GF Masonry			41.2600			39.0000	1609.1400 (32c)
GF Timber			34.3700			9.0000	309.3300 (32c)
1F Timber			81.4300			9.0000	732.8700 (32c)
1F Metal			34.9000			20.0000	698.0000 (32c)
Internal Floor			45.7700			18.0000	823.8600 (32d)
Internal Floor 1			45.7700			18.0000	823.8600 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	15039.5420 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							162.5194 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.1836 (36)
Total fabric heat loss						(33) + (36) =	74.5254 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	46.2090	45.8341	45.4667	43.7409	43.4180	41.9148	41.9148	41.6365	42.4938	43.4180	44.0712	44.7541 (38)
Heat transfer coeff	120.7343	120.3595	119.9920	118.2662	117.9433	116.4402	116.4402	116.1618	117.0192	117.9433	118.5965	119.2794 (39)
Average = Sum(39)m / 12 =												118.2647 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.3047	1.3006	1.2967	1.2780	1.2745	1.2583	1.2583	1.2553	1.2645	1.2745	1.2816	1.2890 (40)
HLP (average)												1.2780 (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												2.6589 (42)
Average daily hot water use (litres/day)												97.3492 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Daily hot water use	107.0842	103.1902	99.2962	95.4022	91.5083	87.6143	87.6143	91.5083	95.4022	99.2962	103.1902	107.0842 (44)
Energy conte	158.8027	138.8899	143.3219	124.9515	119.8939	103.4594	95.8703	110.0126	111.3265	129.7403	141.6217	153.7919 (45)
Energy content (annual)										Total = Sum (45)m =		1531.6825 (45)
Distribution loss (46)m = 0.15 x (45)m	23.8204	20.8335	21.4983	18.7427	17.9841	15.5189	14.3805	16.5019	16.6990	19.4610	21.2432	23.0688 (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	21.0464	18.9901	20.9755	20.2193	20.8354	20.0965	20.7248	20.7965	20.1634	20.9175	20.3157	21.0249 (61)
Total heat required for water heating calculated for each month	179.8492	157.8800	164.2974	145.1708	140.7293	123.5558	116.5951	130.8090	131.4899	150.6578	161.9373	174.8168 (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												1.1841 (H8)
Utilisation factor												0.5703 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												97.3492 (H14)
Volume ratio Veff/V												0.7704 (H15)
Solar storage volume factor												0.9478 (H16)
Solar input												-861.9358 (H17)
Solar input	-24.9944	-41.7085	-71.0344	-95.2000	-117.6116	-115.6310	-114.1028	-99.6922	-78.0790	-53.3188	-29.6470	-20.9161 (63)
Solar input (sum of months) = Sum (63)m =												-861.9358 (63)
Output from w/h	154.8547	116.1715	93.2631	49.9708	23.1177	7.9249	2.4922	31.1168	53.4109	97.3390	132.2903	153.9008 (64)
Total per year (kWh/year) = Sum (64)m =												915.8527 (64)
Heat gains from water heating, kWh/month	58.0635	50.9284	52.8984	46.6012	45.0736	39.4244	37.0581	41.7783	42.0569	48.3680	52.1681	56.3920 (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	159.5349	159.5349	159.5349	159.5349	159.5349	159.5349	159.5349	159.5349	159.5349	159.5349	159.5349	159.5349	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	56.4505	50.1388	40.7756	30.8698	23.0755	19.4813	21.0503	27.3619	36.7251	46.6310	54.4252	58.0194	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	363.6923	367.4663	357.9559	337.7096	312.1522	288.1318	272.0848	268.3108	277.8211	298.0675	323.6249	347.6452	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.6124	53.6124	53.6124	53.6124	53.6124	53.6124	53.6124	53.6124	53.6124	53.6124	53.6124	53.6124	(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)	-106.3566	-106.3566	-106.3566	-106.3566	-106.3566	-106.3566	-106.3566	-106.3566	-106.3566	-106.3566	-106.3566	-106.3566	(71)
Water heating gains (Table 5)	78.0424	75.7863	71.1000	64.7239	60.5828	54.7560	49.8092	56.1536	58.4124	65.0108	72.4557	75.7958	(72)
Total internal gains	607.9758	603.1821	579.6223	543.0939	505.6012	472.1599	452.7350	461.6170	482.7493	519.4999	560.2965	591.2511	(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				0.6800	11.2829		0.7100		0.7000		0.7700		2.6425 (75)
East				5.7600	19.6403		0.7100		0.7000		0.7700		38.9636 (76)
Southeast				0.6800	36.7938		0.7100		0.7000		0.7700		8.6173 (77)
West				4.8200	19.6403		0.7100		0.7000		0.7700		32.6050 (80)
West				3.1500	19.6403		0.7100		0.7000		0.7700		21.3082 (80)
Solar gains	104.1367	201.7443	328.9873	477.1838	584.0710	597.9468	569.2258	489.1712	381.5517	238.3831	129.4531		85.9101 (83)
Total gains	712.1125	804.9264	908.6096	1020.2778	1089.6722	1070.1067	1021.9608	950.7883	864.3009	757.8831	689.7496		677.1612 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	34.6020	34.7098	34.8161	35.3241	35.4208	35.8781	35.8781	35.9641	35.7006	35.4208	35.2257	35.0241
alpha	3.3068	3.3140	3.3211	3.3549	3.3614	3.3919	3.3919	3.3976	3.3800	3.3614	3.3484	3.3349
util living area	0.9791	0.9675	0.9412	0.8803	0.7732	0.6185	0.4761	0.5243	0.7448	0.9137	0.9678	0.9821 (86)
MIT	19.2188	19.4333	19.8030	20.2758	20.6541	20.8862	20.9648	20.9510	20.7767	20.2734	19.6679	19.1851 (87)
Th 2	19.8372	19.8403	19.8435	19.8581	19.8609	19.8737	19.8737	19.8760	19.8687	19.8609	19.8553	19.8495 (88)
util rest of house	0.9744	0.9603	0.9279	0.8527	0.7208	0.5331	0.3646	0.4111	0.6689	0.8875	0.9594	0.9781 (89)
MIT 2	17.4994	17.8106	18.3413	19.0100	19.5080	19.7865	19.8566	19.8501	19.6751	19.0248	18.1628	17.4584 (90)
Living area fraction									fLA = Living area / (4) =			0.1961 (91)
MIT	17.8366	18.1288	18.6280	19.2583	19.7328	20.0022	20.0739	20.0660	19.8911	19.2697	18.4580	17.7970 (92)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Temperature adjustment													-0.1500
adjusted MIT	17.6866	17.9788	18.4780	19.1083	19.5828	19.8522	19.9239	19.9160	19.7411	19.1197	18.3080		17.6470 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9617	0.9440	0.9070	0.8305	0.7062	0.5313	0.3699	0.4153	0.6590	0.8654	0.9432	0.9666	(94)
Useful gains	684.8151	759.8272	824.0792	847.3133	769.5185	568.5999	377.9840	394.9000	569.6048	655.9090	650.5984	654.5664	(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													
	1616.2244	1574.1609	1437.2597	1207.2928	929.7226	611.5656	387.0395	408.4270	660.1221	1004.8445	1329.2268	1603.9566	(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													
	692.9685	547.2322	456.2063	259.1852	119.1918	0.0000	0.0000	0.0000	0.0000	259.6080	488.6124	706.3463	(98)
Space heating													3529.3508 (98)
Space heating per m2											(98) / (4) =		38.1387 (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													3921.5009 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	692.9685	547.2322	456.2063	259.1852	119.1918	0.0000	0.0000	0.0000	0.0000	259.6080	488.6124	706.3463	(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)	769.9650	608.0358	506.8959	287.9836	132.4353	0.0000	0.0000	0.0000	0.0000	288.4533	542.9027	784.8292	(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	154.8547	116.1715	93.2631	49.9708	23.1177	7.9249	2.4922	31.1168	53.4109	97.3390	132.2903	153.9008	(64)
Efficiency of water heater (217)m	89.3786	89.4041	89.4223	89.4497	89.4469	86.7000	86.7000	86.7000	86.7000	89.0754	89.2760	86.7000	(216)
Fuel for water heating, kWh/month	173.2570	129.9398	104.2951	55.8647	25.8451	9.1406	2.8745	35.8902	61.6042	109.2771	148.1813	172.1653	(219)
Water heating fuel used													1028.3349 (219)
Annual totals kWh/year													
Space heating fuel - main system													3921.5009 (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)													398.7732 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 908 * 1.00) =										-588.2895			-588.2895 (233)
Total delivered energy for all uses													4885.3195 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3921.5009	3.4800	136.4682	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1028.3349	3.4800	35.7861	(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	398.7732	13.1900	52.5982	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-588.2895	13.1900	-77.5954	(252)
Total energy cost			283.7446	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):			0.4200 (256)
Energy cost factor (ECF)			0.8665 (257)
SAP value		[(255) x (256)] / [(4) + 45.0] =	87.9129
SAP rating (Section 12)			88 (258)
SAP band			B

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	3921.5009	0.2160	847.0442 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1028.3349	0.2160	222.1203 (264)
Space and water heating			1069.1645 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	398.7732	0.5190	206.9633 (268)
Energy saving/generation technologies			
PV Unit	-588.2895	0.5190	-305.3223 (269)
Total kg/year			1035.6806 (272)
CO2 emissions per m2			11.1900 (273)
EI value			89.9098
EI rating			90 (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	46.7700 (1b)	x 2.3100 (2b)	= 108.0387 (1b) - (3b)
First floor	45.7700 (1c)	x 2.4800 (2c)	= 113.5096 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	92.5400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 221.5483 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																4 * 10 =	40.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =										40.0000 / (5) =							0.1805 (8)
Pressure test										Yes							
Measured/design AP50																	4.4500
Infiltration rate																	0.4030 (18)
Number of sides sheltered																	0 (19)
Shelter factor										(20) = 1 - [0.075 x (19)] =							1.0000 (20)
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =							0.4030 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
Wind factor	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)				
Adj infilt rate	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)				
	0.4232	0.3930	0.4030	0.3829	0.3829	0.3728	0.3627	0.3527	0.3426	0.3728	0.3527	0.3728	(22b)				
Effective ac	0.5895	0.5772	0.5812	0.5733	0.5733	0.5695	0.5658	0.5622	0.5587	0.5695	0.5622	0.5695	(25)				

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K						
Solid Door			1.9600	0.9000	1.7640			(26)					
Window (Uw = 1.40)			11.9400	1.3258	15.8295			(27)					
French (Uw = 1.40)			3.1500	1.3258	4.1761			(27)					
Half Glazed Door			1.8900	1.3000	2.4570			(26a)					
Heat Loss Floor			46.7700	0.1500	7.0155	75.0000	3507.7500	(28a)					
100mm Knauf Supafil	134.7300	18.9400	115.7900	0.2500	28.9475	52.8000	6113.7120	(29a)					
External Plane Roof	45.7700		45.7700	0.1300	5.9501	9.0000	411.9300	(30)					
Bay	1.0100		1.0100	0.2000	0.2020	9.0000	9.0900	(30)					
Total net area of external elements Aum(A, m2)			228.2800					(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		66.3418			(33)					
GF Masonry			41.2600			39.0000	1609.1400	(32c)					
GF Timber			34.3700			9.0000	309.3300	(32c)					
1F Timber			81.4300			9.0000	732.8700	(32c)					
1F Metal			34.9000			20.0000	698.0000	(32c)					
Internal Floor			45.7700			18.0000	823.8600	(32d)					
Internal Floor 1			45.7700			18.0000	823.8600	(32e)					
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		15039.5420	(34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							162.5194	(35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.1836	(36)					
Total fabric heat loss						(33) + (36) =	74.5254	(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	43.1025	42.2006	42.4938	41.9148	41.9148	41.6365	41.3655	41.1020	40.8459	41.6365	41.1020	41.6365	(38)
Heat transfer coeff	117.6278	116.7260	117.0192	116.4402	116.4402	116.1618	115.8909	115.6274	115.3713	116.1618	115.6274	116.1618	(39)
Average = Sum(39)m / 12 =												116.2713	(39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2711	1.2614	1.2645	1.2583	1.2583	1.2553	1.2523	1.2495	1.2467	1.2553	1.2495	1.2553	(40)
HLP (average)												1.2564	(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												2.6589 (42)
Average daily hot water use (litres/day)												97.3492 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Daily hot water use	107.0842	103.1902	99.2962	95.4022	91.5083	87.6143	87.6143	91.5083	95.4022	99.2962	103.1902	107.0842 (44)
Energy conte	158.8027	138.8899	143.3219	124.9515	119.8939	103.4594	95.8703	110.0126	111.3265	129.7403	141.6217	153.7919 (45)
Energy content (annual)										Total = Sum (45)m =		1531.6825 (45)
Distribution loss (46)m = 0.15 x (45)m	23.8204	20.8335	21.4983	18.7427	17.9841	15.5189	14.3805	16.5019	16.6990	19.4610	21.2432	23.0688 (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	21.0464	18.9901	20.9755	20.2193	20.8354	20.0965	20.7248	20.7965	20.1634	20.9175	20.3157	21.0249 (61)
Total heat required for water heating calculated for each month	179.8492	157.8800	164.2974	145.1708	140.7293	123.5558	116.5951	130.8090	131.4899	150.6578	161.9373	174.8168 (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												1.3251 (H8)
Utilisation factor												0.5298 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												97.3492 (H14)
Volume ratio Veff/V												0.7704 (H15)
Solar storage volume factor												0.9478 (H16)
Solar input												-896.2419 (H17)
Solar input	-29.2376	-41.5740	-71.4557	-96.4103	-113.2396	-120.9578	-118.4140	-105.9842	-82.9783	-57.3683	-34.5804	-24.0418 (63)
Solar input (sum of months) = Sum (63)m =												-896.2419 (63)
Output from w/h	150.6116	116.3060	92.8418	48.7605	27.4897	2.5980	0.0000	24.8249	48.5116	93.2895	127.3570	150.7750 (64)
Total per year (kWh/year) = Sum (64)m =												883.3655 (64)
Heat gains from water heating, kWh/month	58.0635	50.9284	52.8984	46.6012	45.0736	39.4244	37.0581	41.7783	42.0569	48.3680	52.1681	56.3920 (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	159.5349	159.5349	159.5349	159.5349	159.5349	159.5349	159.5349	159.5349	159.5349	159.5349	159.5349	159.5349	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	56.4505	50.1388	40.7756	30.8698	23.0755	19.4813	21.0503	27.3619	36.7251	46.6310	54.4252	58.0194	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	363.6923	367.4663	357.9559	337.7096	312.1522	288.1318	272.0848	268.3108	277.8211	298.0675	323.6249	347.6452	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.6124	53.6124	53.6124	53.6124	53.6124	53.6124	53.6124	53.6124	53.6124	53.6124	53.6124	53.6124	(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)	-106.3566	-106.3566	-106.3566	-106.3566	-106.3566	-106.3566	-106.3566	-106.3566	-106.3566	-106.3566	-106.3566	-106.3566	(71)
Water heating gains (Table 5)	78.0424	75.7863	71.1000	64.7239	60.5828	54.7560	49.8092	56.1536	58.4124	65.0108	72.4557	75.7958	(72)
Total internal gains	607.9758	603.1821	579.6223	543.0939	505.6012	472.1599	452.7350	461.6170	482.7493	519.4999	560.2965	591.2511	(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					0.6800	14.6176	0.7100	0.7000	0.7700	3.4235 (75)		
East					5.7600	25.1925	0.7100	0.7000	0.7700	49.9786 (76)		
Southeast					0.6800	45.1778	0.7100	0.7000	0.7700	10.5809 (77)		
West					4.8200	25.1925	0.7100	0.7000	0.7700	41.8224 (80)		
West					3.1500	25.1925	0.7100	0.7000	0.7700	27.3320 (80)		
Solar gains	133.1375	219.5422	360.2956	524.0978	608.1362	675.6123	638.3866	563.2690	440.7991	279.7715	164.9897	107.9449 (83)
Total gains	741.1133	822.7244	939.9179	1067.1918	1113.7374	1147.7722	1091.1215	1024.8860	923.5484	799.2714	725.2862	699.1960 (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	35.5158	35.7902	35.7006	35.8781	35.8781	35.9641	36.0481	36.1303	36.2105	35.9641	36.1303	35.9641
alpha	3.3677	3.3860	3.3800	3.3919	3.3919	3.3976	3.4032	3.4087	3.4140	3.3976	3.4087	3.3976
util living area	0.9737	0.9623	0.9286	0.8510	0.7248	0.5355	0.4019	0.4246	0.6736	0.8812	0.9559	0.9772 (86)
MIT	19.4042	19.5795	19.9561	20.4115	20.7507	20.9352	20.9816	20.9784	20.8566	20.4385	19.8758	19.3936 (87)
Th 2	19.8635	19.8712	19.8687	19.8737	19.8737	19.8760	19.8784	19.8806	19.8828	19.8760	19.8806	19.8760 (88)
util rest of house	0.9678	0.9539	0.9125	0.8176	0.6636	0.4443	0.2918	0.3095	0.5868	0.8456	0.9443	0.9720 (89)
MIT 2	17.7840	18.0403	18.5741	19.2028	19.6346	19.8328	19.8712	19.8721	19.7705	19.2581	18.4766	17.7773 (90)
Living area fraction									fLA = Living area / (4) =			0.1961 (91)
MIT	18.1018	18.3422	18.8451	19.4398	19.8535	20.0490	20.0890	20.0890	19.9835	19.4896	18.7510	18.0943 (92)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Temperature adjustment													-0.1500
adjusted MIT	17.9518	18.1922	18.6951	19.2898	19.7035	19.8990	19.9390	19.9390	19.8335	19.3396	18.6010		17.9443 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9536	0.9369	0.8910	0.7971	0.6533	0.4463	0.2980	0.3158	0.5825	0.8245	0.9260	0.9589	(94)
Useful gains	706.6914	770.7783	837.4817	850.6259	727.6282	512.2207	325.1054	323.6363	538.0080	658.9596	671.5948	670.4656	(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													
	1535.2524	1504.8528	1368.5551	1139.9309	838.7810	534.2287	329.0106	328.2711	592.2555	922.2747	1237.3281	1503.6317	(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													
	616.4494	493.2981	395.1186	208.2996	82.6977	0.0000	0.0000	0.0000	0.0000	195.9064	407.3280	619.8755	(98)
Space heating													3018.9734 (98)
Space heating per m2											(98) / (4) =	32.6234	(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													3354.4149 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	616.4494	493.2981	395.1186	208.2996	82.6977	0.0000	0.0000	0.0000	0.0000	195.9064	407.3280	619.8755	(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)	684.9438	548.1090	439.0207	231.4440	91.8863	0.0000	0.0000	0.0000	0.0000	217.6738	452.5867	688.7506	(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	150.6116	116.3060	92.8418	48.7605	27.4897	2.5980	0.0000	24.8249	48.5116	93.2895	127.3570	150.7750	(64)
Efficiency of water heater (217)m	89.3324	89.3511	89.3529	89.3549	89.1534	86.7000	86.7000	86.7000	86.7000	88.9084	89.1914	86.7000	(216)
Fuel for water heating, kWh/month	168.5969	130.1674	103.9046	54.5695	30.8341	2.9966	0.0000	28.6331	55.9534	104.9277	142.7907	168.7754	(219)
Water heating fuel used												992.1492	(219)
Annual totals kWh/year													
Space heating fuel - main system												3354.4149	(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)												398.7732	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 1031 * 1.00) =									-668.0993			-668.0993	(233)
Total delivered energy for all uses												4202.2380	(238)

10a. Fuel costs - using BEDF prices (453)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3354.4149	3.9300	131.8285	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	992.1492	3.9300	38.9915	(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	398.7732	17.5600	70.0246	(250)
Additional standing charges			88.0000	(251)
Energy saving/generation technologies				
PV Unit	-668.0993	17.5600	-117.3182	(252)
Total energy cost			233.4763	(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	3354.4149	0.2160	724.5536	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	992.1492	0.2160	214.3042	(264)
Space and water heating			938.8578	(265)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	398.7732	0.5190	206.9633 (268)
Energy saving/generation technologies			
PV Unit	-668.0993	0.5190	-346.7435 (269)
Total kg/year			863.9526 (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	3354.4149	1.2200	4092.3861 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	992.1492	1.2200	1210.4220 (264)
Space and water heating			5302.8081 (265)
Pumps and fans	125.0000	3.0700	383.7500 (267)
Energy for lighting	398.7732	3.0700	1224.2338 (268)
Energy saving/generation technologies			
PV Unit	-668.0993	3.0700	-2051.0649 (269)
Primary energy kWh/year			4859.7271 (272)
Primary energy kWh/m2/year			52.5149 (273)

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

Overheating Calculation Input Data

Dwelling type	Detached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	East
Overshading	Average or unknown
Thermal mass parameter	162.5 (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	292.44 (P1)
Transmission heat loss coefficient	74.53 (37)
Summer heat loss coefficient	366.97 (P2)

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

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

[Jul]	Area m2	Solar flux Table 6a W/m2	Specific data g or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North East	0.6800	106.0502	0.7100	0.7000	0.9000	29.0310
East	5.7600	125.2818	0.7100	0.7000	0.9000	290.5038
South East	0.6800	127.3119	0.7100	0.7000	0.9000	34.8513
West	4.8200	125.2818	0.7100	0.7000	0.9000	243.0952
West	3.1500	125.2818	0.7100	0.7000	0.9000	158.8693

total: 756.3506

	Jun	Jul	Aug	
Solar gains	814	756	665	(P3)
Internal gains	469	450	459	
Total summer gains	1283	1206	1124	(P5)

Summer gain/loss ratio	3.50	3.29	3.06	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 162.5)	0.86	0.86	0.86	
Threshold temperature	19.76	21.45	21.22	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	

Assessment of likelihood of high internal temperature: Slight