

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



Property Reference	4907-0015-3817-182				Issued on Date	03/12/2018
Assessment Reference	As Built		Prop Type Ref	P306i - Semi (As)		
Property	2, Appleby Drive, Botley, SOUTHAMPTON, SO32 2GE					
SAP Rating		88 B	DER	13.32	TER	17.44
Environmental		90 B	% DER<TER	23.64		
CO ₂ Emissions (t/year)		0.91	DFEE	45.89	TFEE	50.87
General Requirements Compliance		Pass	% DFEE<TFEE	9.78		
Assessor	Silvio Junges, Tel: 01884 242050				Assessor ID	P637-0001
Client						

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

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DWELLING AS BUILT

Semi-Detached House, total floor area 93 m²

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

1a TER and DER

Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 17.44 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 13.32 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 50.9 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE) 45.9 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.25 (max. 0.30)	0.25 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.14 (max. 0.25)	0.14 (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: 4.85 (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 East: 7.97 m², No overhang
Windows facing South West: 0.68 m², No overhang
Windows facing West: 5.76 m², No overhang
Windows facing North West: 0.68 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

10 Key features

Party wall U-value 0.00 W/m²K
Door U-value 0.90 W/m²K
Photovoltaic array

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	46.7700 (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					4.8500
Infiltration rate					0.4230 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3913 (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	0.4989	0.4891	0.4794	0.4305	0.4207	0.3718	0.3718	0.3620	0.3913	0.4207	0.4402	0.4598 (22b)
Effective ac	0.6245	0.6196	0.6149	0.5926	0.5885	0.5691	0.5691	0.5655	0.5766	0.5885	0.5969	0.6057 (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)
Heat Loss Floor			46.7700	0.1400	6.5478	75.0000	3507.7500 (28a)
100mm Knauf Supafil	96.8900	17.0500	79.8400	0.2500	19.9600	52.8000	4215.5520 (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)			190.4400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	54.4296		(33)
E-WM-30			37.8400	0.0000	0.0000	110.0000	4162.4000 (32)
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			45.7700			18.0000	823.8600 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 17303.7820 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 186.9871 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 8.5835 (36)
Total fabric heat loss (33) + (36) = 63.0131 (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	45.6553	45.3020	44.9556	43.3288	43.0244	41.6074	41.6074	41.3451	42.1532	43.0244	43.6401	44.2839 (38)
Heat transfer coeff	108.6684	108.3150	107.9687	106.3418	106.0375	104.6205	104.6205	104.3581	105.1663	106.0375	106.6532	107.2970 (39)
Average = Sum(39)m / 12 =												106.3404 (39)
HLP	1.1743	1.1705	1.1667	1.1491	1.1459	1.1305	1.1305	1.1277	1.1364	1.1459	1.1525	1.1595 (40)
HLP (average)												1.1491 (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	

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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)												
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	

East					4.8200	19.6403	0.6200	0.7000	0.7700		28.4720 (76)	
Southwest					0.6800	36.7938	0.6200	0.7000	0.7700		7.5250 (79)	
West					5.7600	19.6403	0.6200	0.7000	0.7700		34.0246 (80)	
Northwest					0.6800	11.2829	0.6200	0.7000	0.7700		2.3076 (81)	
East					3.1500	19.6403	0.6200	0.7000	0.7700		18.6072 (76)	

Solar gains	90.9363	176.1711	287.2847	416.6957	510.0338	522.1507	497.0705	427.1636	333.1860	208.1656	113.0436	75.0201 (83)
Total gains	501.1164	584.0991	680.4092	785.9167	854.8725	843.6313	803.4803	739.9139	658.3122	557.4177	489.9817	472.8296 (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	44.2319	44.3762	44.5185	45.1996	45.3293	45.9432	45.9432	46.0588	45.7048	45.3293	45.0676	44.7972
alpha	3.9488	3.9584	3.9679	4.0133	4.0220	4.0629	4.0629	4.0706	4.0470	4.0220	4.0045	3.9865
util living area	0.9955	0.9912	0.9789	0.9412	0.8536	0.7008	0.5459	0.6047	0.8389	0.9671	0.9920	0.9964 (86)
MIT	19.3414	19.5304	19.8643	20.3066	20.6747	20.9003	20.9723	20.9585	20.7795	20.2849	19.7379	19.3161 (87)
Th 2	19.9406	19.9437	19.9467	19.9609	19.9636	19.9760	19.9760	19.9783	19.9712	19.9636	19.9582	19.9526 (88)
util rest of house	0.9943	0.9889	0.9731	0.9242	0.8106	0.6176	0.4307	0.4887	0.7754	0.9545	0.9895	0.9955 (89)
MIT 2	17.7228	18.0002	18.4863	19.1256	19.6231	19.8987	19.9627	19.9562	19.7719	19.1073	18.3135	17.6937 (90)
Living area fraction									fLA = Living area / (4) =			
MIT	18.0402	18.3003	18.7566	19.3572	19.8293	20.0952	20.1607	20.1528	19.9695	19.3382	18.5928	18.0119 (91)
Temperature adjustment												-0.1500
adjusted MIT	17.8902	18.1503	18.6066	19.2072	19.6793	19.9452	20.0107	20.0028	19.8195	19.1882	18.4428	17.8619 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9907	0.9829	0.9626	0.9082	0.7967	0.6148	0.4348	0.4917	0.7641	0.9411	0.9839	0.9925 (94)
Useful gains	496.4555	574.1187	654.9574	713.7816	681.0993	518.6912	349.3744	363.8362	503.0349	524.6025	482.0825	469.2962 (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	1476.8276	1435.2077	1307.1334	1096.0858	846.1075	559.2142	356.8288	375.9829	601.5033	910.6757	1209.7494	1465.8786 (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	729.3968	578.6518	485.2189	275.2591	122.7661	0.0000	0.0000	0.0000	0.0000	287.2384	523.9202	741.4573 (98)
Space heating												3743.9085 (98)

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Space heating per m2 (98) / (4) = 40.4572 (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													4159.8984 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	729.3968	578.6518	485.2189	275.2591	122.7661	0.0000	0.0000	0.0000	0.0000	287.2384	523.9202	741.4573	(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)	810.4409	642.9464	539.1321	305.8434	136.4068	0.0000	0.0000	0.0000	0.0000	319.1538	582.1336	823.8414	(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	89.3275	89.2716	89.1417	88.8325	88.2069	86.7000	86.7000	86.7000	86.7000	88.8367	89.1984	86.7000	(216)
Fuel for water heating, kWh/month	201.3369	176.8535	184.3103	163.4208	159.5446	142.5096	134.4811	150.8755	151.6607	169.5897	181.5474	195.6515	(219)
Water heating fuel used												2011.7815	(219)
Annual totals kWh/year													
Space heating fuel - main system												4159.8984	(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 * 1029 * 1.00) =										-666.9130		-666.9130	(233)
Total delivered energy for all uses												5978.5401	(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	4159.8984	0.2160	898.5381 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2011.7815	0.2160	434.5448 (264)
Space and water heating			1333.0829 (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	-666.9130	0.5190	-346.1278 (269)
Total CO2, kg/year			1232.8433 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.3200 (273)

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

DER		13.3200	ZC1
Total Floor Area		92.5400	
Assumed number of occupants	TFA	2.6589	
CO2 emission factor in Table 12 for electricity displaced from grid	N	0.5190	
CO2 emissions from appliances, equation (L14)	EF	15.6036	ZC2
CO2 emissions from cooking, equation (L16)		1.9755	ZC3
Total CO2 emissions		30.8991	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		30.8991	ZC8

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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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		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 221.5483 (5)
Dwelling volume			

2. Ventilation rate

	main heating	+	secondary heating	+	other	=	total	m3 per hour				
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000 (6a)				
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000 (6b)				
Number of intermittent fans							3 * 10 =	30.0000 (7a)				
Number of passive vents							0 * 10 =	0.0000 (7b)				
Number of flueless gas fires							0 * 40 =	0.0000 (7c)				
								Air changes per hour				
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =						30.0000 / (5) =	0.1354 (8)				
Pressure test							Yes					
Measured/design AP50							5.0000					
Infiltration rate							0.3854	(18)				
Number of sides sheltered							1	(19)				
Shelter factor							(20) = 1 - [0.075 x (19)] =	0.9250 (20)				
Infiltration rate adjusted to include shelter factor							(21) = (18) x (20) =	0.3565 (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	0.4545	0.4456	0.4367	0.3922	0.3832	0.3387	0.3387	0.3298	0.3565	0.3832	0.4011	0.4189 (22b)
Effective ac	0.6033	0.5993	0.5954	0.5769	0.5734	0.5574	0.5574	0.5544	0.5635	0.5734	0.5804	0.5877 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opaque door			1.9600	1.0000	1.9600		(26)					
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	96.8900	17.0500	79.8400	0.1800	14.3712		(30)					
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, m2)			190.4400				(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	48.4984	(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.6954 (36)					
Total fabric heat loss						(33) + (36) =	59.1938 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	44.1082	43.8149	43.5274	42.1772	41.9246	40.7485	40.7485	40.5307	41.2015	41.9246	42.4356	42.9699 (38)
Average = Sum(39)m / 12 =	103.3020	103.0087	102.7212	101.3710	101.1183	99.9423	99.9423	99.7245	100.3953	101.1183	101.6294	102.1637 (39)
												101.3698 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1163	1.1131	1.1100	1.0954	1.0927	1.0800	1.0800	1.0776	1.0849	1.0927	1.0982	1.1040 (40)
Days in month												1.0954 (40)
	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	Jan 107.0842	Feb 103.1902	Mar 99.2962	Apr 95.4022	May 91.5083	Jun 87.6143	Jul 87.6143	Aug 91.5083	Sep 95.4022	Oct 99.2962	Nov 103.1902	Dec 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)

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 (57)
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)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	
East				7.9700	19.6403		0.6300		0.7000	0.7700	47.8385 (76)	
Southwest				0.6800	36.7938		0.6300		0.7000	0.7700	7.6464 (79)	
West				5.7600	19.6403		0.6300		0.7000	0.7700	34.5734 (80)	
Northwest				0.6800	11.2829		0.6300		0.7000	0.7700	2.3448 (81)	
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, 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	62.2097	62.3869	62.5615	63.3948	63.5532	64.3010	64.3010	64.4414	64.0109	63.5532	63.2336	62.9029
alpha	5.1473	5.1591	5.1708	5.2263	5.2369	5.2867	5.2867	5.2961	5.2674	5.2369	5.2156	5.1935
util living area	0.9986	0.9967	0.9895	0.9596	0.8697	0.6965	0.5271	0.5895	0.8523	0.9809	0.9971	0.9990 (86)
MIT	19.7611	19.9135	20.1804	20.5315	20.8131	20.9583	20.9920	20.9862	20.8777	20.4957	20.0654	19.7384 (87)
Th 2	19.9875	19.9901	19.9927	20.0046	20.0068	20.0172	20.0172	20.0191	20.0132	20.0068	20.0023	19.9976 (88)
util rest of house	0.9982	0.9956	0.9857	0.9444	0.8237	0.6081	0.4143	0.4727	0.7834	0.9712	0.9959	0.9987 (89)
MIT 2	18.3291	18.5534	18.9432	19.4516	19.8237	19.9896	20.0143	20.0134	19.9133	19.4107	18.7846	18.3030 (90)
Living area fraction									fLA = Living area / (4) =			0.1961 (91)
MIT	18.6100	18.8202	19.1858	19.6634	20.0177	20.1796	20.2060	20.2042	20.1025	19.6235	19.0358	18.5845 (92)
Temperature adjustment												0.0000
adjusted MIT	18.6100	18.8202	19.1858	19.6634	20.0177	20.1796	20.2060	20.2042	20.1025	19.6235	19.0358	18.5845 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9972	0.9936	0.9815	0.9378	0.8242	0.6237	0.4365	0.4956	0.7907	0.9661	0.9941	0.9979 (94)
Ext temp.	511.1954	593.1899	682.1605	752.1056	718.5483	536.4006	357.7569	374.3893	532.1252	551.3965	498.9130	483.0813 (95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Month fracti	1478.2508	1433.8986	1303.1059	1091.0949	841.0740	557.6341	360.3957	379.3724	602.6199	912.4388	1213.0317	1469.5740 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating	719.4893	564.9562	461.9833	244.0723	91.1591	0.0000	0.0000	0.0000	0.0000	268.6155	514.1655	733.9506 (98)
Space heating per m2												3598.3918 (98)
										(98) / (4) =		38.8847 (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													3852.6679 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	719.4893	564.9562	461.9833	244.0723	91.1591	0.0000	0.0000	0.0000	0.0000	268.6155	514.1655	733.9506	(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)	770.3311	604.8782	494.6288	261.3194	97.6008	0.0000	0.0000	0.0000	0.0000	287.5969	550.4984	785.8143	(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	87.9042	87.6804	87.1588	85.9319	83.6044	80.3000	80.3000	80.3000	80.3000	86.0523	87.4224	80.3000	(216)
Fuel for water heating, kWh/month	238.6252	210.8991	222.4929	200.1575	199.1827	182.6481	174.9908	195.0737	197.2281	209.5708	218.4071	232.7082	(219)
Water heating fuel used												2481.9841	(219)
Annual totals kWh/year													
Space heating fuel - main system												3852.6679	(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												6808.4253	(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	3852.6679	0.2160	832.1763 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2481.9841	0.2160	536.1086 (264)
Space and water heating			1368.2848 (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			1614.1731 (272)
Emissions per m2 for space and water heating			14.7859 (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) = (14.7859 * 1.00) + 2.2365 + 0.4206, rounded to 2 d.p.			17.4400 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



Property Reference	4907-0015-3817-182	Issued on Date	03/12/2018
Assessment Reference	As Built	Prop Type Ref	P306i - Semi (As)
Property	2, Appleby Drive, Botley, SOUTHAMPTON, SO32 2GE		
SAP Rating	88 B	DER	13.32
Environmental	90 B	% DER<TER	23.64
CO ₂ Emissions (t/year)	0.91	DFEE	45.89
General Requirements Compliance	Pass	% DFEE<TFEE	50.87
Assessor	Silvio Junges, Tel: 01884 242050	Assessor ID	P637-0001
Client			

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	=	0 * 40 =	0.0000 (6a)				
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000 (6b)				
Number of intermittent fans							3 * 10 =	30.0000 (7a)				
Number of passive vents							0 * 10 =	0.0000 (7b)				
Number of flueless gas fires							0 * 40 =	0.0000 (7c)				
							Air changes per hour					
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =						30.0000 / (5) =	0.1354 (8)				
Pressure test							Yes					
Measured/design AP50								4.8500				
Infiltration rate								0.3779 (18)				
Number of sides sheltered								1 (19)				
Shelter factor							(20) = 1 - [0.075 x (19)] =	0.9250 (20)				
Infiltration rate adjusted to include shelter factor							(21) = (18) x (20) =	0.3496 (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	0.4457	0.4370	0.4282	0.3845	0.3758	0.3321	0.3321	0.3233	0.3496	0.3758	0.3933	0.4107 (22b)
Effective ac	0.5993	0.5955	0.5917	0.5739	0.5706	0.5551	0.5551	0.5523	0.5611	0.5706	0.5773	0.5844 (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)
Heat Loss Floor			46.7700	0.1400	6.5478	75.0000	3507.7500 (28a)
100mm Knauf Supafil	96.8900	17.0500	79.8400	0.2500	19.9600	52.8000	4215.5520 (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)			190.4400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	54.4296		(33)
E-WM-30			37.8400	0.0000	0.0000	110.0000	4162.4000 (32)
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			45.7700			9.0000	411.9300 (32e)
Heat capacity Cm = Sum (A x k)					(28)...(30) + (32) + (32a)...(32e) =		16891.8520 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							182.5357 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.5835 (36)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Total fabric heat loss	(33) + (36) =											63.0131 (37)
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	43.8171	43.5351	43.2587	41.9605	41.7176	40.5869	40.5869	40.3775	41.0225	41.7176	42.2090	42.7227 (38)
Average = Sum(39)m / 12 =	106.8302	106.5482	106.2718	104.9736	104.7307	103.6000	103.6000	103.3906	104.0355	104.7307	105.2221	105.7358 (39)
	104.9724 (39)											
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1544	1.1514	1.1484	1.1344	1.1317	1.1195	1.1195	1.1173	1.1242	1.1317	1.1370	1.1426 (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
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 content (annual)	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)
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												
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	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
East					4.8200	19.6403	0.6200	0.7000			0.7700	28.4720 (76)
Southwest					0.6800	36.7938	0.6200	0.7000			0.7700	7.5250 (79)
West					5.7600	19.6403	0.6200	0.7000			0.7700	34.0246 (80)
Northwest					0.6800	11.2829	0.6200	0.7000			0.7700	2.3076 (81)
East					3.1500	19.6403	0.6200	0.7000			0.7700	18.6072 (76)

Solar gains	90.9363	176.1711	287.2847	416.6957	510.0338	522.1507	497.0705	427.1636	333.1860	208.1656	113.0436	75.0201 (83)
Total gains	465.4310	549.2325	647.2445	755.0708	825.5336	816.4102	778.0534	712.1819	629.7566	526.4631	456.3241	437.9596 (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	43.9219	44.0381	44.1526	44.6987	44.8023	45.2913	45.2913	45.3830	45.1017	44.8023	44.5931	44.3765
alpha	3.9281	3.9359	3.9435	3.9799	3.9868	4.0194	4.0194	4.0255	4.0068	3.9868	3.9729	3.9584
util living area	0.9962	0.9923	0.9808	0.9447	0.8596	0.7101	0.5555	0.6175	0.8490	0.9708	0.9933	0.9970 (86)
MIT	19.2983	19.4905	19.8306	20.2790	20.6575	20.8918	20.9693	20.9535	20.7622	20.2510	19.6939	19.2687 (87)
Th 2	19.9566	19.9591	19.9615	19.9729	19.9750	19.9849	19.9849	19.9868	19.9811	19.9750	19.9707	19.9662 (88)
util rest of house	0.9952	0.9903	0.9755	0.9287	0.8184	0.6284	0.4405	0.5020	0.7886	0.9595	0.9912	0.9963 (89)
MIT 2	18.3980	18.5912	18.9301	19.3759	19.7275	19.9266	19.9746	19.9694	19.8315	19.3574	18.8035	18.3757 (90)
Living area fraction	18.5746	18.7676	19.1067	19.5530	19.9099	20.1159	20.1697	20.1624	20.0141	19.5327	18.9782	18.5509 (92)
Temperature adjustment												0.0000

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adjusted MIT 18.5746 18.7676 19.1067 19.5530 19.9099 20.1159 20.1697 20.1624 20.0141 19.5327 18.9782 18.5509 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9934	0.9871	0.9698	0.9207	0.8154	0.6399	0.4625	0.5234	0.7909	0.9532	0.9883	0.9948	(94)
Useful gains	462.3662	542.1595	627.7200	695.2294	673.1443	522.3917	359.8166	372.7489	498.0458	501.7988	450.9979	435.6782	(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													
	1524.9582	1477.5692	1339.7392	1118.2827	859.8316	571.4505	369.8175	388.9980	615.2738	935.5254	1249.8468	1517.4010	(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													
	790.5684	628.5953	529.7423	304.5984	138.8953	0.0000	0.0000	0.0000	0.0000	322.6926	575.1712	804.8018	(98)
Space heating												4095.0654	(98)
Space heating per m2											(98) / (4) =	44.2518	(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	973.8400	766.6400	785.7687	0.0000	0.0000	0.0000	0.0000	(100)	
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8316	0.8934	0.8633	0.0000	0.0000	0.0000	0.0000	(101)	
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	809.8013	684.8992	678.3848	0.0000	0.0000	0.0000	0.0000	(102)	
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1055.2447	1008.2995	933.1671	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	176.7193	240.6098	189.5581	0.0000	0.0000	0.0000	0.0000	(104)	
Space cooling													606.8872	(104)
Cooled fraction													1.0000	(105)
Intermittency factor (Table 10b)													FC = cooled area / (4) =	
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh														
	0.0000	0.0000	0.0000	0.0000	0.0000	44.1798	60.1525	47.3895	0.0000	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling													151.7218	(107)
Space cooling per m2													1.6395	(108)
Energy for space heating													44.2518	(99)
Energy for space cooling													1.6395	(108)
Total													45.8914	(109)
Dwelling Fabric Energy Efficiency (DFEE)													45.9	(109)

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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					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3565 (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	0.4545	0.4456	0.4367	0.3922	0.3832	0.3387	0.3387	0.3298	0.3565	0.3832	0.4011	0.4189 (22b)
Effective ac	0.6033	0.5993	0.5954	0.5769	0.5734	0.5574	0.5574	0.5544	0.5635	0.5734	0.5804	0.5877 (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 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	96.8900	17.0500	79.8400	0.1800	14.3712		(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)			190.4400				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	48.4984	(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)							10.6954 (36)
Total fabric heat loss						(33) + (36) =	59.1938 (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	44.1082	43.8149	43.5274	42.1772	41.9246	40.7485	40.7485	40.5307	41.2015	41.9246	42.4356	42.9699 (38)
Heat transfer coeff	103.3020	103.0087	102.7212	101.3710	101.1183	99.9423	99.9423	99.7245	100.3953	101.1183	101.6294	102.1637 (39)
Average = Sum(39)m / 12 =												101.3698 (39)
HLP	1.1163	1.1131	1.1100	1.0954	1.0927	1.0800	1.0800	1.0776	1.0849	1.0927	1.0982	1.1040 (40)
HLP (average)												1.0954 (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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	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 content (annual)	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)
Distribution loss (46)m = 0.15 x (45)m												1531.6825 (45)
Water 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 (46)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)

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If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month	33.7456	29.5141	30.4559	26.5522	25.4775	21.9851	20.3724	23.3777	23.6569	27.5698	30.0946	(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	
East	7.9700	19.6403	0.6300	0.7000	0.7700	47.8385	(76)
Southwest	0.6800	36.7938	0.6300	0.7000	0.7700	7.6464	(79)
West	5.7600	19.6403	0.6300	0.7000	0.7700	34.5734	(80)
Northwest	0.6800	11.2829	0.6300	0.7000	0.7700	2.3448	(81)

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, 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	62.2097	62.3869	62.5615	63.3948	63.5532	64.3010	64.3010	64.4414	64.0109	63.5532	63.2336	62.9029		
alpha	5.1473	5.1591	5.1708	5.2263	5.2369	5.2867	5.2867	5.2961	5.2674	5.2369	5.2156	5.1935		
util living area	0.9991	0.9977	0.9921	0.9669	0.8856	0.7186	0.5477	0.6152	0.8746	0.9861	0.9981	0.9994	(86)	
MIT	19.7147	19.8683	20.1385	20.4977	20.7928	20.9518	20.9905	20.9832	20.8590	20.4573	20.0212	19.6926	(87)	
Th 2	19.9875	19.9901	19.9927	20.0046	20.0068	20.0172	20.0172	20.0191	20.0132	20.0068	20.0023	19.9976	(88)	
util rest of house	0.9988	0.9969	0.9892	0.9539	0.8428	0.6302	0.4315	0.4953	0.8108	0.9788	0.9973	0.9992	(89)	
MIT 2	18.8089	18.9643	19.2350	19.5956	19.8660	19.9950	20.0148	20.0143	19.9324	19.5631	19.1270	18.7949	(90)	
Living area fraction									fLA = Living area / (4) =			0.1961	(91)	
MIT	18.9866	19.1416	19.4122	19.7725	20.0478	20.1826	20.2061	20.2043	20.1141	19.7385	19.3024	18.9710	(92)	
Temperature adjustment												0.0000		
adjusted MIT	18.9866	19.1416	19.4122	19.7725	20.0478	20.1826	20.2061	20.2043	20.1141	19.7385	19.3024	18.9710	(93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Useful gains	466.1472	549.8440	643.3513	723.8520	704.3593	532.9453	357.2212	373.2099	519.8146	517.1489	456.5400	438.6575	(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	1517.1547	1467.0055	1326.3538	1102.1583	844.1124	557.9414	360.4068	379.3832	603.7875	924.0688	1240.1191	1509.0549	(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	781.9496	616.3325	508.1538	272.3805	103.9763	0.0000	0.0000	0.0000	0.0000	302.7484	564.1770	796.3757	(98)	
Space heating												3946.0937	(98)	
Space heating per m2												42.6420	(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	939.4577	739.5731	757.9064	0.0000	0.0000	0.0000	0.0000	(100)	
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8887	0.9416	0.9169	0.0000	0.0000	0.0000	0.0000	(101)	
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	834.8790	696.3824	694.9377	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)	
Space cooling kWh														

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Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	165.7508	239.0382	183.2341	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction												588.0230 (104)
Intermittency factor (Table 10b)									fC = cooled area / (4) =			1.0000 (105)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	41.4377	59.7595	45.8085	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling per m2												147.0058 (107)
Energy for space heating												1.5886 (108)
Energy for space cooling												42.6420 (99)
Total												1.5886 (108)
Target Fabric Energy Efficiency (TFEE)												44.2306 (109)
												50.9 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



Property Reference	4907-0015-3817-182	Issued on Date	03/12/2018
Assessment Reference	As Built	Prop Type Ref	P306i - Semi (As)
Property	2, Appleby Drive, Botley, SOUTHAMPTON, SO32 2GE		
SAP Rating	88 B	DER	13.32
Environmental	90 B	% DER<TER	23.64
CO ₂ Emissions (t/year)	0.91	DFEE	45.89
General Requirements Compliance	Pass	% DFEE<TFEE	50.87
Assessor	Silvio Junges, Tel: 01884 242050	Assessor ID	P637-0001
Client			

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 heating		secondary heating		other		total	m3 per hour				
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000 (6a)				
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000 (6b)				
Number of intermittent fans							4 * 10 =	40.0000 (7a)				
Number of passive vents							0 * 10 =	0.0000 (7b)				
Number of flueless gas fires							0 * 40 =	0.0000 (7c)				
							Air changes per hour					
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =						40.0000 / (5) =	0.1805 (8)				
Pressure test							Yes					
Measured/design AP50							4.8500					
Infiltration rate							0.4230	(18)				
Number of sides sheltered							1	(19)				
Shelter factor							(20) = 1 - [0.075 x (19)] =	0.9250 (20)				
Infiltration rate adjusted to include shelter factor							(21) = (18) x (20) =	0.3913 (21)				
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000 (22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250 (22a)
Adj infiltr rate	0.4109	0.3815	0.3913	0.3718	0.3718	0.3620	0.3522	0.3424	0.3326	0.3620	0.3424	0.3620 (22b)
Effective ac	0.5844	0.5728	0.5766	0.5691	0.5691	0.5655	0.5620	0.5586	0.5553	0.5655	0.5586	0.5655 (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)
Heat Loss Floor			46.7700	0.1400	6.5478	75.0000	3507.7500 (28a)
100mm Knauf Supafil	96.8900	17.0500	79.8400	0.2500	19.9600	52.8000	4215.5520 (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)			190.4400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	54.4296		(33)
E-WM-30			37.8400	0.0000	0.0000	110.0000	4162.4000 (32)
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			45.7700			18.0000	823.8600 (32e)
Heat capacity Cm = Sum (A x k)					(28)...(30) + (32) + (32a)...(32e) =		17303.7820 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							186.9871 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.5835 (36)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Total fabric heat loss (33) + (36) = 63.0131 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	42.7270	41.8768	42.1532	41.6074	41.6074	41.3451	41.0897	40.8413	40.5999	41.3451	40.8413	41.3451	(38)
Heat transfer coeff	105.7401	104.8899	105.1663	104.6205	104.6205	104.3581	104.1027	103.8543	103.6129	104.3581	103.8543	104.3581	(39)
Average = Sum(39)m / 12 =													(39)
HLP	1.1426	1.1335	1.1364	1.1305	1.1305	1.1277	1.1249	1.1223	1.1197	1.1277	1.1223	1.1277	(40)
HLP (average)													(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	
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)													(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	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)
Solar input (sum of months) = Sum(63)m =													(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													(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													
(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		Specific data		factor		W
					W/m2		or Table 6b		or Table 6c		Table 6d		
East			4.8200		25.1925		0.6200		0.7000		0.7700		36.5209 (76)
Southwest			0.6800		45.1778		0.6200		0.7000		0.7700		9.2397 (79)
West			5.7600		25.1925		0.6200		0.7000		0.7700		43.6433 (80)
Northwest			0.6800		14.6176		0.6200		0.7000		0.7700		2.9896 (81)
East			3.1500		25.1925		0.6200		0.7000		0.7700		23.8674 (76)
Solar gains	116.2609	191.7129	314.6243	457.6629	531.0485	589.9713	557.4643	491.8687	384.9232	244.3075	144.0755	94.2618	(83)
Total gains	724.2367	794.8951	894.2466	1000.7568	1036.6497	1062.1312	1010.1993	953.4857	867.6725	763.8075	704.3720	685.5129	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
tau	45.4568	45.8252	45.7048	45.9432	45.9432	46.0588	46.1718	46.2822	46.3900	46.0588	46.2822	46.0588	
alpha	4.0305	4.0550	4.0470	4.0629	4.0629	4.0706	4.0781	4.0855	4.0927	4.0706	4.0855	4.0706	
util living area	0.9814	0.9723	0.9432	0.8687	0.7367	0.5355	0.3960	0.4173	0.6763	0.8946	0.9661	0.9841	(86)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF HEAT DEMAND 09 Jan 2014

MIT	19.7411	19.8883	20.2005	20.5751	20.8401	20.9668	20.9924	20.9909	20.9159	20.5942	20.1326	19.7324 (87)
Th 2	19.9662	19.9736	19.9712	19.9760	19.9760	19.9783	19.9805	19.9827	19.9848	19.9783	19.9827	19.9783 (88)
util rest of house												
MIT 2	0.9768	0.9656	0.9292	0.8372	0.6769	0.4490	0.2954	0.3121	0.5919	0.8609	0.9562	0.9801 (89)
Living area fraction	18.3194	18.5359	18.9784	19.4946	19.8259	19.9571	19.9777	19.9793	19.9213	19.5348	18.8968	18.3154 (90)
MIT	18.5982	18.8012	19.2181	19.7065	20.0249	20.1551	20.1767	20.1777	20.1164	19.7426	19.1392	18.5933 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.4482	18.6512	19.0681	19.5565	19.8749	20.0051	20.0267	20.0277	19.9664	19.5926	18.9892	18.4433 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9673	0.9539	0.9136	0.8220	0.6704	0.4513	0.3000	0.3168	0.5903	0.8453	0.9432	0.9715	(94)
Useful gains	700.5611	758.2164	817.0056	822.6577	694.9552	479.3619	303.0742	302.1072	512.1671	645.6121	664.3855	665.9973	(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	1432.5888	1400.4041	1269.1579	1052.1155	771.5618	491.0146	304.6812	304.0553	545.6665	854.9657	1151.6575	1402.9216	(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	544.6286	431.5501	336.4013	165.2096	56.9953	0.0000	0.0000	0.0000	0.0000	155.7590	350.8358	548.2717	(98)
Space heating												2589.6515	(98)
RHI space heating demand												2590	(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 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					4.8500
Infiltration rate					0.4230 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3913 (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	0.4989	0.4891	0.4794	0.4305	0.4207	0.3718	0.3718	0.3620	0.3913	0.4207	0.4402	0.4598 (22b)
Effective ac	0.6245	0.6196	0.6149	0.5926	0.5885	0.5691	0.5691	0.5655	0.5766	0.5885	0.5969	0.6057 (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)
Heat Loss Floor			46.7700	0.1400	6.5478	75.0000	3507.7500 (28a)
100mm Knauf Supafil	96.8900	17.0500	79.8400	0.2500	19.9600	52.8000	4215.5520 (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)			190.4400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	54.4296		(33)
E-WM-30			37.8400	0.0000	0.0000	110.0000	4162.4000 (32)
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			45.7700			18.0000	823.8600 (32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	17303.7820 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K		186.9871 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		8.5835 (36)
Total fabric heat loss	(33) + (36) =	63.0131 (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	45.6553	45.3020	44.9556	43.3288	43.0244	41.6074	41.6074	41.3451	42.1532	43.0244	43.6401	44.2839 (38)
Heat transfer coeff	108.6684	108.3150	107.9687	106.3418	106.0375	104.6205	104.6205	104.3581	105.1663	106.0375	106.6532	107.2970 (39)
Average = Sum(39)m / 12 =												106.3404 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1743	1.1705	1.1667	1.1491	1.1459	1.1305	1.1305	1.1277	1.1364	1.1459	1.1525	1.1595 (40)
HLP (average)												1.1491 (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

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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	

East					4.8200	19.6403	0.6200	0.7000	0.7700		28.4720 (76)	
Southwest					0.6800	36.7938	0.6200	0.7000	0.7700		7.5250 (79)	
West					5.7600	19.6403	0.6200	0.7000	0.7700		34.0246 (80)	
Northwest					0.6800	11.2829	0.6200	0.7000	0.7700		2.3076 (81)	
East					3.1500	19.6403	0.6200	0.7000	0.7700		18.6072 (76)	

Solar gains	90.9363	176.1711	287.2847	416.6957	510.0338	522.1507	497.0705	427.1636	333.1860	208.1656	113.0436	75.0201 (83)
Total gains	698.9121	779.3532	866.9070	959.7897	1015.6350	994.3106	949.8054	888.7806	815.9352	727.6655	673.3401	666.2712 (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	44.2319	44.3762	44.5185	45.1996	45.3293	45.9432	45.9432	46.0588	45.7048	45.3293	45.0676	44.7972
alpha	3.9488	3.9584	3.9679	4.0133	4.0220	4.0629	4.0629	4.0706	4.0470	4.0220	4.0045	3.9865
util living area	0.9857	0.9768	0.9548	0.8982	0.7889	0.6224	0.4711	0.5189	0.7523	0.9271	0.9764	0.9880 (86)
MIT	19.5809	19.7604	20.0685	20.4617	20.7654	20.9354	20.9837	20.9760	20.8578	20.4568	19.9549	19.5528 (87)
Th 2	19.9406	19.9437	19.9467	19.9609	19.9636	19.9760	19.9760	19.9783	19.9712	19.9636	19.9582	19.9526 (88)
util rest of house	0.9822	0.9711	0.9436	0.8727	0.7379	0.5400	0.3676	0.4129	0.6778	0.9031	0.9696	0.9850 (89)
MIT 2	18.0702	18.3313	18.7746	19.3322	19.7278	19.9283	19.9685	19.9663	19.8513	19.3398	18.6253	18.0375 (90)
Living area fraction									fLA = Living area / (4) =			0.1961 (91)
MIT	18.3665	18.6116	19.0284	19.5538	19.9313	20.1258	20.1676	20.1643	20.0487	19.5589	18.8860	18.3347 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.2165	18.4616	18.8784	19.4038	19.7813	19.9758	20.0176	20.0143	19.8987	19.4089	18.7360	18.1847 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9739	0.9601	0.9286	0.8562	0.7278	0.5399	0.3720	0.4168	0.6719	0.8867	0.9585	0.9778 (94)
Useful gains	680.6716	748.2460	805.0264	821.7921	739.1390	536.8680	353.3096	370.4680	548.2475	645.2499	645.4121	651.4541 (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	1512.2795	1468.9274	1336.4746	1116.9886	856.9258	562.4234	357.5503	377.1840	609.8286	934.0686	1241.0219	1500.5119 (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	618.7163	484.2979	395.3974	212.5415	87.6333	0.0000	0.0000	0.0000	0.0000	214.8811	428.8391	631.6990 (98)
Space heating												3074.0057 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Space heating per m2

(98) / (4) = 33.2181 (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													3415.5619 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	618.7163	484.2979	395.3974	212.5415	87.6333	0.0000	0.0000	0.0000	0.0000	214.8811	428.8391	631.6990	(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)	687.4626	538.1088	439.3305	236.1572	97.3704	0.0000	0.0000	0.0000	0.0000	238.7568	476.4879	701.8878	(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	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	89.2351	89.1656	89.0055	88.6309	87.9373	86.7000	86.7000	86.7000	86.7000	88.6099	89.0707	86.7000	(216)
Fuel for water heating, kWh/month	201.5454	177.0638	184.5924	163.7925	160.0336	142.5096	134.4811	150.8755	151.6607	170.0236	181.8076	195.8435	(219)
Water heating fuel used												2014.2292	(219)
Annual totals kWh/year													
Space heating fuel - main system												3415.5619	(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 * 1029 * 1.00) =										-666.9130		-666.9130	(233)
Total delivered energy for all uses												5236.6513	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3415.5619	3.4800	118.8616 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2014.2292	3.4800	70.0952 (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	-666.9130	13.1900	-87.9658 (252)
Total energy cost			283.4816 (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] =	0.8657 (257)
SAP value		87.9241
SAP rating (Section 12)		88 (258)
SAP band		B

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	3415.5619	0.2160	737.7614 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2014.2292	0.2160	435.0735 (264)
Space and water heating			1172.8349 (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	-666.9130	0.5190	-346.1278 (269)
Total kg/year			1072.5953 (272)
CO2 emissions per m2			11.5900 (273)
EI value			89.5501
EI rating			90 (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
 $3.48 / 0.8814 = 3.948$, stars = 4
 $0.216 / 0.8814 = 0.2451$, 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	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) =														
Pressure test										40.0000 / (5) =							0.1805 (8)							
Measured/design AP50										Yes							4.8500							
Infiltration rate																	0.4230 (18)							
Number of sides sheltered																	1 (19)							
Shelter factor										(20) = 1 - [0.075 x (19)] =							0.9250 (20)							
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =							0.3913 (21)							
													Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed													4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000 (22)
Wind factor													1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250 (22a)
Adj infilt rate													0.4109	0.3815	0.3913	0.3718	0.3718	0.3620	0.3522	0.3424	0.3326	0.3620	0.3424	0.3620 (22b)
Effective ac													0.5844	0.5728	0.5766	0.5691	0.5691	0.5655	0.5620	0.5586	0.5553	0.5655	0.5586	0.5655 (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)					
Heat Loss Floor			46.7700	0.1400	6.5478	75.0000	3507.7500	(28a)					
100mm Knauf Supafil	96.8900	17.0500	79.8400	0.2500	19.9600	52.8000	4215.5520	(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)			190.4400					(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	54.4296			(33)					
E-WM-30			37.8400	0.0000	0.0000	110.0000	4162.4000	(32)					
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			45.7700			18.0000	823.8600	(32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	17303.7820	(34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							186.9871	(35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.5835	(36)					
Total fabric heat loss						(33) + (36) =	63.0131	(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 42.7270	Feb 41.8768	Mar 42.1532	Apr 41.6074	May 41.6074	Jun 41.3451	Jul 41.0897	Aug 40.8413	Sep 40.5999	Oct 41.3451	Nov 40.8413	Dec 41.3451	(38)
Heat transfer coeff	105.7401	104.8899	105.1663	104.6205	104.6205	104.3581	104.1027	103.8543	103.6129	104.3581	103.8543	104.3581	(39)
Average = Sum(39)m / 12 =												104.4613	(39)
HLP	Jan 1.1426	Feb 1.1335	Mar 1.1364	Apr 1.1305	May 1.1305	Jun 1.1277	Jul 1.1249	Aug 1.1223	Sep 1.1197	Oct 1.1277	Nov 1.1223	Dec 1.1277	(40)
HLP (average)												1.1288	(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	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	

East					4.8200	25.1925	0.6200	0.7000	0.7700		36.5209 (76)	
Southwest					0.6800	45.1778	0.6200	0.7000	0.7700		9.2397 (79)	
West					5.7600	25.1925	0.6200	0.7000	0.7700		43.6433 (80)	
Northwest					0.6800	14.6176	0.6200	0.7000	0.7700		2.9896 (81)	
East					3.1500	25.1925	0.6200	0.7000	0.7700		23.8674 (76)	

Solar gains	116.2609	191.7129	314.6243	457.6629	531.0485	589.9713	557.4643	491.8687	384.9232	244.3075	144.0755	94.2618 (83)
Total gains	724.2367	794.8951	894.2466	1000.7568	1036.6497	1062.1312	1010.1993	953.4857	867.6725	763.8075	704.3720	685.5129 (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	45.4568	45.8252	45.7048	45.9432	45.9432	46.0588	46.1718	46.2822	46.3900	46.0588	46.2822	46.0588
alpha	4.0305	4.0550	4.0470	4.0629	4.0629	4.0706	4.0781	4.0855	4.0927	4.0706	4.0855	4.0706
util living area	0.9814	0.9723	0.9432	0.8687	0.7367	0.5355	0.3960	0.4173	0.6763	0.8946	0.9661	0.9841 (86)
MIT	19.7411	19.8883	20.2005	20.5751	20.8401	20.9668	20.9924	20.9909	20.9159	20.5942	20.1326	19.7324 (87)
Th 2	19.9662	19.9736	19.9712	19.9760	19.9760	19.9783	19.9805	19.9827	19.9848	19.9783	19.9827	19.9783 (88)
util rest of house	0.9768	0.9656	0.9292	0.8372	0.6769	0.4490	0.2954	0.3121	0.5919	0.8609	0.9562	0.9801 (89)
MIT	18.3194	18.5359	18.9784	19.4946	19.8259	19.9571	19.9777	19.9793	19.9213	19.5348	18.8968	18.3154 (90)
Living area fraction									fLA = Living area / (4) =			0.1961 (91)
MIT	18.5982	18.8012	19.2181	19.7065	20.0249	20.1551	20.1767	20.1777	20.1164	19.7426	19.1392	18.5933 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.4482	18.6512	19.0681	19.5565	19.8749	20.0051	20.0267	20.0277	19.9664	19.5926	18.9892	18.4433 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9673	0.9539	0.9136	0.8220	0.6704	0.4513	0.3000	0.3168	0.5903	0.8453	0.9432	0.9715 (94)
Useful gains	700.5611	758.2164	817.0056	822.6577	694.9552	479.3619	303.0742	302.1072	512.1671	645.6121	664.3855	665.9973 (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	1432.5888	1400.4041	1269.1579	1052.1155	771.5618	491.0146	304.6812	304.0553	545.6665	854.9657	1151.6575	1402.9216 (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	544.6286	431.5501	336.4013	165.2096	56.9953	0.0000	0.0000	0.0000	0.0000	155.7590	350.8358	548.2717 (98)
Space heating												2589.6515 (98)

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Space heating per m2 (98) / (4) = 27.9841 (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													2877.3905 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	544.6286	431.5501	336.4013	165.2096	56.9953	0.0000	0.0000	0.0000	0.0000	155.7590	350.8358	548.2717	(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)	605.1429	479.5001	373.7792	183.5662	63.3281	0.0000	0.0000	0.0000	0.0000	173.0656	389.8176	609.1908	(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	89.1576	89.0917	88.8898	88.4258	87.6262	86.7000	86.7000	86.7000	86.7000	88.3467	88.9310	86.7000	(216)
Fuel for water heating, kWh/month	201.7206	177.2107	184.8327	164.1724	160.6019	142.5096	134.4811	150.8755	151.6607	170.5303	182.0932	196.0284	(219)
Water heating fuel used												2016.7171	(219)
Annual totals kWh/year													
Space heating fuel - main system												2877.3905	(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 * 1156 * 1.00) =										-749.2375		-749.2375	(233)
Total delivered energy for all uses												4618.6433	(238)

10a. Fuel costs - using BEDF prices (435)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2877.3905	3.9400	113.3692 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2016.7171	3.9400	79.4587 (247)
Pumps and fans for heating	75.0000	16.5500	12.4125 (249)
Energy for lighting	398.7732	16.5500	65.9970 (250)
Additional standing charges			87.0000 (251)
Energy saving/generation technologies			
PV Unit	-749.2375	16.5500	-123.9988 (252)
Total energy cost			234.2385 (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	2877.3905	0.2160	621.5164 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2016.7171	0.2160	435.6109 (264)
Space and water heating			1057.1272 (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	-749.2375	0.5190	-388.8543 (269)
Total kg/year			914.1613 (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	2877.3905	1.2200	3510.4164 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2016.7171	1.2200	2460.3948 (264)
Space and water heating			5970.8113 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	398.7732	3.0700	1224.2338 (268)

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Energy saving/generation technologies			
PV Unit	-749.2375	3.0700	-2300.1591 (269)
Primary energy kWh/year			5125.1360 (272)
Primary energy kWh/m2/year			55.3829 (273)

SAP 2012 EPC IMPROVEMENTS

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

(For testing purposes):

A	Not considered
B	Not considered
C	Not considered
D	Not considered
E Low energy lighting	Already installed
F	Not considered
G	Not considered
H	Not considered
I	Not considered
J	Not considered
K	Not considered
M	Not considered
N Solar water heating	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	-£ 32	-195 kg (21.3%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£32 2.11 kg/m²	B 89	B 91
Total Savings	£32 2.11 kg/m²		

Potential energy efficiency rating:	B 89
Potential environmental impact rating:	B 91

Fuel prices for cost data on this page from database revision number 435 TEST (16 Nov 2018)
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	£78	£87	-£8
Mains gas	£280	£239	£40
Space heating	£213	£213	£0
Water heating	£79	£47	£32
Lighting	£66	£66	£0
Generated (PV)	-£124	-£124	£0
Total cost of fuels	£234	£202	£32
Total cost of uses	£234	£202	£32
Delivered energy	50 kWh/m²	39 kWh/m²	11 kWh/m²
Carbon dioxide emissions	0.9 tonnes	0.7 tonnes	0.2 tonnes
CO2 emissions per m²	10 kg/m²	8 kg/m²	2 kg/m²
Primary energy	55 kWh/m²	44 kWh/m²	12 kWh/m²

FULL SAP CALCULATION PRINTOUT

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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					4.8500
Infiltration rate					0.4230 (18)
Number of sides sheltered					1 (19)
Shelter factor			(20) = 1 - [0.075 x (19)]	=	0.9250 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20)	=	0.3913 (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	0.4989	0.4891	0.4794	0.4305	0.4207	0.3718	0.3718	0.3620	0.3913	0.4207	0.4402	0.4598 (22b)
Effective ac	0.6245	0.6196	0.6149	0.5926	0.5885	0.5691	0.5691	0.5655	0.5766	0.5885	0.5969	0.6057 (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)
Heat Loss Floor			46.7700	0.1400	6.5478	75.0000	3507.7500 (28a)
100mm Knauf Supafil	96.8900	17.0500	79.8400	0.2500	19.9600	52.8000	4215.5520 (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)			190.4400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	54.4296		(33)
E-WM-30			37.8400	0.0000	0.0000	110.0000	4162.4000 (32)
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			45.7700			18.0000	823.8600 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	17303.7820 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							186.9871 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.5835 (36)
Total fabric heat loss						(33) + (36) =	63.0131 (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	45.6553	45.3020	44.9556	43.3288	43.0244	41.6074	41.6074	41.3451	42.1532	43.0244	43.6401	44.2839 (38)
Heat transfer coeff	108.6684	108.3150	107.9687	106.3418	106.0375	104.6205	104.6205	104.3581	105.1663	106.0375	106.6532	107.2970 (39)
Average = Sum(39)m / 12 =												106.3404 (39)
HLP	1.1743	1.1705	1.1667	1.1491	1.1459	1.1305	1.1305	1.1277	1.1364	1.1459	1.1525	1.1595 (40)
HLP (average)												1.1491 (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	

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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
East				4.8200	19.6403		0.6200		0.7000		0.7700		28.4720 (76)
Southwest				0.6800	36.7938		0.6200		0.7000		0.7700		7.5250 (79)
West				5.7600	19.6403		0.6200		0.7000		0.7700		34.0246 (80)
Northwest				0.6800	11.2829		0.6200		0.7000		0.7700		2.3076 (81)
East				3.1500	19.6403		0.6200		0.7000		0.7700		18.6072 (76)
Solar gains	90.9363	176.1711	287.2847	416.6957	510.0338	522.1507	497.0705	427.1636	333.1860	208.1656	113.0436		75.0201 (83)
Total gains	698.9121	779.3532	866.9070	959.7897	1015.6350	994.3106	949.8054	888.7806	815.9352	727.6655	673.3401		666.2712 (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	44.2319	44.3762	44.5185	45.1996	45.3293	45.9432	45.9432	46.0588	45.7048	45.3293	45.0676	44.7972
alpha	3.9488	3.9584	3.9679	4.0133	4.0220	4.0629	4.0629	4.0706	4.0470	4.0220	4.0045	3.9865
util living area	0.9857	0.9768	0.9548	0.8982	0.7889	0.6224	0.4711	0.5189	0.7523	0.9271	0.9764	0.9880 (86)
MIT	19.5809	19.7604	20.0685	20.4617	20.7654	20.9354	20.9837	20.9760	20.8578	20.4568	19.9549	19.5528 (87)
Th 2	19.9406	19.9437	19.9467	19.9609	19.9636	19.9760	19.9760	19.9783	19.9712	19.9636	19.9582	19.9526 (88)
util rest of house	0.9822	0.9711	0.9436	0.8727	0.7379	0.5400	0.3676	0.4129	0.6778	0.9031	0.9696	0.9850 (89)
MIT 2	18.0702	18.3313	18.7746	19.3322	19.7278	19.9283	19.9685	19.9663	19.8513	19.3398	18.6253	18.0375 (90)
Living area fraction									fLA = Living area / (4) =			0.1961 (91)
MIT	18.3665	18.6116	19.0284	19.5538	19.9313	20.1258	20.1676	20.1643	20.0487	19.5589	18.8860	18.3347 (92)

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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	3415.5619	0.2160	737.7614	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1029.1276	0.2160	222.2916	(264)
Space and water heating			960.0529	(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	-666.9130	0.5190	-346.1278	(269)
Total kg/year			885.7634	(272)
CO2 emissions per m2			9.5700	(273)
EI value			91.3703	
EI rating			91	(274)
EI band			B	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	46.7700 (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) =							
Pressure test										40.0000 / (5) =							0.1805 (8)
Measured/design AP50										Yes							4.8500
Infiltration rate																	0.4230 (18)
Number of sides sheltered																	1 (19)
Shelter factor										(20) = 1 - [0.075 x (19)] =							0.9250 (20)
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =							0.3913 (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)				
	0.4109	0.3815	0.3913	0.3718	0.3718	0.3620	0.3522	0.3424	0.3326	0.3620	0.3424	0.3620	(22b)				
Effective ac	0.5844	0.5728	0.5766	0.5691	0.5691	0.5655	0.5620	0.5586	0.5553	0.5655	0.5586	0.5655	(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)					
Heat Loss Floor			46.7700	0.1400	6.5478	75.0000	3507.7500	(28a)					
100mm Knauf Supafil	96.8900	17.0500	79.8400	0.2500	19.9600	52.8000	4215.5520	(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)			190.4400					(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	54.4296			(33)					
E-WM-30			37.8400	0.0000	0.0000	110.0000	4162.4000	(32)					
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			45.7700			18.0000	823.8600	(32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	17303.7820	(34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							186.9871	(35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.5835	(36)					
Total fabric heat loss						(33) + (36) =	63.0131	(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 42.7270	Feb 41.8768	Mar 42.1532	Apr 41.6074	May 41.6074	Jun 41.3451	Jul 41.0897	Aug 40.8413	Sep 40.5999	Oct 41.3451	Nov 40.8413	Dec 41.3451	(38)
Heat transfer coeff	105.7401	104.8899	105.1663	104.6205	104.6205	104.3581	104.1027	103.8543	103.6129	104.3581	103.8543	104.3581	(39)
Average = Sum(39)m / 12 =												104.4613	(39)
HLP	Jan 1.1426	Feb 1.1335	Mar 1.1364	Apr 1.1305	May 1.1305	Jun 1.1277	Jul 1.1249	Aug 1.1223	Sep 1.1197	Oct 1.1277	Nov 1.1223	Dec 1.1277	(40)
HLP (average)												1.1288	(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	
East					4.8200	25.1925		0.6200	0.7000	0.7700		36.5209 (76)	
Southwest					0.6800	45.1778		0.6200	0.7000	0.7700		9.2397 (79)	
West					5.7600	25.1925		0.6200	0.7000	0.7700		43.6433 (80)	
Northwest					0.6800	14.6176		0.6200	0.7000	0.7700		2.9896 (81)	
East					3.1500	25.1925		0.6200	0.7000	0.7700		23.8674 (76)	
Solar gains	116.2609	191.7129	314.6243	457.6629	531.0485	589.9713	557.4643	491.8687	384.9232	244.3075	144.0755	94.2618 (83)	
Total gains	724.2367	794.8951	894.2466	1000.7568	1036.6497	1062.1312	1010.1993	953.4857	867.6725	763.8075	704.3720	685.5129 (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	45.4568	45.8252	45.7048	45.9432	45.9432	46.0588	46.1718	46.2822	46.3900	46.0588	46.2822	46.0588
alpha	4.0305	4.0550	4.0470	4.0629	4.0629	4.0706	4.0781	4.0855	4.0927	4.0706	4.0855	4.0706
util living area	0.9814	0.9723	0.9432	0.8687	0.7367	0.5355	0.3960	0.4173	0.6763	0.8946	0.9661	0.9841 (86)
MIT	19.7411	19.8883	20.2005	20.5751	20.8401	20.9668	20.9924	20.9909	20.9159	20.5942	20.1326	19.7324 (87)
Th 2	19.9662	19.9736	19.9712	19.9760	19.9760	19.9783	19.9805	19.9827	19.9848	19.9783	19.9827	19.9783 (88)
util rest of house	0.9768	0.9656	0.9292	0.8372	0.6769	0.4490	0.2954	0.3121	0.5919	0.8609	0.9562	0.9801 (89)
MIT 2	18.3194	18.5359	18.9784	19.4946	19.8259	19.9571	19.9777	19.9793	19.9213	19.5348	18.8968	18.3154 (90)
Living area fraction									f1A = Living area / (4) =			0.1961 (91)
MIT	18.5982	18.8012	19.2181	19.7065	20.0249	20.1551	20.1767	20.1777	20.1164	19.7426	19.1392	18.5933 (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	18.4482	18.6512	19.0681	19.5565	19.8749	20.0051	20.0267	20.0277	19.9664	19.5926	18.9892		18.4433 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9673	0.9539	0.9136	0.8220	0.6704	0.4513	0.3000	0.3168	0.5903	0.8453	0.9432	0.9715	(94)
Useful gains	700.5611	758.2164	817.0056	822.6577	694.9552	479.3619	303.0742	302.1072	512.1671	645.6121	664.3855	665.9973	(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	1432.5888	1400.4041	1269.1579	1052.1155	771.5618	491.0146	304.6812	304.0553	545.6665	854.9657	1151.6575	1402.9216	(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	544.6286	431.5501	336.4013	165.2096	56.9953	0.0000	0.0000	0.0000	0.0000	155.7590	350.8358	548.2717	(98)
Space heating												2589.6515	(98)
Space heating per m2											(98) / (4) =	27.9841	(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													2877.3905 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	544.6286	431.5501	336.4013	165.2096	56.9953	0.0000	0.0000	0.0000	0.0000	155.7590	350.8358	548.2717	(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)	605.1429	479.5001	373.7792	183.5662	63.3281	0.0000	0.0000	0.0000	0.0000	173.0656	389.8176	609.1908	(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	89.2640	89.2786	89.2651	89.2261	88.8990	86.7000	86.7000	86.7000	86.7000	88.7349	89.0968	86.7000	(216)
Fuel for water heating, kWh/month	168.7260	130.2731	104.0068	54.6483	30.9223	2.9966	0.0000	28.6331	55.9534	105.1328	142.9422	168.9031	(219)
Water heating fuel used												993.1379	(219)
Annual totals kWh/year													
Space heating fuel - main system												2877.3905	(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 * 1156 * 1.00) =										-749.2375		-749.2375	(233)
Total delivered energy for all uses												3645.0641	(238)

10a. Fuel costs - using BEDF prices (435)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2877.3905	3.9400	113.3692	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	993.1379	3.9400	39.1296	(247)
Pumps and fans for heating	75.0000	16.5500	12.4125	(249)
Pump for solar water heating	50.0000	16.5500	8.2750	(249)
Energy for lighting	398.7732	16.5500	65.9970	(250)
Additional standing charges			87.0000	(251)
Energy saving/generation technologies				
PV Unit	-749.2375	16.5500	-123.9988	(252)
Total energy cost			202.1845	(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	2877.3905	0.2160	621.5164	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	993.1379	0.2160	214.5178	(264)
Space and water heating			836.0341	(265)

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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	-749.2375	0.5190	-388.8543 (269)
Total kg/year			719.0182 (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	2877.3905	1.2200	3510.4164 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	993.1379	1.2200	1211.6282 (264)
Space and water heating			4722.0446 (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	-749.2375	3.0700	-2300.1591 (269)
Primary energy kWh/year			4029.8693 (272)
Primary energy kWh/m2/year			43.5473 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



Property Reference	4907-0015-3817-182				Issued on Date	03/12/2018
Assessment Reference	As Built	Prop Type Ref	P306i - Semi (As)			
Property	2, Appleby Drive, Botley, SOUTHAMPTON, SO32 2GE					
SAP Rating	88 B	DER	13.32	TER	17.44	
Environmental	90 B	% DER<TER	23.64			
CO ₂ Emissions (t/year)	0.91	DFEE	45.89	TFEE	50.87	
General Requirements Compliance	Pass	% DFEE<TFEE	9.78			
Assessor	Silvio Junges, Tel: 01884 242050				Assessor ID	P637-0001
Client						

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

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

Overheating Calculation Input Data

Dwelling type	SemiDetached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	West
Overshading	Average or unknown
Thermal mass parameter	187.0 (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	63.01 (37)
Summer heat loss coefficient	355.46 (P2)

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

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

[Jul]	Area m2	Solar flux Table 6a W/m2	Specific data g or Table 6b	FF Specific data or Table 6c	Shading	Gains W
East	4.8200	125.2818	0.6200	0.7000	0.9000	212.2803
South West	0.6800	127.3119	0.6200	0.7000	0.9000	30.4335
West	5.7600	125.2818	0.6200	0.7000	0.9000	253.6794
North West	0.6800	106.0502	0.6200	0.7000	0.9000	25.3510
East	3.1500	125.2818	0.6200	0.7000	0.9000	138.7309
total:						660.4752

	Jun	Jul	Aug	
Solar gains	711	660	581	(P3)
Internal gains	469	450	459	
Total summer gains	1180	1110	1040	(P5)
Summer gain/loss ratio	3.32	3.12	2.92	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 187.0)	0.69	0.69	0.69	
Threshold temperature	19.41	21.11	20.92	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	
Assessment of likelihood of high internal temperature:	Slight			