

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



Property Reference	4907-0015-3817-144				Issued on Date	13/06/2019
Assessment Reference	As Built	Prop Type Ref	P506-A - Det			
Property	45, Appleby Drive, Botley, SOUTHAMPTON, SO32 2GE					
SAP Rating		90 B	DER	10.77	TER	14.11
Environmental		89 B	% DER<TER	23.65		
CO ₂ Emissions (t/year)		1.51	DFEE	44.82	TFEE	51.76
General Requirements Compliance		Pass	% DFEE<TFEE	13.40		
Assessor Details	Mr. Fraser Browning, Fraser Browning, Tel: 01884 242050, Fraser.browning@aessc.co.uk				Assessor ID	T511-0001
Client						

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

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DWELLING AS BUILT

Detached House, total floor area 184 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) 14.11 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 10.77 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)51.8 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)44.8 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.25 (max. 0.30)	0.25 (max. 0.70)	OK
Floor	0.15 (max. 0.25)	0.15 (max. 0.70)	OK
Roof	0.13 (max. 0.20)	0.13 (max. 0.35)	OK
Openings	1.37 (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: 4.77 (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 Ultra 18 Heat 18

Efficiency: 89.2% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation

Hot water storage Measured cylinder loss: 1.61 kWh/day
Permitted by DBSCG 2.56 OK
Primary pipework insulated: Yes OK

6 Controls

Space heating controls: Time and temperature zone control OK

Hot water controls: Cylinderstat OK
Independent timer for DHW OK

Boiler interlock Yes OK

7 Low energy lights

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

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Southern England): Slight OK

Based on:

Overshading: Average
Windows facing North: 1.37 m², No overhang
Windows facing North East: 1.83 m², No overhang
Windows facing South East: 19.15 m², No overhang
Windows facing South: 0.69 m², No overhang
Windows facing South West: 2.96 m², No overhang
Windows facing West: 2.06 m², No overhang
Windows facing North West: 9.12 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

10 Key features

Door U-value 0.90 W/m²K
Thermal bridging y-value 0.035 W/m²K
Photovoltaic array 1.35 kW

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	93.1200 (1b)	x 2.3100 (2b)	= 215.1072 (1b) - (3b)
First floor	90.8600 (1c)	x 2.4800 (2c)	= 225.3328 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	183.9800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 440.4400 (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					5 * 10 = 50.0000 (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) =					50.0000 / (5) = 0.1135 (8)
Pressure test					Yes
Measured/design AP50					4.7700
Infiltration rate					0.3520 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3520 (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	0.4488	0.4400	0.4312	0.3872	0.3784	0.3344	0.3344	0.3256	0.3520	0.3784	0.3960	0.4136 (22b)
Effective ac	0.6007	0.5968	0.5930	0.5750	0.5716	0.5559	0.5559	0.5530	0.5620	0.5716	0.5784	0.5855 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid Door			2.1300	0.9000	1.9170		(26)
Window (Uw = 1.40)			23.0300	1.3258	30.5322		(27)
French (Uw = 1.40)			14.1500	1.3258	18.7595		(27)
Heat Loss Floor 1			93.1200	0.1500	13.9680	75.0000	6984.0000 (28a)
100mm Knauf Supafil	185.6200	39.3100	146.3100	0.2500	36.5775	60.0000	8778.6000 (29a)
External Plane Roof	90.8600		90.8600	0.1300	11.8118	9.0000	817.7400 (30)
Bay	2.2600		2.2600	0.1300	0.2938	9.0000	20.3400 (30)
Total net area of external elements Aum(A, m ²)			371.8600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	113.8598		(33)
GF Masonry			70.1300			39.0000	2735.0700 (32c)
GF Timber			65.0500			9.0000	585.4500 (32c)
1F Timber			174.6500			9.0000	1571.8500 (32c)
Internal Floor 1			90.8600			18.0000	1635.4800 (32d)
Internal Floor 1			90.8600			18.0000	1635.4800 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	24764.0100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							134.6016 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							13.0293 (36)
Total fabric heat loss						(33) + (36) =	126.8891 (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	87.3123	86.7438	86.1866	83.5694	83.0797	80.8001	80.8001	80.3780	81.6782	83.0797	84.0703	85.1059 (38)
Heat transfer coeff	214.2014	213.6329	213.0757	210.4585	209.9688	207.6893	207.6893	207.2671	208.5673	209.9688	210.9594	211.9951 (39)
Average = Sum(39)m / 12 =												210.4561 (39)
HLP	1.1643	1.1612	1.1581	1.1439	1.1413	1.1289	1.1289	1.1266	1.1336	1.1413	1.1466	1.1523 (40)
HLP (average)												1.1439 (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												2.9810 (42)
Average daily hot water use (litres/day)												104.9995 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	115.4994	111.2995	107.0995	102.8995	98.6995	94.4995	94.4995	98.6995	102.8995	107.0995	111.2995	115.4994 (44)

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Energy content (annual)	171.2823	149.8046	154.5850	134.7709	129.3159	111.5898	103.4043	118.6580	120.0751	139.9360	152.7511	165.8778 (45)
Distribution loss (46)m = 0.15 x (45)m	25.6924	22.4707	23.1877	20.2156	19.3974	16.7385	15.5107	17.7987	18.0113	20.9904	22.9127	24.8817 (46)
Water storage loss:												
Store volume												250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.6100 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.8694 (55)
Total storage loss	26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514 (56)
If cylinder contains dedicated solar storage	26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	221.4961	195.1590	204.7988	183.3649	179.5297	160.1838	153.6181	168.8718	168.6691	190.1498	201.3451	216.0916 (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	221.4961	195.1590	204.7988	183.3649	179.5297	160.1838	153.6181	168.8718	168.6691	190.1498	201.3451	216.0916 (64)
Heat gains from water heating, kWh/month	97.1224	86.0936	91.5705	83.6865	83.1686	75.9788	74.5530	79.6248	78.8002	86.6998	89.6649	95.3254 (65)
Total per year (kWh/year) = Sum(64)m =												2243.2779 (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	149.0516	149.0516	149.0516	149.0516	149.0516	149.0516	149.0516	149.0516	149.0516	149.0516	149.0516	149.0516 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	31.8877	28.3224	23.0333	17.4377	13.0349	11.0046	11.8908	15.4562	20.7452	26.3408	30.7437	32.7739 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	355.5533	359.2428	349.9453	330.1521	305.1666	281.6838	265.9959	262.3063	271.6038	291.3971	316.3826	339.8654 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.9052	37.9052	37.9052	37.9052	37.9052	37.9052	37.9052	37.9052	37.9052	37.9052	37.9052	37.9052 (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)	-119.2413	-119.2413	-119.2413	-119.2413	-119.2413	-119.2413	-119.2413	-119.2413	-119.2413	-119.2413	-119.2413	-119.2413 (71)
Water heating gains (Table 5)	130.5409	128.1154	123.0787	116.2313	111.7857	105.5261	100.2056	107.0226	109.4447	116.5319	124.5346	128.1255 (72)
Total internal gains	588.6973	586.3961	566.7728	534.5365	500.7027	468.9300	448.8078	455.5006	472.5092	504.9854	542.3763	571.4803 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	g	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	1.3700	10.6334	0.7100	0.7100	0.7000	0.7700	5.0174 (74)
Northeast	1.8300	11.2829	0.7100	0.7100	0.7000	0.7700	7.1115 (75)
Southeast	5.0000	36.7938	0.7100	0.7100	0.7000	0.7700	63.3628 (77)
South	0.6900	46.7521	0.7100	0.7100	0.7000	0.7700	11.1107 (78)
Southwest	2.9600	36.7938	0.7100	0.7100	0.7000	0.7700	37.5108 (79)
West	2.0600	19.6403	0.7100	0.7100	0.7000	0.7700	13.9349 (80)
Northwest	9.1200	11.2829	0.7100	0.7100	0.7000	0.7700	35.4411 (81)
Southeast	14.1500	36.7938	0.7100	0.7100	0.7000	0.7700	179.3168 (77)

Solar gains	352.8061	618.9297	893.4404	1183.2535	1393.5819	1413.1608	1350.1226	1188.9121	993.2537	696.7221	425.8806	299.7781 (83)
Total gains	941.5034	1205.3258	1460.2132	1717.7900	1894.2845	1882.0908	1798.9304	1644.4127	1465.7630	1201.7075	968.2569	871.2584 (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	32.1141	32.1996	32.2838	32.6853	32.7615	33.1211	33.1211	33.1885	32.9816	32.7615	32.6077	32.4484
alpha	3.1409	3.1466	3.1523	3.1790	3.1841	3.2081	3.2081	3.2126	3.1988	3.1841	3.1738	3.1632
util living area	0.9888	0.9757	0.9480	0.8846	0.7724	0.6178	0.4778	0.5328	0.7548	0.9268	0.9799	0.9912 (86)
MIT	18.8817	19.1865	19.6325	20.1732	20.6056	20.8654	20.9561	20.9374	20.7313	20.1379	19.4042	18.8329 (87)
Th 2	19.9487	19.9512	19.9536	19.9651	19.9673	19.9773	19.9773	19.9792	19.9735	19.9673	19.9629	19.9584 (88)
util rest of house	0.9866	0.9710	0.9377	0.8614	0.7268	0.5425	0.3781	0.4312	0.6896	0.9071	0.9752	0.9894 (89)
MIT 2	17.1078	17.5513	18.1949	18.9639	19.5434	19.8639	19.9521	19.9404	19.7201	18.9326	17.8781	17.0423 (90)
Living area fraction									fLA = Living area / (4) =			0.1408 (91)
MIT	17.3576	17.7816	18.3974	19.1342	19.6930	20.0049	20.0935	20.0808	19.8625	19.1023	18.0930	17.2945 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.2076	17.6316	18.2474	18.9842	19.5430	19.8549	19.9435	19.9308	19.7125	18.9523	17.9430	17.1445 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	920.1933	1151.6480	1335.6598	1432.8944	1336.0536	1002.6068	673.9245	700.6575	982.6646	1058.7968	930.7471	855.3433 (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												

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Month fracti	2764.8265	2719.8939	2503.0848	2122.3080	1646.7874	1091.3938	694.4153	731.8252	1170.5927	1753.7298	2287.4281	2744.1656 (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	1372.4072	1053.8613	868.5643	496.3778	231.1860	0.0000	0.0000	0.0000	0.0000	517.0302	976.8104	1405.2838 (98)
Space heating												6921.5208 (98)
Space heating per m2											(98) / (4) =	37.6211 (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 %)												90.2000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												7673.5264 (211)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1372.4072	1053.8613	868.5643	496.3778	231.1860	0.0000	0.0000	0.0000	0.0000	517.0302	976.8104	1405.2838 (98)
Space heating efficiency (main heating system 1)	90.2000	90.2000	90.2000	90.2000	90.2000	0.0000	0.0000	0.0000	0.0000	90.2000	90.2000	90.2000 (210)
Space heating fuel (main heating system)	1521.5157	1168.3606	962.9315	550.3080	256.3038	0.0000	0.0000	0.0000	0.0000	573.2042	1082.9383	1557.9643 (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	221.4961	195.1590	204.7988	183.3649	179.5297	160.1838	153.6181	168.8718	168.6691	190.1498	201.3451	216.0916 (64)
Efficiency of water heater	88.5439	88.3422	87.9416	87.0399	85.1882	79.5000	79.5000	79.5000	79.5000	87.0497	88.1719	79.5000 (216)
(217)m	88.5439	88.3422	87.9416	87.0399	85.1882	79.5000	79.5000	79.5000	79.5000	87.0497	88.1719	88.6105 (217)
Fuel for water heating, kWh/month	250.1540	220.9126	232.8803	210.6677	210.7447	201.4890	193.2304	212.4174	212.1625	218.4382	228.3551	243.8668 (219)
Water heating fuel used												2635.3186 (219)
Annual totals kWh/year												
Space heating fuel - main system												7673.5264 (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)												563.1464 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 1.35 * 1029 * 1.00) =									-1111.5217			-1111.5217 (233)
Total delivered energy for all uses												9835.4698 (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	7673.5264	0.2160	1657.4817 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2635.3186	0.2160	569.2288 (264)
Space and water heating			2226.7105 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	563.1464	0.5190	292.2730 (268)
Energy saving/generation technologies			
PV Unit	-1111.5217	0.5190	-576.8797 (269)
Total CO2, kg/year			1981.0288 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			10.7700 (273)

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

DER		10.7700 ZC1
Total Floor Area		183.9800
Assumed number of occupants	TFA	2.9810
CO2 emission factor in Table 12 for electricity displaced from grid	N	0.5190
CO2 emissions from appliances, equation (L14)	EF	11.4520 ZC2
CO2 emissions from cooking, equation (L16)		1.0357 ZC3
Total CO2 emissions		23.2577 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		23.2577 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	93.1200 (1b)	x 2.3100 (2b)	= 215.1072 (1b) - (3b)
First floor	90.8600 (1c)	x 2.4800 (2c)	= 225.3328 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	183.9800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 440.4400 (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) = 0.0908 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3408 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3408 (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	0.4345	0.4260	0.4175	0.3749	0.3664	0.3238	0.3238	0.3153	0.3408	0.3664	0.3834	0.4005 (22b)
Effective ac	0.5944	0.5907	0.5872	0.5703	0.5671	0.5524	0.5524	0.5497	0.5581	0.5671	0.5735	0.5802 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			2.1300	1.0000	2.1300		(26)
TER Opening Type (Uw = 1.40)			37.1800	1.3258	49.2917		(27)
Heat Loss Floor 1			93.1200	0.1300	12.1056		(28a)
100mm Knauf Supafil	185.6200	39.3100	146.3100	0.1800	26.3358		(29a)
External Plane Roof	90.8600		90.8600	0.1300	11.8118		(30)
Bay	2.2600		2.2600	0.1300	0.2938		(30)
Total net area of external elements Aum(A, m ²)			371.8600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	101.9687		(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)							16.3548 (36)
Total fabric heat loss						(33) + (36) =	118.3235 (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	86.3952	85.8623	85.3400	82.8867	82.4277	80.2910	80.2910	79.8953	81.1140	82.4277	83.3563	84.3271 (38)
Heat transfer coeff	204.7187	204.1858	203.6635	201.2102	200.7512	198.6145	198.6145	198.2188	199.4375	200.7512	201.6798	202.6505 (39)
Average = Sum(39)m / 12 =												201.2080 (39)
HLP	1.1127	1.1098	1.1070	1.0937	1.0912	1.0795	1.0795	1.0774	1.0840	1.0912	1.0962	1.1015 (40)
HLP (average)												1.0936 (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												2.9810 (42)
Average daily hot water use (litres/day)												104.9995 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	115.4994	111.2995	107.0995	102.8995	98.6995	94.4995	94.4995	98.6995	102.8995	107.0995	111.2995	115.4994 (44)
Energy content (annual)	171.2823	149.8046	154.5850	134.7709	129.3159	111.5898	103.4043	118.6580	120.0751	139.9360	152.7511	165.8778 (45)
Distribution loss (46)m = 0.15 x (45)m	25.6924	22.4707	23.1877	20.2156	19.3974	16.7385	15.5107	17.7987	18.0113	20.9904	22.9127	24.8817 (46)
Water storage loss:												250.0000 (47)
Store volume												1.8903 (48)
a) If manufacturer declared loss factor is known (kWh/day):												

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Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.0208 (55)
Total storage loss	31.6444	28.5820	31.6444	30.6236	31.6444	30.6236	31.6444	31.6444	30.6236	31.6444	30.6236	31.6444 (56)
If cylinder contains dedicated solar storage	31.6444	28.5820	31.6444	30.6236	31.6444	30.6236	31.6444	31.6444	30.6236	31.6444	30.6236	31.6444 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	226.1891	199.3979	209.4917	187.9065	184.2227	164.7254	158.3111	173.5648	173.2108	194.8428	205.8867	220.7846 (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	226.1891	199.3979	209.4917	187.9065	184.2227	164.7254	158.3111	173.5648	173.2108	194.8428	205.8867	220.7846 (64)
Heat gains from water heating, kWh/month	100.8768	89.4846	95.3249	87.3198	86.9230	79.6121	78.3074	83.3792	82.4335	90.4542	93.2982	99.0798 (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	149.0516	149.0516	149.0516	149.0516	149.0516	149.0516	149.0516	149.0516	149.0516	149.0516	149.0516	149.0516	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	31.8877	28.3224	23.0333	17.4377	13.0349	11.0046	11.8908	15.4562	20.7452	26.3408	30.7437	32.7739	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	355.5533	359.2428	349.9453	330.1521	305.1666	281.6838	265.9959	262.3063	271.6038	291.3971	316.3826	339.8654	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.9052	37.9052	37.9052	37.9052	37.9052	37.9052	37.9052	37.9052	37.9052	37.9052	37.9052	37.9052	(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)	-119.2413	-119.2413	-119.2413	-119.2413	-119.2413	-119.2413	-119.2413	-119.2413	-119.2413	-119.2413	-119.2413	-119.2413	(71)
Water heating gains (Table 5)	135.5871	133.1616	128.1249	121.2775	116.8319	110.5723	105.2518	112.0688	114.4909	121.5782	129.5809	133.1718	(72)
Total internal gains	593.7436	591.4423	571.8190	539.5827	505.7489	473.9762	453.8540	460.5468	477.5555	510.0316	547.4225	576.5265	(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			
North				1.3700	10.6334	0.6300	0.7000	0.7700	4.4521 (74)			
Northeast				1.8300	11.2829	0.6300	0.7000	0.7700	6.3102 (75)			
Southeast				19.1500	36.7938	0.6300	0.7000	0.7700	215.3355 (77)			
South				0.6900	46.7521	0.6300	0.7000	0.7700	9.8587 (78)			
Southwest				2.9600	36.7938	0.6300	0.7000	0.7700	33.2842 (79)			
West				2.0600	19.6403	0.6300	0.7000	0.7700	12.3648 (80)			
Northwest				9.1200	11.2829	0.6300	0.7000	0.7700	31.4477 (81)			
Solar gains	313.0533	549.1912	792.7711	1049.9292	1236.5586	1253.9314	1197.9961	1054.9502	881.3378	618.2182	377.8940	266.0003 (83)
Total gains	906.7969	1140.6335	1364.5901	1589.5119	1742.3075	1727.9076	1651.8501	1515.4970	1358.8933	1128.2498	925.3166	842.5268 (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	62.4095	62.5724	62.7328	63.4977	63.6429	64.3276	64.3276	64.4560	64.0621	63.6429	63.3499	63.0464	
alpha	5.1606	5.1715	5.1822	5.2332	5.2429	5.2885	5.2885	5.2971	5.2708	5.2429	5.2233	5.2031	
util living area	0.9992	0.9973	0.9901	0.9599	0.8674	0.6908	0.5203	0.5847	0.8458	0.9814	0.9979	0.9995	(86)
MIT	19.7086	19.8945	20.1757	20.5312	20.8164	20.9599	20.9925	20.9867	20.8828	20.4940	20.0309	19.6803	(87)
Th 2	19.9905	19.9928	19.9951	20.0060	20.0081	20.0176	20.0176	20.0193	20.0139	20.0081	20.0039	19.9996	(88)
util rest of house	0.9989	0.9963	0.9865	0.9448	0.8209	0.6025	0.4087	0.4686	0.7756	0.9718	0.9971	0.9993	(89)
MIT 2	18.2544	18.5277	18.9384	19.4525	19.8285	19.9911	20.0148	20.0138	19.9190	19.4094	18.7356	18.2195	(90)
Living area fraction	18.4592	18.7201	19.1126	19.6044	19.9677	20.1276	20.1525	20.1509	20.0547	19.5621	18.9180	18.4252	(91)
MIT	18.4592	18.7201	19.1126	19.6044	19.9677	20.1276	20.1525	20.1509	20.0547	19.5621	18.9180	18.4252	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.4592	18.7201	19.1126	19.6044	19.9677	20.1276	20.1525	20.1509	20.0547	19.5621	18.9180	18.4252	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9983	0.9945	0.9820	0.9371	0.8188	0.6130	0.4244	0.4848	0.7790	0.9659	0.9956	0.9988	(94)
Ext temp.	905.2466	1134.3320	1339.9799	1489.5332	1426.5213	1059.2588	701.0616	734.6787	1058.5867	1089.7277	921.2639	841.5359	(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	2898.6441	2821.8786	2568.7312	2153.8318	1659.7428	1097.8518	705.5797	743.4890	1187.5934	1799.1538	2383.4476	2882.7525	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating per m2	1483.0878	1134.0313	914.1910	478.2950	173.5169	0.0000	0.0000	0.0000	0.0000	527.8130	1052.7722	1518.6652	(98)
												7282.3723	(98)
												39.5824	(99)

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8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000	(201)
Fraction of space heat from main system(s)													1.0000	(202)
Efficiency of main space heating system 1 (in %)													93.5000	(206)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement													7788.6335	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	1483.0878	1134.0313	914.1910	478.2950	173.5169	0.0000	0.0000	0.0000	0.0000	527.8130	1052.7722	1518.6652	(98)	
Space heating efficiency (main heating system 1)	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)	
Space heating fuel (main heating system)	1586.1902	1212.8677	977.7443	511.5454	185.5795	0.0000	0.0000	0.0000	0.0000	564.5059	1125.9596	1624.2408	(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	226.1891	199.3979	209.4917	187.9065	184.2227	164.7254	158.3111	173.5648	173.2108	194.8428	205.8867	220.7846	(64)	
Efficiency of water heater (217)m	88.9222	88.7211	88.2929	87.2021	84.6547	79.8000	79.8000	79.8000	79.8000	87.3424	88.5577	88.9855	(216)	
Fuel for water heating, kWh/month	254.3674	224.7469	237.2692	215.4841	217.6167	206.4228	198.3849	217.4997	217.0561	223.0793	232.4889	248.1129	(219)	
Water heating fuel used												2692.5288	(219)	
Annual totals kWh/year														
Space heating fuel - main system													7788.6335	(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)													563.1464	(232)
Total delivered energy for all uses													11119.3087	(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	7788.6335	0.2160	1682.3448 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2692.5288	0.2160	581.5862 (264)
Space and water heating			2263.9311 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	563.1464	0.5190	292.2730 (268)
Total CO2, kg/m2/year			2595.1290 (272)
Emissions per m2 for space and water heating			12.3053 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			1.5886 (272b)
Emissions per m2 for pumps and fans			0.2116 (272c)
Target Carbon Dioxide Emission Rate (TER) = (12.3053 * 1.00) + 1.5886 + 0.2116, rounded to 2 d.p.			14.1100 (273)

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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	93.1200 (1b)	x 2.3100 (2b)	= 215.1072 (1b) - (3b)
First floor	90.8600 (1c)	x 2.4800 (2c)	= 225.3328 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	183.9800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 440.4400 (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) = 0.0908 (8)
Pressure test					Yes
Measured/design AP50					4.7700
Infiltration rate					0.3293 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3293 (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	0.4199	0.4116	0.4034	0.3623	0.3540	0.3129	0.3129	0.3046	0.3293	0.3540	0.3705	0.3869 (22b)
Effective ac	0.5881	0.5847	0.5814	0.5656	0.5627	0.5489	0.5489	0.5464	0.5542	0.5627	0.5686	0.5749 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid Door			2.1300	0.9000	1.9170		(26)
Window (Uw = 1.40)			23.0300	1.3258	30.5322		(27)
French (Uw = 1.40)			14.1500	1.3258	18.7595		(27)
Heat Loss Floor 1			93.1200	0.1500	13.9680	75.0000	6984.0000 (28a)
100mm Knauf Supafil	185.6200	39.3100	146.3100	0.2500	36.5775	60.0000	8778.6000 (29a)
External Plane Roof	90.8600		90.8600	0.1300	11.8118	9.0000	817.7400 (30)
Bay	2.2600		2.2600	0.1300	0.2938	9.0000	20.3400 (30)
Total net area of external elements Aum(A, m ²)			371.8600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	113.8598		(33)
GF Masonry			70.1300			39.0000	2735.0700 (32c)
GF Timber			65.0500			9.0000	585.4500 (32c)
1F Timber			174.6500			9.0000	1571.8500 (32c)
Internal Floor 1			90.8600			18.0000	1635.4800 (32d)
Internal Floor 1			90.8600			9.0000	817.7400 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	23946.2700 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							130.1569 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							13.0293 (36)
Total fabric heat loss						(33) + (36) =	126.8891 (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	85.4848	84.9873	84.4996	82.2091	81.7805	79.7855	79.7855	79.4161	80.5540	81.7805	82.6475	83.5538 (38)
Heat transfer coeff	212.3739	211.8764	211.3887	209.0982	208.6696	206.6747	206.6747	206.3052	207.4431	208.6696	209.5366	210.4429 (39)
Average = Sum(39)m / 12 =												209.0961 (39)
HLP	1.1543	1.1516	1.1490	1.1365	1.1342	1.1234	1.1234	1.1213	1.1275	1.1342	1.1389	1.1438 (40)
HLP (average)												1.1365 (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												2.9810 (42)
Average daily hot water use (litres/day)												104.9995 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	115.4994	111.2995	107.0995	102.8995	98.6995	94.4995	94.4995	98.6995	102.8995	107.0995	111.2995	115.4994 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Energy conte	171.2823	149.8046	154.5850	134.7709	129.3159	111.5898	103.4043	118.6580	120.0751	139.9360	152.7511	165.8778 (45)
Energy content (annual)										Total =	Sum (45)m =	1652.0509 (45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	36.3975	31.8335	32.8493	28.6388	27.4796	23.7128	21.9734	25.2148	25.5160	29.7364	32.4596	35.2490 (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	149.0516	149.0516	149.0516	149.0516	149.0516	149.0516	149.0516	149.0516	149.0516	149.0516	149.0516	149.0516 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	31.8877	28.3224	23.0333	17.4377	13.0349	11.0046	11.8908	15.4562	20.7452	26.3408	30.7437	32.7739 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	355.5533	359.2428	349.9453	330.1521	305.1666	281.6838	265.9959	262.3063	271.6038	291.3971	316.3826	339.8654 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.9052	37.9052	37.9052	37.9052	37.9052	37.9052	37.9052	37.9052	37.9052	37.9052	37.9052	37.9052 (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)	-119.2413	-119.2413	-119.2413	-119.2413	-119.2413	-119.2413	-119.2413	-119.2413	-119.2413	-119.2413	-119.2413	-119.2413 (71)
Water heating gains (Table 5)	48.9214	47.3713	44.1523	39.7761	36.9350	32.9345	29.5342	33.8909	35.4388	39.9683	45.0828	47.3777 (72)
Total internal gains	504.0778	502.6519	484.8464	455.0814	422.8519	393.3384	375.1363	379.3689	395.5034	425.4217	459.9245	487.7325 (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
North					1.3700	10.6334	0.7100	0.7000				0.7700	5.0174 (74)
Northeast					1.8300	11.2829	0.7100	0.7000				0.7700	7.1115 (75)
Southeast					5.0000	36.7938	0.7100	0.7000				0.7700	63.3628 (77)
South					0.6900	46.7521	0.7100	0.7000				0.7700	11.1107 (78)
Southwest					2.9600	36.7938	0.7100	0.7000				0.7700	37.5108 (79)
West					2.0600	19.6403	0.7100	0.7000				0.7700	13.9349 (80)
Northwest					9.1200	11.2829	0.7100	0.7000				0.7700	35.4411 (81)
Southeast					14.1500	36.7938	0.7100	0.7000				0.7700	179.3168 (77)
Solar gains	352.8061	618.9297	893.4404	1183.2535	1393.5819	1413.1608	1350.1226	1188.9121	993.2537	696.7221	425.8806	299.7781	(83)
Total gains	856.8839	1121.5816	1378.2868	1638.3349	1816.4338	1806.4991	1725.2589	1568.2810	1388.7571	1122.1438	885.8050	787.5106	(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	31.3209	31.3944	31.4669	31.8116	31.8769	32.1846	32.1846	32.2422	32.0654	31.8769	31.7450	31.6083
alpha	3.0881	3.0930	3.0978	3.1208	3.1251	3.1456	3.1456	3.1495	3.1377	3.1251	3.1163	3.1072
util living area	0.9905	0.9783	0.9519	0.8910	0.7820	0.6308	0.4913	0.5490	0.7696	0.9342	0.9828	0.9927 (86)
MIT	18.7853	19.0989	19.5586	20.1168	20.5705	20.8482	20.9489	20.9271	20.7001	20.0736	19.3161	18.7325 (87)
Th 2	19.9567	19.9589	19.9610	19.9711	19.9730	19.9818	19.9818	19.9834	19.9784	19.9730	19.9692	19.9652 (88)
util rest of house	0.9887	0.9741	0.9425	0.8691	0.7380	0.5563	0.3907	0.4470	0.7070	0.9165	0.9789	0.9912 (89)
MIT 2	17.9226	18.2352	18.6895	19.2358	19.6544	19.8929	19.9612	19.9517	19.7818	19.2071	18.4605	17.8760 (90)
Living area fraction									fLA = Living area / (4) =			0.1408 (91)
MIT	18.0441	18.3568	18.8119	19.3599	19.7834	20.0274	20.1003	20.0891	19.9111	19.3291	18.5810	17.9967 (92)
Temperature adjustment												0.0000
adjusted MIT	18.0441	18.3568	18.8119	19.3599	19.7834	20.0274	20.1003	20.0891	19.9111	19.3291	18.5810	17.9967 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9838	0.9654	0.9291	0.8537	0.7288	0.5599	0.4031	0.4583	0.7023	0.9023	0.9715	0.9873 (94)
Useful gains	843.0437	1082.7536	1280.5681	1398.5671	1323.8775	1011.4488	695.3767	718.7853	975.2572	1012.4665	860.5183	777.5064 (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	2918.8790	2851.1756	2602.5889	2187.1467	1686.7591	1121.7109	723.4300	761.0755	1205.4762	1821.5064	2405.6921	2903.4092 (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	1544.4215	1188.3796	983.5834	567.7773	269.9839	0.0000	0.0000	0.0000	0.0000	601.9257	1112.5251	1581.6716 (98)
Space heating												7850.2681 (98)
Space heating per m2										(98) / (4) =		42.6691 (99)

8c. Space cooling requirement

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Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

 Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000		
Heat loss rate W														
	0.0000	0.0000	0.0000	0.0000	0.0000	1942.7417	1529.3924	1567.9196	0.0000	0.0000	0.0000	0.0000	(100)	
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8110	0.8693	0.8374	0.0000	0.0000	0.0000	0.0000	(101)	
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1575.5589	1329.4297	1313.0138	0.0000	0.0000	0.0000	0.0000	(102)	
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	2248.1038	2149.8232	1969.1587	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	484.2323	610.3728	488.1718	0.0000	0.0000	0.0000	0.0000	(104)	
Space cooling													(104)	
Cooled fraction									FC = cooled area / (4) =			1582.7769	(104)	
Intermittency factor (Table 10b)												1.0000	(105)	
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)	
Space cooling kWh														
	0.0000	0.0000	0.0000	0.0000	0.0000	121.0581	152.5932	122.0429	0.0000	0.0000	0.0000	0.0000	(107)	
Space cooling													(107)	
Space cooling per m2													395.6942	(107)
Energy for space heating													2.1507	(108)
Energy for space cooling													42.6691	(99)
Total													2.1507	(108)
Dwelling Fabric Energy Efficiency (DFEE)													44.8199	(109)
													44.8	(109)

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Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	93.1200 (1b)	x 2.3100 (2b)	= 215.1072 (1b) - (3b)
First floor	90.8600 (1c)	x 2.4800 (2c)	= 225.3328 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	183.9800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 440.4400 (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) = 0.0908 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3408 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3408 (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	0.4345	0.4260	0.4175	0.3749	0.3664	0.3238	0.3238	0.3153	0.3408	0.3664	0.3834	0.4005 (22b)
Effective ac	0.5944	0.5907	0.5872	0.5703	0.5671	0.5524	0.5524	0.5497	0.5581	0.5671	0.5735	0.5802 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			2.1300	1.0000	2.1300		(26)
TER Opening Type (Uw = 1.40)			37.1800	1.3258	49.2917		(27)
Heat Loss Floor 1			93.1200	0.1300	12.1056		(28a)
100mm Knauf Supafil	185.6200	39.3100	146.3100	0.1800	26.3358		(29a)
External Plane Roof	90.8600		90.8600	0.1300	11.8118		(30)
Bay	2.2600		2.2600	0.1300	0.2938		(30)
Total net area of external elements Aum(A, m ²)			371.8600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	101.9687		(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)							16.3548 (36)
Total fabric heat loss						(33) + (36) =	118.3235 (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	86.3952	85.8623	85.3400	82.8867	82.4277	80.2910	80.2910	79.8953	81.1140	82.4277	83.3563	84.3271 (38)
Heat transfer coeff	204.7187	204.1858	203.6635	201.2102	200.7512	198.6145	198.6145	198.2188	199.4375	200.7512	201.6798	202.6505 (39)
Average = Sum(39)m / 12 =												201.2080 (39)
HLP	1.1127	1.1098	1.1070	1.0937	1.0912	1.0795	1.0795	1.0774	1.0840	1.0912	1.0962	1.1015 (40)
HLP (average)												1.0936 (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												2.9810 (42)
Average daily hot water use (litres/day)												104.9995 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	115.4994	111.2995	107.0995	102.8995	98.6995	94.4995	94.4995	98.6995	102.8995	107.0995	111.2995	115.4994 (44)
Energy content (annual)	171.2823	149.8046	154.5850	134.7709	129.3159	111.5898	103.4043	118.6580	120.0751	139.9360	152.7511	165.8778 (45)
Distribution loss (46)m = 0.15 x (45)m												Total = Sum(45)m = 1652.0509 (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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Calculation Type: New Build (As Built)

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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	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	36.3975	31.8335	32.8493	28.6388	27.4796	23.7128	21.9734	25.2148	25.5160	29.7364	32.4596	35.2490 (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	149.0516	149.0516	149.0516	149.0516	149.0516	149.0516	149.0516	149.0516	149.0516	149.0516	149.0516	149.0516	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	31.8877	28.3224	23.0333	17.4377	13.0349	11.0046	11.8908	15.4562	20.7452	26.3408	30.7437	32.7739	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	355.5533	359.2428	349.9453	330.1521	305.1666	281.6838	265.9959	262.3063	271.6038	291.3971	316.3826	339.8654	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.9052	37.9052	37.9052	37.9052	37.9052	37.9052	37.9052	37.9052	37.9052	37.9052	37.9052	37.9052	(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)	-119.2413	-119.2413	-119.2413	-119.2413	-119.2413	-119.2413	-119.2413	-119.2413	-119.2413	-119.2413	-119.2413	-119.2413	(71)
Water heating gains (Table 5)	48.9214	47.3713	44.1523	39.7761	36.9350	32.9345	29.5342	33.8909	35.4388	39.9683	45.0828	47.3777	(72)
Total internal gains	504.0778	502.6519	484.8464	455.0814	422.8519	393.3384	375.1363	379.3689	395.5034	425.4217	459.9245	487.7325	(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
North	1.3700	10.6334	0.6300	0.7000	0.7700	4.4521 (74)
Northeast	1.8300	11.2829	0.6300	0.7000	0.7700	6.3102 (75)
Southeast	19.1500	36.7938	0.6300	0.7000	0.7700	215.3355 (77)
South	0.6900	46.7521	0.6300	0.7000	0.7700	9.8587 (78)
Southwest	2.9600	36.7938	0.6300	0.7000	0.7700	33.2842 (79)
West	2.0600	19.6403	0.6300	0.7000	0.7700	12.3648 (80)
Northwest	9.1200	11.2829	0.6300	0.7000	0.7700	31.4477 (81)

Solar gains	313.0533	549.1912	792.7711	1049.9292	1236.5586	1253.9314	1197.9961	1054.9502	881.3378	618.2182	377.8940	266.0003	(83)
Total gains	817.1311	1051.8431	1277.6174	1505.0105	1659.4105	1647.2698	1573.1324	1434.3191	1276.8412	1043.6399	837.8185	753.7328	(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	62.4095	62.5724	62.7328	63.4977	63.6429	64.3276	64.3276	64.4560	64.0621	63.6429	63.3499	63.0464	
alpha	5.1606	5.1715	5.1822	5.2332	5.2429	5.2885	5.2885	5.2971	5.2708	5.2429	5.2233	5.2031	
util living area	0.9995	0.9981	0.9926	0.9676	0.8849	0.7160	0.5442	0.6134	0.8703	0.9866	0.9987	0.9997	(86)
MIT	19.6627	19.8494	20.1331	20.4954	20.7944	20.9526	20.9908	20.9835	20.8631	20.4540	19.9862	19.6347	(87)
Th 2	19.9905	19.9928	19.9951	20.0060	20.0081	20.0176	20.0176	20.0193	20.0139	20.0081	20.0039	19.9996	(88)
util rest of house	0.9994	0.9975	0.9898	0.9549	0.8419	0.6276	0.4286	0.4937	0.8054	0.9795	0.9982	0.9996	(89)
MIT 2	18.7593	18.9476	19.2317	19.5947	19.8684	19.9958	20.0152	20.0146	19.9358	19.5610	19.0934	18.7387	(90)
Living area fraction									fLA = Living area / (4) =			0.1408	(91)
MIT	18.8865	19.0746	19.3586	19.7215	19.9988	20.1305	20.1526	20.1510	20.0664	19.6868	19.2192	18.8648	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8865	19.0746	19.3586	19.7215	19.9988	20.1305	20.1526	20.1510	20.0664	19.6868	19.2192	18.8648	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	816.3913	1048.2676	1261.5615	1430.2617	1396.3504	1051.8733	699.9586	732.3129	1033.5894	1018.9851	835.7643	753.2859	(94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	2986.1259	2894.2534	2618.8326	2177.4039	1665.9891	1098.4440	705.6002	743.5188	1189.9310	1824.1790	2444.1900	2971.8385	(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	1614.2825	1240.5024	1009.8097	537.9424	200.6112	0.0000	0.0000	0.0000	0.0000	599.0643	1158.0665	1650.6032	(98)
Space heating												8010.8822	(98)
Space heating per m2												(98) / (4) =	43.5421 (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	1866.9760	1469.7470	1506.4627	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8796	0.9361	0.9079	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1642.2597	1375.8815	1367.6668	0.0000	0.0000	0.0000	0.0000	(102)

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Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	2061.9915	1972.0131	1812.5798	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												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	302.2069	443.5219	331.0153	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												1076.7441 (104)
Cooled fraction									fC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)												
Intermittency factor	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	75.5517	110.8805	82.7538	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												269.1860 (107)
Space cooling per m2												1.4631 (108)
Energy for space heating												43.5421 (99)
Energy for space cooling												1.4631 (108)
Total												45.0053 (109)
Target Fabric Energy Efficiency (TFEE)												51.8 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	93.1200 (1b)	x 2.3100 (2b)	= 215.1072 (1b) - (3b)
First floor	90.8600 (1c)	x 2.4800 (2c)	= 225.3328 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	183.9800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 440.4400 (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					5 * 10 = 50.0000 (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)					50.0000 / (5) = 0.1135 (8)
Pressure test					Yes
Measured/design AP50					4.7700
Infiltration rate					0.3520 (18)
Number of sides sheltered					0 (19)
Shelter factor			(20) = 1 - [0.075 x (19)]	=	1.0000 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20)	=	0.3520 (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	0.3696	0.3432	0.3520	0.3344	0.3344	0.3256	0.3168	0.3080	0.2992	0.3256	0.3080	0.3256 (22b)
Effective ac	0.5683	0.5589	0.5620	0.5559	0.5559	0.5530	0.5502	0.5474	0.5448	0.5530	0.5474	0.5530 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid Door			2.1300	0.9000	1.9170		(26)
Window (Uw = 1.40)			23.0300	1.3258	30.5322		(27)
French (Uw = 1.40)			14.1500	1.3258	18.7595		(27)
Heat Loss Floor 1			93.1200	0.1500	13.9680	75.0000	6984.0000 (28a)
100mm Knauf Supafil	185.6200	39.3100	146.3100	0.2500	36.5775	60.0000	8778.6000 (29a)
External Plane Roof	90.8600		90.8600	0.1300	11.8118	9.0000	817.7400 (30)
Bay	2.2600		2.2600	0.1300	0.2938	9.0000	20.3400 (30)
Total net area of external elements Aum(A, m ²)			371.8600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	113.8598		(33)
GF Masonry			70.1300			39.0000	2735.0700 (32c)
GF Timber			65.0500			9.0000	585.4500 (32c)
1F Timber			174.6500			9.0000	1571.8500 (32c)
Internal Floor 1			90.8600			18.0000	1635.4800 (32d)
Internal Floor 1			90.8600			18.0000	1635.4800 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	24764.0100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							134.6016 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							13.0293 (36)
Total fabric heat loss						(33) + (36) =	126.8891 (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	82.6013	81.2335	81.6782	80.8001	80.8001	80.3780	79.9671	79.5675	79.1791	80.3780	79.5675	80.3780 (38)
Heat transfer coeff	209.4904	208.1226	208.5673	207.6893	207.6893	207.2671	206.8562	206.4566	206.0682	207.2671	206.4566	207.2671 (39)
Average = Sum(39)m / 12 =												207.4332 (39)
HLP	1.1387	1.1312	1.1336	1.1289	1.1289	1.1266	1.1243	1.1222	1.1201	1.1266	1.1222	1.1266 (40)
HLP (average)												1.1275 (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												2.9810 (42)
Average daily hot water use (litres/day)												104.9995 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	115.4994	111.2995	107.0995	102.8995	98.6995	94.4995	94.4995	98.6995	102.8995	107.0995	111.2995	115.4994 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Energy content (annual)	171.2823	149.8046	154.5850	134.7709	129.3159	111.5898	103.4043	118.6580	120.0751	139.9360	152.7511	165.8778 (45)
Distribution loss (46)m = 0.15 x (45)m	25.6924	22.4707	23.1877	20.2156	19.3974	16.7385	15.5107	17.7987	18.0113	20.9904	22.9127	24.8817 (46)
Water storage loss:												
Store volume												250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.6100 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.8694 (55)
Total storage loss	26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514 (56)
If cylinder contains dedicated solar storage	26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	221.4961	195.1590	204.7988	183.3649	179.5297	160.1838	153.6181	168.8718	168.6691	190.1498	201.3451	216.0916 (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	221.4961	195.1590	204.7988	183.3649	179.5297	160.1838	153.6181	168.8718	168.6691	190.1498	201.3451	216.0916 (64)
Total per year (kWh/year) = Sum(64)m =												2243.2779 (64)
RHI water heating demand												2243 (64)
Heat gains from water heating, kWh/month	97.1224	86.0936	91.5705	83.6865	83.1686	75.9788	74.5530	79.6248	78.8002	86.6998	89.6649	95.3254 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	178.8619	178.8619	178.8619	178.8619	178.8619	178.8619	178.8619	178.8619	178.8619	178.8619	178.8619	178.8619 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	79.7192	70.8059	57.5832	43.5942	32.5872	27.5115	29.7271	38.6404	51.8631	65.8521	76.8591	81.9348 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	530.6766	536.1833	522.3065	492.7643	455.4726	420.4236	397.0087	391.5020	405.3789	434.9210	472.2128	507.2617 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.8672	55.8672	55.8672	55.8672	55.8672	55.8672	55.8672	55.8672	55.8672	55.8672	55.8672	55.8672 (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)	-119.2413	-119.2413	-119.2413	-119.2413	-119.2413	-119.2413	-119.2413	-119.2413	-119.2413	-119.2413	-119.2413	-119.2413 (71)
Water heating gains (Table 5)	130.5409	128.1154	123.0787	116.2313	111.7857	105.5261	100.2056	107.0226	109.4447	116.5319	124.5346	128.1255 (72)
Total internal gains	859.4245	853.5925	821.4562	771.0776	718.3333	671.9490	645.4293	655.6529	685.1745	735.7929	792.0944	835.8100 (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
North				1.3700	13.4839		0.7100		0.7000		0.7700		6.3625 (74)
Northeast				1.8300	14.6176		0.7100		0.7000		0.7700		9.2134 (75)
Southeast				5.0000	45.1778		0.7100		0.7000		0.7700		77.8010 (77)
South				0.6900	56.7559		0.7100		0.7000		0.7700		13.4881 (78)
Southwest				2.9600	45.1778		0.7100		0.7000		0.7700		46.0582 (79)
West				2.0600	25.1925		0.7100		0.7000		0.7700		17.8743 (80)
Northwest				9.1200	14.6176		0.7100		0.7000		0.7700		45.9158 (81)
Southeast				14.1500	45.1778		0.7100		0.7000		0.7700		220.1767 (77)
Solar gains	436.8898	653.6845	955.8510	1282.2117	1442.1059	1591.3008	1507.3077	1355.2435	1125.2774	795.1397	525.9258	364.7720	(83)
Total gains	1296.3143	1507.2770	1777.3073	2053.2893	2160.4392	2263.2499	2152.7370	2010.8964	1810.4519	1530.9326	1318.0202	1200.5819	(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	32.8363	33.0521	32.9816	33.1211	33.1211	33.1885	33.2545	33.3188	33.3816	33.1885	33.3188	33.1885
alpha	3.1891	3.2035	3.1988	3.2081	3.2081	3.2126	3.2170	3.2213	3.2254	3.2126	3.2213	3.2126
util living area	0.9703	0.9530	0.9087	0.8165	0.6806	0.4890	0.3646	0.3876	0.6251	0.8514	0.9468	0.9753 (86)
MIT	19.2945	19.5203	19.9462	20.4242	20.7615	20.9395	20.9823	20.9791	20.8650	20.4446	19.8198	19.2639 (87)
Th 2	19.9694	19.9754	19.9735	19.9773	19.9773	19.9792	19.9810	19.9828	19.9845	19.9792	19.9828	19.9792 (88)
util rest of house	0.9647	0.9444	0.8921	0.7840	0.6255	0.4120	0.2736	0.2918	0.5488	0.8162	0.9352	0.9705 (89)
MIT 2	17.7178	18.0452	18.6483	19.3067	19.7384	19.9348	19.9728	19.9729	19.8713	19.3527	18.4852	17.6804 (90)
Living area fraction									fLA = Living area / (4) =			0.1408 (91)
MIT	17.9398	18.2529	18.8311	19.4640	19.8825	20.0763	20.1149	20.1146	20.0112	19.5065	18.6732	17.9034 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.7898	18.1029	18.6811	19.3140	19.7325	19.9263	19.9649	19.9646	19.8612	19.3565	18.5232	17.7534 (93)

8. Space heating requirement

Utilisation	0.9475	0.9230	0.8656	0.7596	0.6110	0.4078	0.2721	0.2901	0.5387	0.7902	0.9124	0.9551 (94)
Useful gains	1228.2607	1391.1639	1538.4738	1559.5875	1320.0202	922.8931	585.8284	583.2614	975.3449	1209.6721	1202.5844	1146.7312 (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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF HEAT DEMAND 09 Jan 2014

Heat loss rate W	2700.2972	2664.5797	2436.2928	2038.2712	1502.1158	958.8723	592.6310	591.4086	1063.5653	1649.1211	2193.2203	2643.3680 (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												
Space heating	1095.1951	855.7354	667.9773	344.6522	135.4792	0.0000	0.0000	0.0000	0.0000	326.9501	713.2579	1113.4978 (98)
RHI space heating demand												5252.7450 (98)
												5253 (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	93.1200 (1b)	x 2.3100 (2b)	= 215.1072 (1b) - (3b)
First floor	90.8600 (1c)	x 2.4800 (2c)	= 225.3328 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	183.9800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 440.4400 (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					5 * 10 = 50.0000 (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)					50.0000 / (5) = 0.1135 (8)
Pressure test					Yes
Measured/design AP50					4.7700
Infiltration rate					0.3520 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3520 (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	0.4488	0.4400	0.4312	0.3872	0.3784	0.3344	0.3344	0.3256	0.3520	0.3784	0.3960	0.4136 (22b)
Effective ac	0.6007	0.5968	0.5930	0.5750	0.5716	0.5559	0.5559	0.5530	0.5620	0.5716	0.5784	0.5855 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid Door			2.1300	0.9000	1.9170		(26)
Window (Uw = 1.40)			23.0300	1.3258	30.5322		(27)
French (Uw = 1.40)			14.1500	1.3258	18.7595		(27)
Heat Loss Floor 1			93.1200	0.1500	13.9680	75.0000	6984.0000 (28a)
100mm Knauf Supafil	185.6200	39.3100	146.3100	0.2500	36.5775	60.0000	8778.6000 (29a)
External Plane Roof	90.8600		90.8600	0.1300	11.8118	9.0000	817.7400 (30)
Bay	2.2600		2.2600	0.1300	0.2938	9.0000	20.3400 (30)
Total net area of external elements Aum(A, m ²)			371.8600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	113.8598		(33)
GF Masonry			70.1300			39.0000	2735.0700 (32c)
GF Timber			65.0500			9.0000	585.4500 (32c)
1F Timber			174.6500			9.0000	1571.8500 (32c)
Internal Floor 1			90.8600			18.0000	1635.4800 (32d)
Internal Floor 1			90.8600			18.0000	1635.4800 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	24764.0100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							134.6016 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							13.0293 (36)
Total fabric heat loss						(33) + (36) =	126.8891 (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	87.3123	86.7438	86.1866	83.5694	83.0797	80.8001	80.8001	80.3780	81.6782	83.0797	84.0703	85.1059 (38)
Heat transfer coeff	214.2014	213.6329	213.0757	210.4585	209.9688	207.6893	207.6893	207.2671	208.5673	209.9688	210.9594	211.9951 (39)
Average = Sum(39)m / 12 =												210.4561 (39)
HLP	1.1643	1.1612	1.1581	1.1439	1.1413	1.1289	1.1289	1.1266	1.1336	1.1413	1.1466	1.1523 (40)
HLP (average)												1.1439 (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												2.9810 (42)
Average daily hot water use (litres/day)												104.9995 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	115.4994	111.2995	107.0995	102.8995	98.6995	94.4995	94.4995	98.6995	102.8995	107.0995	111.2995	115.4994 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Energy content (annual)	171.2823	149.8046	154.5850	134.7709	129.3159	111.5898	103.4043	118.6580	120.0751	139.9360	152.7511	165.8778 (45)
Distribution loss (46)m = 0.15 x (45)m	25.6924	22.4707	23.1877	20.2156	19.3974	16.7385	15.5107	17.7987	18.0113	20.9904	22.9127	24.8817 (46)
Water storage loss:												
Store volume												250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.6100 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.8694 (55)
Total storage loss	26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514 (56)
If cylinder contains dedicated solar storage	26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	221.4961	195.1590	204.7988	183.3649	179.5297	160.1838	153.6181	168.8718	168.6691	190.1498	201.3451	216.0916 (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	221.4961	195.1590	204.7988	183.3649	179.5297	160.1838	153.6181	168.8718	168.6691	190.1498	201.3451	216.0916 (64)
Heat gains from water heating, kWh/month	97.1224	86.0936	91.5705	83.6865	83.1686	75.9788	74.5530	79.6248	78.8002	86.6998	89.6649	95.3254 (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	178.8619	178.8619	178.8619	178.8619	178.8619	178.8619	178.8619	178.8619	178.8619	178.8619	178.8619	178.8619 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	79.7192	70.8059	57.5832	43.5942	32.5872	27.5115	29.7271	38.6404	51.8631	65.8521	76.8591	81.9348 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	530.6766	536.1833	522.3065	492.7643	455.4726	420.4236	397.0087	391.5020	405.3789	434.9210	472.2128	507.2617 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.8672	55.8672	55.8672	55.8672	55.8672	55.8672	55.8672	55.8672	55.8672	55.8672	55.8672	55.8672 (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)	-119.2413	-119.2413	-119.2413	-119.2413	-119.2413	-119.2413	-119.2413	-119.2413	-119.2413	-119.2413	-119.2413	-119.2413 (71)
Water heating gains (Table 5)	130.5409	128.1154	123.0787	116.2313	111.7857	105.5261	100.2056	107.0226	109.4447	116.5319	124.5346	128.1255 (72)
Total internal gains	859.4245	853.5925	821.4562	771.0776	718.3333	671.9490	645.4293	655.6529	685.1745	735.7929	792.0944	835.8100 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	1.3700	10.6334	0.7100	0.7000	0.7700	5.0174 (74)
Northeast	1.8300	11.2829	0.7100	0.7000	0.7700	7.1115 (75)
Southeast	5.0000	36.7938	0.7100	0.7000	0.7700	63.3628 (77)
South	0.6900	46.7521	0.7100	0.7000	0.7700	11.1107 (78)
Southwest	2.9600	36.7938	0.7100	0.7000	0.7700	37.5108 (79)
West	2.0600	19.6403	0.7100	0.7000	0.7700	13.9349 (80)
Northwest	9.1200	11.2829	0.7100	0.7000	0.7700	35.4411 (81)
Southeast	14.1500	36.7938	0.7100	0.7000	0.7700	179.3168 (77)

Solar gains	352.8061	618.9297	893.4404	1183.2535	1393.5819	1413.1608	1350.1226	1188.9121	993.2537	696.7221	425.8806	299.7781 (83)
Total gains	1212.2306	1472.5222	1714.8966	1954.3311	2111.9152	2085.1098	1995.5519	1844.5650	1678.4282	1432.5150	1217.9750	1135.5880 (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	32.1141	32.1996	32.2838	32.6853	32.7615	33.1211	33.1211	33.1885	32.9816	32.7615	32.6077	32.4484
alpha	3.1409	3.1466	3.1523	3.1790	3.1841	3.2081	3.2081	3.2126	3.1988	3.1841	3.1738	3.1632
util living area	0.9777	0.9592	0.9238	0.8502	0.7304	0.5733	0.4369	0.4849	0.7003	0.8916	0.9631	0.9815 (86)
MIT	19.0852	19.3759	19.7929	20.2874	20.6695	20.8918	20.9660	20.9523	20.7871	20.2695	19.5846	19.0345 (87)
Th 2	19.9487	19.9512	19.9536	19.9651	19.9673	19.9773	19.9773	19.9792	19.9735	19.9673	19.9629	19.9584 (88)
util rest of house	0.9734	0.9517	0.9098	0.8227	0.6819	0.4994	0.3434	0.3890	0.6317	0.8652	0.9551	0.9780 (89)
MIT 2	17.4022	17.8224	18.4192	19.1148	19.6182	19.8880	19.9583	19.9504	19.7786	19.1088	18.1361	17.3347 (90)
Living area fraction												0.1408 (91)
MIT	17.6392	18.0412	18.6126	19.2800	19.7663	20.0293	20.1002	20.0915	19.9206	19.2723	18.3401	17.5741 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.4892	17.8912	18.4626	19.1300	19.6163	19.8793	19.9502	19.9415	19.7706	19.1223	18.1901	17.4241 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	1162.1968	1371.1188	1515.5723	1555.9416	1401.2447	1025.5894	680.1849	710.6575	1034.6522	1200.2314	1139.2660	1095.9220 (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												

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Month fraction	2825.1542	2775.3476	2548.9468	2152.9862	1662.1724	1096.4642	695.7991	734.0353	1182.7005	1789.4088	2339.5511	2803.4498 (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 requirement	1237.2403	943.6417	768.8306	429.8721	194.1302	0.0000	0.0000	0.0000	0.0000	438.3480	864.2053	1270.4007 (98)
Space heating requirement per m2												6146.6690 (98)
												33.4094 (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 %)												90.2000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												6814.4889 (211)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1237.2403	943.6417	768.8306	429.8721	194.1302	0.0000	0.0000	0.0000	0.0000	438.3480	864.2053	1270.4007 (98)
Space heating efficiency (main heating system 1)	90.2000	90.2000	90.2000	90.2000	90.2000	0.0000	0.0000	0.0000	0.0000	90.2000	90.2000	90.2000 (210)
Space heating fuel (main heating system)	1371.6633	1046.1660	852.3621	476.5766	215.2220	0.0000	0.0000	0.0000	0.0000	485.9734	958.0990	1408.4265 (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	221.4961	195.1590	204.7988	183.3649	179.5297	160.1838	153.6181	168.8718	168.6691	190.1498	201.3451	216.0916 (64)
Efficiency of water heater	88.3935	88.1664	87.7167	86.7104	84.7214	79.5000	79.5000	79.5000	79.5000	86.6708	87.9629	79.5000 (216)
Fuel for water heating, kWh/month	250.5795	221.3530	233.4775	211.4682	211.9060	201.4890	193.2304	212.4174	212.1625	219.3933	228.8977	244.2567 (219)
Water heating fuel used												2640.6311 (219)
Annual totals kWh/year												
Space heating fuel - main system												6814.4889 (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)												563.1464 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 1.35 * 1029 * 1.00) =									-1111.5217			-1111.5217 (233)
Total delivered energy for all uses												8981.7448 (238)

10a. Fuel costs - using Table 12 prices

	Fuel	Fuel price	Fuel cost
	kWh/year	p/kWh	£/year
Space heating - main system 1	6814.4889	3.4800	237.1442 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2640.6311	3.4800	91.8940 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	563.1464	13.1900	74.2790 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-1111.5217	13.1900	-146.6097 (252)
Total energy cost			386.6000 (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] =	0.7091 (257)
SAP value		90.1079
SAP rating (Section 12)		90 (258)
SAP band		B

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

	Energy	Emission factor	Emissions
	kWh/year	kg CO2/kWh	kg CO2/year
Space heating - main system 1	6814.4889	0.2160	1471.9296 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2640.6311	0.2160	570.3763 (264)
Space and water heating			2042.3059 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	563.1464	0.5190	292.2730 (268)
Energy saving/generation technologies			
PV Unit	-1111.5217	0.5190	-576.8797 (269)

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Total kg/year	1796.6242 (272)
CO2 emissions per m2	9.7700 (273)
EI value	89.4861
EI rating	89 (274)
EI band	B

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

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9020 = 3.858$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9020 = 0.2395$, stars = 4
Water heating energy efficiency	$3.48 / 0.8473 = 4.107$, stars = 4
Water heating environmental impact	$0.216 / 0.8473 = 0.2549$, 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	93.1200 (1b)	x 2.3100 (2b)	= 215.1072 (1b) - (3b)
First floor	90.8600 (1c)	x 2.4800 (2c)	= 225.3328 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	183.9800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 440.4400 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					5 * 10 = 50.0000 (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) =					50.0000 / (5) = 0.1135 (8)
Pressure test					Yes
Measured/design AP50					4.7700
Infiltration rate					0.3520 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3520 (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	0.3696	0.3432	0.3520	0.3344	0.3344	0.3256	0.3168	0.3080	0.2992	0.3256	0.3080	0.3256 (22b)
Effective ac	0.5683	0.5589	0.5620	0.5559	0.5559	0.5530	0.5502	0.5474	0.5448	0.5530	0.5474	0.5530 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid Door			2.1300	0.9000	1.9170		(26)
Window (Uw = 1.40)			23.0300	1.3258	30.5322		(27)
French (Uw = 1.40)			14.1500	1.3258	18.7595		(27)
Heat Loss Floor 1			93.1200	0.1500	13.9680	75.0000	6984.0000 (28a)
100mm Knauf Supafil	185.6200	39.3100	146.3100	0.2500	36.5775	60.0000	8778.6000 (29a)
External Plane Roof	90.8600		90.8600	0.1300	11.8118	9.0000	817.7400 (30)
Bay	2.2600		2.2600	0.1300	0.2938	9.0000	20.3400 (30)
Total net area of external elements Aum(A, m ²)			371.8600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	113.8598		(33)
GF Masonry			70.1300			39.0000	2735.0700 (32c)
GF Timber			65.0500			9.0000	585.4500 (32c)
1F Timber			174.6500			9.0000	1571.8500 (32c)
Internal Floor 1			90.8600			18.0000	1635.4800 (32d)
Internal Floor 1			90.8600			18.0000	1635.4800 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 24764.0100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							134.6016 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							13.0293 (36)
Total fabric heat loss							(33) + (36) = 126.8891 (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	82.6013	81.2335	81.6782	80.8001	80.8001	80.3780	79.9671	79.5675	79.1791	80.3780	79.5675	80.3780 (38)
Heat transfer coeff	209.4904	208.1226	208.5673	207.6893	207.6893	207.2671	206.8562	206.4566	206.0682	207.2671	206.4566	207.2671 (39)
Average = Sum(39)m / 12 =												207.4332 (39)
HLP	1.1387	1.1312	1.1336	1.1289	1.1289	1.1266	1.1243	1.1222	1.1201	1.1266	1.1222	1.1266 (40)
HLP (average)												1.1275 (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												2.9810 (42)
Average daily hot water use (litres/day)												104.9995 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	115.4994	111.2995	107.0995	102.8995	98.6995	94.4995	94.4995	98.6995	102.8995	107.0995	111.2995	115.4994 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Energy content (annual)	171.2823	149.8046	154.5850	134.7709	129.3159	111.5898	103.4043	118.6580	120.0751	139.9360	152.7511	165.8778 (45)
Distribution loss (46)m = 0.15 x (45)m	25.6924	22.4707	23.1877	20.2156	19.3974	16.7385	15.5107	17.7987	18.0113	20.9904	22.9127	24.8817 (46)
Water storage loss:												
Store volume												250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.6100 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.8694 (55)
Total storage loss	26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514 (56)
If cylinder contains dedicated solar storage	26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	221.4961	195.1590	204.7988	183.3649	179.5297	160.1838	153.6181	168.8718	168.6691	190.1498	201.3451	216.0916 (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	221.4961	195.1590	204.7988	183.3649	179.5297	160.1838	153.6181	168.8718	168.6691	190.1498	201.3451	216.0916 (64)
Heat gains from water heating, kWh/month	97.1224	86.0936	91.5705	83.6865	83.1686	75.9788	74.5530	79.6248	78.8002	86.6998	89.6649	95.3254 (65)
Total per year (kWh/year) = Sum(64)m =												2243.2779 (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	178.8619	178.8619	178.8619	178.8619	178.8619	178.8619	178.8619	178.8619	178.8619	178.8619	178.8619	178.8619 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	79.7192	70.8059	57.5832	43.5942	32.5872	27.5115	29.7271	38.6404	51.8631	65.8521	76.8591	81.9348 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	530.6766	536.1833	522.3065	492.7643	455.4726	420.4236	397.0087	391.5020	405.3789	434.9210	472.2128	507.2617 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.8672	55.8672	55.8672	55.8672	55.8672	55.8672	55.8672	55.8672	55.8672	55.8672	55.8672	55.8672 (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)	-119.2413	-119.2413	-119.2413	-119.2413	-119.2413	-119.2413	-119.2413	-119.2413	-119.2413	-119.2413	-119.2413	-119.2413 (71)
Water heating gains (Table 5)	130.5409	128.1154	123.0787	116.2313	111.7857	105.5261	100.2056	107.0226	109.4447	116.5319	124.5346	128.1255 (72)
Total internal gains	859.4245	853.5925	821.4562	771.0776	718.3333	671.9490	645.4293	655.6529	685.1745	735.7929	792.0944	835.8100 (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
North	1.3700	13.4839	0.7100	0.7000	0.7700	6.3625 (74)
Northeast	1.8300	14.6176	0.7100	0.7000	0.7700	9.2134 (75)
Southeast	5.0000	45.1778	0.7100	0.7000	0.7700	77.8010 (77)
South	0.6900	56.7559	0.7100	0.7000	0.7700	13.4881 (78)
Southwest	2.9600	45.1778	0.7100	0.7000	0.7700	46.0582 (79)
West	2.0600	25.1925	0.7100	0.7000	0.7700	17.8743 (80)
Northwest	9.1200	14.6176	0.7100	0.7000	0.7700	45.9158 (81)
Southeast	14.1500	45.1778	0.7100	0.7000	0.7700	220.1767 (77)

Solar gains	436.8898	653.6845	955.8510	1282.2117	1442.1059	1591.3008	1507.3077	1355.2435	1125.2774	795.1397	525.9258	364.7720 (83)
Total gains	1296.3143	1507.2770	1777.3073	2053.2893	2160.4392	2263.2499	2152.7370	2010.8964	1810.4519	1530.9326	1318.0202	1200.5819 (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	32.8363	33.0521	32.9816	33.1211	33.1211	33.1885	33.2545	33.3188	33.3816	33.1885	33.3188	33.1885
alpha	3.1891	3.2035	3.1988	3.2081	3.2081	3.2126	3.2170	3.2213	3.2254	3.2126	3.2213	3.2126
util living area	0.9703	0.9530	0.9087	0.8165	0.6806	0.4890	0.3646	0.3876	0.6251	0.8514	0.9468	0.9753 (86)
MIT	19.2945	19.5203	19.9462	20.4242	20.7615	20.9395	20.9823	20.9791	20.8650	20.4446	19.8198	19.2639 (87)
Th 2	19.9694	19.9754	19.9735	19.9773	19.9773	19.9792	19.9810	19.9828	19.9845	19.9792	19.9828	19.9792 (88)
util rest of house	0.9647	0.9444	0.8921	0.7840	0.6255	0.4120	0.2736	0.2918	0.5488	0.8162	0.9352	0.9705 (89)
MIT 2	17.7178	18.0452	18.6483	19.3067	19.7384	19.9348	19.9728	19.9729	19.8713	19.3527	18.4852	17.6804 (90)
Living area fraction	17.9398	18.2529	18.8311	19.4640	19.8825	20.0763	20.1149	20.1146	20.0112	19.5065	18.6732	17.9034 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.7898	18.1029	18.6811	19.3140	19.7325	19.9263	19.9649	19.9646	19.8612	19.3565	18.5232	17.7534 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	1228.2607	1391.1639	1538.4738	1559.5875	1320.0202	922.8931	585.8284	583.2614	975.3449	1209.6721	1202.5844	1146.7312 (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												

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Month fraction	2700.2972	2664.5797	2436.2928	2038.2712	1502.1158	958.8723	592.6310	591.4086	1063.5653	1649.1211	2193.2203	2643.3680	(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 requirement	1095.1951	855.7354	667.9773	344.6522	135.4792	0.0000	0.0000	0.0000	0.0000	326.9501	713.2579	1113.4978	(98)
Space heating requirement per m2												5252.7450	(98)
												28.5506	(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 %)													90.2000	(206)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement													5823.4424	(211)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec			
Space heating requirement	1095.1951	855.7354	667.9773	344.6522	135.4792	0.0000	0.0000	0.0000	0.0000	326.9501	713.2579	1113.4978	(98)	
Space heating efficiency (main heating system 1)	90.2000	90.2000	90.2000	90.2000	90.2000	0.0000	0.0000	0.0000	0.0000	90.2000	90.2000	90.2000	(210)	
Space heating fuel (main heating system)	1214.1853	948.7089	740.5514	382.0978	150.1986	0.0000	0.0000	0.0000	0.0000	362.4724	790.7515	1234.4765	(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	221.4961	195.1590	204.7988	183.3649	179.5297	160.1838	153.6181	168.8718	168.6691	190.1498	201.3451	216.0916	(64)	
Efficiency of water heater	88.2030	88.0005	87.4385	86.1723	83.7740	79.5000	79.5000	79.5000	79.5000	85.9463	87.6043	88.2692	(216)	
Fuel for water heating, kWh/month	251.1209	221.7705	234.2203	212.7886	214.3024	201.4890	193.2304	212.4174	212.1625	221.2425	229.8347	244.8098	(219)	
Water heating fuel used												2649.3889	(219)	
Annual totals kWh/year														
Space heating fuel - main system												5823.4424	(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)													563.1464	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 1.35 * 1156 * 1.00) =										-1248.7291		-1248.7291	(233)	
Total delivered energy for all uses												7862.2486	(238)	

10a. Fuel costs - using BEDF prices (442)

	Fuel	Fuel price	Fuel cost	
	kWh/year	p/kWh	£/year	
Space heating - main system 1	5823.4424	3.9200	228.2789	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	2649.3889	3.9200	103.8560	(247)
Pumps and fans for heating	75.0000	16.9600	12.7200	(249)
Energy for lighting	563.1464	16.9600	95.5096	(250)
Additional standing charges			88.0000	(251)
Energy saving/generation technologies				
PV Unit	-1248.7291	16.9600	-211.7845	(252)
Total energy cost			316.5802	(255)

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

	Energy	Emission factor	Emissions	
	kWh/year	kg CO2/kWh	kg CO2/year	
Space heating - main system 1	5823.4424	0.2160	1257.8636	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2649.3889	0.2160	572.2680	(264)
Space and water heating			1830.1316	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	563.1464	0.5190	292.2730	(268)
Energy saving/generation technologies				
PV Unit	-1248.7291	0.5190	-648.0904	(269)
Total kg/year			1513.2391	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy	Primary energy factor	Primary energy	
	kWh/year	kg CO2/kWh	kWh/year	
Space heating - main system 1	5823.4424	1.2200	7104.5997	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)

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Water heating (other fuel)	2649.3889	1.2200	3232.2545 (264)
Space and water heating			10336.8542 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	563.1464	3.0700	1728.8595 (268)
Energy saving/generation technologies			
PV Unit	-1248.7291	3.0700	-3833.5984 (269)
Primary energy kWh/year			8462.3652 (272)
Primary energy kWh/m2/year			45.9961 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 90
Current environmental impact rating: B 89

(For testing purposes):

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

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.0	-£ 45	-270 kg (17.9%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£45	1.47 kg/m²	B 91
Total Savings	£45	1.47 kg/m²	B 91

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

Fuel prices for cost data on this page from database revision number 442 TEST (29 Apr 2019)
Recommendation texts revision number 4.9c (22 Feb 2014)

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

	Current	Potential	Saving
Electricity	£108	£117	-£8
Mains gas	£420	£366	£54
Space heating	£329	£330	-£1
Water heating	£104	£57	£47
Lighting	£96	£96	£0
Generated (PV)	-£212	-£212	£0
Total cost of fuels	£316	£271	£46
Total cost of uses	£317	£271	£46
Delivered energy	43 kWh/m²	36 kWh/m²	7 kWh/m²
Carbon dioxide emissions	1.5 tonnes	1.2 tonnes	0.3 tonnes
CO2 emissions per m²	8 kg/m²	7 kg/m²	1 kg/m²
Primary energy	46 kWh/m²	38 kWh/m²	8 kWh/m²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	93.1200 (1b)	x 2.3100 (2b)	= 215.1072 (1b) - (3b)
First floor	90.8600 (1c)	x 2.4800 (2c)	= 225.3328 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	183.9800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 440.4400 (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					5 * 10 = 50.0000 (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)					50.0000 / (5) = 0.1135 (8)
Pressure test					Yes
Measured/design AP50					4.7700
Infiltration rate					0.3520 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3520 (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	0.4488	0.4400	0.4312	0.3872	0.3784	0.3344	0.3344	0.3256	0.3520	0.3784	0.3960	0.4136 (22b)
Effective ac	0.6007	0.5968	0.5930	0.5750	0.5716	0.5559	0.5559	0.5530	0.5620	0.5716	0.5784	0.5855 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid Door			2.1300	0.9000	1.9170		(26)
Window (Uw = 1.40)			23.0300	1.3258	30.5322		(27)
French (Uw = 1.40)			14.1500	1.3258	18.7595		(27)
Heat Loss Floor 1			93.1200	0.1500	13.9680	75.0000	6984.0000 (28a)
100mm Knauf Supafil	185.6200	39.3100	146.3100	0.2500	36.5775	60.0000	8778.6000 (29a)
External Plane Roof	90.8600		90.8600	0.1300	11.8118	9.0000	817.7400 (30)
Bay	2.2600		2.2600	0.1300	0.2938	9.0000	20.3400 (30)
Total net area of external elements Aum(A, m ²)			371.8600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	113.8598		(33)
GF Masonry			70.1300			39.0000	2735.0700 (32c)
GF Timber			65.0500			9.0000	585.4500 (32c)
1F Timber			174.6500			9.0000	1571.8500 (32c)
Internal Floor 1			90.8600			18.0000	1635.4800 (32d)
Internal Floor 1			90.8600			18.0000	1635.4800 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 24764.0100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							134.6016 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							13.0293 (36)
Total fabric heat loss							(33) + (36) = 126.8891 (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	87.3123	86.7438	86.1866	83.5694	83.0797	80.8001	80.8001	80.3780	81.6782	83.0797	84.0703	85.1059 (38)
Heat transfer coeff	214.2014	213.6329	213.0757	210.4585	209.9688	207.6893	207.6893	207.2671	208.5673	209.9688	210.9594	211.9951 (39)
Average = Sum(39)m / 12 =												210.4561 (39)
HLP	1.1643	1.1612	1.1581	1.1439	1.1413	1.1289	1.1289	1.1266	1.1336	1.1413	1.1466	1.1523 (40)
HLP (average)												1.1439 (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												2.9810 (42)
Average daily hot water use (litres/day)												104.9995 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	115.4994	111.2995	107.0995	102.8995	98.6995	94.4995	94.4995	98.6995	102.8995	107.0995	111.2995	115.4994 (44)

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Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Energy content (annual)	171.2823	149.8046	154.5850	134.7709	129.3159	111.5898	103.4043	118.6580	120.0751	139.9360	152.7511	165.8778 (45)
Distribution loss (46)m = 0.15 x (45)m	25.6924	22.4707	23.1877	20.2156	19.3974	16.7385	15.5107	17.7987	18.0113	20.9904	22.9127	1652.0509 (45)
Water storage loss:												
Store volume												250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.6100 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.8694 (55)
Total storage loss	26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514 (56)
If cylinder contains dedicated solar storage	18.8660	17.0402	18.8660	18.2574	18.8660	18.2574	18.8660	18.8660	18.2574	18.8660	18.2574	18.8660 (57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	213.4107	187.8561	195.3176	168.7867	158.6500	139.7525	132.5058	148.6899	155.4417	180.6686	193.5205	208.0062 (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												1.0978 (H8)
Utilisation factor												0.5978 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												127.5000 (H13)
Daily hot water demand												104.9995 (H14)
Volume ratio Veff/V												1.2143 (H15)
Solar storage volume factor												1.0000 (H16)
Solar input												-953.3794 (H17)
Solar input	-27.6461	-46.1334	-78.5705	-105.2999	-130.0892	-127.8984	-126.2081	-110.2687	-86.3625	-58.9754	-32.7923	-23.1351 (63)
Solar input (sum of months) = Sum(63)m =												-953.3794 (63)
Output from w/h	185.7646	141.7227	116.7471	63.4868	28.5608	11.8541	6.2976	38.4212	69.0792	121.6932	160.7282	184.8711 (64)
Total per year (kWh/year) = Sum(64)m =												1129.2268 (64)
Heat gains from water heating, kWh/month	90.6541	80.2512	83.9856	72.0240	66.4648	59.6337	57.6631	63.4793	68.2182	79.1148	83.4053	88.8571 (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	178.8619	178.8619	178.8619	178.8619	178.8619	178.8619	178.8619	178.8619	178.8619	178.8619	178.8619	178.8619	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	79.7192	70.8059	57.5832	43.5942	32.5872	27.5115	29.7271	38.6404	51.8631	65.8521	76.8591	81.9348	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	530.6766	536.1833	522.3065	492.7643	455.4726	420.4236	397.0087	391.5020	405.3789	434.9210	472.2128	507.2617	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.8672	55.8672	55.8672	55.8672	55.8672	55.8672	55.8672	55.8672	55.8672	55.8672	55.8672	55.8672	(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)	-119.2413	-119.2413	-119.2413	-119.2413	-119.2413	-119.2413	-119.2413	-119.2413	-119.2413	-119.2413	-119.2413	-119.2413	(71)
Water heating gains (Table 5)	121.8469	119.4214	112.8839	100.0333	89.3344	82.8247	77.5042	85.3217	94.7475	106.3371	115.8406	119.4315	(72)
Total internal gains	850.7305	844.8985	811.2614	754.8796	695.8820	649.2476	622.7279	633.9519	670.4773	725.5981	783.4004	827.1160	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	Access factor Table 6d	Gains W
North	1.3700	10.6334	0.7100	0.7700	0.7700	5.0174 (74)
Northeast	1.8300	11.2829	0.7100	0.7700	0.7700	7.1115 (75)
Southeast	5.0000	36.7938	0.7100	0.7700	0.7700	63.3628 (77)
South	0.6900	46.7521	0.7100	0.7700	0.7700	11.1107 (78)
Southwest	2.9600	36.7938	0.7100	0.7700	0.7700	37.5108 (79)
West	2.0600	19.6403	0.7100	0.7700	0.7700	13.9349 (80)
Northwest	9.1200	11.2829	0.7100	0.7700	0.7700	35.4411 (81)
Southeast	14.1500	36.7938	0.7100	0.7700	0.7700	179.3168 (77)

Solar gains	352.8061	618.9297	893.4404	1183.2535	1393.5819	1413.1608	1350.1226	1188.9121	993.2537	696.7221	425.8806	299.7781 (83)
Total gains	1203.5366	1463.8282	1704.7018	1938.1331	2089.4638	2062.4084	1972.8505	1822.8641	1663.7310	1422.3202	1209.2810	1126.8940 (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	32.1141	32.1996	32.2838	32.6853	32.7615	33.1211	33.1211	33.1885	32.9816	32.7615	32.6077	32.4484
alpha	3.1409	3.1466	3.1523	3.1790	3.1841	3.2081	3.2081	3.2126	3.1988	3.1841	3.1738	3.1632
util living area	0.9781	0.9598	0.9249	0.8526	0.7346	0.5781	0.4413	0.4898	0.7040	0.8932	0.9638	0.9819 (86)
MIT	19.0788	19.3699	19.7867	20.2801	20.6634	20.8992	20.9650	20.9509	20.7837	20.2641	19.5785	19.0280 (87)
Th 2	19.9487	19.9512	19.9536	19.9651	19.9673	19.9773	19.9773	19.9792	19.9735	19.9673	19.9629	19.9584 (88)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

util rest of house	0.9739	0.9524	0.9110	0.8253	0.6864	0.5040	0.3471	0.3932	0.6355	0.8671	0.9559	0.9785 (89)
MIT 2	17.3930	17.8139	18.4107	19.1053	19.6113	19.8856	19.9577	19.9495	19.7751	19.1016	18.1274	17.3253 (90)
Living area fraction									fLA = Living area / (4) =			0.1408 (91)
MIT	17.6304	18.0331	18.6045	19.2707	19.7594	20.0270	20.0995	20.0905	19.9171	19.2653	18.3318	17.5651 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.4804	17.8831	18.4545	19.1207	19.6094	19.8770	19.9495	19.9405	19.7671	19.1153	18.1818	17.4151 (93)

8. Space heating requirement

Utilisation	Jan 0.9594	Feb 0.9320	Mar 0.8850	Apr 0.7987	May 0.6677	Jun 0.4962	Jul 0.3445	Aug 0.3894	Sep 0.6200	Oct 0.8398	Nov 0.9364	Dec 0.9657 (94)
Useful gains	1154.6724	1364.2655	1508.7380	1548.0741	1395.0977	1023.3211	679.5667	709.7385	1031.5006	1194.4431	1132.3202	1088.2377 (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	2823.2650	2773.6074	2547.2043	2151.0374	1660.7356	1095.9671	695.6628	733.8330	1181.9752	1787.9547	2337.8044	2801.5425 (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	1241.4330	947.0777	772.6189	434.1336	197.6346	0.0000	0.0000	0.0000	0.0000	441.5726	867.9486	1274.6987 (98)
Space heating												6177.1177 (98)
Space heating per m2										(98) / (4) =		33.5749 (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 %)												90.2000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												6848.2458 (211)
Space heating requirement	Jan 1241.4330	Feb 947.0777	Mar 772.6189	Apr 434.1336	May 197.6346	Jun 0.0000	Jul 0.0000	Aug 0.0000	Sep 0.0000	Oct 441.5726	Nov 867.9486	Dec 1274.6987 (98)
Space heating efficiency (main heating system 1)	90.2000	90.2000	90.2000	90.2000	90.2000	0.0000	0.0000	0.0000	0.0000	90.2000	90.2000	90.2000 (210)
Space heating fuel (main heating system)	1376.3115	1049.9753	856.5619	481.3011	219.1071	0.0000	0.0000	0.0000	0.0000	489.5483	962.2490	1413.1915 (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	185.7646	141.7227	116.7471	63.4868	28.5608	11.8541	6.2976	38.4212	69.0792	121.6932	160.7282	184.8711 (64)
Efficiency of water heater (217)m	88.6470	88.6470	88.6340	88.6773	88.6927	79.5000	79.5000	79.5000	79.5000	87.6512	88.3422	79.5000 (216)
Fuel for water heating, kWh/month	209.5553	159.8731	131.7182	71.5931	32.2020	14.9108	7.9216	48.3286	86.8920	138.8380	181.9382	208.4509 (219)
Water heating fuel used												1292.2218 (219)
Annual totals kWh/year												
Space heating fuel - main system												6848.2458 (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)												563.1464 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 1.35 * 1029 * 1.00) =									-1111.5217			-1111.5217 (233)
Total delivered energy for all uses												7717.0923 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	6848.2458	3.4800	238.3190 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1292.2218	3.4800	44.9693 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Pump for solar water heating	50.0000	13.1900	6.5950 (249)
Energy for lighting	563.1464	13.1900	74.2790 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-1111.5217	13.1900	-146.6097 (252)
Total energy cost			347.4451 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.4200 (256)
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FULL SAP CALCULATION PRINTOUT

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CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] = 0.6373 (257)
 SAP value 91.1098
 SAP rating (Section 12) 91 (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	6848.2458	0.2160	1479.2211 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1292.2218	0.2160	279.1199 (264)
Space and water heating			1758.3410 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	563.1464	0.5190	292.2730 (268)
Energy saving/generation technologies			
PV Unit	-1111.5217	0.5190	-576.8797 (269)
Total kg/year			1538.6092 (272)
CO2 emissions per m2			8.3600 (273)
EI value			90.9960
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	93.1200 (1b)	x 2.3100 (2b)	= 215.1072 (1b) - (3b)
First floor	90.8600 (1c)	x 2.4800 (2c)	= 225.3328 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	183.9800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 440.4400 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					5 * 10 = 50.0000 (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) =					50.0000 / (5) = 0.1135 (8)
Pressure test					Yes
Measured/design AP50					4.7700
Infiltration rate					0.3520 (18)
Number of sides sheltered					0 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		1.0000 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3520 (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	0.3696	0.3432	0.3520	0.3344	0.3344	0.3256	0.3168	0.3080	0.2992	0.3256	0.3080	0.3256 (22b)
Effective ac	0.5683	0.5589	0.5620	0.5559	0.5559	0.5530	0.5502	0.5474	0.5448	0.5530	0.5474	0.5530 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid Door			2.1300	0.9000	1.9170		(26)
Window (Uw = 1.40)			23.0300	1.3258	30.5322		(27)
French (Uw = 1.40)			14.1500	1.3258	18.7595		(27)
Heat Loss Floor 1			93.1200	0.1500	13.9680	75.0000	6984.0000 (28a)
100mm Knauf Supafil	185.6200	39.3100	146.3100	0.2500	36.5775	60.0000	8778.6000 (29a)
External Plane Roof	90.8600		90.8600	0.1300	11.8118	9.0000	817.7400 (30)
Bay	2.2600		2.2600	0.1300	0.2938	9.0000	20.3400 (30)
Total net area of external elements Aum(A, m ²)			371.8600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	113.8598		(33)
GF Masonry			70.1300			39.0000	2735.0700 (32c)
GF Timber			65.0500			9.0000	585.4500 (32c)
1F Timber			174.6500			9.0000	1571.8500 (32c)
Internal Floor 1			90.8600			18.0000	1635.4800 (32d)
Internal Floor 1			90.8600			18.0000	1635.4800 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	24764.0100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							134.6016 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							13.0293 (36)
Total fabric heat loss						(33) + (36) =	126.8891 (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	82.6013	81.2335	81.6782	80.8001	80.8001	80.3780	79.9671	79.5675	79.1791	80.3780	79.5675	80.3780 (38)
Heat transfer coeff	209.4904	208.1226	208.5673	207.6893	207.6893	207.2671	206.8562	206.4566	206.0682	207.2671	206.4566	207.2671 (39)
Average = Sum(39)m / 12 =												207.4332 (39)
HLP	1.1387	1.1312	1.1336	1.1289	1.1289	1.1266	1.1243	1.1222	1.1201	1.1266	1.1222	1.1266 (40)
HLP (average)												1.1275 (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												2.9810 (42)
Average daily hot water use (litres/day)												104.9995 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	115.4994	111.2995	107.0995	102.8995	98.6995	94.4995	94.4995	98.6995	102.8995	107.0995	111.2995	115.4994 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Energy content (annual)	171.2823	149.8046	154.5850	134.7709	129.3159	111.5898	103.4043	118.6580	120.0751	139.9360	152.7511	165.8778 (45)
Distribution loss (46)m = 0.15 x (45)m	25.6924	22.4707	23.1877	20.2156	19.3974	16.7385	15.5107	17.7987	18.0113	20.9904	22.9127	1652.0509 (45)
Water storage loss:												
Store volume												250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.6100 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.8694 (55)
Total storage loss	26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514 (56)
If cylinder contains dedicated solar storage	18.8660	17.0402	18.8660	18.2574	18.8660	18.2574	18.8660	18.8660	18.2574	18.8660	18.2574	18.8660 (57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	213.4107	187.8561	195.3176	168.7867	158.6500	139.7525	132.5058	148.6899	155.4417	180.6686	193.5205	208.0062 (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												1.2286 (H8)
Utilisation factor												0.5569 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												127.5000 (H13)
Daily hot water demand												104.9995 (H14)
Volume ratio Veff/V												1.2143 (H15)
Solar storage volume factor												1.0000 (H16)
Solar input												-993.8825 (H17)
Solar input	-32.4229	-46.1032	-79.2404	-106.9136	-125.5765	-134.1355	-131.3146	-117.5306	-92.0183	-63.6183	-38.3477	-26.6610 (63)
Solar input (sum of months) = Sum(63)m =												-993.8825 (63)
Output from w/h	180.9879	141.7528	116.0772	61.8731	33.0735	5.6170	1.1912	31.1594	63.4234	117.0503	155.1728	181.3452 (64)
Total per year (kWh/year) = Sum(64)m =												1088.7237 (64)
Heat gains from water heating, kWh/month	90.6541	80.2512	83.9856	72.0240	66.4648	59.6337	57.6631	63.4793	68.2182	79.1148	83.4053	88.8571 (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	178.8619	178.8619	178.8619	178.8619	178.8619	178.8619	178.8619	178.8619	178.8619	178.8619	178.8619	178.8619	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	79.7192	70.8059	57.5832	43.5942	32.5872	27.5115	29.7271	38.6404	51.8631	65.8521	76.8591	81.9348	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	530.6766	536.1833	522.3065	492.7643	455.4726	420.4236	397.0087	391.5020	405.3789	434.9210	472.2128	507.2617	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.8672	55.8672	55.8672	55.8672	55.8672	55.8672	55.8672	55.8672	55.8672	55.8672	55.8672	55.8672	(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)	-119.2413	-119.2413	-119.2413	-119.2413	-119.2413	-119.2413	-119.2413	-119.2413	-119.2413	-119.2413	-119.2413	-119.2413	(71)
Water heating gains (Table 5)	121.8469	119.4214	112.8839	100.0333	89.3344	82.8247	77.5042	85.3217	94.7475	106.3371	115.8406	119.4315	(72)
Total internal gains	850.7305	844.8985	811.2614	754.8796	695.8820	649.2476	622.7279	633.9519	670.4773	725.5981	783.4004	827.1160	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	Access factor Table 6d	Gains W
North	1.3700	13.4839	0.7100	0.7000	0.7700	6.3625 (74)
Northeast	1.8300	14.6176	0.7100	0.7000	0.7700	9.2134 (75)
Southeast	5.0000	45.1778	0.7100	0.7000	0.7700	77.8010 (77)
South	0.6900	56.7559	0.7100	0.7000	0.7700	13.4881 (78)
Southwest	2.9600	45.1778	0.7100	0.7000	0.7700	46.0582 (79)
West	2.0600	25.1925	0.7100	0.7000	0.7700	17.8743 (80)
Northwest	9.1200	14.6176	0.7100	0.7000	0.7700	45.9158 (81)
Southeast	14.1500	45.1778	0.7100	0.7000	0.7700	220.1767 (77)

Solar gains	436.8898	653.6845	955.8510	1282.2117	1442.1059	1591.3008	1507.3077	1355.2435	1125.2774	795.1397	525.9258	364.7720 (83)
Total gains	1287.6203	1498.5830	1767.1125	2037.0913	2137.9879	2240.5484	2130.0355	1989.1955	1795.7547	1520.7378	1309.3262	1191.8879 (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	32.8363	33.0521	32.9816	33.1211	33.1211	33.1885	33.2545	33.3188	33.3816	33.1885	33.3188	33.1885	
alpha	3.1891	3.2035	3.1988	3.2081	3.2081	3.2126	3.2170	3.2213	3.2254	3.2126	3.2213	3.2126	
util living area	0.9708	0.9537	0.9099	0.8191	0.6850	0.4931	0.3682	0.3914	0.6287	0.8534	0.9477	0.9757 (86)	
MIT	19.2882	19.5144	19.9404	20.4179	20.7567	20.9380	20.9818	20.9784	20.8627	20.4400	19.8140	19.2575 (87)	
Th 2	19.9694	19.9754	19.9735	19.9773	19.9773	19.9792	19.9810	19.9828	19.9845	19.9792	19.9828	19.9792 (88)	

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util rest of house	0.9653	0.9452	0.8934	0.7869	0.6300	0.4157	0.2764	0.2949	0.5523	0.8185	0.9362	0.9710 (89)
MIT 2	17.7088	18.0369	18.6403	19.2985	19.7333	19.9336	19.9725	19.9726	19.8692	19.3469	18.4771	17.6712 (90)
Living area fraction									fLA = Living area / (4) =			0.1408 (91)
MIT	17.9312	18.2449	18.8234	19.4562	19.8774	20.0750	20.1147	20.1142	20.0091	19.5008	18.6654	17.8946 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.7812	18.0949	18.6734	19.3062	19.7274	19.9250	19.9647	19.9642	19.8591	19.3508	18.5154	17.7446 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9483	0.9239	0.8670	0.7623	0.6152	0.4114	0.2749	0.2931	0.5420	0.7923	0.9136	0.9559 (94)	
Useful gains	1221.0284	1384.5170	1532.0887	1552.8269	1315.3584	921.7243	585.5625	582.9392	973.3602	1204.8633	1196.1784	1139.3130 (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	2698.4973	2662.9189	2434.6927	2036.6375	1501.0587	958.6204	592.5712	591.3363	1063.1247	1647.9417	2191.6243	2641.5429 (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	1099.2368	859.0861	671.5374	348.3436	138.1610	0.0000	0.0000	0.0000	0.0000	329.6503	716.7210	1117.6590 (98)	
Space heating												5280.3954 (98)	
Space heating per m2												28.7009 (99)	(98) / (4) =

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.2000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													5854.0968 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1099.2368	859.0861	671.5374	348.3436	138.1610	0.0000	0.0000	0.0000	0.0000	329.6503	716.7210	1117.6590 (98)	
Space heating efficiency (main heating system 1)	90.2000	90.2000	90.2000	90.2000	90.2000	0.0000	0.0000	0.0000	0.0000	90.2000	90.2000	90.2000 (210)	
Space heating fuel (main heating system)	1218.6661	952.4236	744.4982	386.1903	153.1719	0.0000	0.0000	0.0000	0.0000	365.4660	794.5909	1239.0898 (211)	
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)	
Water heating													
Water heating requirement	180.9879	141.7528	116.0772	61.8731	33.0735	5.6170	1.1912	31.1594	63.4234	117.0503	155.1728	181.3452 (64)	
Efficiency of water heater (217)m	88.5158	88.5127	88.4456	88.4053	87.9146	79.5000	79.5000	79.5000	79.5000	87.1273	88.0899	88.5365 (217)	
Fuel for water heating, kWh/month	204.4696	160.1497	131.2414	69.9880	37.6200	7.0654	1.4983	39.1942	79.7778	134.3441	176.1527	204.8254 (219)	
Water heating fuel used												1246.3266 (219)	
Annual totals kWh/year													
Space heating fuel - main system												5854.0968 (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)													563.1464 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.35 * 1156 * 1.00) =										-1248.7291		-1248.7291 (233)	
Total delivered energy for all uses												6539.8407 (238)	

10a. Fuel costs - using BEDF prices (442)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	5854.0968	3.9200	229.4806 (240)	
Space heating - secondary	0.0000	0.0000	0.0000 (242)	
Water heating (other fuel)	1246.3266	3.9200	48.8560 (247)	
Pumps and fans for heating	75.0000	16.9600	12.7200 (249)	
Pump for solar water heating	50.0000	16.9600	8.4800 (249)	
Energy for lighting	563.1464	16.9600	95.5096 (250)	
Additional standing charges			88.0000 (251)	
Energy saving/generation technologies				
PV Unit	-1248.7291	16.9600	-211.7845 (252)	
Total energy cost			271.2618 (255)	

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

Energy	Emission factor	Emissions
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FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

	kWh/year	kg CO2/kWh	kg CO2/year
Space heating - main system 1	5854.0968	0.2160	1264.4849 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1246.3266	0.2160	269.2065 (264)
Space and water heating			1533.6915 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	563.1464	0.5190	292.2730 (268)
Energy saving/generation technologies			
PV Unit	-1248.7291	0.5190	-648.0904 (269)
Total kg/year			1242.7490 (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	5854.0968	1.2200	7141.9982 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1246.3266	1.2200	1520.5184 (264)
Space and water heating			8662.5166 (265)
Pumps and fans	125.0000	3.0700	383.7500 (267)
Energy for lighting	563.1464	3.0700	1728.8595 (268)
Energy saving/generation technologies			
PV Unit	-1248.7291	3.0700	-3833.5984 (269)
Primary energy kWh/year			6941.5276 (272)
Primary energy kWh/m2/year			37.7298 (273)

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

Overheating Calculation Input Data

Dwelling type	Detached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	North West
Overshading	Average or unknown
Thermal mass parameter	134.6 (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	581.38 (P1)
Transmission heat loss coefficient	126.89 (37)
Summer heat loss coefficient	708.27 (P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
North	0.000	1.000	None
North East	0.000	1.000	None
South East	0.000	1.000	None
South	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
North	1.000	0.90	1.000	0.900 (P8)
North East	1.000	0.90	1.000	0.900 (P8)
South East	1.000	0.90	1.000	0.900 (P8)
South	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	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	1.3700	87.1704	0.7100	0.7000	0.9000	48.0763
North East	1.8300	106.0502	0.7100	0.7000	0.9000	78.1275
South East	5.0000	127.3119	0.7100	0.7000	0.9000	256.2597
South	0.6900	118.5567	0.7100	0.7000	0.9000	32.9319
South West	2.9600	127.3119	0.7100	0.7000	0.9000	151.7057
West	2.0600	125.2818	0.7100	0.7000	0.9000	103.8955
North West	9.1200	106.0502	0.7100	0.7000	0.9000	389.3568
South East	14.1500	127.3119	0.7100	0.7000	0.9000	725.2149
total:						1785.5683

	Jun	Jul	Aug	(P3)
Solar gains	1916	1786	1600	
Internal gains	669	642	653	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



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

Total summer gains	2585	2428	2253	(P5)
Summer gain/loss ratio	3.65	3.43	3.18	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 134.6)	1.06	1.06	1.06	
Threshold temperature	20.11	21.79	21.54	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	
Assessment of likelihood of high internal temperature:	Slight			