

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

Property Reference	Plot 25			Issued on Date	05/06/2023
Assessment Reference	plot 25 ham	Prop Type Ref	21809		
Property	44 Alder Avenue, Southampton, SO30 0AS				
SAP Rating	87 B	DER	14.07	TER	18.09
Environmental	89 B	% DER<TER	22.21		
CO ₂ Emissions (t/year)	0.84	DFEE	46.05	TFEE	51.37
General Requirements Compliance	Pass	% DFEE<TFEE	10.35		
Assessor Details	Mr. Patrick McGuigan, JSP Sustainability Ltd, Tel: 01904 435 325, technical@jspsustainability.co.uk			Assessor ID	Y128-0001
Client					

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

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DWELLING AS BUILT

Semi-Detached House, total floor area 86 m²

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

1a TER and DER

Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.09 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 14.07 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)51.4 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)46.1 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.12 (max. 0.25)	0.12 (max. 0.70)	OK
Roof	0.11 (max. 0.20)	0.11 (max. 0.35)	OK
Openings	1.34 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals: 4.76 (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
Ideal LOGIC COMBI ESP1 35
Combi boiler
Efficiency: 89.6% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system:

None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls: Programmer, room thermostat and TRVs OK

Hot water controls:

No cylinder

Boiler interlock

Yes

OK

7 Low energy lights

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

8 Mechanical ventilation

Continuous extract system (decentralised)
Specific fan power: 0.1600 0.1800
Maximum 0.7 OK

9 Summertime temperature

Overheating risk (Southern England): Not significant OK

Based on:

Overshading: Average
Windows facing North: 7.50 m², No overhang
Windows facing South: 4.05 m², No overhang
Windows facing West: 0.65 m², No overhang
Air change rate: 0.00 ach
Blinds/curtains: None

10 Key features

Party wall U-value 0.00 W/m²K
Roof U-value 0.11 W/m²K
Floor U-value 0.12 W/m²K
Door U-value 1.00 W/m²K
Photovoltaic array 0.90 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	42.9000 (1b)	x 2.4500 (2b)	= 105.1050 (1b) - (3b)
First floor	42.9000 (1c)	x 2.6000 (2c)	= 111.5400 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	85.8000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 216.6450 (5)

2. Ventilation rate

					main heating	secondary heating	other		total	m3 per hour		
Number of chimneys					0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues					0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans											0 * 10 =	0.0000 (7a)
Number of passive vents											0 * 10 =	0.0000 (7b)
Number of flueless gas fires											0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =											0.0000 / (5) =	0.0000 (8)
Pressure test											Yes	
Measured/design AP50												4.7600
Infiltration rate												0.2380 (18)
Number of sides sheltered												2 (19)
Shelter factor											(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =	0.2023 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
	0.2579	0.2529	0.2478	0.2225	0.2175	0.1922	0.1922	0.1871	0.2023	0.2175	0.2276	0.2377 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5079	0.5029	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross 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
entrance			2.0000	1.0000	2.0000		(26)
front (Uw = 1.40)			12.2000	1.3258	16.1742		(27)
ground			42.9000	0.1200	5.1480	75.0000	3217.5001 (28a)
external	94.9400	14.2000	80.7400	0.2700	21.7998	150.0000	12111.0003 (29a)
cd	42.9000		42.9000	0.1100	4.7190	9.0000	386.1000 (30)
Total net area of external elements Aum(A, m ²)			180.7400				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	49.8410			(33)
party			44.9500	0.0000	0.0000	45.0000	2022.7500 (32)
stud			156.4000			9.0000	1407.5999 (32c)
internal			42.9000			18.0000	772.2000 (32d)
internal			42.9000			9.0000	386.1000 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 20303.2505 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							236.6346 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.7489 (36)
Total fabric heat loss							(33) + (36) = 57.5900 (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	36.3135	35.9520	35.7464	35.7464	35.7464	35.7464	35.7464	35.7464	35.7464	35.7464	35.7464	35.7464 (38)
Heat transfer coeff	93.9035	93.5420	93.3364	93.3364	93.3364	93.3364	93.3364	93.3364	93.3364	93.3364	93.3364	93.3364 (39)
Average = Sum(39)m / 12 =												93.4008 (39)
HLP	Jan 1.0944	Feb 1.0902	Mar 1.0878	Apr 1.0878	May 1.0878	Jun 1.0878	Jul 1.0878	Aug 1.0878	Sep 1.0878	Oct 1.0878	Nov 1.0878	Dec 1.0878 (40)
HLP (average)												1.0886 (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												2.5638 (42)
Average daily hot water use (litres/day)												95.0893 (43)
Daily hot water use	Jan 104.5983	Feb 100.7947	Mar 96.9911	Apr 93.1875	May 89.3840	Jun 85.5804	Jul 85.5804	Aug 89.3840	Sep 93.1875	Oct 96.9911	Nov 100.7947	Dec 104.5983 (44)

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Energy conte	155.1162	135.6656	139.9948	122.0508	117.1107	101.0576	93.6447	107.4587	108.7421	126.7284	138.3340	150.2218 (45)
Energy content (annual)										Total =	Sum (45)m =	1496.1255 (45)
Distribution loss (46)m = 0.15 x (45)m												
	23.2674	20.3498	20.9992	18.3076	17.5666	15.1586	14.0467	16.1188	16.3113	19.0093	20.7501	22.5333 (46)
Water storage loss:												
Total storage loss												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.1288	12.7509	14.0824	13.5858	14.0078	13.5204	13.9489	13.9871	13.5560	14.0516	13.6448	14.1171 (61)
Total heat required for water heating calculated for each month												
Solar input	169.2451	148.4165	154.0772	135.6366	131.1185	114.5780	107.5936	121.4458	122.2981	140.7800	151.9788	164.3389 (62)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) =	Sum (63)m =			0.0000 (63)
Output from w/h	169.2451	148.4165	154.0772	135.6366	131.1185	114.5780	107.5936	121.4458	122.2981	140.7800	151.9788	164.3389 (64)
								Total per year (kWh/year) =	Sum (64)m =			1661.5070 (64)
Heat gains from water heating, kWh/month												
	55.1084	48.2965	50.0689	43.9783	42.4413	36.9817	34.6241	39.2268	39.5458	45.6501	49.4073	53.4780 (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	128.1881	128.1881	128.1881	128.1881	128.1881	128.1881	128.1881	128.1881	128.1881	128.1881	128.1881	128.1881 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	22.0320	19.5686	15.9143	12.0481	9.0061	7.6033	8.2157	10.6791	14.3334	18.1995	21.2416	22.6443 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	231.1353	233.5338	227.4897	214.6227	198.3803	183.1148	172.9165	170.5180	176.5621	189.4291	205.6715	220.9370 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	35.8188	35.8188	35.8188	35.8188	35.8188	35.8188	35.8188	35.8188	35.8188	35.8188	35.8188	35.8188 (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)												
	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505 (71)
Water heating gains (Table 5)												
	74.0704	71.8699	67.2969	61.0810	57.0447	51.3635	46.5378	52.7242	54.9247	61.3577	68.6212	71.8790 (72)
Total internal gains	391.6941	389.4287	375.1573	352.2083	328.8875	306.5381	292.1264	298.3777	310.2766	333.4428	359.9907	379.9168 (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				7.5000	10.6334	0.4500	0.0000	0.7700			27.6335 (74)	
South				4.0500	46.7521	0.4500	0.0000	0.7700			65.6083 (78)	
West				0.6500	19.6403	0.4500	0.0000	0.7700			4.4235 (80)	
Solar gains	97.6653	168.9119	240.8579	319.6168	380.8402	389.0709	370.4655	322.4909	267.4440	189.0246	117.3733	83.3660 (83)
Total gains	489.3594	558.3406	616.0152	671.8250	709.7278	695.6090	662.5919	620.8686	577.7205	522.4673	477.3640	463.2828 (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	60.0594	60.2916	60.4243	60.4243	60.4243	60.4243	60.4243	60.4243	60.4243	60.4243	60.4243	60.4243
alpha	5.0040	5.0194	5.0283	5.0283	5.0283	5.0283	5.0283	5.0283	5.0283	5.0283	5.0283	5.0283
util living area	0.9980	0.9957	0.9895	0.9689	0.9057	0.7648	0.5973	0.6541	0.8759	0.9790	0.9958	0.9985 (86)
MIT	19.7527	19.9016	20.1397	20.4467	20.7395	20.9245	20.9827	20.9731	20.8404	20.4689	20.0493	19.7214 (87)
Th 2	20.0054	20.0088	20.0108	20.0108	20.0108	20.0108	20.0108	20.0108	20.0108	20.0108	20.0108	20.0108 (88)
util rest of house												
	0.9973	0.9943	0.9859	0.9572	0.8689	0.6795	0.4741	0.5310	0.8143	0.9689	0.9942	0.9980 (89)
MIT 2	18.8656	19.0167	19.2547	19.5551	19.8268	19.9734	20.0059	20.0023	19.9168	19.5804	19.1660	18.8387 (90)
Living area fraction									fLA =	Living area / (4) =		0.1527 (91)
MIT	19.0010	19.1518	19.3898	19.6912	19.9662	20.1186	20.1551	20.1505	20.0578	19.7160	19.3009	18.9735 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.8510	19.0018	19.2398	19.5412	19.8162	19.9686	20.0051	20.0005	19.9078	19.5660	19.1509	18.8235 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9962	0.9923	0.9820	0.9499	0.8601	0.6754	0.4734	0.5297	0.8065	0.9627	0.9922	0.9971 (94)
Useful gains	487.5124	554.0138	604.9308	638.1950	610.4152	469.8279	313.6545	328.8435	465.9165	502.9565	473.6501	461.9435 (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												
	1366.3934	1319.1146	1189.0885	993.2145	757.5360	501.0834	317.8165	336.0611	542.0819	836.8573	1124.7833	1364.9061 (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												
	653.8874	514.1477	434.6134	255.6141	109.4579	0.0000	0.0000	0.0000	0.0000	248.4222	468.8159	671.8041 (98)
Space heating												3356.7627 (98)
Space heating per m2												(98) / (4) = 39.1231 (99)

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8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3709.1301 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	653.8874	514.1477	434.6134	255.6141	109.4579	0.0000	0.0000	0.0000	0.0000	248.4222	468.8159	671.8041	(98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)	722.5276	568.1190	480.2358	282.4465	120.9480	0.0000	0.0000	0.0000	0.0000	274.4997	518.0286	742.3250	(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	169.2451	148.4165	154.0772	135.6366	131.1185	114.5780	107.5936	121.4458	122.2981	140.7800	151.9788	164.3389	(64)
Efficiency of water heater	89.8230	89.7630	89.6400	89.3644	88.7274	87.3000	87.3000	87.3000	87.3000	89.3158	89.6951	87.3000	(216)
Fuel for water heating, kWh/month	188.4206	165.3427	171.8844	151.7792	147.7767	131.2463	123.2459	139.1132	140.0895	157.6205	169.4394	182.8981	(219)
Water heating fuel used												1868.8563	(219)
Annual totals kWh/year													
Space heating fuel - main system												3709.1301	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 9.8800, total flow = 45.0000, SFP = 0.2196)													
mechanical ventilation fans (SFP = 0.2196)													58.0300 (230a)
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													133.0300 (231)
Electricity for lighting (calculated in Appendix L)													389.0918 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.90 * 720 * 1.00) =													-518.0724 (233)
Total delivered energy for all uses													5582.0359 (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	3709.1301	0.2160	801.1721 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1868.8563	0.2160	403.6730 (264)
Space and water heating			1204.8451 (265)
Pumps and fans	133.0300	0.5190	69.0426 (267)
Energy for lighting	389.0918	0.5190	201.9386 (268)
Energy saving/generation technologies			
PV Unit	-518.0724	0.5190	-268.8796 (269)
Total CO2, kg/year			1206.9467 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			14.0700 (273)

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

DER			14.0700 ZC1
Total Floor Area		TFA	85.8000
Assumed number of occupants		N	2.5638
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190
CO2 emissions from appliances, equation (L14)			15.9634 ZC2
CO2 emissions from cooking, equation (L16)			2.1041 ZC3
Total CO2 emissions			32.1375 ZC4
Residual CO2 emissions offset from biofuel CHP			0.0000 ZC5
Additional allowable electricity generation, kWh/m²/year			0.0000 ZC6
Resulting CO2 emissions offset from additional allowable electricity generation			0.0000 ZC7
Net CO2 emissions			32.1375 ZC8

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	42.9000 (1b)	x 2.4500 (2b)	= 105.1050 (1b) - (3b)
First floor	42.9000 (1c)	x 2.6000 (2c)	= 111.5400 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	85.8000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 216.6450 (5)

2. Ventilation rate

										main heating	secondary heating	other	total	m3 per hour			
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																3 * 10 =	30.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000	/ (5) =	0.1385 (8)
Pressure test										Yes							
Measured/design AP50										5.0000							
Infiltration rate										0.3885 (18)							
Number of sides sheltered										2 (19)							
Shelter factor										(20) = 1 - [0.075 x (19)] =					0.8500 (20)		
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =					0.3302 (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	0.4210	0.4128	0.4045	0.3632	0.3550	0.3137	0.3137	0.3054	0.3302	0.3550	0.3715	0.3880	(22b)				
Effective ac	0.5886	0.5852	0.5818	0.5660	0.5630	0.5492	0.5492	0.5466	0.5545	0.5630	0.5690	0.5753	(25)				

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opaque door			2.0000	1.0000	2.0000		(26)					
TER Opening Type (Uw = 1.40)			12.2000	1.3258	16.1742		(27)					
ground			42.9000	0.1300	5.5770		(28a)					
external	94.9400	14.2000	80.7400	0.1800	14.5332		(29a)					
cd	42.9000		42.9000	0.1300	5.5770		(30)					
Total net area of external elements Aum(A, m2)			180.7400				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		43.8614		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.5970 (36)					
Total fabric heat loss						(33) + (36) =	53.4584 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 42.0825	Feb 41.8364	Mar 41.5953	Apr 40.4625	May 40.2506	Jun 39.2640	Jul 39.2640	Aug 39.0813	Sep 39.6440	Oct 40.2506	Nov 40.6793	Dec 41.1276 (38)
Heat transfer coeff	95.5409	95.2949	95.0537	93.9210	93.7090	92.7225	92.7225	92.5398	93.1025	93.7090	94.1378	94.5860 (39)
Average = Sum(39)m / 12 =												93.9200 (39)
HLP	Jan 1.1135	Feb 1.1107	Mar 1.1079	Apr 1.0946	May 1.0922	Jun 1.0807	Jul 1.0807	Aug 1.0786	Sep 1.0851	Oct 1.0922	Nov 1.0972	Dec 1.1024 (40)
HLP (average)												1.0946 (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												2.5638 (42)
Average daily hot water use (litres/day)												95.0893 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	104.5983	100.7947	96.9911	93.1875	89.3840	85.5804	85.5804	89.3840	93.1875	96.9911	100.7947	104.5983 (44)
Energy conte	155.1162	135.6656	139.9948	122.0508	117.1107	101.0576	93.6447	107.4587	108.7421	126.7284	138.3340	150.2218 (45)
Energy content (annual)												Total = Sum(45)m = 1496.1255 (45)
Distribution loss	(46)m = 0.15 x (45)m											
	23.2674	20.3498	20.9992	18.3076	17.5666	15.1586	14.0467	16.1188	16.3113	19.0093	20.7501	22.5333 (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												

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Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Total heat required for water heating calculated for each month	50.9589	46.0274	49.4256	45.9555	45.5491	42.2040	43.6108	45.5491	45.9555	49.4256	49.3151	50.9589 (61)
Solar input	206.0751	181.6930	189.4204	168.0063	162.6598	143.2617	137.2556	153.0078	154.6976	176.1541	187.6491	201.1807 (62)
Output from w/h	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)
Heat gains from water heating, kWh/month	206.0751	181.6930	189.4204	168.0063	162.6598	143.2617	137.2556	153.0078	154.6976	176.1541	187.6491	201.1807 (64)
	64.3159	56.6157	58.9047	52.0708	50.3266	44.1527	42.0396	47.1173	47.6456	54.4936	58.3248	62.6885 (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	128.1881	128.1881	128.1881	128.1881	128.1881	128.1881	128.1881	128.1881	128.1881	128.1881	128.1881	128.1881	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	22.0320	19.5686	15.9143	12.0481	9.0061	7.6033	8.2157	10.6791	14.3334	18.1995	21.2416	22.6443	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	231.1353	233.5338	227.4897	214.6227	198.3803	183.1148	172.9165	170.5180	176.5621	189.4291	205.6715	220.9370	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.8188	35.8188	35.8188	35.8188	35.8188	35.8188	35.8188	35.8188	35.8188	35.8188	35.8188	35.8188	(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)	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	(71)
Water heating gains (Table 5)	86.4461	84.2495	79.1729	72.3205	67.6432	61.3231	56.5048	63.3297	66.1745	73.2441	81.0067	84.2587	(72)
Total internal gains	404.0698	401.8083	387.0334	363.4477	339.4861	316.4977	302.0934	308.9832	321.5264	345.3292	372.3762	392.2964	(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				7.5000	10.6334		0.6300		0.7000	0.7700			24.3728 (74)
South				4.0500	46.7521		0.6300		0.7000	0.7700			57.8666 (78)
West				0.6500	19.6403		0.6300		0.7000	0.7700			3.9015 (80)

Solar gains	86.1408	148.9803	212.4367	281.9020	335.9011	343.1606	326.7506	284.4370	235.8856	166.7197	103.5233	73.5288	(83)
Total gains	490.2106	550.7886	599.4700	645.3498	675.3872	659.6583	628.8440	593.4202	557.4120	512.0489	475.8994	465.8252	(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	62.3642	62.5252	62.6839	63.4399	63.5833	64.2599	64.2599	64.3867	63.9976	63.5833	63.2938	62.9938	
alpha	5.1576	5.1683	5.1789	5.2293	5.2389	5.2840	5.2840	5.2924	5.2665	5.2389	5.2196	5.1996	
util living area	0.9984	0.9968	0.9924	0.9769	0.9257	0.7933	0.6240	0.6775	0.8936	0.9834	0.9968	0.9988	(86)
MIT	19.7812	19.9138	20.1359	20.4405	20.7275	20.9222	20.9827	20.9738	20.8402	20.4789	20.0781	19.7592	(87)
Th 2	19.9898	19.9921	19.9944	20.0052	20.0072	20.0166	20.0166	20.0184	20.0130	20.0072	20.0031	19.9989	(88)
util rest of house	0.9979	0.9957	0.9895	0.9674	0.8930	0.7089	0.4970	0.5520	0.8351	0.9748	0.9954	0.9984	(89)
MIT 2	18.3600	18.5553	18.8805	19.3271	19.7231	19.9604	20.0097	20.0066	19.8751	19.3877	18.8037	18.3343	(90)
Living area fraction	18.5770	18.7627	19.0722	19.4971	19.8764	20.1073	20.1583	20.1543	20.0225	19.5543	18.9983	18.5519	(92)
Temperature adjustment	18.5770	18.7627	19.0722	19.4971	19.8764	20.1073	20.1583	20.1543	20.0225	19.5543	18.9983	18.5519	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	488.6055	547.2807	590.9624	620.1050	599.5202	473.3736	324.6499	338.6466	465.8997	496.3174	472.7437	464.6477	(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	1364.0365	1321.0470	1195.0302	995.2896	766.2061	510.6485	329.9331	347.4187	551.3959	839.0960	1120.0773	1357.4853	(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	651.3207	519.9709	449.4265	270.1329	124.0143	0.0000	0.0000	0.0000	0.0000	255.0273	466.0802	664.2712	(98)
Space heating												3400.2439	(98)
Space heating per m2												39.6299	(99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												93.4000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												3640.5181 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	651.3207	519.9709	449.4265	270.1329	124.0143	0.0000	0.0000	0.0000	0.0000	255.0273	466.0802	664.2712 (98)
Space heating efficiency (main heating system 1)	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000 (210)
Space heating fuel (main heating system)	697.3455	556.7141	481.1846	289.2215	132.7776	0.0000	0.0000	0.0000	0.0000	273.0485	499.0152	711.2112 (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	206.0751	181.6930	189.4204	168.0063	162.6598	143.2617	137.2556	153.0078	154.6976	176.1541	187.6491	201.1807 (64)
Efficiency of water heater	87.7473	87.5486	87.1499	86.2406	84.3782	80.3000	80.3000	80.3000	80.3000	85.9818	87.2499	80.3000 (216)
(217)m												87.8320 (217)
Fuel for water heating, kWh/month	234.8506	207.5340	217.3502	194.8112	192.7747	178.4080	170.9285	190.5452	192.6496	204.8736	215.0707	229.0518 (219)
Water heating fuel used												2428.8481 (219)
Annual totals kWh/year												
Space heating fuel - main system												3640.5181 (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)												389.0918 (232)
Total delivered energy for all uses												6533.4581 (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	3640.5181	0.2160	786.3519 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2428.8481	0.2160	524.6312 (264)
Space and water heating			1310.9831 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	389.0918	0.5190	201.9386 (268)
Total CO2, kg/m2/year			1551.8468 (272)
Emissions per m2 for space and water heating			15.2795 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.3536 (272b)
Emissions per m2 for pumps and fans			0.4537 (272c)
Target Carbon Dioxide Emission Rate (TER) = (15.2795 * 1.00) + 2.3536 + 0.4537, rounded to 2 d.p.			18.0900 (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	42.9000 (1b)	x 2.4500 (2b)	= 105.1050 (1b) - (3b)
First floor	42.9000 (1c)	x 2.6000 (2c)	= 111.5400 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	85.8000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 216.6450 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1385 (8)
Pressure test					Yes
Measured/design AP50					4.7600
Infiltration rate					0.3765 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3200 (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	0.4080	0.4000	0.3920	0.3520	0.3440	0.3040	0.3040	0.2960	0.3200	0.3440	0.3600	0.3760 (22b)
Effective ac	0.5832	0.5800	0.5768	0.5620	0.5592	0.5462	0.5462	0.5438	0.5512	0.5592	0.5648	0.5707 (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
entrance			2.0000	1.0000	2.0000		(26)
front (Uw = 1.40)			12.2000	1.3258	16.1742		(27)
ground			42.9000	0.1200	5.1480	75.0000	3217.5001 (28a)
external	94.9400	14.2000	80.7400	0.2700	21.7998	150.0000	12111.0003 (29a)
cd	42.9000		42.9000	0.1100	4.7190	9.0000	386.1000 (30)
Total net area of external elements Aum(A, m ²)			180.7400				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		49.8410		(33)
party			44.9500	0.0000	0.0000	45.0000	2022.7500 (32)
stud			156.4000			9.0000	1407.5999 (32c)
internal			42.9000			18.0000	772.2000 (32d)
internal			42.9000			9.0000	386.1000 (32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss
(28)...(30) + (32) + (32a)...(32e) = 20303.2505 (34)
236.6346 (35)
7.7489 (36)
(33) + (36) = 57.5900 (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	41.6971	41.4660	41.2395	40.1757	39.9766	39.0501	39.0501	38.8785	39.4070	39.9766	40.3793	40.8002 (38)
Heat transfer coeff	99.2871	99.0560	98.8295	97.7657	97.5666	96.6400	96.6400	96.4685	96.9969	97.5666	97.9693	98.3902 (39)
Average = Sum(39)m / 12 =												97.7647 (39)
HLP	1.1572	1.1545	1.1519	1.1395	1.1371	1.1263	1.1263	1.1243	1.1305	1.1371	1.1418	1.1467 (40)
HLP (average)												1.1394 (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												2.5638 (42)
Average daily hot water use (litres/day)												95.0893 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	104.5983	100.7947	96.9911	93.1875	89.3840	85.5804	85.5804	89.3840	93.1875	96.9911	100.7947	104.5983 (44)
Energy conte	155.1162	135.6656	139.9948	122.0508	117.1107	101.0576	93.6447	107.4587	108.7421	126.7284	138.3340	150.2218 (45)
Energy content (annual)												Total = Sum(45)m = 1496.1255 (45)
Distribution loss (46)m = 0.15 x (45)m												

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	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	32.9622	28.8289	29.7489	25.9358	24.8860	21.4747	19.8995	22.8350	23.1077	26.9298	29.3960	31.9221 (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	128.1881	128.1881	128.1881	128.1881	128.1881	128.1881	128.1881	128.1881	128.1881	128.1881	128.1881	128.1881	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	22.0320	19.5686	15.9143	12.0481	9.0061	7.6033	8.2157	10.6791	14.3334	18.1995	21.2416	22.6443	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	231.1353	233.5338	227.4897	214.6227	198.3803	183.1148	172.9165	170.5180	176.5621	189.4291	205.6715	220.9370	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.8188	35.8188	35.8188	35.8188	35.8188	35.8188	35.8188	35.8188	35.8188	35.8188	35.8188	35.8188	(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)	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	(71)
Water heating gains (Table 5)	44.3040	42.9002	39.9851	36.0219	33.4490	29.8260	26.7466	30.6922	32.0940	36.1960	40.8277	42.9061	(72)
Total internal gains	358.9277	357.4590	344.8455	324.1492	302.2918	282.0006	269.3353	273.3457	284.4459	305.2811	329.1972	347.9438	(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				7.5000	10.6334		0.4500		0.0000		0.7700		27.6335 (74)
South				4.0500	46.7521		0.4500		0.0000		0.7700		65.6083 (78)
West				0.6500	19.6403		0.4500		0.0000		0.7700		4.4235 (80)
Solar gains	97.6653	168.9119	240.8579	319.6168	380.8402	389.0709	370.4655	322.4909	267.4440	189.0246	117.3733	83.3660	(83)
Total gains	456.5931	526.3709	585.7034	643.7659	683.1320	671.0715	639.8007	595.8366	551.8899	494.3056	446.5705	431.3098	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.8029	56.9354	57.0659	57.6868	57.8045	58.3587	58.3587	58.4625	58.1440	57.8045	57.5669	57.3206	
alpha	4.7869	4.7957	4.8044	4.8458	4.8536	4.8906	4.8906	4.8975	4.8763	4.8536	4.8378	4.8214	
util living area	0.9985	0.9967	0.9919	0.9754	0.9231	0.7947	0.6314	0.6903	0.8990	0.9841	0.9969	0.9989	(86)
MIT	19.6279	19.7780	20.0265	20.3644	20.6829	20.9022	20.9756	20.9627	20.8014	20.3948	19.9508	19.6024	(87)
Th 2	19.9544	19.9566	19.9587	19.9687	19.9706	19.9794	19.9794	19.9810	19.9760	19.9706	19.9668	19.9628	(88)
util rest of house	0.9980	0.9956	0.9890	0.9656	0.8902	0.7103	0.5009	0.5622	0.8429	0.9761	0.9957	0.9985	(89)
MIT 2	18.7005	18.8519	19.1009	19.4414	19.7429	19.9298	19.9724	19.9690	19.8558	19.4760	19.0329	18.6817	(90)
Living area fraction									fLA = Living area / (4) =			0.1527	(91)
MIT	18.8421	18.9933	19.2422	19.5823	19.8864	20.0782	20.1256	20.1207	20.0002	19.6162	19.1730	18.8223	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8421	18.9933	19.2422	19.5823	19.8864	20.0782	20.1256	20.1207	20.0002	19.6162	19.1730	18.8223	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9972	0.9942	0.9863	0.9609	0.8870	0.7195	0.5208	0.5813	0.8445	0.9724	0.9944	0.9979	(94)
Ext temp.	455.3295	523.3103	577.6894	618.5990	605.9138	482.8455	333.2202	346.3737	466.0879	480.6386	444.0644	430.4021	(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	1443.8442	1396.0248	1259.3060	1044.3632	798.7184	529.4172	340.7112	358.9300	572.3006	879.6849	1182.7869	1438.6900	(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	735.4550	586.4642	507.1228	306.5503	143.4466	0.0000	0.0000	0.0000	0.0000	296.8904	531.8802	750.1662	(98)
Space heating												3857.9756	(98)
Space heating per m2												(98) / (4) =	44.9648 (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	908.4164	715.1363	733.1603	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8173	0.8905	0.8613	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	742.4733	636.8357	631.4752	0.0000	0.0000	0.0000	0.0000	(102)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	881.1198	842.6034	793.0533	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	99.8255	153.0911	120.2142	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												373.1308 (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	24.9564	38.2728	30.0535	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												93.2827 (107)
Space cooling per m2												1.0872 (108)
Energy for space heating												44.9648 (99)
Energy for space cooling												1.0872 (108)
Total												46.0520 (109)
Dwelling Fabric Energy Efficiency (DFEE)												46.1 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	42.9000 (1b)	x 2.4500 (2b)	= 105.1050 (1b) - (3b)
First floor	42.9000 (1c)	x 2.6000 (2c)	= 111.5400 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	85.8000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 216.6450 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					30.0000 / (5) = 0.1385 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3885 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3302 (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	0.4210	0.4128	0.4045	0.3632	0.3550	0.3137	0.3137	0.3054	0.3302	0.3550	0.3715	0.3880 (22b)
Effective ac	0.5886	0.5852	0.5818	0.5660	0.5630	0.5492	0.5492	0.5466	0.5545	0.5630	0.5690	0.5753 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opaque door			2.0000	1.0000	2.0000		(26)					
TER Opening Type (Uw = 1.40)			12.2000	1.3258	16.1742		(27)					
ground			42.9000	0.1300	5.5770		(28a)					
external	94.9400	14.2000	80.7400	0.1800	14.5332		(29a)					
cd	42.9000		42.9000	0.1300	5.5770		(30)					
Total net area of external elements Aum(A, m2)			180.7400				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	43.8614		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.5970 (36)					
Total fabric heat loss						(33) + (36) =	53.4584 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 42.0825	Feb 41.8364	Mar 41.5953	Apr 40.4625	May 40.2506	Jun 39.2640	Jul 39.2640	Aug 39.0813	Sep 39.6440	Oct 40.2506	Nov 40.6793	Dec 41.1276 (38)
Heat transfer coeff	95.5409	95.2949	95.0537	93.9210	93.7090	92.7225	92.7225	92.5398	93.1025	93.7090	94.1378	94.5860 (39)
Average = Sum(39)m / 12 =												93.9200 (39)
HLP	Jan 1.1135	Feb 1.1107	Mar 1.1079	Apr 1.0946	May 1.0922	Jun 1.0807	Jul 1.0807	Aug 1.0786	Sep 1.0851	Oct 1.0922	Nov 1.0972	Dec 1.1024 (40)
HLP (average)												1.0946 (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												2.5638 (42)
Average daily hot water use (litres/day)												95.0893 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	104.5983	100.7947	96.9911	93.1875	89.3840	85.5804	85.5804	89.3840	93.1875	96.9911	100.7947	104.5983 (44)
Energy conte	155.1162	135.6656	139.9948	122.0508	117.1107	101.0576	93.6447	107.4587	108.7421	126.7284	138.3340	150.2218 (45)
Energy content (annual)											Total = Sum(45)m =	1496.1255 (45)
Distribution loss	(46)m = 0.15 x (45)m											
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Heat gains from water heating, kWh/month	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
	32.9622	28.8289	29.7489	25.9358	24.8860	21.4747	19.8995	22.8350	23.1077	26.9298	29.3960	31.9221 (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	128.1881	128.1881	128.1881	128.1881	128.1881	128.1881	128.1881	128.1881	128.1881	128.1881	128.1881	128.1881	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	22.0320	19.5686	15.9143	12.0481	9.0061	7.6033	8.2157	10.6791	14.3334	18.1995	21.2416	22.6443	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	231.1353	233.5338	227.4897	214.6227	198.3803	183.1148	172.9165	170.5180	176.5621	189.4291	205.6715	220.9370	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.8188	35.8188	35.8188	35.8188	35.8188	35.8188	35.8188	35.8188	35.8188	35.8188	35.8188	35.8188	(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)	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	(71)
Water heating gains (Table 5)	44.3040	42.9002	39.9851	36.0219	33.4490	29.8260	26.7466	30.6922	32.0940	36.1960	40.8277	42.9061	(72)
Total internal gains	358.9277	357.4590	344.8455	324.1492	302.2918	282.0006	269.3353	273.3457	284.4459	305.2811	329.1972	347.9438	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	FF	Access factor Table 6d	Gains W
North	7.5000	10.6334	0.6300		0.7000	0.7700	24.3728 (74)
South	4.0500	46.7521	0.6300		0.7000	0.7700	57.8666 (78)
West	0.6500	19.6403	0.6300		0.7000	0.7700	3.9015 (80)

Solar gains	86.1408	148.9803	212.4367	281.9020	335.9011	343.1606	326.7506	284.4370	235.8856	166.7197	103.5233	73.5288 (83)
Total gains	445.0686	506.4393	557.2822	606.0512	638.1929	625.1612	596.0858	557.7827	520.3315	472.0007	432.7205	421.4726 (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	62.3642	62.5252	62.6839	63.4399	63.5833	64.2599	64.2599	64.3867	63.9976	63.5833	63.2938	62.9938	
alpha	5.1576	5.1683	5.1789	5.2293	5.2389	5.2840	5.2840	5.2924	5.2665	5.2389	5.2196	5.1996	
util living area	0.9990	0.9978	0.9945	0.9822	0.9389	0.8182	0.6523	0.7103	0.9146	0.9883	0.9979	0.9993	(86)
MIT	19.7318	19.8656	20.0910	20.4016	20.6988	20.9092	20.9788	20.9673	20.8155	20.4379	20.0311	19.7105	(87)
Th 2	19.9898	19.9921	19.9944	20.0052	20.0072	20.0166	20.0166	20.0184	20.0130	20.0072	20.0031	19.9989	(88)
util rest of house	0.9987	0.9971	0.9924	0.9746	0.9104	0.7369	0.5225	0.5835	0.8631	0.9820	0.9971	0.9990	(89)
MIT 2	18.8278	18.9632	19.1896	19.5050	19.7888	19.9706	20.0107	20.0080	19.9007	19.5448	19.1375	18.8138	(90)
Living area fraction									fLA = Living area / (4) =			0.1527	(91)
MIT	18.9658	19.1010	19.3272	19.6419	19.9278	20.1139	20.1585	20.1545	20.0404	19.6812	19.2739	18.9507	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9658	19.1010	19.3272	19.6419	19.9278	20.1139	20.1585	20.1545	20.0404	19.6812	19.2739	18.9507	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	444.2483	504.4633	551.9939	588.4756	579.2388	466.4035	323.3207	336.1667	450.0383	462.1670	431.0475	420.8896	(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	1401.1847	1353.2832	1219.2747	1008.8926	771.0151	511.2604	329.9536	347.4373	553.0634	850.9861	1146.0261	1395.2078	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	711.9607	570.4069	496.4569	302.7002	142.6816	0.0000	0.0000	0.0000	0.0000	289.2814	514.7846	724.8928	(98)
Space heating												3753.1651	(98)
Space heating per m2												43.7432	(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	871.5911	686.1462	703.3021	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8182	0.8944	0.8661	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	713.1677	613.6759	609.1320	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	827.4584	791.5080	748.5747	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	82.2893	132.3070	103.7454	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												318.3417	(104)

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Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Cooled fraction											FC = cooled area / (4) =	1.0000 (105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	20.5723	33.0768	25.9363	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												79.5854 (107)
Space cooling per m2												0.9276 (108)
Energy for space heating												43.7432 (99)
Energy for space cooling												0.9276 (108)
Total												44.6708 (109)
Target Fabric Energy Efficiency (TFEE)												51.4 (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	42.9000 (1b)	x 2.4500 (2b)	= 105.1050 (1b) - (3b)
First floor	42.9000 (1c)	x 2.6000 (2c)	= 111.5400 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	85.8000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 216.6450 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour							
										heating	heating										
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)				
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)				
Number of intermittent fans																0 * 10 =	0.0000 (7a)				
Number of passive vents																0 * 10 =	0.0000 (7b)				
Number of flueless gas fires																0 * 40 =	0.0000 (7c)				
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =					0.0000 / (5) =	0.0000 (8)					
Pressure test															Yes						
Measured/design AP50															4.7600						
Infiltration rate															0.2380 (18)						
Number of sides sheltered															2 (19)						
Shelter factor										(20) = 1 - [0.075 x (19)] =					0.8500 (20)						
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =					0.2023 (21)						
										Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.7000	4.4000	4.4000	4.0000	4.1000	3.9000	3.9000	3.8000	3.8000	4.1000	4.0000	4.1000 (22)									
Wind factor	1.1750	1.1000	1.1000	1.0000	1.0250	0.9750	0.9750	0.9500	0.9500	1.0250	1.0000	1.0250 (22a)									
Adj infilt rate	0.2377	0.2225	0.2225	0.2023	0.2074	0.1972	0.1972	0.1922	0.1922	0.2074	0.2023	0.2074 (22b)									
Mechanical extract ventilation - decentralised																					
If mechanical ventilation:										0.5000 (23a)											
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)									

3. Heat losses and heat loss parameter

Element	Gross 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
entrance			2.0000	1.0000	2.0000		(26)
front (Uw = 1.40)			12.2000	1.3258	16.1742		(27)
ground			42.9000	0.1200	5.1480	75.0000	3217.5001 (28a)
external	94.9400	14.2000	80.7400	0.2700	21.7998	150.0000	12111.0003 (29a)
cd	42.9000		42.9000	0.1100	4.7190	9.0000	386.1000 (30)
Total net area of external elements Aum(A, m ²)			180.7400				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	49.8410			(33)
party			44.9500	0.0000	0.0000	45.0000	2022.7500 (32)
stud			156.4000			9.0000	1407.5999 (32c)
internal			42.9000			18.0000	772.2000 (32d)
internal			42.9000			9.0000	386.1000 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 20303.2505 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							236.6346 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.7489 (36)
Total fabric heat loss							(33) + (36) = 57.5900 (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	35.7464	35.7464	35.7464	35.7464	35.7464	35.7464	35.7464	35.7464	35.7464	35.7464	35.7464	35.7464 (38)
Heat transfer coeff	93.3364	93.3364	93.3364	93.3364	93.3364	93.3364	93.3364	93.3364	93.3364	93.3364	93.3364	93.3364 (39)
Average = Sum(39)m / 12 =												93.3364 (39)
HLP	Jan 1.0878	Feb 1.0878	Mar 1.0878	Apr 1.0878	May 1.0878	Jun 1.0878	Jul 1.0878	Aug 1.0878	Sep 1.0878	Oct 1.0878	Nov 1.0878	Dec 1.0878 (40)
HLP (average)												1.0878 (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												2.5638 (42)
Average daily hot water use (litres/day)												95.0893 (43)
Daily hot water use	Jan 104.5983	Feb 100.7947	Mar 96.9911	Apr 93.1875	May 89.3840	Jun 85.5804	Jul 85.5804	Aug 89.3840	Sep 93.1875	Oct 96.9911	Nov 100.7947	Dec 104.5983 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Energy content (annual)	155.1162	135.6656	139.9948	122.0508	117.1107	101.0576	93.6447	107.4587	108.7421	126.7284	138.3340	150.2218 (45)
Distribution loss (46)m = 0.15 x (45)m	23.2674	20.3498	20.9992	18.3076	17.5666	15.1586	14.0467	16.1188	16.3113	19.0093	20.7501	1496.1255 (45)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.1288	12.7509	14.0824	13.5858	14.0078	13.5204	13.9489	13.9871	13.5560	14.0516	13.6448	14.1171 (61)
Total heat required for water heating calculated for each month	169.2451	148.4165	154.0772	135.6366	131.1185	114.5780	107.5936	121.4458	122.2981	140.7800	151.9788	164.3389 (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	169.2451	148.4165	154.0772	135.6366	131.1185	114.5780	107.5936	121.4458	122.2981	140.7800	151.9788	164.3389 (64)
RHI water heating demand	55.1084	48.2965	50.0689	43.9783	42.4413	36.9817	34.6241	39.2268	39.5458	45.6501	49.4073	53.4780 (65)
Heat gains from water heating, kWh/month												
	55.1084	48.2965	50.0689	43.9783	42.4413	36.9817	34.6241	39.2268	39.5458	45.6501	49.4073	53.4780 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	153.8257	153.8257	153.8257	153.8257	153.8257	153.8257	153.8257	153.8257	153.8257	153.8257	153.8257	153.8257 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	55.0800	48.9215	39.7857	30.1203	22.5153	19.0084	20.5392	26.6976	35.8335	45.4989	53.1039	56.6108 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	344.9781	348.5579	339.5369	320.3323	296.0900	273.3057	258.0843	254.5045	263.5255	282.7301	306.9724	329.7567 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.9463	52.9463	52.9463	52.9463	52.9463	52.9463	52.9463	52.9463	52.9463	52.9463	52.9463	52.9463 (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)	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505 (71)
Water heating gains (Table 5)	74.0704	71.8699	67.2969	61.0810	57.0447	51.3635	46.5378	52.7242	54.9247	61.3577	68.6212	71.8790 (72)
Total internal gains	581.3500	576.5708	553.8410	518.7552	482.8716	450.8991	432.3829	441.1479	461.5052	496.8081	535.9190	565.4681 (73)

6. Solar gains

[Jan]												
Area	7.5000	7.5000	7.5000	7.5000	7.5000	7.5000	7.5000	7.5000	7.5000	7.5000	7.5000	7.5000
Solar flux	13.4684	13.4684	13.4684	13.4684	13.4684	13.4684	13.4684	13.4684	13.4684	13.4684	13.4684	13.4684
Specific data	0.4500	0.4500	0.4500	0.4500	0.4500	0.4500	0.4500	0.4500	0.4500	0.4500	0.4500	0.4500
Specific data	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Access factor	0.7700	0.7700	0.7700	0.7700	0.7700	0.7700	0.7700	0.7700	0.7700	0.7700	0.7700	0.7700
Gains	35.0010	35.0010	35.0010	35.0010	35.0010	35.0010	35.0010	35.0010	35.0010	35.0010	35.0010	35.0010
North	7.5000	7.5000	7.5000	7.5000	7.5000	7.5000	7.5000	7.5000	7.5000	7.5000	7.5000	7.5000
South	4.0500	4.0500	4.0500	4.0500	4.0500	4.0500	4.0500	4.0500	4.0500	4.0500	4.0500	4.0500
West	0.6500	0.6500	0.6500	0.6500	0.6500	0.6500	0.6500	0.6500	0.6500	0.6500	0.6500	0.6500
Solar gains	120.0795	177.3495	259.4201	348.9792	393.6446	445.7833	407.5397	368.6162	302.7373	214.6835	143.9513	96.9681 (83)
Total gains	701.4295	753.9203	813.2611	867.7345	876.5162	896.6824	839.9225	809.7641	764.2425	711.4916	679.8703	662.4362 (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	60.4243	60.4243	60.4243	60.4243	60.4243	60.4243	60.4243	60.4243	60.4243	60.4243	60.4243	60.4243
alpha	5.0283	5.0283	5.0283	5.0283	5.0283	5.0283	5.0283	5.0283	5.0283	5.0283	5.0283	5.0283
util living area	0.9859	0.9790	0.9566	0.8928	0.7547	0.5203	0.3652	0.3673	0.6483	0.8915	0.9704	0.9886 (86)
MIT	20.1374	20.2344	20.4532	20.7194	20.9123	20.9891	20.9985	20.9985	20.9685	20.7728	20.4244	20.1058 (87)
Th 2	20.0108	20.0108	20.0108	20.0108	20.0108	20.0108	20.0108	20.0108	20.0108	20.0108	20.0108	20.0108 (88)
util rest of house	0.9815	0.9725	0.9429	0.8596	0.6865	0.4244	0.2566	0.2546	0.5490	0.8492	0.9594	0.9850 (89)
MIT 2	19.2514	19.3463	19.5579	19.8036	19.9607	20.0072	20.0106	20.0106	19.9983	19.8556	19.5334	19.2206 (90)
Living area fraction	19.3867	19.4819	19.6946	19.9434	20.1060	20.1571	20.1614	20.1614	20.1464	19.9956	19.6695	19.3557 (92)
MIT	19.3867	19.4819	19.6946	19.9434	20.1060	20.1571	20.1614	20.1614	20.1464	19.9956	19.6695	19.3557 (92)
Temperature adjustment												-0.1500
adjusted MIT	19.2367	19.3319	19.5446	19.7934	19.9560	20.0071	20.0114	20.0114	19.9964	19.8456	19.5195	19.2057 (93)

8. Space heating requirement

Utilisation	0.9769	0.9666	0.9349	0.8510	0.6824	0.4241	0.2567	0.2547	0.5474	0.8407	0.9524	0.9809 (94)
Useful gains	685.2460	728.7763	760.3136	738.4735	598.1390	380.2653	215.5673	206.2483	418.3648	598.1557	647.4922	649.8056 (95)
Ext temp.	5.6000	6.0000	7.6000	10.1000	13.1000	15.9000	17.7000	17.8000	15.4000	12.1000	8.6000	5.7000 (96)
Heat loss rate W	1272.7980	1244.3473	1114.8694	904.7494	639.9175	383.3432	215.7399	206.4076	429.0126	722.9504	1019.1826	1260.5752 (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	437.1387	346.4637	263.7895	119.7186	31.0832	0.0000	0.0000	0.0000	0.0000	92.8473	267.6171	454.4126 (98)
Space heating												2013.0706 (98)
RHI space heating demand												2013 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	42.9000 (1b)	x 2.4500 (2b)	= 105.1050 (1b) - (3b)
First floor	42.9000 (1c)	x 2.6000 (2c)	= 111.5400 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	85.8000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 216.6450 (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					0 * 10 = 0.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					0.0000 / (5) = 0.0000 (8)
Pressure test					Yes
Measured/design AP50					4.7600
Infiltration rate					0.2380 (18)
Number of sides sheltered					2 (19)
Shelter factor			(20) = 1 - [0.075 x (19)]	=	0.8500 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20)	=	0.2023 (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	0.2579	0.2529	0.2478	0.2225	0.2175	0.1922	0.1922	0.1871	0.2023	0.2175	0.2276	0.2377 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5079	0.5029	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross 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
entrance			2.0000	1.0000	2.0000		(26)
front (Uw = 1.40)			12.2000	1.3258	16.1742		(27)
ground			42.9000	0.1200	5.1480	75.0000	3217.5001 (28a)
external	94.9400	14.2000	80.7400	0.2700	21.7998	150.0000	12111.0003 (29a)
cd	42.9000		42.9000	0.1100	4.7190	9.0000	386.1000 (30)
Total net area of external elements Aum(A, m ²)			180.7400				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	49.8410			(33)
party			44.9500	0.0000	0.0000	45.0000	2022.7500 (32)
stud			156.4000			9.0000	1407.5999 (32c)
internal			42.9000			18.0000	772.2000 (32d)
internal			42.9000			9.0000	386.1000 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	20303.2505 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							236.6346 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.7489 (36)
Total fabric heat loss						(33) + (36) =	57.5900 (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	36.3135	35.9520	35.7464	35.7464	35.7464	35.7464	35.7464	35.7464	35.7464	35.7464	35.7464	35.7464 (38)
Heat transfer coeff	93.9035	93.5420	93.3364	93.3364	93.3364	93.3364	93.3364	93.3364	93.3364	93.3364	93.3364	93.3364 (39)
Average = Sum(39)m / 12 =												93.4008 (39)
HLP	1.0944	1.0902	1.0878	1.0878	1.0878	1.0878	1.0878	1.0878	1.0878	1.0878	1.0878	1.0878 (40)
HLP (average)												1.0886 (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												2.5638 (42)
Average daily hot water use (litres/day)												95.0893 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	104.5983	100.7947	96.9911	93.1875	89.3840	85.5804	85.5804	89.3840	93.1875	96.9911	100.7947	104.5983 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Energy conte	155.1162	135.6656	139.9948	122.0508	117.1107	101.0576	93.6447	107.4587	108.7421	126.7284	138.3340	150.2218 (45)
Energy content (annual)	Total = Sum (45)m =											1496.1255 (45)
Distribution loss (46)m = 0.15 x (45)m	23.2674	20.3498	20.9992	18.3076	17.5666	15.1586	14.0467	16.1188	16.3113	19.0093	20.7501	22.5333 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.1288	12.7509	14.0824	13.5858	14.0078	13.5204	13.9489	13.9871	13.5560	14.0516	13.6448	14.1171 (61)
Total heat required for water heating calculated for each month	169.2451	148.4165	154.0772	135.6366	131.1185	114.5780	107.5936	121.4458	122.2981	140.7800	151.9788	164.3389 (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	169.2451	148.4165	154.0772	135.6366	131.1185	114.5780	107.5936	121.4458	122.2981	140.7800	151.9788	164.3389 (64)
Heat gains from water heating, kWh/month	55.1084	48.2965	50.0689	43.9783	42.4413	36.9817	34.6241	39.2268	39.5458	45.6501	49.4073	53.4780 (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	153.8257	153.8257	153.8257	153.8257	153.8257	153.8257	153.8257	153.8257	153.8257	153.8257	153.8257	153.8257 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	55.0800	48.9215	39.7857	30.1203	22.5153	19.0084	20.5392	26.6976	35.8335	45.4989	53.1039	56.6108 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	344.9781	348.5579	339.5369	320.3323	296.0900	273.3057	258.0843	254.5045	263.5255	282.7301	306.9724	329.7567 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.9463	52.9463	52.9463	52.9463	52.9463	52.9463	52.9463	52.9463	52.9463	52.9463	52.9463	52.9463 (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)	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505 (71)
Water heating gains (Table 5)	74.0704	71.8699	67.2969	61.0810	57.0447	51.3635	46.5378	52.7242	54.9247	61.3577	68.6212	71.8790 (72)
Total internal gains	581.3500	576.5708	553.8410	518.7552	482.8716	450.8991	432.3829	441.1479	461.5052	496.8081	535.9190	565.4681 (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				7.5000	10.6334	0.4500	0.0000		0.7700		27.6335 (74)	
South				4.0500	46.7521	0.4500	0.0000		0.7700		65.6083 (78)	
West				0.6500	19.6403	0.4500	0.0000		0.7700		4.4235 (80)	
Solar gains	97.6653	168.9119	240.8579	319.6168	380.8402	389.0709	370.4655	322.4909	267.4440	189.0246	117.3733	83.3660 (83)
Total gains	679.0153	745.4827	794.6989	838.3720	863.7118	839.9701	802.8484	763.6388	728.9492	685.8327	653.2923	648.8341 (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	60.0594	60.2916	60.4243	60.4243	60.4243	60.4243	60.4243	60.4243	60.4243	60.4243	60.4243	60.4243	
alpha	5.0040	5.0194	5.0283	5.0283	5.0283	5.0283	5.0283	5.0283	5.0283	5.0283	5.0283	5.0283	
util living area	0.9913	0.9850	0.9704	0.9309	0.8362	0.6687	0.5028	0.5482	0.7785	0.9416	0.9840	0.9930 (86)	
MIT	19.9661	20.1078	20.3267	20.5965	20.8314	20.9588	20.9919	20.9876	20.9115	20.6242	20.2430	19.9316 (87)	
Th 2	20.0054	20.0088	20.0108	20.0108	20.0108	20.0108	20.0108	20.0108	20.0108	20.0108	20.0108	20.0108 (88)	
util rest of house	0.9888	0.9805	0.9613	0.9090	0.7863	0.5818	0.3942	0.4373	0.7011	0.9185	0.9784	0.9909 (89)	
MIT 2	19.0774	19.2200	19.4359	19.6928	19.8991	19.9919	20.0086	20.0072	19.9638	19.7234	19.3563	19.0476 (90)	
Living area fraction	fLA = Living area / (4) =												0.1527 (91)
MIT	19.2131	19.3556	19.5719	19.8307	20.0414	20.1395	20.1588	20.1569	20.1085	19.8610	19.4917	19.1826 (92)	
Temperature adjustment													-0.1500
adjusted MIT	19.0631	19.2056	19.4219	19.6807	19.8914	19.9895	20.0088	20.0069	19.9585	19.7110	19.3417	19.0326 (93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9855	0.9758	0.9544	0.9001	0.7795	0.5798	0.3940	0.4368	0.6965	0.9097	0.9733	0.9881 (94)
Useful gains	669.1408	727.4329	758.4994	754.6425	673.2306	486.9859	316.3266	333.5683	507.7118	623.8820	635.8663	641.1243 (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	1386.3033	1338.1705	1206.0818	1006.2359	764.5598	503.0355	318.1624	336.6532	546.8107	850.3862	1142.5950	1384.4217 (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	533.5689	410.4156	333.0013	181.1473	67.9489	0.0000	0.0000	0.0000	0.0000	168.5191	364.8446	553.0133 (98)
Space heating												2612.4591 (98)
Space heating per m2										(98) / (4) =		30.4482 (99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												90.5000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2886.6951	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	533.5689	410.4156	333.0013	181.1473	67.9489	0.0000	0.0000	0.0000	0.0000	168.5191	364.8446	553.0133	(98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)	589.5789	453.4979	367.9573	200.1627	75.0817	0.0000	0.0000	0.0000	0.0000	186.2089	403.1432	611.0644	(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	169.2451	148.4165	154.0772	135.6366	131.1185	114.5780	107.5936	121.4458	122.2981	140.7800	151.9788	164.3389	(64)
Efficiency of water heater	89.7081	89.6275	89.4627	89.1016	88.3665	87.3000	87.3000	87.3000	87.3000	89.0149	89.5349	87.3000	(216)
(217)m	89.7081	89.6275	89.4627	89.1016	88.3665	87.3000	87.3000	87.3000	87.3000	89.0149	89.5349	89.7464	(217)
Fuel for water heating, kWh/month	188.6618	165.5926	172.2251	152.2269	148.3803	131.2463	123.2459	139.1132	140.0895	158.1533	169.7425	183.1148	(219)
Water heating fuel used												1871.7922	(219)
Annual totals kWh/year													
Space heating fuel - main system												2886.6951	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 9.8800, total flow = 45.0000, SFP = 0.2196)													
mechanical ventilation fans (SFP = 0.2196)												58.0300	(230a)
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												133.0300	(231)
Electricity for lighting (calculated in Appendix L)												389.0918	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.90 * 720 * 1.00) =										-518.0724		-518.0724	(233)
Total delivered energy for all uses												4762.5368	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2886.6951	3.4800	100.4570	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1871.7922	3.4800	65.1384	(247)
Mechanical ventilation fans	58.0300	13.1900	7.6542	(249)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	389.0918	13.1900	51.3212	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-518.0724	13.1900	-68.3337	(252)
Total energy cost			286.1295	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	0.9188	(257)
SAP value		87.1832	
SAP rating (Section 12)		87	(258)
SAP band		B	

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2886.6951	0.2160	623.5261	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1871.7922	0.2160	404.3071	(264)
Space and water heating			1027.8333	(265)
Pumps and fans	133.0300	0.5190	69.0426	(267)
Energy for lighting	389.0918	0.5190	201.9386	(268)
Energy saving/generation technologies				
PV Unit	-518.0724	0.5190	-268.8796	(269)
Total kg/year			1029.9349	(272)
CO2 emissions per m2			12.0000	(273)
EI value			89.4487	
EI rating			89	(274)
EI band			B	

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Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

Calculation of stars for heating and DHW

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9050 = 3.845$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9050 = 0.2387$, stars = 4
Water heating energy efficiency	$3.48 / 0.8865 = 3.926$, stars = 4
Water heating environmental impact	$0.216 / 0.8865 = 0.2437$, 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	42.9000 (1b)	x 2.4500 (2b)	= 105.1050 (1b) - (3b)
First floor	42.9000 (1c)	x 2.6000 (2c)	= 111.5400 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	85.8000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 216.6450 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																0 * 10 =	0.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =					0.0000 / (5) =	0.0000 (8)	
Pressure test															Yes		
Measured/design AP50															4.7600		
Infiltration rate															0.2380 (18)		
Number of sides sheltered															2 (19)		
Shelter factor										(20) = 1 - [0.075 x (19)] =					0.8500 (20)		
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =					0.2023 (21)		
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
	4.7000	4.4000	4.4000	4.0000	4.1000	3.9000	3.9000	3.8000	3.8000	4.1000	4.0000	4.1000 (22)					
Wind factor	1.1750	1.1000	1.1000	1.0000	1.0250	0.9750	0.9750	0.9500	0.9500	1.0250	1.0000	1.0250 (22a)					
Adj infilt rate																	
	0.2377	0.2225	0.2225	0.2023	0.2074	0.1972	0.1972	0.1922	0.1922	0.2074	0.2023	0.2074 (22b)					
Mechanical extract ventilation - decentralised																	
If mechanical ventilation:															0.5000 (23a)		
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)					

3. Heat losses and heat loss parameter

Element	Gross 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
entrance			2.0000	1.0000	2.0000		(26)
front (Uw = 1.40)			12.2000	1.3258	16.1742		(27)
ground			42.9000	0.1200	5.1480	75.0000	3217.5001 (28a)
external	94.9400	14.2000	80.7400	0.2700	21.7998	150.0000	12111.0003 (29a)
cd	42.9000		42.9000	0.1100	4.7190	9.0000	386.1000 (30)
Total net area of external elements Aum(A, m ²)			180.7400				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	49.8410			(33)
party			44.9500	0.0000	0.0000	45.0000	2022.7500 (32)
stud			156.4000			9.0000	1407.5999 (32c)
internal			42.9000			18.0000	772.2000 (32d)
internal			42.9000			9.0000	386.1000 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	20303.2505 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							236.6346 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.7489 (36)
Total fabric heat loss						(33) + (36) =	57.5900 (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	35.7464	35.7464	35.7464	35.7464	35.7464	35.7464	35.7464	35.7464	35.7464	35.7464	35.7464	35.7464 (38)
Heat transfer coeff	93.3364	93.3364	93.3364	93.3364	93.3364	93.3364	93.3364	93.3364	93.3364	93.3364	93.3364	93.3364 (39)
Average = Sum(39)m / 12 =												93.3364 (39)
HLP	Jan 1.0878	Feb 1.0878	Mar 1.0878	Apr 1.0878	May 1.0878	Jun 1.0878	Jul 1.0878	Aug 1.0878	Sep 1.0878	Oct 1.0878	Nov 1.0878	Dec 1.0878 (40)
HLP (average)												1.0878 (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												2.5638 (42)
Average daily hot water use (litres/day)												95.0893 (43)
Jan	Jan 104.5983	Feb 100.7947	Mar 96.9911	Apr 93.1875	May 89.3840	Jun 85.5804	Jul 85.5804	Aug 89.3840	Sep 93.1875	Oct 96.9911	Nov 100.7947	Dec 104.5983 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Energy conte	155.1162	135.6656	139.9948	122.0508	117.1107	101.0576	93.6447	107.4587	108.7421	126.7284	138.3340	150.2218 (45)
Energy content (annual)	Total = Sum (45)m =											1496.1255 (45)
Distribution loss (46)m = 0.15 x (45)m	23.2674	20.3498	20.9992	18.3076	17.5666	15.1586	14.0467	16.1188	16.3113	19.0093	20.7501	22.5333 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.1288	12.7509	14.0824	13.5858	14.0078	13.5204	13.9489	13.9871	13.5560	14.0516	13.6448	14.1171 (61)
Total heat required for water heating calculated for each month	169.2451	148.4165	154.0772	135.6366	131.1185	114.5780	107.5936	121.4458	122.2981	140.7800	151.9788	164.3389 (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	169.2451	148.4165	154.0772	135.6366	131.1185	114.5780	107.5936	121.4458	122.2981	140.7800	151.9788	164.3389 (64)
Heat gains from water heating, kWh/month	55.1084	48.2965	50.0689	43.9783	42.4413	36.9817	34.6241	39.2268	39.5458	45.6501	49.4073	53.4780 (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	153.8257	153.8257	153.8257	153.8257	153.8257	153.8257	153.8257	153.8257	153.8257	153.8257	153.8257	153.8257 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	55.0800	48.9215	39.7857	30.1203	22.5153	19.0084	20.5392	26.6976	35.8335	45.4989	53.1039	56.6108 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	344.9781	348.5579	339.5369	320.3323	296.0900	273.3057	258.0843	254.5045	263.5255	282.7301	306.9724	329.7567 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.9463	52.9463	52.9463	52.9463	52.9463	52.9463	52.9463	52.9463	52.9463	52.9463	52.9463	52.9463 (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)	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505 (71)
Water heating gains (Table 5)	74.0704	71.8699	67.2969	61.0810	57.0447	51.3635	46.5378	52.7242	54.9247	61.3577	68.6212	71.8790 (72)
Total internal gains	581.3500	576.5708	553.8410	518.7552	482.8716	450.8991	432.3829	441.1479	461.5052	496.8081	535.9190	565.4681 (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				7.5000	13.4684		0.4500	0.0000	0.7700		35.0010 (74)	
South				4.0500	56.5862		0.4500	0.0000	0.7700		79.4089 (78)	
West				0.6500	25.1733		0.4500	0.0000	0.7700		5.6696 (80)	

Solar gains	120.0795	177.3495	259.4201	348.9792	393.6446	445.7833	407.5397	368.6162	302.7373	214.6835	143.9513	96.9681 (83)
Total gains	701.4295	753.9203	813.2611	867.7345	876.5162	896.6824	839.9225	809.7641	764.2425	711.4916	679.8703	662.4362 (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	60.4243	60.4243	60.4243	60.4243	60.4243	60.4243	60.4243	60.4243	60.4243	60.4243	60.4243	60.4243
alpha	5.0283	5.0283	5.0283	5.0283	5.0283	5.0283	5.0283	5.0283	5.0283	5.0283	5.0283	5.0283
util living area	0.9859	0.9790	0.9566	0.8928	0.7547	0.5203	0.3652	0.3673	0.6483	0.8915	0.9704	0.9886 (86)
MIT	20.1374	20.2344	20.4532	20.7194	20.9123	20.9891	20.9985	20.9985	20.9685	20.7728	20.4244	20.1058 (87)
Th 2	20.0108	20.0108	20.0108	20.0108	20.0108	20.0108	20.0108	20.0108	20.0108	20.0108	20.0108	20.0108 (88)
util rest of house	0.9815	0.9725	0.9429	0.8596	0.6865	0.4244	0.2566	0.2546	0.5490	0.8492	0.9594	0.9850 (89)
MIT 2	19.2514	19.3463	19.5579	19.8036	19.9607	20.0072	20.0106	20.0106	19.9983	19.8556	19.5334	19.2206 (90)
Living area fraction	19.3867	19.4819	19.6946	19.9434	20.1060	20.1571	20.1614	20.1614	20.1464	19.9956	19.6695	19.3557 (91)
MIT	19.3867	19.4819	19.6946	19.9434	20.1060	20.1571	20.1614	20.1614	20.1464	19.9956	19.6695	19.3557 (92)
Temperature adjustment	19.2367	19.3319	19.5446	19.7934	19.9560	20.0071	20.0114	20.0114	19.9964	19.8456	19.5195	19.2057 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	685.2460	728.7763	760.3136	738.4735	598.1390	380.2653	215.5673	206.2483	418.3648	598.1557	647.4922	649.8056 (95)
Ext temp.	5.6000	6.0000	7.6000	10.1000	13.1000	15.9000	17.7000	17.8000	15.4000	12.1000	8.6000	5.7000 (96)
Heat loss rate W	1272.7980	1244.3473	1114.8694	904.7494	639.9175	383.3432	215.7399	206.4076	429.0126	722.9504	1019.1826	1260.5752 (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	437.1387	346.4637	263.7895	119.7186	31.0832	0.0000	0.0000	0.0000	0.0000	92.8473	267.6171	454.4126 (98)
Space heating												2013.0706 (98)
Space heating per m ²												(98) / (4) = 23.4624 (99)

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

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													2224.3874 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	437.1387	346.4637	263.7895	119.7186	31.0832	0.0000	0.0000	0.0000	0.0000	92.8473	267.6171	454.4126	(98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)	483.0261	382.8328	291.4801	132.2858	34.3461	0.0000	0.0000	0.0000	0.0000	102.5936	295.7095	502.1134	(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	169.2451	148.4165	154.0772	135.6366	131.1185	114.5780	107.5936	121.4458	122.2981	140.7800	151.9788	164.3389	(64)
Efficiency of water heater	89.5835	89.5159	89.2931	88.7716	87.8956	87.3000	87.3000	87.3000	87.3000	88.5442	89.3142	87.3000	(216)
(217)m	89.5835	89.5159	89.2931	88.7716	87.8956	87.3000	87.3000	87.3000	87.3000	88.5442	89.3142	89.6274	(217)
Fuel for water heating, kWh/month	188.9244	165.7990	172.5521	152.7928	149.1753	131.2463	123.2459	139.1132	140.0895	158.9939	170.1620	183.3578	(219)
Water heating fuel used	1875.4519											1875.4519	(219)
Annual totals kWh/year													
Space heating fuel - main system												2224.3874	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 9.8800, total flow = 45.0000, SFP = 0.2196)													
mechanical ventilation fans (SFP = 0.2196)												58.0300	(230a)
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												133.0300	(231)
Electricity for lighting (calculated in Appendix L)												389.0918	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.90 * 842 * 1.00) =										-605.9410		-605.9410	(233)
Total delivered energy for all uses												4016.0202	(238)

10a. Fuel costs - using BEDF prices (516)

	Fuel	Fuel price	Fuel cost
	kWh/year	p/kWh	£/year
Space heating - main system 1	2224.3874	9.7400	216.6553 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1875.4519	9.7400	182.6690 (247)
Mechanical ventilation fans	58.0300	36.8500	21.3841 (249)
Pumps and fans for heating	75.0000	36.8500	27.6375 (249)
Energy for lighting	389.0918	36.8500	143.3803 (250)
Additional standing charges			104.0000 (251)
Energy saving/generation technologies			
PV Unit	-605.9410	36.8500	-223.2893 (252)
Total energy cost			472.4370 (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	2224.3874	0.2160	480.4677 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1875.4519	0.2160	405.0976 (264)
Space and water heating			885.5653 (265)
Pumps and fans	133.0300	0.5190	69.0426 (267)
Energy for lighting	389.0918	0.5190	201.9386 (268)
Energy saving/generation technologies			
PV Unit	-605.9410	0.5190	-314.4834 (269)
Total kg/year			842.0632 (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	2224.3874	1.2200	2713.7527 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1875.4519	1.2200	2288.0513 (264)
Space and water heating			5001.8040 (265)
Pumps and fans	133.0300	3.0700	408.4023 (267)
Energy for lighting	389.0918	3.0700	1194.5118 (268)
Energy saving/generation technologies			

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

PV Unit -605.9410 3.0700 -1860.2389 (269)
Primary energy kWh/year 4744.4792 (272)
Primary energy kWh/m2/year 55.2970 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 87
Current environmental impact rating: B 89

(For testing purposes):

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

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.2	-£ 78	-188 kg (22.4%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£78 2.20 kg/m²	B 88	B 91
Total Savings	£78 2.20 kg/m²		

Potential energy efficiency rating: B 88
Potential environmental impact rating: B 91

Fuel prices for cost data on this page from database revision number 516 TEST (28 Apr 2023)
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	£192	£211	-£19
Mains gas	£503	£407	£97
Space heating	£370	£370	£0
Water heating	£183	£104	£78
Lighting	£143	£143	£0
Generated (PV)	-£223	-£223	£0
Total cost of fuels	£472	£395	£79
Total cost of uses	£473	£394	£78
Delivered energy	47 kWh/m²	36 kWh/m²	11 kWh/m²
Carbon dioxide emissions	0.8 tonnes	0.7 tonnes	0.2 tonnes
CO2 emissions per m²	10 kg/m²	8 kg/m²	2 kg/m²
Primary energy	55 kWh/m²	43 kWh/m²	12 kWh/m²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	42.9000 (1b)	x 2.4500 (2b)	= 105.1050 (1b) - (3b)
First floor	42.9000 (1c)	x 2.6000 (2c)	= 111.5400 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	85.8000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 216.6450 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																0 * 10 =	0.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =					0.0000 / (5) =	0.0000 (8)	
Pressure test															Yes		
Measured/design AP50															4.7600		
Infiltration rate															0.2380 (18)		
Number of sides sheltered															2 (19)		
Shelter factor										(20) = 1 - [0.075 x (19)] =					0.8500 (20)		
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =					0.2023 (21)		
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)					
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)					
Adj infilt rate																	
	0.2579	0.2529	0.2478	0.2225	0.2175	0.1922	0.1922	0.1871	0.2023	0.2175	0.2276	0.2377 (22b)					
Mechanical extract ventilation - decentralised																	
If mechanical ventilation:															0.5000 (23a)		
Effective ac	0.5079	0.5029	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)					

3. Heat losses and heat loss parameter

Element	Gross 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
entrance			2.0000	1.0000	2.0000		(26)
front (Uw = 1.40)			12.2000	1.3258	16.1742		(27)
ground			42.9000	0.1200	5.1480	75.0000	3217.5001 (28a)
external	94.9400	14.2000	80.7400	0.2700	21.7998	150.0000	12111.0003 (29a)
cd	42.9000		42.9000	0.1100	4.7190	9.0000	386.1000 (30)
Total net area of external elements Aum(A, m ²)			180.7400				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	49.8410			(33)
party			44.9500	0.0000	0.0000	45.0000	2022.7500 (32)
stud			156.4000			9.0000	1407.5999 (32c)
internal			42.9000			18.0000	772.2000 (32d)
internal			42.9000			9.0000	386.1000 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	20303.2505 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							236.6346 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.7489 (36)
Total fabric heat loss						(33) + (36) =	57.5900 (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	36.3135	35.9520	35.7464	35.7464	35.7464	35.7464	35.7464	35.7464	35.7464	35.7464	35.7464	35.7464 (38)
Heat transfer coeff	93.9035	93.5420	93.3364	93.3364	93.3364	93.3364	93.3364	93.3364	93.3364	93.3364	93.3364	93.3364 (39)
Average = Sum(39)m / 12 =												93.4008 (39)
HLP	Jan 1.0944	Feb 1.0902	Mar 1.0878	Apr 1.0878	May 1.0878	Jun 1.0878	Jul 1.0878	Aug 1.0878	Sep 1.0878	Oct 1.0878	Nov 1.0878	Dec 1.0878 (40)
HLP (average)												1.0886 (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												2.5638 (42)
Average daily hot water use (litres/day)												95.0893 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	104.5983	100.7947	96.9911	93.1875	89.3840	85.5804	85.5804	89.3840	93.1875	96.9911	100.7947	104.5983 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Energy content (annual)	155.1162	135.6656	139.9948	122.0508	117.1107	101.0576	93.6447	107.4587	108.7421	126.7284	138.3340	150.2218 (45)
Distribution loss (46)m = 0.15 x (45)m	23.2674	20.3498	20.9992	18.3076	17.5666	15.1586	14.0467	16.1188	16.3113	19.0093	20.7501	22.5333 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.1288	12.7509	14.0824	13.5858	14.0078	13.5204	13.9489	13.9871	13.5560	14.0516	13.6448	14.1171 (61)
Total heat required for water heating calculated for each month	169.2451	148.4165	154.0772	135.6366	131.1185	114.5780	107.5936	121.4458	122.2981	140.7800	151.9788	164.3389 (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												1.2122 (H8)
Utilisation factor												0.5617 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												95.0893 (H14)
Volume ratio Veff/V												0.7887 (H15)
Solar storage volume factor												0.9525 (H16)
Solar input												-853.2830 (H17)
Solar input	-24.7435	-41.2898	-70.3213	-94.2443	-116.4309	-114.4702	-112.9574	-98.6914	-77.2952	-52.7835	-29.3494	-20.7061 (63)
Solar input (sum of months) = Sum (63)m =												-853.2830 (63)
Output from w/h	144.5015	107.1267	83.7560	41.3923	14.6875	0.1078	0.0000	22.7543	45.0029	87.9965	122.6294	143.6328 (64)
Total per year (kWh/year) = Sum (64)m =												813.5878 (64)
Heat gains from water heating, kWh/month	55.1084	48.2965	50.0689	43.9783	42.4413	36.9817	34.6241	39.2268	39.5458	45.6501	49.4073	53.4780 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(66)
(66)m	153.8257	153.8257	153.8257	153.8257	153.8257	153.8257	153.8257	153.8257	153.8257	153.8257	153.8257	153.8257	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	55.0800	48.9215	39.7857	30.1203	22.5153	19.0084	20.5392	26.6976	35.8335	45.4989	53.1039	56.6108	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	344.9781	348.5579	339.5369	320.3323	296.0900	273.3057	258.0843	254.5045	263.5255	282.7301	306.9724	329.7567	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.9463	52.9463	52.9463	52.9463	52.9463	52.9463	52.9463	52.9463	52.9463	52.9463	52.9463	52.9463	(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)	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	(71)
Water heating gains (Table 5)	74.0704	71.8699	67.2969	61.0810	57.0447	51.3635	46.5378	52.7242	54.9247	61.3577	68.6212	71.8790	(72)
Total internal gains	581.3500	576.5708	553.8410	518.7552	482.8716	450.8991	432.3829	441.1479	461.5052	496.8081	535.9190	565.4681	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
North				7.5000	10.6334		0.4500		0.0000		0.7700		27.6335 (74)
South				4.0500	46.7521		0.4500		0.0000		0.7700		65.6083 (78)
West				0.6500	19.6403		0.4500		0.0000		0.7700		4.4235 (80)
Solar gains	97.6653	168.9119	240.8579	319.6168	380.8402	389.0709	370.4655	322.4909	267.4440	189.0246	117.3733		83.3660 (83)
Total gains	679.0153	745.4827	794.6989	838.3720	863.7118	839.9701	802.8484	763.6388	728.9492	685.8327	653.2923		648.8341 (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	60.0594	60.2916	60.4243	60.4243	60.4243	60.4243	60.4243	60.4243	60.4243	60.4243	60.4243	60.4243
alpha	5.0040	5.0194	5.0283	5.0283	5.0283	5.0283	5.0283	5.0283	5.0283	5.0283	5.0283	5.0283
util living area	0.9913	0.9850	0.9704	0.9309	0.8362	0.6687	0.5028	0.5482	0.7785	0.9416	0.9840	0.9930 (86)
MIT	19.9661	20.1078	20.3267	20.5965	20.8314	20.9588	20.9919	20.9876	20.9115	20.6242	20.2430	19.9316 (87)
Th 2	20.0054	20.0088	20.0108	20.0108	20.0108	20.0108	20.0108	20.0108	20.0108	20.0108	20.0108	20.0108 (88)
util rest of house	0.9888	0.9805	0.9613	0.9090	0.7863	0.5818	0.3942	0.4373	0.7011	0.9185	0.9784	0.9909 (89)
MIT 2	19.0774	19.2200	19.4359	19.6928	19.8991	19.9919	20.0086	20.0072	19.9638	19.7234	19.3563	19.0476 (90)
Living area fraction									fLA = Living area / (4) =			0.1527 (91)
MIT	19.2131	19.3556	19.5719	19.8307	20.0414	20.1395	20.1588	20.1569	20.1085	19.8610	19.4917	19.1826 (92)
Temperature adjustment												-0.1500
adjusted MIT	19.0631	19.2056	19.4219	19.6807	19.8914	19.9895	20.0088	20.0069	19.9585	19.7110	19.3417	19.0326 (93)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9855	0.9758	0.9544	0.9001	0.7795	0.5798	0.3940	0.4368	0.6965	0.9097	0.9733	0.9881	(94)
Useful gains	669.1408	727.4329	758.4994	754.6425	673.2306	486.9859	316.3266	333.5683	507.7118	623.8820	635.8663	641.1243	(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	1386.3033	1338.1705	1206.0818	1006.2359	764.5598	503.0355	318.1624	336.6532	546.8107	850.3862	1142.5950	1384.4217	(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	533.5689	410.4156	333.0013	181.1473	67.9489	0.0000	0.0000	0.0000	0.0000	168.5191	364.8446	553.0133	(98)
Space heating												2612.4591	(98)
Space heating per m2												30.4482	(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 %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													2886.6951 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	533.5689	410.4156	333.0013	181.1473	67.9489	0.0000	0.0000	0.0000	0.0000	168.5191	364.8446	553.0133	(98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)	589.5789	453.4979	367.9573	200.1627	75.0817	0.0000	0.0000	0.0000	0.0000	186.2089	403.1432	611.0644	(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	144.5015	107.1267	83.7560	41.3923	14.6875	0.1078	0.0000	22.7543	45.0029	87.9965	122.6294	143.6328	(64)
Efficiency of water heater	89.7985	89.8185	89.8382	89.8872	89.9142	87.3000	87.3000	87.3000	87.3000	89.3761	89.6731	87.3000	(216)
(217)m	89.7985	89.8185	89.8382	89.8872	89.9142	87.3000	87.3000	87.3000	87.3000	89.3761	89.6731	89.8212	(217)
Fuel for water heating, kWh/month	160.9175	119.2702	93.2298	46.0491	16.3351	0.1235	0.0000	26.0645	51.5497	98.4563	136.7516	159.9097	(219)
Water heating fuel used												908.6571	(219)
Annual totals kWh/year													
Space heating fuel - main system												2886.6951	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 9.8800, total flow = 45.0000, SFP = 0.2196)													
mechanical ventilation fans (SFP = 0.2196)													58.0300 (230a)
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													183.0300 (231)
Electricity for lighting (calculated in Appendix L)													389.0918 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.90 * 720 * 1.00) =										-518.0724		-518.0724	(233)
Total delivered energy for all uses												3849.4016	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2886.6951	3.4800	100.4570	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	908.6571	3.4800	31.6213	(247)
Mechanical ventilation fans	58.0300	13.1900	7.6542	(249)
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	389.0918	13.1900	51.3212	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-518.0724	13.1900	-68.3337	(252)
Total energy cost			259.2074	(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] =	0.8323	(257)
SAP value		88.3892	
SAP rating (Section 12)		88	(258)
SAP band		B	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	2886.6951	0.2160	623.5261 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	908.6571	0.2160	196.2699 (264)
Space and water heating			819.7961 (265)
Pumps and fans	183.0300	0.5190	94.9926 (267)
Energy for lighting	389.0918	0.5190	201.9386 (268)
Energy saving/generation technologies			
PV Unit	-518.0724	0.5190	-268.8796 (269)
Total kg/year			847.8477 (272)
CO2 emissions per m2			9.8800 (273)
EI value			91.3141
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	42.9000 (1b)	x 2.4500 (2b)	= 105.1050 (1b) - (3b)
First floor	42.9000 (1c)	x 2.6000 (2c)	= 111.5400 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	85.8000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 216.6450 (5)

2. Ventilation rate

					main heating	secondary heating	other		total	m3 per hour		
Number of chimneys					0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues					0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans											0 * 10 =	0.0000 (7a)
Number of passive vents											0 * 10 =	0.0000 (7b)
Number of flueless gas fires											0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =											0.0000 / (5) =	0.0000 (8)
Pressure test											Yes	
Measured/design AP50												4.7600
Infiltration rate												0.2380 (18)
Number of sides sheltered												2 (19)
Shelter factor											(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =	0.2023 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	4.7000	4.4000	4.4000	4.0000	4.1000	3.9000	3.9000	3.8000	3.8000	4.1000	4.0000	4.1000 (22)
Wind factor	1.1750	1.1000	1.1000	1.0000	1.0250	0.9750	0.9750	0.9500	0.9500	1.0250	1.0000	1.0250 (22a)
Adj infilt rate												
	0.2377	0.2225	0.2225	0.2023	0.2074	0.1972	0.1972	0.1922	0.1922	0.2074	0.2023	0.2074 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross 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
entrance			2.0000	1.0000	2.0000		(26)
front (Uw = 1.40)			12.2000	1.3258	16.1742		(27)
ground			42.9000	0.1200	5.1480	75.0000	3217.5001 (28a)
external	94.9400	14.2000	80.7400	0.2700	21.7998	150.0000	12111.0003 (29a)
cd	42.9000		42.9000	0.1100	4.7190	9.0000	386.1000 (30)
Total net area of external elements Aum(A, m ²)			180.7400				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	49.8410			(33)
party			44.9500	0.0000	0.0000	45.0000	2022.7500 (32)
stud			156.4000			9.0000	1407.5999 (32c)
internal			42.9000			18.0000	772.2000 (32d)
internal			42.9000			9.0000	386.1000 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	20303.2505 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							236.6346 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.7489 (36)
Total fabric heat loss						(33) + (36) =	57.5900 (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	35.7464	35.7464	35.7464	35.7464	35.7464	35.7464	35.7464	35.7464	35.7464	35.7464	35.7464	35.7464 (38)
Heat transfer coeff	93.3364	93.3364	93.3364	93.3364	93.3364	93.3364	93.3364	93.3364	93.3364	93.3364	93.3364	93.3364 (39)
Average = Sum(39)m / 12 =												93.3364 (39)
HLP	Jan 1.0878	Feb 1.0878	Mar 1.0878	Apr 1.0878	May 1.0878	Jun 1.0878	Jul 1.0878	Aug 1.0878	Sep 1.0878	Oct 1.0878	Nov 1.0878	Dec 1.0878 (40)
HLP (average)												1.0878 (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												2.5638 (42)
Average daily hot water use (litres/day)												95.0893 (43)
Daily hot water use	Jan 104.5983	Feb 100.7947	Mar 96.9911	Apr 93.1875	May 89.3840	Jun 85.5804	Jul 85.5804	Aug 89.3840	Sep 93.1875	Oct 96.9911	Nov 100.7947	Dec 104.5983 (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)	155.1162	135.6656	139.9948	122.0508	117.1107	101.0576	93.6447	107.4587	108.7421	126.7284	138.3340	150.2218 (45)
Distribution loss (46)m = 0.15 x (45)m	23.2674	20.3498	20.9992	18.3076	17.5666	15.1586	14.0467	16.1188	16.3113	19.0093	20.7501	22.5333 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.1288	12.7509	14.0824	13.5858	14.0078	13.5204	13.9489	13.9871	13.5560	14.0516	13.6448	14.1171 (61)
Total heat required for water heating calculated for each month	169.2451	148.4165	154.0772	135.6366	131.1185	114.5780	107.5936	121.4458	122.2981	140.7800	151.9788	164.3389 (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												1206.0102 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												2026.0972 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.3542 (H8)
Utilisation factor												0.5221 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												95.0893 (H14)
Volume ratio Veff/V												0.7887 (H15)
Solar storage volume factor												0.9525 (H16)
Solar input												-886.0488 (H17)
Solar input	-28.9129	-41.1174	-71.3493	-95.9768	-111.5315	-121.3139	-115.0241	-104.8908	-82.0978	-56.7431	-34.1974	-22.8937 (63)
Solar input (sum of months) = Sum (63)m =												-886.0488 (63)
Output from w/h	140.3321	107.2991	82.7280	39.6598	19.5869	0.0000	0.0000	16.5549	40.2003	84.0369	117.7814	141.4452 (64)
Total per year (kWh/year) = Sum (64)m =												789.6247 (64)
Heat gains from water heating, kWh/month	55.1084	48.2965	50.0689	43.9783	42.4413	36.9817	34.6241	39.2268	39.5458	45.6501	49.4073	53.4780 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(66)
(66)m	153.8257	153.8257	153.8257	153.8257	153.8257	153.8257	153.8257	153.8257	153.8257	153.8257	153.8257	153.8257	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	55.0800	48.9215	39.7857	30.1203	22.5153	19.0084	20.5392	26.6976	35.8335	45.4989	53.1039	56.6108	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	344.9781	348.5579	339.5369	320.3323	296.0900	273.3057	258.0843	254.5045	263.5255	282.7301	306.9724	329.7567	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.9463	52.9463	52.9463	52.9463	52.9463	52.9463	52.9463	52.9463	52.9463	52.9463	52.9463	52.9463	(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)	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	(71)
Water heating gains (Table 5)	74.0704	71.8699	67.2969	61.0810	57.0447	51.3635	46.5378	52.7242	54.9247	61.3577	68.6212	71.8790	(72)
Total internal gains	581.3500	576.5708	553.8410	518.7552	482.8716	450.8991	432.3829	441.1479	461.5052	496.8081	535.9190	565.4681	(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				7.5000	13.4684		0.4500	0.0000	0.7700		35.0010 (74)	
South				4.0500	56.5862		0.4500	0.0000	0.7700		79.4089 (78)	
West				0.6500	25.1733		0.4500	0.0000	0.7700		5.6696 (80)	

Solar gains	120.0795	177.3495	259.4201	348.9792	393.6446	445.7833	407.5397	368.6162	302.7373	214.6835	143.9513	96.9681 (83)
Total gains	701.4295	753.9203	813.2611	867.7345	876.5162	896.6824	839.9225	809.7641	764.2425	711.4916	679.8703	662.4362 (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	60.4243	60.4243	60.4243	60.4243	60.4243	60.4243	60.4243	60.4243	60.4243	60.4243	60.4243	60.4243	
alpha	5.0283	5.0283	5.0283	5.0283	5.0283	5.0283	5.0283	5.0283	5.0283	5.0283	5.0283	5.0283	
util living area	0.9859	0.9790	0.9566	0.8928	0.7547	0.5203	0.3652	0.3673	0.6483	0.8915	0.9704	0.9886 (86)	
MIT	20.1374	20.2344	20.4532	20.7194	20.9123	20.9891	20.9985	20.9985	20.9685	20.7728	20.4244	20.1058 (87)	
Th 2	20.0108	20.0108	20.0108	20.0108	20.0108	20.0108	20.0108	20.0108	20.0108	20.0108	20.0108	20.0108 (88)	
util rest of house	0.9815	0.9725	0.9429	0.8596	0.6865	0.4244	0.2566	0.2546	0.5490	0.8492	0.9594	0.9850 (89)	
MIT 2	19.2514	19.3463	19.5579	19.8036	19.9607	20.0072	20.0106	20.0106	19.9983	19.8556	19.5334	19.2206 (90)	
Living area fraction													fLA = Living area / (4) = 0.1527 (91)
MIT	19.3867	19.4819	19.6946	19.9434	20.1060	20.1571	20.1614	20.1614	20.1464	19.9956	19.6695	19.3557 (92)	
Temperature adjustment													-0.1500
adjusted MIT	19.2367	19.3319	19.5446	19.7934	19.9560	20.0071	20.0114	20.0114	19.9964	19.8456	19.5195	19.2057 (93)	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9769	0.9666	0.9349	0.8510	0.6824	0.4241	0.2567	0.2547	0.5474	0.8407	0.9524	0.9809	(94)
Useful gains	685.2460	728.7763	760.3136	738.4735	598.1390	380.2653	215.5673	206.2483	418.3648	598.1557	647.4922	649.8056	(95)
Ext temp.	5.6000	6.0000	7.6000	10.1000	13.1000	15.9000	17.7000	17.8000	15.4000	12.1000	8.6000	5.7000	(96)
Heat loss rate W	1272.7980	1244.3473	1114.8694	904.7494	639.9175	383.3432	215.7399	206.4076	429.0126	722.9504	1019.1826	1260.5752	(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	437.1387	346.4637	263.7895	119.7186	31.0832	0.0000	0.0000	0.0000	0.0000	92.8473	267.6171	454.4126	(98)
Space heating												2013.0706	(98)
Space heating per m2											(98) / (4) =	23.4624	(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 %)													90.5000	(206)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement													2224.3874	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	437.1387	346.4637	263.7895	119.7186	31.0832	0.0000	0.0000	0.0000	0.0000	92.8473	267.6171	454.4126	(98)	
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)	
Space heating fuel (main heating system)	483.0261	382.8328	291.4801	132.2858	34.3461	0.0000	0.0000	0.0000	0.0000	102.5936	295.7095	502.1134	(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	140.3321	107.2991	82.7280	39.6598	19.5869	0.0000	0.0000	16.5549	40.2003	84.0369	117.7814	141.4452	(64)	
Efficiency of water heater	89.7010	89.7223	89.7149	89.6820	89.2356	87.3000	87.3000	87.3000	87.3000	88.9509	89.4974	87.3000	(216)	
(217)m	89.7010	89.7223	89.7149	89.6820	89.2356	87.3000	87.3000	87.3000	87.3000	88.9509	89.4974	87.3000	(217)	
Fuel for water heating, kWh/month	156.4444	119.5902	92.2121	44.2227	21.9497	0.0000	0.0000	18.9633	46.0484	94.4756	131.6031	157.6530	(219)	
Water heating fuel used												883.1624	(219)	
Annual totals kWh/year														
Space heating fuel - main system												2224.3874	(211)	
Space heating fuel - secondary												0.0000	(215)	
Electricity for pumps and fans:														
(MEV)Decentralised, Database: total watage = 9.8800, total flow = 45.0000, SFP = 0.2196)														
mechanical ventilation fans (SFP = 0.2196)													58.0300	(230a)
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													183.0300	(231)
Electricity for lighting (calculated in Appendix L)													389.0918	(232)
Energy saving/generation technologies (Appendices M, N and Q)														
PV Unit 0 (0.80 * 0.90 * 842 * 1.00) =										-605.9410			-605.9410	(233)
Total delivered energy for all uses													3073.7307	(238)

10a. Fuel costs - using BEDF prices (516)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2224.3874	9.7400	216.6553	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	883.1624	9.7400	86.0200	(247)
Mechanical ventilation fans	58.0300	36.8500	21.3841	(249)
Pumps and fans for heating	75.0000	36.8500	27.6375	(249)
Pump for solar water heating	50.0000	36.8500	18.4250	(249)
Energy for lighting	389.0918	36.8500	143.3803	(250)
Additional standing charges			104.0000	(251)
Energy saving/generation technologies				
PV Unit	-605.9410	36.8500	-223.2893	(252)
Total energy cost			394.2130	(255)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2224.3874	0.2160	480.4677	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	883.1624	0.2160	190.7631	(264)
Space and water heating			671.2308	(265)
Pumps and fans	183.0300	0.5190	94.9926	(267)

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 for lighting	389.0918	0.5190	201.9386 (268)
Energy saving/generation technologies			
PV Unit	-605.9410	0.5190	-314.4834 (269)
Total kg/year			653.6786 (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	2224.3874	1.2200	2713.7527 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	883.1624	1.2200	1077.4582 (264)
Space and water heating			3791.2108 (265)
Pumps and fans	183.0300	3.0700	561.9023 (267)
Energy for lighting	389.0918	3.0700	1194.5118 (268)
Energy saving/generation technologies			
PV Unit	-605.9410	3.0700	-1860.2389 (269)
Primary energy kWh/year			3687.3860 (272)
Primary energy kWh/m2/year			42.9765 (273)

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

Overheating Calculation Input Data

Dwelling type	SemiDetached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	South
Overshading	Average or unknown
Thermal mass parameter	236.6 (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	285.97 (P1)
Transmission heat loss coefficient	57.59 (37)
Summer heat loss coefficient	343.56 (P2)

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

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

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	7.5000	87.1704	0.4500	0.0000	0.9000	264.7802
South	4.0500	118.5567	0.4500	0.0000	0.9000	194.4626
West	0.6500	125.2818	0.4500	0.0000	0.9000	32.9804
total:						492.2232

	Jun	Jul	Aug	
Solar gains	530	492	436	(P4)
Internal gains	448	429	438	
Total summer gains	978	922	874	(P5)
Summer gain/loss ratio	2.85	2.68	2.54	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 236.6)	0.34	0.34	0.34	
Threshold temperature	18.59	20.33	20.19	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	
Assessment of likelihood of high internal temperature:	Not significant			

BASIC COMPLIANCE REPORT

Calculation Type: New Build (As Built)

Property Reference	Plot 25	Issued on Date	05/06/2023
Assessment Reference	plot 25 ham	Prop Type Ref	21809
Property	44 Alder Avenue, Southampton, SO30 0AS		
SAP Rating	87 B	DER	14.07
Environmental	89 B	TER	18.09
CO ₂ Emissions (t/year)	0.84	% DER<TER	22.21
General Requirements Compliance	Pass	DfEE	46.05
		TFEE	51.37
		% DfEE<TFEE	10.35
Assessor Details	Mr. Patrick McGuigan, JSP Sustainability Ltd, Tel: 01904 435 325, technical@jpsustainability.co.uk		Assessor ID
			Y128-0001
Client			

SUMMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	18.09	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	14.07	kgCO ₂ /m ²	Pass
	-4.02 (-22.2%)	kgCO ₂ /m ²	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	51.37	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DFEE)	46.05	kWh/m ² /yr	
	-5.3 (-10.3%)	kWh/m ² /yr	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.12 (max. 0.25)	0.12 (max. 0.70)	Pass
Roof	0.11 (max. 0.20)	0.11 (max. 0.35)	Pass
Openings	1.34 (max. 2.00)	1.40 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.76 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

BASIC COMPLIANCE REPORT

Calculation Type: New Build (As Built)

Main heating system

Boiler system with radiators or underfloor - Mains gas
Data from database
Ideal LOGIC COMBI ESP1 35
Combi boiler
Efficiency: 89.6% SEDBUK2009
Minimum: 88.0%

Pass

Secondary heating system

None

5 Cylinder insulation

Hot water storage

No cylinder

6 Controls

Space heating controls

Programmer, room thermostat and TRVs

Pass

Hot water controls

No cylinder

Boiler interlock

Yes

Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings

100 %

Minimum

75 %

Pass

8 Mechanical ventilation

Continuous extract system (decentralised)

Specific fan power

0.1600 0.1800

Maximum

0.7

Pass

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)

Not significant

Pass

Based on:

Overshading

Average

Windows facing North

7.50 m², No overhang

Windows facing South

4.05 m², No overhang

Windows facing West

0.65 m², No overhang

Air change rate

0.00 ach

Blinds/curtains

None

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type

U-value

Filled Cavity with Edge Sealing

0.00

W/m²K

Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals

4.76 (measured in this dwelling)

Maximum

10.0

Pass

10 Key features

Party wall U-value

0.00

W/m²K

Roof U-value

0.11

W/m²K

Floor U-value

0.12

W/m²K

Door U-value

1.00

W/m²K

Photovoltaic array

0.90

kW

BASIC COMPLIANCE REPORT

Calculation Type: New Build (As Built)

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.