

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

Property Reference	Plot 71			Issued on Date	27/11/2023
Assessment Reference	21809 plot 71	Prop Type Ref	21809		
Property	4 Wayfaring Close, Southampton, SO30 0AT				
SAP Rating	87 B	DER	14.05	TER	18.97
Environmental	90 B	% DER<TER	25.94		
CO ₂ Emissions (t/year)	0.68	DFEE	46.15	TFEE	51.89
General Requirements Compliance	Pass	% DFEE<TFEE	11.05		
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 70 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) 18.97 kgCO₂/m²

Dwelling Carbon Dioxide Emission Rate (DER) 14.05 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)51.9 kWh/m²/yr

Dwelling Fabric Energy Efficiency (DFEE)46.2 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:	3.99 (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): Slight OK

Based on:

Overshading: Average

Windows facing East: 6.35 m², No overhang

Windows facing South: 0.65 m², No overhang

Windows facing West: 4.20 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

Air permeability 4.0 m³/m²h

Photovoltaic array 0.74 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	35.0000 (1b)	x 2.4500 (2b)	= 85.7500 (1b) - (3b)
First floor	35.0000 (1c)	x 2.6000 (2c)	= 91.0000 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 176.7500 (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											3.9900	
Infiltration rate											0.1995 (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) =	0.1696 (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												
	0.2162	0.2120	0.2077	0.1865	0.1823	0.1611	0.1611	0.1569	0.1696	0.1823	0.1908	0.1993 (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			2.1000	1.0000	2.1000		(26)
front (Uw = 1.40)			11.2000	1.3258	14.8485		(27)
ground			35.0000	0.1200	4.2000	75.0000	2625.0000 (28a)
external	84.8400	13.3000	71.5400	0.2700	19.3158	150.0000	10730.9995 (29a)
cd	35.0000		35.0000	0.1100	3.8500	9.0000	315.0000 (30)
Total net area of external elements Aum(A, m ²)			154.8400				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	44.3143			(33)
party			41.4100	0.0000	0.0000	45.0000	1863.4500 (32)
stud			124.8000			9.0000	1123.2000 (32c)
internal			35.0000			18.0000	630.0000 (32d)
internal			35.0000			9.0000	315.0000 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	17602.6495 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							251.4664 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.0094 (36)
Total fabric heat loss						(33) + (36) =	51.3237 (37)

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

(38)m	Jan 29.1638	Feb 29.1638	Mar 29.1638	Apr 29.1638	May 29.1638	Jun 29.1638	Jul 29.1638	Aug 29.1638	Sep 29.1638	Oct 29.1638	Nov 29.1638	Dec 29.1638 (38)
Heat transfer coeff	80.4874	80.4874	80.4874	80.4874	80.4874	80.4874	80.4874	80.4874	80.4874	80.4874	80.4874	80.4874 (39)
Average = Sum(39)m / 12 =												80.4874 (39)
HLP	Jan 1.1498	Feb 1.1498	Mar 1.1498	Apr 1.1498	May 1.1498	Jun 1.1498	Jul 1.1498	Aug 1.1498	Sep 1.1498	Oct 1.1498	Nov 1.1498	Dec 1.1498 (40)
HLP (average)												1.1498 (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												2.2461 (42)
Average daily hot water use (litres/day)												87.5455 (43)
Daily hot water use	Jan 96.3000	Feb 92.7982	Mar 89.2964	Apr 85.7946	May 82.2927	Jun 78.7909	Jul 78.7909	Aug 82.2927	Sep 85.7946	Oct 89.2964	Nov 92.7982	Dec 96.3000 (44)

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Energy conte	142.8101	124.9027	128.8884	112.3680	107.8198	93.0403	86.2155	98.9335	100.1151	116.6745	127.3593	138.3040 (45)
Energy content (annual)										Total =	Sum (45)m =	1377.4311 (45)
Distribution loss (46)m = 0.15 x (45)m	21.4215	18.7354	19.3333	16.8552	16.1730	13.9560	12.9323	14.8400	15.0173	17.5012	19.1039	20.7456 (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	14.0866	12.7035	14.0328	13.5442	13.9695	13.4887	13.9196	13.9520	13.5189	14.0066	13.5964	14.0762 (61)
Total heat required for water heating calculated for each month	156.8968	137.6061	142.9211	125.9122	121.7893	106.5290	100.1351	112.8855	113.6340	130.6811	140.9558	152.3802 (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	156.8968	137.6061	142.9211	125.9122	121.7893	106.5290	100.1351	112.8855	113.6340	130.6811	140.9558	152.3802 (64)
Heat gains from water heating, kWh/month	51.0060	44.7060	46.3636	40.7484	39.3424	34.3081	32.1465	36.3834	36.6680	42.2959	45.7461	49.5051 (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	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	18.3504	16.2987	13.2550	10.0349	7.5012	6.3328	6.8428	8.8946	11.9383	15.1584	17.6921	18.8604 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	197.2971	199.3444	194.1852	183.2019	169.3374	156.3068	147.6015	145.5542	150.7134	161.6967	175.5612	188.5918 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306 (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)	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450 (71)
Water heating gains (Table 5)	68.5565	66.5268	62.3166	56.5950	52.8796	47.6501	43.2077	48.9024	50.9278	56.8494	63.5362	66.5392 (72)
Total internal gains	343.8959	341.8617	329.4487	309.5236	289.4101	269.9816	257.3439	263.0430	273.2713	293.3963	316.4813	333.6833 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W		
East				6.3500	19.6403	0.4500	0.0000	0.7700		43.2140 (76)		
South				0.6500	46.7521	0.4500	0.0000	0.7700		10.5297 (78)		
West				4.2000	19.6403	0.4500	0.0000	0.7700		28.5825 (80)		
Solar gains	82.3262	157.6941	253.2667	362.1643	439.2907	448.1059	427.2380	369.7195	291.9583	185.2550	102.0031	68.1406 (83)
Total gains	426.2220	499.5558	582.7154	671.6879	728.7008	718.0874	684.5820	632.7625	565.2296	478.6513	418.4844	401.8238 (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	60.7502	60.7502	60.7502	60.7502	60.7502	60.7502	60.7502	60.7502	60.7502	60.7502	60.7502	60.7502
alpha	5.0500	5.0500	5.0500	5.0500	5.0500	5.0500	5.0500	5.0500	5.0500	5.0500	5.0500	5.0500
util living area	0.9979	0.9950	0.9848	0.9469	0.8457	0.6736	0.5082	0.5683	0.8273	0.9736	0.9956	0.9985 (86)
MIT	19.7729	19.9332	20.2077	20.5487	20.8234	20.9580	20.9917	20.9857	20.8828	20.5045	20.0623	19.7300 (87)
Th 2	19.9604	19.9604	19.9604	19.9604	19.9604	19.9604	19.9604	19.9604	19.9604	19.9604	19.9604	19.9604 (88)
util rest of house	0.9972	0.9933	0.9793	0.9276	0.7942	0.5816	0.3929	0.4483	0.7512	0.9606	0.9938	0.9979 (89)
MIT 2	18.8446	19.0042	19.2756	19.6036	19.8454	19.9420	19.9583	19.9565	19.8975	19.5682	19.1334	18.8018 (90)
Living area fraction									fLA = Living area / (4) =			0.1886 (91)
MIT	19.0197	19.1794	19.4514	19.7818	20.0298	20.1336	20.1532	20.1506	20.0833	19.7448	19.3086	18.9768 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.8697	19.0294	19.3014	19.6318	19.8798	19.9836	20.0032	20.0006	19.9333	19.5948	19.1586	18.8268 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9962	0.9911	0.9748	0.9201	0.7897	0.5838	0.3978	0.4531	0.7489	0.9543	0.9918	0.9971 (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	1172.6769	1137.2360	1030.3515	863.7767	658.3700	433.3091	273.9143	289.8011	469.5077	723.9666	970.5638	1177.2743 (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	556.5823	431.4962	343.9804	176.9362	61.7122	0.0000	0.0000	0.0000	0.0000	198.7769	399.9613	577.8009 (98)
Space heating												2747.2464 (98)
Space heating per m ²										(98) / (4) =		39.2464 (99)

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 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													3035.6314 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	556.5823	431.4962	343.9804	176.9362	61.7122	0.0000	0.0000	0.0000	0.0000	198.7769	399.9613	577.8009	(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)	615.0080	476.7914	380.0888	195.5096	68.1903	0.0000	0.0000	0.0000	0.0000	219.6430	441.9462	638.4540	(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	156.8968	137.6061	142.9211	125.9122	121.7893	106.5290	100.1351	112.8855	113.6340	130.6811	140.9558	152.3802	(64)
Efficiency of water heater	89.7763	89.7049	89.5366	89.1415	88.3506	87.3000	87.3000	87.3000	87.3000	89.2030	89.6437	87.3000	(216)
(217)m													
Fuel for water heating, kWh/month	174.7640	153.3986	159.6231	141.2498	137.8477	122.0263	114.7023	129.3075	130.1650	146.4985	157.2400	169.6639	(219)
Water heating fuel used												1736.4866	(219)
Annual totals kWh/year													
Space heating fuel - main system												3035.6314	(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)												47.3439	(230a)
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												122.3439	(231)
Electricity for lighting (calculated in Appendix L)												324.0744	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.74 * 908 * 1.00) =										-537.4497		-537.4497	(233)
Total delivered energy for all uses												4681.0866	(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	3035.6314	0.2160	655.6964	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1736.4866	0.2160	375.0811	(264)
Space and water heating			1030.7775	(265)
Pumps and fans	122.3439	0.5190	63.4965	(267)
Energy for lighting	324.0744	0.5190	168.1946	(268)
Energy saving/generation technologies				
PV Unit	-537.4497	0.5190	-278.9364	(269)
Total CO2, kg/year			983.5322	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			14.0500	(273)

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

DER		14.0500	ZC1
Total Floor Area	TFA	70.0000	
Assumed number of occupants	N	2.2461	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.7020	ZC2
CO2 emissions from cooking, equation (L16)		2.4701	ZC3
Total CO2 emissions		33.2221	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		33.2221	ZC8

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	35.0000 (1b)	x 2.4500 (2b)	= 85.7500 (1b) - (3b)
First floor	35.0000 (1c)	x 2.6000 (2c)	= 91.0000 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 176.7500 (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																2 * 10 =	20.0000 (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) =					20.0000	/ (5) =	0.1132 (8)
Pressure test										Yes							
Measured/design AP50										5.0000							
Infiltration rate										0.3632 (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) =					0.3087 (21)		
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
Wind factor	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)				
Adj infilt rate	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)				
	0.3936	0.3859	0.3781	0.3395	0.3318	0.2932	0.2932	0.2855	0.3087	0.3318	0.3473	0.3627	(22b)				
Effective ac	0.5774	0.5744	0.5715	0.5576	0.5551	0.5430	0.5430	0.5408	0.5476	0.5551	0.5603	0.5658	(25)				

3. Heat losses and heat loss parameter

Element	Gross			Openings		NetArea		U-value		A x U		K-value		A x K	
	m2			m2		m2		W/m2K		W/K		kJ/m2K		kJ/K	
TER Opaque door						2.1000		1.0000		2.1000				(26)	
TER Opening Type (Uw = 1.40)						11.2000		1.3258		14.8485				(27)	
ground						35.0000		0.1300		4.5500				(28a)	
external	84.8400			13.3000		71.5400		0.1800		12.8772				(29a)	
cd	35.0000					35.0000		0.1300		4.5500				(30)	
Total net area of external elements Aum(A, m2)						154.8400								(31)	
Fabric heat loss, W/K = Sum (A x U)								(26)...(30) + (32) =		38.9257				(33)	
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K													250.0000 (35)		
Thermal bridges (Sum(L x Psi) calculated using Appendix K)													8.7810 (36)		
Total fabric heat loss										(33) + (36) =			47.7067 (37)		
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)															
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(38)		
Heat transfer coeff	33.6811	33.5057	33.3337	32.5261	32.3750	31.6717	31.6717	31.5414	31.9426	32.3750	32.6807	33.0003	(38)		
Average = Sum(39)m / 12 =	81.3878	81.2124	81.0404	80.2328	80.0817	79.3783	79.3783	79.2481	79.6493	80.0817	80.3874	80.7070	(39)		
	80.2321												(39)		
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(40)		
HLP (average)	1.1627	1.1602	1.1577	1.1462	1.1440	1.1340	1.1340	1.1321	1.1378	1.1440	1.1484	1.1530	(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												2.2461 (42)
Average daily hot water use (litres/day)												87.5455 (43)
Daily hot water use	Jan 96.3000	Feb 92.7982	Mar 89.2964	Apr 85.7946	May 82.2927	Jun 78.7909	Jul 78.7909	Aug 82.2927	Sep 85.7946	Oct 89.2964	Nov 92.7982	Dec 96.3000 (44)
Energy conte	142.8101	124.9027	128.8884	112.3680	107.8198	93.0403	86.2155	98.9335	100.1151	116.6745	127.3593	138.3040 (45)
Energy content (annual)										Total = Sum(45)m =		1377.4311 (45)
Distribution loss (46)m = 0.15 x (45)m												
Water storage loss:	21.4215	18.7354	19.3333	16.8552	16.1730	13.9560	12.9323	14.8400	15.0173	17.5012	19.1039	20.7456 (46)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
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	49.0734	42.7126	45.5045	42.3096	41.9355	38.8558	40.1510	41.9355	42.3096	45.5045	45.7635	49.0734 (61)
Solar input	191.8836	167.6152	174.3928	154.6776	149.7552	131.8961	126.3665	140.8690	142.4247	162.1789	173.1228	187.3774 (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	191.8836	167.6152	174.3928	154.6776	149.7552	131.8961	126.3665	140.8690	142.4247	162.1789	173.1228	187.3774 (64)
	59.7527	52.2083	54.2315	47.9398	46.3339	40.6498	38.7044	43.3793	43.8657	50.1704	53.7879	58.2544 (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	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	18.3504	16.2987	13.2550	10.0349	7.5012	6.3328	6.8428	8.8946	11.9383	15.1584	17.6921	18.8604	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	197.2971	199.3444	194.1852	183.2019	169.3374	156.3068	147.6015	145.5542	150.7134	161.6967	175.5612	188.5918	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	(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)	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	(71)
Water heating gains (Table 5)	80.3128	77.6909	72.8918	66.5830	62.2768	56.4581	52.0220	58.3055	60.9246	67.4333	74.7053	78.2990	(72)
Total internal gains	355.6522	353.0259	340.0238	319.5116	298.8073	278.7896	266.1582	272.4461	283.2681	303.9803	327.6505	345.4431	(73)

6. Solar gains

[Jan]												Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
East												6.3500	19.6403	0.6300	0.7000	0.7700	38.1147 (76)
South												0.6500	46.7521	0.6300	0.7000	0.7700	9.2872 (78)
West												4.2000	19.6403	0.6300	0.7000	0.7700	25.2097 (80)
Solar gains	72.6117	139.0862	223.3812	319.4289	387.4544	395.2294	376.8239	326.0926	257.5072	163.3949	89.9667	60.1000 (83)					
Total gains	428.2639	492.1120	563.4051	638.9406	686.2617	674.0190	642.9822	598.5387	540.7753	467.3752	417.6172	405.5431 (84)					

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.7278	59.8568	59.9838	60.5876	60.7019	61.2398	61.2398	61.3404	61.0315	60.7019	60.4711	60.2316	
alpha	4.9819	4.9905	4.9989	5.0392	5.0468	5.0827	5.0827	5.0894	5.0688	5.0468	5.0314	5.0154	
util living area	0.9978	0.9952	0.9866	0.9549	0.8668	0.7000	0.5318	0.5890	0.8419	0.9755	0.9956	0.9984	(86)
MIT	19.7527	19.9049	20.1704	20.5157	20.7986	20.9513	20.9901	20.9838	20.8732	20.4937	20.0584	19.7248	(87)
Th 2	19.9500	19.9520	19.9540	19.9633	19.9650	19.9732	19.9732	19.9747	19.9700	19.9650	19.9615	19.9578	(88)
util rest of house	0.9971	0.9936	0.9818	0.9380	0.8192	0.6086	0.4136	0.4677	0.7691	0.9633	0.9937	0.9978	(89)
MIT 2	18.2900	18.5134	18.8999	19.3964	19.7689	19.9410	19.9696	19.9681	19.8684	19.3753	18.7450	18.2548	(90)
Living area fraction	18.5658	18.7758	19.1395	19.6075	19.9631	20.1315	20.1620	20.1596	20.0578	19.5862	18.9927	18.5320	(91)
MIT	18.5658	18.7758	19.1395	19.6075	19.9631	20.1315	20.1620	20.1596	20.0578	19.5862	18.9927	18.5320	(92)
Temperature adjustment	18.5658	18.7758	19.1395	19.6075	19.9631	20.1315	20.1620	20.1596	20.0578	19.5862	18.9927	18.5320	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9956	0.9909	0.9767	0.9308	0.8191	0.6237	0.4359	0.4905	0.7763	0.9572	0.9912	0.9966	(94)
Ext temp.	426.3798	487.6431	550.2701	594.7100	562.0909	420.3733	280.2968	293.5840	419.7928	447.3500	413.9475	404.1677	(95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Month fracti	1161.0628	1126.8860	1024.3114	859.0905	661.7205	439.0844	282.7472	297.9433	474.5377	719.6332	956.0196	1156.6919	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating	546.6041	429.5712	352.6867	190.3539	74.1245	0.0000	0.0000	0.0000	0.0000	202.5787	390.2919	559.8780	(98)
Space heating per m2												2746.0891	(98)
												39.2298	(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													2940.1382 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	546.6041	429.5712	352.6867	190.3539	74.1245	0.0000	0.0000	0.0000	0.0000	202.5787	390.2919	559.8780	(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)	585.2293	459.9264	377.6089	203.8051	79.3624	0.0000	0.0000	0.0000	0.0000	216.8937	417.8714	599.4411	(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	191.8836	167.6152	174.3928	154.6776	149.7552	131.8961	126.3665	140.8690	142.4247	162.1789	173.1228	187.3774	(64)
Efficiency of water heater (217)m	87.5391	87.3174	86.7882	85.5747	83.3845	80.3000	80.3000	80.3000	80.3000	85.6122	87.0362	80.3000	(216)
Fuel for water heating, kWh/month	219.1976	191.9608	200.9406	180.7515	179.5960	164.2541	157.3679	175.4284	177.3658	189.4343	198.9090	213.8133	(219)
Water heating fuel used												2249.0193	(219)
Annual totals kWh/year													
Space heating fuel - main system												2940.1382	(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)												324.0744	(232)
Total delivered energy for all uses												5588.2319	(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	2940.1382	0.2160	635.0699 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2249.0193	0.2160	485.7882 (264)
Space and water heating			1120.8580 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	324.0744	0.5190	168.1946 (268)
Total CO2, kg/m2/year			1327.9776 (272)
Emissions per m2 for space and water heating			16.0123 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.4028 (272b)
Emissions per m2 for pumps and fans			0.5561 (272c)
Target Carbon Dioxide Emission Rate (TER) = (16.0123 * 1.00) + 2.4028 + 0.5561, rounded to 2 d.p.			18.9700 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	35.0000 (1b)	x 2.4500 (2b)	= 85.7500 (1b) - (3b)
First floor	35.0000 (1c)	x 2.6000 (2c)	= 91.0000 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 176.7500 (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					2 * 10 = 20.0000 (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) =					20.0000 / (5) = 0.1132 (8)
Pressure test					Yes
Measured/design AP50					3.9900
Infiltration rate					0.3127 (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) =	0.2658 (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	0.3388	0.3322	0.3256	0.2923	0.2857	0.2525	0.2525	0.2458	0.2658	0.2857	0.2990	0.3123 (22b)
Effective ac	0.5574	0.5552	0.5530	0.5427	0.5408	0.5319	0.5319	0.5302	0.5353	0.5408	0.5447	0.5488 (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			2.1000	1.0000	2.1000		(26)
front (Uw = 1.40)			11.2000	1.3258	14.8485		(27)
ground			35.0000	0.1200	4.2000	75.0000	2625.0000 (28a)
external	84.8400	13.3000	71.5400	0.2700	19.3158	150.0000	10730.9995 (29a)
cd	35.0000		35.0000	0.1100	3.8500	9.0000	315.0000 (30)
Total net area of external elements Aum(A, m ²)			154.8400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	44.3143		(33)
party			41.4100	0.0000	0.0000	45.0000	1863.4500 (32)
stud			124.8000			9.0000	1123.2000 (32c)
internal			35.0000			18.0000	630.0000 (32d)
internal			35.0000			9.0000	315.0000 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 17602.6495 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							251.4664 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.0094 (36)
Total fabric heat loss							(33) + (36) = 51.3237 (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	32.5121	32.3821	32.2546	31.6560	31.5440	31.0227	31.0227	30.9261	31.2235	31.5440	31.7706	32.0075 (38)
Heat transfer coeff	83.8358	83.7058	83.5783	82.9797	82.8677	82.3463	82.3463	82.2498	82.5472	82.8677	83.0943	83.3311 (39)
Average = Sum(39)m / 12 =												82.9792 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1977	1.1958	1.1940	1.1854	1.1838	1.1764	1.1764	1.1750	1.1792	1.1838	1.1871	1.1904 (40)
HLP (average)												1.1854 (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												2.2461 (42)
Average daily hot water use (litres/day)												87.5455 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	96.3000	92.7982	89.2964	85.7946	82.2927	78.7909	78.7909	82.2927	85.7946	89.2964	92.7982	96.3000 (44)
Energy conte	142.8101	124.9027	128.8884	112.3680	107.8198	93.0403	86.2155	98.9335	100.1151	116.6745	127.3593	138.3040 (45)
Energy content (annual)												Total = Sum(45)m = 1377.4311 (45)
Distribution loss (46)m = 0.15 x (45)m												

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CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

	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	30.3472	26.5418	27.3888	23.8782	22.9117	19.7711	18.3208	21.0234	21.2745	24.7933	27.0639	29.3896 (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	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	18.3504	16.2987	13.2550	10.0349	7.5012	6.3328	6.8428	8.8946	11.9383	15.1584	17.6921	18.8604	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	197.2971	199.3444	194.1852	183.2019	169.3374	156.3068	147.6015	145.5542	150.7134	161.6967	175.5612	188.5918	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	(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)	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	(71)
Water heating gains (Table 5)	40.7892	39.4967	36.8129	33.1642	30.7953	27.4598	24.6247	28.2572	29.5479	33.3244	37.5887	39.5021	(72)
Total internal gains	313.1286	311.8317	300.9449	283.0928	264.3258	246.7913	235.7609	239.3978	248.8914	266.8713	287.5338	303.6463	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c		Access factor Table 6d		Gains W	
East				6.3500	19.6403	0.4500	0.0000		0.7700		43.2140 (76)	
South				0.6500	46.7521	0.4500	0.0000		0.7700		10.5297 (78)	
West				4.2000	19.6403	0.4500	0.0000		0.7700		28.5825 (80)	
Solar gains	82.3262	157.6941	253.2667	362.1643	439.2907	448.1059	427.2380	369.7195	291.9583	185.2550	102.0031	68.1406 (83)
Total gains	395.4547	469.5258	554.2116	645.2571	703.6165	694.8971	662.9990	609.1173	540.8496	452.1263	389.5369	371.7868 (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	58.3238	58.4144	58.5035	58.9256	59.0052	59.3788	59.3788	59.4485	59.2343	59.0052	58.8443	58.6770	
alpha	4.8883	4.8943	4.9002	4.9284	4.9337	4.9586	4.9586	4.9632	4.9490	4.9337	4.9230	4.9118	
util living area	0.9985	0.9963	0.9881	0.9564	0.8669	0.7008	0.5338	0.5976	0.8527	0.9798	0.9969	0.9989	(86)
MIT	19.6691	19.8346	20.1199	20.4866	20.7867	20.9468	20.9888	20.9810	20.8560	20.4441	19.9829	19.6364	(87)
Th 2	19.9219	19.9234	19.9248	19.9317	19.9330	19.9389	19.9389	19.9401	19.9366	19.9330	19.9304	19.9277	(88)
util rest of house	0.9980	0.9949	0.9838	0.9398	0.8184	0.6070	0.4116	0.4715	0.7805	0.9693	0.9955	0.9985	(89)
MIT 2	18.7104	18.8765	19.1606	19.5216	19.7917	19.9152	19.9362	19.9348	19.8573	19.4881	19.0305	18.6823	(90)
Living area fraction									fLA = Living area / (4) =			0.1886	(91)
MIT	18.8912	19.0572	19.3415	19.7036	19.9794	20.1097	20.1347	20.1321	20.0457	19.6684	19.2101	18.8622	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8912	19.0572	19.3415	19.7036	19.9794	20.1097	20.1347	20.1321	20.0457	19.6684	19.2101	18.8622	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9973	0.9935	0.9806	0.9354	0.8208	0.6232	0.4348	0.4955	0.7891	0.9658	0.9942	0.9980	(94)
Ext temp.	394.3814	466.4600	543.4833	603.5569	577.5380	433.0620	288.2933	301.8007	426.7871	436.6836	387.2960	371.0367	(95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Month fracti	1223.2619	1185.0378	1073.2726	896.4788	686.0908	453.7077	291.0691	306.9630	490.7976	751.4772	1006.2812	1221.8185	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating	616.6871	482.8842	394.1633	210.9038	80.7633	0.0000	0.0000	0.0000	0.0000	234.2065	445.6693	632.9816	(98)
Space heating per m2												3098.2591	(98)
										(98) / (4) =		44.2608	(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	774.0556	609.3629	625.0984	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8867	0.9387	0.9151	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	686.3878	572.0160	572.0219	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	895.9910	857.0470	795.5237	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	150.9143	212.0631	166.2854	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												529.2628 (104)
Cooled fraction									fC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	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	37.7286	53.0158	41.5713	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												132.3157 (107)
Space cooling per m2												1.8902 (108)
Energy for space heating												44.2608 (99)
Energy for space cooling												1.8902 (108)
Total												46.1511 (109)
Dwelling Fabric Energy Efficiency (DFEE)												46.2 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	35.0000 (1b)	x 2.4500 (2b)	= 85.7500 (1b) - (3b)
First floor	35.0000 (1c)	x 2.6000 (2c)	= 91.0000 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 176.7500 (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					2 * 10 = 20.0000 (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)					20.0000 / (5) = 0.1132 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3632 (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) =	0.3087 (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	0.3936	0.3859	0.3781	0.3395	0.3318	0.2932	0.2932	0.2855	0.3087	0.3318	0.3473	0.3627 (22b)
Effective ac	0.5774	0.5744	0.5715	0.5576	0.5551	0.5430	0.5430	0.5408	0.5476	0.5551	0.5603	0.5658 (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			2.1000	1.0000	2.1000		(26)						
TER Opening Type (Uw = 1.40)			11.2000	1.3258	14.8485		(27)						
ground			35.0000	0.1300	4.5500		(28a)						
external	84.8400	13.3000	71.5400	0.1800	12.8772		(29a)						
cd	35.0000		35.0000	0.1300	4.5500		(30)						
Total net area of external elements Aum(A, m2)			154.8400				(31)						
Fabric heat loss, W/K = Sum (A x U)				(26) ... (30) + (32) =	38.9257		(33)						
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)						
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.7810 (36)						
Total fabric heat loss						(33) + (36) =	47.7067 (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	33.6811	33.5057	33.3337	32.5261	32.3750	31.6717	31.6717	31.5414	31.9426	32.3750	32.6807	33.0003 (38)	
Heat transfer coeff	81.3878	81.2124	81.0404	80.2328	80.0817	79.3783	79.3783	79.2481	79.6493	80.0817	80.3874	80.7070 (39)	
Average = Sum(39)m / 12 =												80.2321 (39)	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1627	1.1602	1.1577	1.1462	1.1440	1.1340	1.1340	1.1321	1.1378	1.1440	1.1484	1.1530 (40)	
HLP (average)												1.1462 (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												2.2461 (42)
Average daily hot water use (litres/day)												87.5455 (43)
Daily hot water use	96.3000	92.7982	89.2964	85.7946	82.2927	78.7909	78.7909	82.2927	85.7946	89.2964	92.7982	96.3000 (44)
Energy conte	142.8101	124.9027	128.8884	112.3680	107.8198	93.0403	86.2155	98.9335	100.1151	116.6745	127.3593	138.3040 (45)
Energy content (annual)										Total = Sum(45)m =		1377.4311 (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 (46)
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)
	30.3472	26.5418	27.3888	23.8782	22.9117	19.7711	18.3208	21.0234	21.2745	24.7933	27.0639	29.3896 (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	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	18.3504	16.2987	13.2550	10.0349	7.5012	6.3328	6.8428	8.8946	11.9383	15.1584	17.6921	18.8604	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	197.2971	199.3444	194.1852	183.2019	169.3374	156.3068	147.6015	145.5542	150.7134	161.6967	175.5612	188.5918	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	(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)	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	(71)
Water heating gains (Table 5)	40.7892	39.4967	36.8129	33.1642	30.7953	27.4598	24.6247	28.2572	29.5479	33.3244	37.5887	39.5021	(72)
Total internal gains	313.1286	311.8317	300.9449	283.0928	264.3258	246.7913	235.7609	239.3978	248.8914	266.8713	287.5338	303.6463	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
East				6.3500	19.6403	0.6300	0.7000	0.7700	38.1147 (76)			
South				0.6500	46.7521	0.6300	0.7000	0.7700	9.2872 (78)			
West				4.2000	19.6403	0.6300	0.7000	0.7700	25.2097 (80)			

Solar gains	72.6117	139.0862	223.3812	319.4289	387.4544	395.2294	376.8239	326.0926	257.5072	163.3949	89.9667	60.1000 (83)
Total gains	385.7403	450.9179	524.3262	602.5217	651.7802	642.0207	612.5849	565.4905	506.3986	430.2663	377.5005	363.7463 (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, (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
tau	59.7278	59.8568	59.9838	60.5876	60.7019	61.2398	61.2398	61.3404	61.0315	60.7019	60.4711	60.2316		
alpha	4.9819	4.9905	4.9989	5.0392	5.0468	5.0827	5.0827	5.0894	5.0688	5.0468	5.0314	5.0154		
util living area	0.9987	0.9968	0.9901	0.9637	0.8849	0.7251	0.5556	0.6183	0.8674	0.9824	0.9972	0.9990	(86)	
MIT	19.6963	19.8509	20.1212	20.4761	20.7744	20.9428	20.9880	20.9800	20.8517	20.4491	20.0056	19.6691	(87)	
Th 2	19.9500	19.9520	19.9540	19.9633	19.9650	19.9732	19.9732	19.9747	19.9700	19.9650	19.9615	19.9578	(88)	
util rest of house	0.9982	0.9956	0.9865	0.9495	0.8410	0.6339	0.4334	0.4934	0.8002	0.9733	0.9960	0.9987	(89)	
MIT 2	18.7604	18.9162	19.1862	19.5397	19.8123	19.9469	19.9701	19.9690	19.8862	19.5202	19.0786	18.7396	(90)	
Living area fraction									fLA = Living area / (4) =			0.1886	(91)	
MIT	18.9369	19.0925	19.3625	19.7163	19.9937	20.1347	20.1621	20.1596	20.0683	19.6954	19.2534	18.9149	(92)	
Temperature adjustment												0.0000		
adjusted MIT	18.9369	19.0925	19.3625	19.7163	19.9937	20.1347	20.1621	20.1596	20.0683	19.6954	19.2534	18.9149	(93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Useful gains	0.9975	0.9944	0.9837	0.9453	0.8424	0.6494	0.4566	0.5171	0.8077	0.9700	0.9949	0.9982	(94)	
Ext temp.	384.7914	448.3704	515.7904	569.5910	549.0481	416.9374	279.7323	292.4254	409.0339	417.3729	375.5578	363.0778	(95)	
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)	
Month fracti	1191.2647	1152.6030	1042.3816	867.8204	664.1731	439.3354	282.7518	297.9415	475.3691	728.3721	976.9780	1187.5916	(97)	
Space heating kWh	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 per m2	600.0161	473.2443	391.7839	214.7251	85.6530	0.0000	0.0000	0.0000	0.0000	231.3834	433.0225	613.4382	(98)	
												3043.2666	(98)	
												43.4752	(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	746.1564	587.3997	602.2854	0.0000	0.0000	0.0000	0.0000	(100)	
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8785	0.9342	0.9104	0.0000	0.0000	0.0000	0.0000	(101)	
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	655.4619	548.7621	548.3377	0.0000	0.0000	0.0000	0.0000	(102)	
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	834.1873	798.1215	744.5313	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	128.6823	185.5234	145.9680	0.0000	0.0000	0.0000	0.0000	(104)	
Space cooling												460.1737	(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	32.1706	46.3809	36.4920	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												115.0434 (107)
Space cooling per m2												1.6435 (108)
Energy for space heating												43.4752 (99)
Energy for space cooling												1.6435 (108)
Total												45.1187 (109)
Target Fabric Energy Efficiency (TFEE)												51.9 (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	35.0000 (1b)	x 2.4500 (2b)	= 85.7500 (1b) - (3b)
First floor	35.0000 (1c)	x 2.6000 (2c)	= 91.0000 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 176.7500 (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												3.9900
Infiltration rate												0.1995 (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) =	0.1696 (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												
	0.1993	0.1865	0.1865	0.1696	0.1738	0.1653	0.1653	0.1611	0.1611	0.1738	0.1696	0.1738 (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			2.1000	1.0000	2.1000		(26)
front (Uw = 1.40)			11.2000	1.3258	14.8485		(27)
ground			35.0000	0.1200	4.2000	75.0000	2625.0000 (28a)
external	84.8400	13.3000	71.5400	0.2700	19.3158	150.0000	10730.9995 (29a)
cd	35.0000		35.0000	0.1100	3.8500	9.0000	315.0000 (30)
Total net area of external elements Aum(A, m ²)			154.8400				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	44.3143			(33)
party			41.4100	0.0000	0.0000	45.0000	1863.4500 (32)
stud			124.8000			9.0000	1123.2000 (32c)
internal			35.0000			18.0000	630.0000 (32d)
internal			35.0000			9.0000	315.0000 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	17602.6495 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							251.4664 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.0094 (36)
Total fabric heat loss						(33) + (36) =	51.3237 (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	29.1638	29.1638	29.1638	29.1638	29.1638	29.1638	29.1638	29.1638	29.1638	29.1638	29.1638	29.1638 (38)
Heat transfer coeff	80.4874	80.4874	80.4874	80.4874	80.4874	80.4874	80.4874	80.4874	80.4874	80.4874	80.4874	80.4874 (39)
Average = Sum(39)m / 12 =												80.4874 (39)
HLP	1.1498	1.1498	1.1498	1.1498	1.1498	1.1498	1.1498	1.1498	1.1498	1.1498	1.1498	1.1498 (40)
HLP (average)												1.1498 (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												2.2461 (42)
Average daily hot water use (litres/day)												87.5455 (43)
Daily hot water use	Jan 96.3000	Feb 92.7982	Mar 89.2964	Apr 85.7946	May 82.2927	Jun 78.7909	Jul 78.7909	Aug 82.2927	Sep 85.7946	Oct 89.2964	Nov 92.7982	Dec 96.3000 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Energy content (annual)	142.8101	124.9027	128.8884	112.3680	107.8198	93.0403	86.2155	98.9335	100.1151	116.6745	127.3593	138.3040 (45)
Distribution loss (46)m = 0.15 x (45)m	21.4215	18.7354	19.3333	16.8552	16.1730	13.9560	12.9323	14.8400	15.0173	17.5012	19.1039	20.7456 (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	14.0866	12.7035	14.0328	13.5442	13.9695	13.4887	13.9196	13.9520	13.5189	14.0066	13.5964	14.0762 (61)
Total heat required for water heating calculated for each month	156.8968	137.6061	142.9211	125.9122	121.7893	106.5290	100.1351	112.8855	113.6340	130.6811	140.9558	152.3802 (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	156.8968	137.6061	142.9211	125.9122	121.7893	106.5290	100.1351	112.8855	113.6340	130.6811	140.9558	152.3802 (64)
RHI water heating demand												1542 (64)
Heat gains from water heating, kWh/month	51.0060	44.7060	46.3636	40.7484	39.3424	34.3081	32.1465	36.3834	36.6680	42.2959	45.7461	49.5051 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	134.7675	134.7675	134.7675	134.7675	134.7675	134.7675	134.7675	134.7675	134.7675	134.7675	134.7675	134.7675 (66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	45.8761	40.7467	33.1375	25.0872	18.7530	15.8321	17.1071	22.2364	29.8457	37.8960	44.2302	47.1511 (67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	294.4732	297.5289	289.8286	273.4356	252.7424	233.2937	220.3007	217.2450	224.9453	241.3383	262.0316	281.4803 (68)
Pumps, fans	50.7229	50.7229	50.7229	50.7229	50.7229	50.7229	50.7229	50.7229	50.7229	50.7229	50.7229	50.7229 (69)
Losses e.g. evaporation (negative values) (Table 5)	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)
Water heating gains (Table 5)	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450 (71)
Total internal gains	68.5565	66.5268	62.3166	56.5950	52.8796	47.6501	43.2077	48.9024	50.9278	56.8494	63.5362	66.5392 (72)
	507.5512	503.4478	483.9281	453.7632	423.0204	395.4212	379.2609	387.0292	404.3642	434.7290	468.4434	493.8159 (73)

6. Solar gains

[Jan]				Area	Solar flux	g	FF	Access			Gains	
				m2	Table 6a	Specific data	Specific data	factor			W	
					W/m2	or Table 6b	or Table 6c	Table 6d				
East				6.3500	25.1733	0.4500	0.0000	0.7700			55.3881 (76)	
South				0.6500	56.5862	0.4500	0.0000	0.7700			12.7446 (78)	
West				4.2000	25.1733	0.4500	0.0000	0.7700			36.6346 (80)	

Solar gains	104.7673	170.8336	278.8209	398.8178	453.9269	511.7993	469.0441	424.4289	336.0106	216.4676	129.4065	82.0661 (83)
Total gains	612.3185	674.2814	762.7490	852.5810	876.9473	907.2205	848.3050	811.4582	740.3748	651.1966	597.8499	575.8820 (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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
alpha	60.7502	60.7502	60.7502	60.7502	60.7502	60.7502	60.7502	60.7502	60.7502	60.7502	60.7502	60.7502
util living area	5.0500	5.0500	5.0500	5.0500	5.0500	5.0500	5.0500	5.0500	5.0500	5.0500	5.0500	5.0500
	0.9854	0.9760	0.9420	0.8464	0.6792	0.4479	0.3125	0.3167	0.5883	0.8718	0.9684	0.9884 (86)
MIT	20.1505	20.2665	20.5191	20.7921	20.9463	20.9945	20.9993	20.9993	20.9798	20.8015	20.4403	20.1156 (87)
Th 2	19.9604	19.9604	19.9604	19.9604	19.9604	19.9604	19.9604	19.9604	19.9604	19.9604	19.9604	19.9604 (88)
util rest of house	0.9806	0.9682	0.9237	0.8034	0.6056	0.3589	0.2144	0.2142	0.4884	0.8224	0.9562	0.9845 (89)
MIT 2	19.2186	19.3316	19.5727	19.8153	19.9322	19.9587	19.9603	19.9603	19.9531	19.8307	19.5026	19.1846 (90)
Living area fraction	19.3943	19.5079	19.7512	19.9995	20.1235	20.1541	20.1562	20.1562	20.1467	20.0138	19.6795	19.3602 (92)
MIT												0.1886 (91)
Temperature adjustment												-0.1500
adjusted MIT	19.2443	19.3579	19.6012	19.8495	19.9735	20.0041	20.0062	20.0062	19.9967	19.8638	19.5295	19.2102 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9761	0.9624	0.9161	0.7983	0.6066	0.3627	0.2187	0.2188	0.4921	0.8170	0.9496	0.9806 (94)
Ext temp.	597.7141	648.9462	698.7298	680.5829	531.9767	329.0438	185.5531	177.5072	364.3209	532.0479	567.6961	564.7107 (95)
Heat loss rate W	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)
Month fracti	1098.1971	1075.1443	965.9418	784.7093	553.2264	330.3246	185.6206	177.5717	369.9770	624.8844	879.6839	1087.3992 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating	372.3593	286.4051	198.8057	74.9710	15.8098	0.0000	0.0000	0.0000	0.0000	69.0704	224.6312	388.8803 (98)
RHI space heating demand												1630.9328 (98)
												1631 (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	35.0000 (1b)	x 2.4500 (2b)	= 85.7500 (1b) - (3b)
First floor	35.0000 (1c)	x 2.6000 (2c)	= 91.0000 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 176.7500 (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												3.9900
Infiltration rate												0.1995 (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) =	0.1696 (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												
	0.2162	0.2120	0.2077	0.1865	0.1823	0.1611	0.1611	0.1569	0.1696	0.1823	0.1908	0.1993 (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			2.1000	1.0000	2.1000		(26)
front (Uw = 1.40)			11.2000	1.3258	14.8485		(27)
ground			35.0000	0.1200	4.2000	75.0000	2625.0000 (28a)
external	84.8400	13.3000	71.5400	0.2700	19.3158	150.0000	10730.9995 (29a)
cd	35.0000		35.0000	0.1100	3.8500	9.0000	315.0000 (30)
Total net area of external elements Aum(A, m ²)			154.8400				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		44.3143		(33)
party			41.4100	0.0000	0.0000	45.0000	1863.4500 (32)
stud			124.8000			9.0000	1123.2000 (32c)
internal			35.0000			18.0000	630.0000 (32d)
internal			35.0000			9.0000	315.0000 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	17602.6495 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							251.4664 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.0094 (36)
Total fabric heat loss						(33) + (36) =	51.3237 (37)

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

(38)m	Jan 29.1638	Feb 29.1638	Mar 29.1638	Apr 29.1638	May 29.1638	Jun 29.1638	Jul 29.1638	Aug 29.1638	Sep 29.1638	Oct 29.1638	Nov 29.1638	Dec 29.1638 (38)
Heat transfer coeff	80.4874	80.4874	80.4874	80.4874	80.4874	80.4874	80.4874	80.4874	80.4874	80.4874	80.4874	80.4874 (39)
Average = Sum(39)m / 12 =												80.4874 (39)
HLP	Jan 1.1498	Feb 1.1498	Mar 1.1498	Apr 1.1498	May 1.1498	Jun 1.1498	Jul 1.1498	Aug 1.1498	Sep 1.1498	Oct 1.1498	Nov 1.1498	Dec 1.1498 (40)
HLP (average)												1.1498 (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												2.2461 (42)
Average daily hot water use (litres/day)												87.5455 (43)
Daily hot water use	Jan 96.3000	Feb 92.7982	Mar 89.2964	Apr 85.7946	May 82.2927	Jun 78.7909	Jul 78.7909	Aug 82.2927	Sep 85.7946	Oct 89.2964	Nov 92.7982	Dec 96.3000 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Energy conte	142.8101	124.9027	128.8884	112.3680	107.8198	93.0403	86.2155	98.9335	100.1151	116.6745	127.3593	138.3040 (45)
Energy content (annual)										Total =	Sum (45)m =	1377.4311 (45)
Distribution loss (46)m = 0.15 x (45)m	21.4215	18.7354	19.3333	16.8552	16.1730	13.9560	12.9323	14.8400	15.0173	17.5012	19.1039	20.7456 (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	14.0866	12.7035	14.0328	13.5442	13.9695	13.4887	13.9196	13.9520	13.5189	14.0066	13.5964	14.0762 (61)
Total heat required for water heating calculated for each month												
Solar input	156.8968	137.6061	142.9211	125.9122	121.7893	106.5290	100.1351	112.8855	113.6340	130.6811	140.9558	152.3802 (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	156.8968	137.6061	142.9211	125.9122	121.7893	106.5290	100.1351	112.8855	113.6340	130.6811	140.9558	152.3802 (64)
								Total per year (kWh/year) =	Sum (64)m =			1542.3261 (64)
Heat gains from water heating, kWh/month												
	51.0060	44.7060	46.3636	40.7484	39.3424	34.3081	32.1465	36.3834	36.6680	42.2959	45.7461	49.5051 (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	134.7675	134.7675	134.7675	134.7675	134.7675	134.7675	134.7675	134.7675	134.7675	134.7675	134.7675	134.7675 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	45.8761	40.7467	33.1375	25.0872	18.7530	15.8321	17.1071	22.2364	29.8457	37.8960	44.2302	47.1511 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	294.4732	297.5289	289.8286	273.4356	252.7424	233.2937	220.3007	217.2450	224.9453	241.3383	262.0316	281.4803 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.7229	50.7229	50.7229	50.7229	50.7229	50.7229	50.7229	50.7229	50.7229	50.7229	50.7229	50.7229 (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)	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450 (71)
Water heating gains (Table 5)	68.5565	66.5268	62.3166	56.5950	52.8796	47.6501	43.2077	48.9024	50.9278	56.8494	63.5362	66.5392 (72)
Total internal gains	507.5512	503.4478	483.9281	453.7632	423.0204	395.4212	379.2609	387.0292	404.3642	434.7290	468.4434	493.8159 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
East				6.3500	19.6403	0.4500	0.0000	0.7700	43.2140 (76)			
South				0.6500	46.7521	0.4500	0.0000	0.7700	10.5297 (78)			
West				4.2000	19.6403	0.4500	0.0000	0.7700	28.5825 (80)			
Solar gains	82.3262	157.6941	253.2667	362.1643	439.2907	448.1059	427.2380	369.7195	291.9583	185.2550	102.0031	68.1406 (83)
Total gains	589.8774	661.1419	737.1948	815.9275	862.3111	843.5271	806.4990	756.7487	696.3224	619.9841	570.4464	561.9565 (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	60.7502	60.7502	60.7502	60.7502	60.7502	60.7502	60.7502	60.7502	60.7502	60.7502	60.7502	60.7502
alpha	5.0500	5.0500	5.0500	5.0500	5.0500	5.0500	5.0500	5.0500	5.0500	5.0500	5.0500	5.0500
util living area	0.9912	0.9833	0.9614	0.8990	0.7706	0.5899	0.4352	0.4824	0.7285	0.9320	0.9834	0.9930 (86)
MIT	19.9857	20.1376	20.3879	20.6790	20.8878	20.9766	20.9958	20.9931	20.9357	20.6538	20.2550	19.9394 (87)
Th 2	19.9604	19.9604	19.9604	19.9604	19.9604	19.9604	19.9604	19.9604	19.9604	19.9604	19.9604	19.9604 (88)
util rest of house	0.9884	0.9782	0.9493	0.8688	0.7111	0.5029	0.3345	0.3769	0.6436	0.9044	0.9772	0.9908 (89)
MIT 2	19.0556	19.2052	19.4481	19.7182	19.8914	19.9507	19.9594	19.9586	19.9290	19.7031	19.3225	19.0098 (90)
Living area fraction									fLA =	Living area / (4) =		0.1886 (91)
MIT	19.2310	19.3810	19.6253	19.8994	20.0793	20.1441	20.1548	20.1537	20.1188	19.8823	19.4983	19.1851 (92)
Temperature adjustment												-0.1500
adjusted MIT	19.0810	19.2310	19.4753	19.7494	19.9293	19.9941	20.0048	20.0037	19.9688	19.7323	19.3483	19.0351 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9852	0.9734	0.9423	0.8617	0.7092	0.5058	0.3388	0.3814	0.6444	0.8969	0.9724	0.9881 (94)
Useful gains	581.1471	643.5568	694.6836	703.0808	611.5208	426.6626	273.2682	288.6348	448.6963	556.0915	554.6996	555.2719 (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	1189.6865	1153.4656	1044.3524	873.2397	662.3519	434.1593	274.0459	290.0494	472.3648	735.0379	985.8359	1194.0420 (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	452.7533	342.6587	260.1535	122.5144	37.8184	0.0000	0.0000	0.0000	0.0000	133.1362	310.4182	475.2449 (98)
Space heating												2134.6976 (98)
Space heating per m ²										(98) / (4) =		30.4957 (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												2358.7818	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	452.7533	342.6587	260.1535	122.5144	37.8184	0.0000	0.0000	0.0000	0.0000	133.1362	310.4182	475.2449	(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)	500.2799	378.6284	287.4625	135.3750	41.7882	0.0000	0.0000	0.0000	0.0000	147.1118	343.0035	525.1325	(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	156.8968	137.6061	142.9211	125.9122	121.7893	106.5290	100.1351	112.8855	113.6340	130.6811	140.9558	152.3802	(64)
Efficiency of water heater	89.6543	89.5594	89.3389	88.8493	88.0376	87.3000	87.3000	87.3000	87.3000	88.8861	89.4758	87.3000	(216)
(217)m	89.6543	89.5594	89.3389	88.8493	88.0376	87.3000	87.3000	87.3000	87.3000	88.8861	89.4758	89.7017	(217)
Fuel for water heating, kWh/month	175.0020	153.6479	159.9765	141.7142	138.3378	122.0263	114.7023	129.3075	130.1650	147.0209	157.5351	169.8744	(219)
Water heating fuel used												1739.3099	(219)
Annual totals kWh/year													
Space heating fuel - main system												2358.7818	(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)												47.3439	(230a)
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												122.3439	(231)
Electricity for lighting (calculated in Appendix L)												324.0744	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.74 * 908 * 1.00) =										-537.4497		-537.4497	(233)
Total delivered energy for all uses												4007.0602	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2358.7818	3.4800	82.0856 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1739.3099	3.4800	60.5280 (247)
Mechanical ventilation fans	47.3439	13.1900	6.2447 (249)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	324.0744	13.1900	42.7454 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-537.4497	13.1900	-70.8896 (252)
Total energy cost			250.6065 (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] = 0.9153 (257)
SAP value	87.2321
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	2358.7818	0.2160	509.4969 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1739.3099	0.2160	375.6909 (264)
Space and water heating			885.1878 (265)
Pumps and fans	122.3439	0.5190	63.4965 (267)
Energy for lighting	324.0744	0.5190	168.1946 (268)
Energy saving/generation technologies			
PV Unit	-537.4497	0.5190	-278.9364 (269)
Total kg/year			837.9425 (272)
CO2 emissions per m2			11.9700 (273)
EI value			90.2361
EI rating			90 (274)
EI band			B

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

Calculation of stars for heating and DHW

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9050 = 3.845$, 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	$3.48 / 0.8856 = 3.930$, stars = 4
Water heating environmental impact	$0.216 / 0.8856 = 0.2439$, 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	35.0000 (1b)	x 2.4500 (2b)	= 85.7500 (1b) - (3b)
First floor	35.0000 (1c)	x 2.6000 (2c)	= 91.0000 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 176.7500 (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												3.9900
Infiltration rate												0.1995 (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) =	0.1696 (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												
	0.1993	0.1865	0.1865	0.1696	0.1738	0.1653	0.1653	0.1611	0.1611	0.1738	0.1696	0.1738 (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			2.1000	1.0000	2.1000		(26)
front (Uw = 1.40)			11.2000	1.3258	14.8485		(27)
ground			35.0000	0.1200	4.2000	75.0000	2625.0000 (28a)
external	84.8400	13.3000	71.5400	0.2700	19.3158	150.0000	10730.9995 (29a)
cd	35.0000		35.0000	0.1100	3.8500	9.0000	315.0000 (30)
Total net area of external elements Aum(A, m ²)			154.8400				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	44.3143			(33)
party			41.4100	0.0000	0.0000	45.0000	1863.4500 (32)
stud			124.8000			9.0000	1123.2000 (32c)
internal			35.0000			18.0000	630.0000 (32d)
internal			35.0000			9.0000	315.0000 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	17602.6495 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							251.4664 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.0094 (36)
Total fabric heat loss						(33) + (36) =	51.3237 (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	29.1638	29.1638	29.1638	29.1638	29.1638	29.1638	29.1638	29.1638	29.1638	29.1638	29.1638	29.1638 (38)
Heat transfer coeff	80.4874	80.4874	80.4874	80.4874	80.4874	80.4874	80.4874	80.4874	80.4874	80.4874	80.4874	80.4874 (39)
Average = Sum(39)m / 12 =												80.4874 (39)
HLP	1.1498	1.1498	1.1498	1.1498	1.1498	1.1498	1.1498	1.1498	1.1498	1.1498	1.1498	1.1498 (40)
HLP (average)												1.1498 (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												2.2461 (42)
Average daily hot water use (litres/day)												87.5455 (43)
Daily hot water use	Jan 96.3000	Feb 92.7982	Mar 89.2964	Apr 85.7946	May 82.2927	Jun 78.7909	Jul 78.7909	Aug 82.2927	Sep 85.7946	Oct 89.2964	Nov 92.7982	Dec 96.3000 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Energy conte	142.8101	124.9027	128.8884	112.3680	107.8198	93.0403	86.2155	98.9335	100.1151	116.6745	127.3593	138.3040 (45)
Energy content (annual)										Total =	Sum (45)m =	1377.4311 (45)
Distribution loss (46)m = 0.15 x (45)m												
	21.4215	18.7354	19.3333	16.8552	16.1730	13.9560	12.9323	14.8400	15.0173	17.5012	19.1039	20.7456 (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	14.0866	12.7035	14.0328	13.5442	13.9695	13.4887	13.9196	13.9520	13.5189	14.0066	13.5964	14.0762 (61)
Total heat required for water heating calculated for each month												
Solar input	156.8968	137.6061	142.9211	125.9122	121.7893	106.5290	100.1351	112.8855	113.6340	130.6811	140.9558	152.3802 (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	156.8968	137.6061	142.9211	125.9122	121.7893	106.5290	100.1351	112.8855	113.6340	130.6811	140.9558	152.3802 (64)
								Total per year (kWh/year) =	Sum (64)m =			1542.3261 (64)
Heat gains from water heating, kWh/month												
	51.0060	44.7060	46.3636	40.7484	39.3424	34.3081	32.1465	36.3834	36.6680	42.2959	45.7461	49.5051 (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	134.7675	134.7675	134.7675	134.7675	134.7675	134.7675	134.7675	134.7675	134.7675	134.7675	134.7675	134.7675 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	45.8761	40.7467	33.1375	25.0872	18.7530	15.8321	17.1071	22.2364	29.8457	37.8960	44.2302	47.1511 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	294.4732	297.5289	289.8286	273.4356	252.7424	233.2937	220.3007	217.2450	224.9453	241.3383	262.0316	281.4803 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	50.7229	50.7229	50.7229	50.7229	50.7229	50.7229	50.7229	50.7229	50.7229	50.7229	50.7229	50.7229 (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)												
	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450 (71)
Water heating gains (Table 5)												
	68.5565	66.5268	62.3166	56.5950	52.8796	47.6501	43.2077	48.9024	50.9278	56.8494	63.5362	66.5392 (72)
Total internal gains												
	507.5512	503.4478	483.9281	453.7632	423.0204	395.4212	379.2609	387.0292	404.3642	434.7290	468.4434	493.8159 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d			Gains W	
East				6.3500	25.1733	0.4500	0.0000	0.7700			55.3881 (76)	
South				0.6500	56.5862	0.4500	0.0000	0.7700			12.7446 (78)	
West				4.2000	25.1733	0.4500	0.0000	0.7700			36.6346 (80)	
Solar gains	104.7673	170.8336	278.8209	398.8178	453.9269	511.7993	469.0441	424.4289	336.0106	216.4676	129.4065	82.0661 (83)
Total gains	612.3185	674.2814	762.7490	852.5810	876.9473	907.2205	848.3050	811.4582	740.3748	651.1966	597.8499	575.8820 (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	60.7502	60.7502	60.7502	60.7502	60.7502	60.7502	60.7502	60.7502	60.7502	60.7502	60.7502	60.7502
alpha	5.0500	5.0500	5.0500	5.0500	5.0500	5.0500	5.0500	5.0500	5.0500	5.0500	5.0500	5.0500
util living area	0.9854	0.9760	0.9420	0.8464	0.6792	0.4479	0.3125	0.3167	0.5883	0.8718	0.9684	0.9884 (86)
MIT	20.1505	20.2665	20.5191	20.7921	20.9463	20.9945	20.9993	20.9993	20.9798	20.8015	20.4403	20.1156 (87)
Th 2	19.9604	19.9604	19.9604	19.9604	19.9604	19.9604	19.9604	19.9604	19.9604	19.9604	19.9604	19.9604 (88)
util rest of house												
	0.9806	0.9682	0.9237	0.8034	0.6056	0.3589	0.2144	0.2142	0.4884	0.8224	0.9562	0.9845 (89)
MIT 2	19.2186	19.3316	19.5727	19.8153	19.9322	19.9587	19.9603	19.9603	19.9531	19.8307	19.5026	19.1846 (90)
Living area fraction									fLA = Living area / (4) =			0.1886 (91)
MIT	19.3943	19.5079	19.7512	19.9995	20.1235	20.1541	20.1562	20.1562	20.1467	20.0138	19.6795	19.3602 (92)
Temperature adjustment												-0.1500
adjusted MIT	19.2443	19.3579	19.6012	19.8495	19.9735	20.0041	20.0062	20.0062	19.9967	19.8638	19.5295	19.2102 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9761	0.9624	0.9161	0.7983	0.6066	0.3627	0.2187	0.2188	0.4921	0.8170	0.9496	0.9806 (94)
Useful gains	597.7141	648.9462	698.7298	680.5829	531.9767	329.0438	185.5531	177.5072	364.3209	532.0479	567.6961	564.7107 (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												
	1098.1971	1075.1443	965.9418	784.7093	553.2264	330.3246	185.6206	177.5717	369.9770	624.8844	879.6839	1087.3992 (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												
	372.3593	286.4051	198.8057	74.9710	15.8098	0.0000	0.0000	0.0000	0.0000	69.0704	224.6312	388.8803 (98)
Space heating												1630.9328 (98)
Space heating per m2										(98) / (4) =		23.2990 (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													1802.1357 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	372.3593	286.4051	198.8057	74.9710	15.8098	0.0000	0.0000	0.0000	0.0000	69.0704	224.6312	388.8803	(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)	411.4468	316.4697	219.6749	82.8409	17.4694	0.0000	0.0000	0.0000	0.0000	76.3209	248.2113	429.7019	(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	156.8968	137.6061	142.9211	125.9122	121.7893	106.5290	100.1351	112.8855	113.6340	130.6811	140.9558	152.3802	(64)
Efficiency of water heater	89.5272	89.4361	89.1335	88.4674	87.6561	87.3000	87.3000	87.3000	87.3000	88.3806	89.2388	87.3000	(216)
(217)m												89.5756	(217)
Fuel for water heating, kWh/month	175.2504	153.8597	160.3449	142.3260	138.9398	122.0263	114.7023	129.3075	130.1650	147.8618	157.9535	170.1135	(219)
Water heating fuel used												1742.8508	(219)
Annual totals kWh/year													
Space heating fuel - main system												1802.1357	(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)												47.3439	(230a)
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												122.3439	(231)
Electricity for lighting (calculated in Appendix L)												324.0744	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.74 * 1030 * 1.00) =											-609.7952	-609.7952	(233)
Total delivered energy for all uses												3381.6096	(238)

10a. Fuel costs - using BEDF prices (531)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1802.1357	10.2300	184.3585 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1742.8508	10.2300	178.2936 (247)
Mechanical ventilation fans	47.3439	36.7200	17.3847 (249)
Pumps and fans for heating	75.0000	36.7200	27.5400 (249)
Energy for lighting	324.0744	36.7200	119.0001 (250)
Additional standing charges			103.0000 (251)
Energy saving/generation technologies			
PV Unit	-609.7952	36.7200	-223.9168 (252)
Total energy cost			405.6601 (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	1802.1357	0.2160	389.2613 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1742.8508	0.2160	376.4558 (264)
Space and water heating			765.7171 (265)
Pumps and fans	122.3439	0.5190	63.4965 (267)
Energy for lighting	324.0744	0.5190	168.1946 (268)
Energy saving/generation technologies			
PV Unit	-609.7952	0.5190	-316.4837 (269)
Total kg/year			680.9245 (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	1802.1357	1.2200	2198.6056 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1742.8508	1.2200	2126.2779 (264)
Space and water heating			4324.8835 (265)
Pumps and fans	122.3439	3.0700	375.5957 (267)
Energy for lighting	324.0744	3.0700	994.9084 (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	-609.7952	3.0700	-1872.0711 (269)
Primary energy kWh/year			3823.3165 (272)
Primary energy kWh/m2/year			54.6188 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating:	B 87
Current environmental impact rating:	B 90

(For testing purposes):

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

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.3	-£ 79	-179 kg (26.2%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£79	2.55 kg/m²	B 89 A 92
Total Savings	£79	2.55 kg/m²	
Potential energy efficiency rating:			B 89
Potential environmental impact rating:			A 92

Fuel prices for cost data on this page from database revision number 531 TEST (31 Oct 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	£164	£182	-£18
Mains gas	£466	£369	£97
Space heating	£332	£332	£0
Water heating	£178	£100	£79
Lighting	£119	£119	£0
Generated (PV)	-£224	-£224	£0
Total cost of fuels	£406	£327	£79
Total cost of uses	£405	£327	£79
Delivered energy	48 kWh/m²	35 kWh/m²	13 kWh/m²
Carbon dioxide emissions	0.7 tonnes	0.5 tonnes	0.2 tonnes
CO2 emissions per m²	10 kg/m²	7 kg/m²	3 kg/m²
Primary energy	55 kWh/m²	40 kWh/m²	14 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	35.0000 (1b)	x 2.4500 (2b)	= 85.7500 (1b) - (3b)
First floor	35.0000 (1c)	x 2.6000 (2c)	= 91.0000 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 176.7500 (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											3.9900	
Infiltration rate											0.1995 (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) =	0.1696 (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												
	0.2162	0.2120	0.2077	0.1865	0.1823	0.1611	0.1611	0.1569	0.1696	0.1823	0.1908	0.1993 (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			2.1000	1.0000	2.1000		(26)
front (Uw = 1.40)			11.2000	1.3258	14.8485		(27)
ground			35.0000	0.1200	4.2000	75.0000	2625.0000 (28a)
external	84.8400	13.3000	71.5400	0.2700	19.3158	150.0000	10730.9995 (29a)
cd	35.0000		35.0000	0.1100	3.8500	9.0000	315.0000 (30)
Total net area of external elements Aum(A, m ²)			154.8400				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	44.3143			(33)
party			41.4100	0.0000	0.0000	45.0000	1863.4500 (32)
stud			124.8000			9.0000	1123.2000 (32c)
internal			35.0000			18.0000	630.0000 (32d)
internal			35.0000			9.0000	315.0000 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	17602.6495 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							251.4664 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.0094 (36)
Total fabric heat loss						(33) + (36) =	51.3237 (37)

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

(38)m	Jan 29.1638	Feb 29.1638	Mar 29.1638	Apr 29.1638	May 29.1638	Jun 29.1638	Jul 29.1638	Aug 29.1638	Sep 29.1638	Oct 29.1638	Nov 29.1638	Dec 29.1638 (38)
Heat transfer coeff	80.4874	80.4874	80.4874	80.4874	80.4874	80.4874	80.4874	80.4874	80.4874	80.4874	80.4874	80.4874 (39)
Average = Sum(39)m / 12 =												80.4874 (39)
HLP	Jan 1.1498	Feb 1.1498	Mar 1.1498	Apr 1.1498	May 1.1498	Jun 1.1498	Jul 1.1498	Aug 1.1498	Sep 1.1498	Oct 1.1498	Nov 1.1498	Dec 1.1498 (40)
HLP (average)												1.1498 (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												2.2461 (42)
Average daily hot water use (litres/day)												87.5455 (43)
Daily hot water use	Jan 96.3000	Feb 92.7982	Mar 89.2964	Apr 85.7946	May 82.2927	Jun 78.7909	Jul 78.7909	Aug 82.2927	Sep 85.7946	Oct 89.2964	Nov 92.7982	Dec 96.3000 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Energy content (annual)	142.8101	124.9027	128.8884	112.3680	107.8198	93.0403	86.2155	98.9335	100.1151	116.6745	127.3593	138.3040 (45)
Distribution loss (46)m = 0.15 x (45)m	21.4215	18.7354	19.3333	16.8552	16.1730	13.9560	12.9323	14.8400	15.0173	17.5012	19.1039	20.7456 (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	14.0866	12.7035	14.0328	13.5442	13.9695	13.4887	13.9196	13.9520	13.5189	14.0066	13.5964	14.0762 (61)
Total heat required for water heating calculated for each month	156.8968	137.6061	142.9211	125.9122	121.7893	106.5290	100.1351	112.8855	113.6340	130.6811	140.9558	152.3802 (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												1.3167 (H8)
Utilisation factor												0.5321 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												87.5455 (H14)
Volume ratio Veff/V												0.8567 (H15)
Solar storage volume factor												0.9691 (H16)
Solar input												-822.2846 (H17)
Solar input	-23.8446	-39.7898	-67.7666	-90.8206	-112.2012	-110.3117	-108.8538	-95.1061	-74.4872	-50.8660	-28.2831	-19.9539 (63)
Solar input (sum of months) = Sum (63)m =												-822.2846 (63)
Output from w/h	133.0521	97.8163	75.1545	35.0916	9.5881	0.0000	0.0000	17.7793	39.1469	79.8151	112.6726	132.4263 (64)
Total per year (kWh/year) = Sum (64)m =												732.5429 (64)
Heat gains from water heating, kWh/month	51.0060	44.7060	46.3636	40.7484	39.3424	34.3081	32.1465	36.3834	36.6680	42.2959	45.7461	49.5051 (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	134.7675	134.7675	134.7675	134.7675	134.7675	134.7675	134.7675	134.7675	134.7675	134.7675	134.7675	134.7675	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	45.8761	40.7467	33.1375	25.0872	18.7530	15.8321	17.1071	22.2364	29.8457	37.8960	44.2302	47.1511	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	294.4732	297.5289	289.8286	273.4356	252.7424	233.2937	220.3007	217.2450	224.9453	241.3383	262.0316	281.4803	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.7229	50.7229	50.7229	50.7229	50.7229	50.7229	50.7229	50.7229	50.7229	50.7229	50.7229	50.7229	(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)	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	(71)
Water heating gains (Table 5)	68.5565	66.5268	62.3166	56.5950	52.8796	47.6501	43.2077	48.9024	50.9278	56.8494	63.5362	66.5392	(72)
Total internal gains	507.5512	503.4478	483.9281	453.7632	423.0204	395.4212	379.2609	387.0292	404.3642	434.7290	468.4434	493.8159	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c		Access factor Table 6d		Gains W	
East				6.3500	19.6403	0.4500	0.0000		0.7700		43.2140 (76)	
South				0.6500	46.7521	0.4500	0.0000		0.7700		10.5297 (78)	
West				4.2000	19.6403	0.4500	0.0000		0.7700		28.5825 (80)	
Solar gains	82.3262	157.6941	253.2667	362.1643	439.2907	448.1059	427.2380	369.7195	291.9583	185.2550	102.0031	68.1406 (83)
Total gains	589.8774	661.1419	737.1948	815.9275	862.3111	843.5271	806.4990	756.7487	696.3224	619.9841	570.4464	561.9565 (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	60.7502	60.7502	60.7502	60.7502	60.7502	60.7502	60.7502	60.7502	60.7502	60.7502	60.7502	60.7502
alpha	5.0500	5.0500	5.0500	5.0500	5.0500	5.0500	5.0500	5.0500	5.0500	5.0500	5.0500	5.0500
util living area	0.9912	0.9833	0.9614	0.8990	0.7706	0.5899	0.4352	0.4824	0.7285	0.9320	0.9834	0.9930 (86)
MIT	19.9857	20.1376	20.3879	20.6790	20.8878	20.9766	20.9958	20.9931	20.9357	20.6538	20.2550	19.9394 (87)
Th 2	19.9604	19.9604	19.9604	19.9604	19.9604	19.9604	19.9604	19.9604	19.9604	19.9604	19.9604	19.9604 (88)
util rest of house	0.9884	0.9782	0.9493	0.8688	0.7111	0.5029	0.3345	0.3769	0.6436	0.9044	0.9772	0.9908 (89)
MIT 2	19.0556	19.2052	19.4481	19.7182	19.8914	19.9507	19.9594	19.9586	19.9290	19.7031	19.3225	19.0098 (90)
Living area fraction									fLA = Living area / (4) =			0.1886 (91)
MIT	19.2310	19.3810	19.6253	19.8994	20.0793	20.1441	20.1548	20.1537	20.1188	19.8823	19.4983	19.1851 (92)
Temperature adjustment												-0.1500
adjusted MIT	19.0810	19.2310	19.4753	19.7494	19.9293	19.9941	20.0048	20.0037	19.9688	19.7323	19.3483	19.0351 (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	0.9852	0.9734	0.9423	0.8617	0.7092	0.5058	0.3388	0.3814	0.6444	0.8969	0.9724	0.9881	(94)
Useful gains	581.1471	643.5568	694.6836	703.0808	611.5208	426.6626	273.2682	288.6348	448.6963	556.0915	554.6996	555.2719	(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	1189.6865	1153.4656	1044.3524	873.2397	662.3519	434.1593	274.0459	290.0494	472.3648	735.0379	985.8359	1194.0420	(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	452.7533	342.6587	260.1535	122.5144	37.8184	0.0000	0.0000	0.0000	0.0000	133.1362	310.4182	475.2449	(98)
Space heating												2134.6976	(98)
Space heating per m2											(98) / (4) =	30.4957	(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													2358.7818	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	452.7533	342.6587	260.1535	122.5144	37.8184	0.0000	0.0000	0.0000	0.0000	133.1362	310.4182	475.2449	(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)	500.2799	378.6284	287.4625	135.3750	41.7882	0.0000	0.0000	0.0000	0.0000	147.1118	343.0035	525.1325	(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	133.0521	97.8163	75.1545	35.0916	9.5881	0.0000	0.0000	17.7793	39.1469	79.8151	112.6726	132.4263	(64)	
Efficiency of water heater	(217)m	89.7528	89.7625	89.7674	89.8340	87.3000	87.3000	87.3000	87.3000	89.2735	89.6251	89.7828	(216)	
Fuel for water heating, kWh/month	148.2429	108.9641	83.7260	39.0917	10.6731	0.0000	0.0000	20.3658	44.8418	89.4052	125.7155	147.4963	(219)	
Water heating fuel used												818.5222	(219)	
Annual totals kWh/year														
Space heating fuel - main system												2358.7818	(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)													47.3439	(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													172.3439	(231)
Electricity for lighting (calculated in Appendix L)													324.0744	(232)
Energy saving/generation technologies (Appendices M, N and Q)														
PV Unit 0 (0.80 * 0.74 * 908 * 1.00) =										-537.4497		-537.4497	(233)	
Total delivered energy for all uses												3136.2726	(238)	

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2358.7818	3.4800	82.0856	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	818.5222	3.4800	28.4846	(247)
Mechanical ventilation fans	47.3439	13.1900	6.2447	(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	324.0744	13.1900	42.7454	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-537.4497	13.1900	-70.8896	(252)
Total energy cost			225.1581	(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] =	0.8223	(257)
SAP value		88.5287	
SAP rating (Section 12)		89	(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	2358.7818	0.2160	509.4969 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	818.5222	0.2160	176.8008 (264)
Space and water heating			686.2977 (265)
Pumps and fans	172.3439	0.5190	89.4465 (267)
Energy for lighting	324.0744	0.5190	168.1946 (268)
Energy saving/generation technologies			
PV Unit	-537.4497	0.5190	-278.9364 (269)
Total kg/year			665.0024 (272)
CO2 emissions per m2			9.5000 (273)
EI value			92.2513
EI rating			92 (274)
EI band			A

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	35.0000 (1b)	x 2.4500 (2b)	= 85.7500 (1b) - (3b)
First floor	35.0000 (1c)	x 2.6000 (2c)	= 91.0000 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 176.7500 (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												3.9900
Infiltration rate												0.1995 (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) =	0.1696 (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												
	0.1993	0.1865	0.1865	0.1696	0.1738	0.1653	0.1653	0.1611	0.1611	0.1738	0.1696	0.1738 (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			2.1000	1.0000	2.1000		(26)
front (Uw = 1.40)			11.2000	1.3258	14.8485		(27)
ground			35.0000	0.1200	4.2000	75.0000	2625.0000 (28a)
external	84.8400	13.3000	71.5400	0.2700	19.3158	150.0000	10730.9995 (29a)
cd	35.0000		35.0000	0.1100	3.8500	9.0000	315.0000 (30)
Total net area of external elements Aum(A, m ²)			154.8400				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	44.3143			(33)
party			41.4100	0.0000	0.0000	45.0000	1863.4500 (32)
stud			124.8000			9.0000	1123.2000 (32c)
internal			35.0000			18.0000	630.0000 (32d)
internal			35.0000			9.0000	315.0000 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	17602.6495 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							251.4664 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.0094 (36)
Total fabric heat loss						(33) + (36) =	51.3237 (37)

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

(38)m	Jan 29.1638	Feb 29.1638	Mar 29.1638	Apr 29.1638	May 29.1638	Jun 29.1638	Jul 29.1638	Aug 29.1638	Sep 29.1638	Oct 29.1638	Nov 29.1638	Dec 29.1638 (38)
Heat transfer coeff	80.4874	80.4874	80.4874	80.4874	80.4874	80.4874	80.4874	80.4874	80.4874	80.4874	80.4874	80.4874 (39)
Average = Sum(39)m / 12 =												80.4874 (39)
HLP	Jan 1.1498	Feb 1.1498	Mar 1.1498	Apr 1.1498	May 1.1498	Jun 1.1498	Jul 1.1498	Aug 1.1498	Sep 1.1498	Oct 1.1498	Nov 1.1498	Dec 1.1498 (40)
HLP (average)												1.1498 (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												2.2461 (42)
Average daily hot water use (litres/day)												87.5455 (43)
Daily hot water use	Jan 96.3000	Feb 92.7982	Mar 89.2964	Apr 85.7946	May 82.2927	Jun 78.7909	Jul 78.7909	Aug 82.2927	Sep 85.7946	Oct 89.2964	Nov 92.7982	Dec 96.3000 (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)	142.8101	124.9027	128.8884	112.3680	107.8198	93.0403	86.2155	98.9335	100.1151	116.6745	127.3593	138.3040 (45)
Distribution loss (46)m = 0.15 x (45)m	21.4215	18.7354	19.3333	16.8552	16.1730	13.9560	12.9323	14.8400	15.0173	17.5012	19.1039	20.7456 (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	14.0866	12.7035	14.0328	13.5442	13.9695	13.4887	13.9196	13.9520	13.5189	14.0066	13.5964	14.0762 (61)
Total heat required for water heating calculated for each month	156.8968	137.6061	142.9211	125.9122	121.7893	106.5290	100.1351	112.8855	113.6340	130.6811	140.9558	152.3802 (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												1.4709 (H8)
Utilisation factor												0.4933 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												87.5455 (H14)
Volume ratio Veff/V												0.8567 (H15)
Solar storage volume factor												0.9691 (H16)
Solar input												-851.6522 (H17)
Solar input	-27.7905	-39.5212	-68.5795	-92.2510	-107.2019	-116.6045	-110.5589	-100.8190	-78.9108	-54.5403	-32.8698	-22.0049 (63)
Solar input (sum of months) = Sum (63)m =												-851.6522 (63)
Output from w/h	129.1063	98.0849	74.3417	33.6612	14.5874	0.0000	0.0000	12.0665	34.7233	76.1408	108.0859	130.3753 (64)
Total per year (kWh/year) = Sum (64)m =												711.1732 (64)
Heat gains from water heating, kWh/month	51.0060	44.7060	46.3636	40.7484	39.3424	34.3081	32.1465	36.3834	36.6680	42.2959	45.7461	49.5051 (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	134.7675	134.7675	134.7675	134.7675	134.7675	134.7675	134.7675	134.7675	134.7675	134.7675	134.7675	134.7675	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	45.8761	40.7467	33.1375	25.0872	18.7530	15.8321	17.1071	22.2364	29.8457	37.8960	44.2302	47.1511	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	294.4732	297.5289	289.8286	273.4356	252.7424	233.2937	220.3007	217.2450	224.9453	241.3383	262.0316	281.4803	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.7229	50.7229	50.7229	50.7229	50.7229	50.7229	50.7229	50.7229	50.7229	50.7229	50.7229	50.7229	(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)	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	(71)
Water heating gains (Table 5)	68.5565	66.5268	62.3166	56.5950	52.8796	47.6501	43.2077	48.9024	50.9278	56.8494	63.5362	66.5392	(72)
Total internal gains	507.5512	503.4478	483.9281	453.7632	423.0204	395.4212	379.2609	387.0292	404.3642	434.7290	468.4434	493.8159	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	g Specific data or Table 6c	FF Specific data or Table 6c	Access factor Table 6d	Gains W		
East				6.3500	25.1733	0.4500		0.0000	0.7700	55.3881 (76)		
South				0.6500	56.5862	0.4500		0.0000	0.7700	12.7446 (78)		
West				4.2000	25.1733	0.4500		0.0000	0.7700	36.6346 (80)		
Solar gains	104.7673	170.8336	278.8209	398.8178	453.9269	511.7993	469.0441	424.4289	336.0106	216.4676	129.4065	82.0661 (83)
Total gains	612.3185	674.2814	762.7490	852.5810	876.9473	907.2205	848.3050	811.4582	740.3748	651.1966	597.8499	575.8820 (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	60.7502	60.7502	60.7502	60.7502	60.7502	60.7502	60.7502	60.7502	60.7502	60.7502	60.7502	60.7502	
alpha	5.0500	5.0500	5.0500	5.0500	5.0500	5.0500	5.0500	5.0500	5.0500	5.0500	5.0500	5.0500	
util living area	0.9854	0.9760	0.9420	0.8464	0.6792	0.4479	0.3125	0.3167	0.5883	0.8718	0.9684	0.9884	(86)
MIT	20.1505	20.2665	20.5191	20.7921	20.9463	20.9945	20.9993	20.9993	20.9798	20.8015	20.4403	20.1156	(87)
Th 2	19.9604	19.9604	19.9604	19.9604	19.9604	19.9604	19.9604	19.9604	19.9604	19.9604	19.9604	19.9604	(88)
util rest of house	0.9806	0.9682	0.9237	0.8034	0.6056	0.3589	0.2144	0.2142	0.4884	0.8224	0.9562	0.9845	(89)
MIT 2	19.2186	19.3316	19.5727	19.8153	19.9322	19.9587	19.9603	19.9603	19.9531	19.8307	19.5026	19.1846	(90)
Living area fraction									fLA = Living area / (4) =			0.1886	(91)
MIT	19.3943	19.5079	19.7512	19.9995	20.1235	20.1541	20.1562	20.1562	20.1467	20.0138	19.6795	19.3602	(92)
Temperature adjustment												-0.1500	
adjusted MIT	19.2443	19.3579	19.6012	19.8495	19.9735	20.0041	20.0062	20.0062	19.9967	19.8638	19.5295	19.2102	(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	0.9761	0.9624	0.9161	0.7983	0.6066	0.3627	0.2187	0.2188	0.4921	0.8170	0.9496	0.9806	(94)
Useful gains	597.7141	648.9462	698.7298	680.5829	531.9767	329.0438	185.5531	177.5072	364.3209	532.0479	567.6961	564.7107	(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	1098.1971	1075.1443	965.9418	784.7093	553.2264	330.3246	185.6206	177.5717	369.9770	624.8844	879.6839	1087.3992	(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	372.3593	286.4051	198.8057	74.9710	15.8098	0.0000	0.0000	0.0000	0.0000	69.0704	224.6312	388.8803	(98)
Space heating												1630.9328	(98)
Space heating per m2												23.2990	(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													1802.1357 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	372.3593	286.4051	198.8057	74.9710	15.8098	0.0000	0.0000	0.0000	0.0000	69.0704	224.6312	388.8803	(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)	411.4468	316.4697	219.6749	82.8409	17.4694	0.0000	0.0000	0.0000	0.0000	76.3209	248.2113	429.7019	(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	129.1063	98.0849	74.3417	33.6612	14.5874	0.0000	0.0000	12.0665	34.7233	76.1408	108.0859	130.3753	(64)
Efficiency of water heater	(217)m	89.6539	89.6061	89.4836	88.9356	87.3000	87.3000	87.3000	87.3000	88.7934	89.4350	87.3000	(216)
Fuel for water heating, kWh/month	144.0051	109.3946	82.9650	37.6172	16.4022	0.0000	0.0000	13.8219	39.7746	85.7505	120.8541	145.3869	(219)
Water heating fuel used												795.9722	(219)
Annual totals kWh/year													
Space heating fuel - main system												1802.1357	(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)													47.3439 (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													172.3439 (231)
Electricity for lighting (calculated in Appendix L)													324.0744 (232)
Energy saving/generation technologies (Appendices M, N and Q)													
PV Unit 0 (0.80 * 0.74 * 1030 * 1.00) =										-609.7952		-609.7952	(233)
Total delivered energy for all uses												2484.7310	(238)

10a. Fuel costs - using BEDF prices (531)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1802.1357	10.2300	184.3585	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	795.9722	10.2300	81.4280	(247)
Mechanical ventilation fans	47.3439	36.7200	17.3847	(249)
Pumps and fans for heating	75.0000	36.7200	27.5400	(249)
Pump for solar water heating	50.0000	36.7200	18.3600	(249)
Energy for lighting	324.0744	36.7200	119.0001	(250)
Additional standing charges			103.0000	(251)
Energy saving/generation technologies				
PV Unit	-609.7952	36.7200	-223.9168	(252)
Total energy cost			327.1544	(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	1802.1357	0.2160	389.2613	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	795.9722	0.2160	171.9300	(264)
Space and water heating			561.1913	(265)
Pumps and fans	172.3439	0.5190	89.4465	(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	324.0744	0.5190	168.1946 (268)
Energy saving/generation technologies			
PV Unit	-609.7952	0.5190	-316.4837 (269)
Total kg/year			502.3487 (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	1802.1357	1.2200	2198.6056 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	795.9722	1.2200	971.0861 (264)
Space and water heating			3169.6917 (265)
Pumps and fans	172.3439	3.0700	529.0957 (267)
Energy for lighting	324.0744	3.0700	994.9084 (268)
Energy saving/generation technologies			
PV Unit	-609.7952	3.0700	-1872.0711 (269)
Primary energy kWh/year			2821.6246 (272)
Primary energy kWh/m2/year			40.3089 (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	West
Overshading	Average or unknown
Thermal mass parameter	251.5 (calculated from construction elements)
Night ventilation	No
Ventilation rate during hot weather (ach)	4.00 (Windows half open)

Overheating Calculation

Summer ventilation heat loss coefficient	233.31 (P1)
Transmission heat loss coefficient	51.32 (37)
Summer heat loss coefficient	284.63 (P2)

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

Solar shading Orientation	Z blinds	Solar access	Z overhangs	Z summer
East	1.000	0.90	1.000	0.900 (P8)
South	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
East	6.3500	125.2818	0.4500	0.0000	0.9000	322.1934
South	0.6500	118.5567	0.4500	0.0000	0.9000	31.2100
West	4.2000	125.2818	0.4500	0.0000	0.9000	213.1043
total:						566.5078

	Jun	Jul	Aug	
Solar gains	609	567	502	(P4)
Internal gains	392	376	384	
Total summer gains	1001	943	886	(P5)
Summer gain/loss ratio	3.52	3.31	3.11	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 251.5)	0.24	0.24	0.24	
Threshold temperature	19.16	20.85	20.65	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	
Assessment of likelihood of high internal temperature:	Slight			

BASIC COMPLIANCE REPORT

Calculation Type: New Build (As Built)

Property Reference	Plot 71	Issued on Date	27/11/2023
Assessment Reference	21809 plot 71	Prop Type Ref	21809
Property	4 Wayfaring Close, Southampton, SO30 0AT		
SAP Rating	87 B	DER	14.05
Environmental	90 B	TER	18.97
CO ₂ Emissions (t/year)	0.68	% DER<TER	25.94
General Requirements Compliance	Pass	DfEE	46.15
		TfEE	51.89
		% DfEE<TfEE	11.05
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)	18.97	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	14.05	kgCO ₂ /m ²	Pass
	-4.92 (-25.9%)	kgCO ₂ /m ²	

1b TfEE and DfEE

Target Fabric Energy Efficiency (TfEE)	51.89	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DfEE)	46.15	kWh/m ² /yr	
	-5.7 (-11.0%)	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	3.99 (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)

Slight

Pass

Based on:

Overshading

Average

Windows facing East

6.35 m², No overhang

Windows facing South

0.65 m², No overhang

Windows facing West

4.20 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

3.99 (measured in this dwelling)

Maximum

10.0

Pass

BASIC COMPLIANCE REPORT

Calculation Type: New Build (As Built)

10 Key features

Party wall U-value	0.00	W/m ² K
Roof U-value	0.11	W/m ² K
Floor U-value	0.12	W/m ² K
Door U-value	1.00	W/m ² K
Air permeability	4.0	m ³ /m ² h
Photovoltaic array	0.74	kW

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