

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

Property Reference	Plot 81			Issued on Date	12/10/2023
Assessment Reference	plot 81 way	Prop Type Ref	21809		
Property	3 Wayfaring Close, Southampton, SO30 0AT				
SAP Rating	87 B	DER	14.31	TER	17.90
Environmental	89 B	% DER<TER	20.07		
CO ₂ Emissions (t/year)	0.89	DFEE	45.42	TFEE	50.86
General Requirements Compliance	Pass	% DFEE<TFEE	10.70		
Assessor Details	Mr. Ben Tunningley, Ben Tunningley, Tel: 01904217325, ben.tunningley@jspsustainability.co.uk			Assessor ID	AU36-0001
Client					

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

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DWELLING AS BUILT

Semi-Detached House, total floor area 86 m²

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

1a TER and DER

Fuel for main heating:Mains gas

Fuel factor:1.00 (mains gas)

Target Carbon Dioxide Emission Rate (TER) 17.90 kgCO₂/m²

Dwelling Carbon Dioxide Emission Rate (DER) 14.31 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)50.9 kWh/m²/yr

Dwelling Fabric Energy Efficiency (DFEE)45.4 kWh/m²/yrOK

2 Fabric U-values

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

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals: 4.63 (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: 4.35 m², No overhang

Windows facing South: 0.65 m², No overhang

Windows facing West: 7.50 m², No overhang

Air change rate: 0.00 ach

Blinds/curtains: None

10 Key features

Party wall U-value 0.00 W/m²K

Roof U-value 0.11 W/m²K

Floor U-value 0.12 W/m²K

Door U-value 1.00 W/m²K

Photovoltaic array 0.60 kW

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

1. Overall dwelling dimensions

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

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					0 * 10 = 0.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					0.0000 / (5) = 0.0000 (8)
Pressure test					Yes
Measured/design AP50					4.6300
Infiltration rate					0.2315 (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)	=	0.1968 (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	0.2509	0.2460	0.2410	0.2165	0.2115	0.1869	0.1869	0.1820	0.1968	0.2115	0.2214	0.2312 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5009	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
entrance			2.0000	1.0000	2.0000		(26)
front (Uw = 1.40)			12.5000	1.3258	16.5720		(27)
ground			42.9000	0.1200	5.1480	75.0000	3217.5001 (28a)
external	94.9400	14.5000	80.4400	0.2700	21.7188	150.0000	12066.0004 (29a)
cd	42.9000		42.9000	0.1100	4.7190	9.0000	386.1000 (30)
Total net area of external elements Aum(A, m ²)			180.7400				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	50.1578			(33)
party			44.9500	0.0000	0.0000	45.0000	2022.7500 (32)
stud			156.4000			9.0000	1407.5999 (32c)
internal			42.9000			18.0000	772.2000 (32d)
internal			42.9000			9.0000	386.1000 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	20258.2505 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							236.1101 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.5500 (36)
Total fabric heat loss						(33) + (36) =	57.7078 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	35.8099	35.7464	35.7464	35.7464	35.7464	35.7464	35.7464	35.7464	35.7464	35.7464	35.7464	35.7464 (38)
Heat transfer coeff	93.5177	93.4542	93.4542	93.4542	93.4542	93.4542	93.4542	93.4542	93.4542	93.4542	93.4542	93.4542 (39)
Average = Sum(39)m / 12 =												93.4595 (39)
HLP	1.0900	1.0892	1.0892	1.0892	1.0892	1.0892	1.0892	1.0892	1.0892	1.0892	1.0892	1.0892 (40)
HLP (average)												1.0893 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.5638 (42)
Average daily hot water use (litres/day)												95.0893 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	104.5983	100.7947	96.9911	93.1875	89.3840	85.5804	85.5804	89.3840	93.1875	96.9911	100.7947	104.5983 (44)

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Energy conte	155.1162	135.6656	139.9948	122.0508	117.1107	101.0576	93.6447	107.4587	108.7421	126.7284	138.3340	150.2218 (45)
Energy content (annual)	Total = Sum(45)m = 1496.1255 (45)											
Distribution loss (46)m = 0.15 x (45)m	23.2674	20.3498	20.9992	18.3076	17.5666	15.1586	14.0467	16.1188	16.3113	19.0093	20.7501	22.5333 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.1288	12.7509	14.0824	13.5858	14.0078	13.5204	13.9489	13.9871	13.5560	14.0516	13.6448	14.1171 (61)
Total heat required for water heating calculated for each month	169.2451	148.4165	154.0772	135.6366	131.1185	114.5780	107.5936	121.4458	122.2981	140.7800	151.9788	164.3389 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	169.2451	148.4165	154.0772	135.6366	131.1185	114.5780	107.5936	121.4458	122.2981	140.7800	151.9788	164.3389 (64)
Heat gains from water heating, kWh/month	55.1084	48.2965	50.0689	43.9783	42.4413	36.9817	34.6241	39.2268	39.5458	45.6501	49.4073	53.4780 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	128.1881	128.1881	128.1881	128.1881	128.1881	128.1881	128.1881	128.1881	128.1881	128.1881	128.1881	128.1881 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.9173	19.4667	15.8314	11.9854	8.9592	7.5638	8.1729	10.6234	14.2588	18.1048	21.1310	22.5264 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	231.1353	233.5338	227.4897	214.6227	198.3803	183.1148	172.9165	170.5180	176.5621	189.4291	205.6715	220.9370 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.8188	35.8188	35.8188	35.8188	35.8188	35.8188	35.8188	35.8188	35.8188	35.8188	35.8188	35.8188 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505 (71)
Water heating gains (Table 5)	74.0704	71.8699	67.2969	61.0810	57.0447	51.3635	46.5378	52.7242	54.9247	61.3577	68.6212	71.8790 (72)
Total internal gains	391.5794	389.3268	375.0744	352.1455	328.8407	306.4985	292.0836	298.3221	310.2019	333.3480	359.8801	379.7989 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W		
East				4.3500	19.6403	0.4500	0.0000	0.7700	29.6033 (76)			
South				0.6500	46.7521	0.4500	0.0000	0.7700	10.5297 (78)			
West				7.5000	19.6403	0.4500	0.0000	0.7700	51.0401 (80)			
Solar gains	91.1731	175.0006	281.7681	403.7319	490.2333	500.2547	476.8858	412.3662	325.1065	205.7907	113.0342	75.4159 (83)
Total gains	482.7525	564.3274	656.8425	755.8774	819.0740	806.7532	768.9694	710.6883	635.3085	539.1387	472.9142	455.2148 (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	60.1735	60.2144	60.2144	60.2144	60.2144	60.2144	60.2144	60.2144	60.2144	60.2144	60.2144	60.2144
alpha	5.0116	5.0143	5.0143	5.0143	5.0143	5.0143	5.0143	5.0143	5.0143	5.0143	5.0143	5.0143
util living area	0.9981	0.9954	0.9862	0.9517	0.8574	0.6901	0.5237	0.5847	0.8399	0.9761	0.9960	0.9986 (86)
MIT	19.7493	19.9079	20.1807	20.5235	20.8068	20.9521	20.9902	20.9834	20.8711	20.4838	20.0409	19.7080 (87)
Th 2	20.0090	20.0097	20.0097	20.0097	20.0097	20.0097	20.0097	20.0097	20.0097	20.0097	20.0097	20.0097 (88)
util rest of house	0.9975	0.9939	0.9815	0.9350	0.8108	0.6028	0.4114	0.4687	0.7704	0.9649	0.9944	0.9981 (89)
MIT 2	18.8653	19.0238	19.2940	19.6257	19.8793	19.9873	20.0070	20.0047	19.9369	19.5936	19.1569	18.8246 (90)
Living area fraction	fLA = Living area / (4) = 0.1690 (91)											
MIT	19.0147	19.1732	19.4439	19.7774	20.0361	20.1504	20.1732	20.1701	20.0948	19.7441	19.3063	18.9739 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.8647	19.0232	19.2939	19.6274	19.8861	20.0004	20.0232	20.0201	19.9448	19.5941	19.1563	18.8239 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9964	0.9919	0.9770	0.9269	0.8040	0.6019	0.4130	0.4699	0.7651	0.9584	0.9925	0.9973 (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	1362.0607	1319.8711	1195.6420	1002.5209	765.0235	504.6879	319.9108	338.3135	546.2194	840.5332	1126.7155	1366.6625 (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	655.4892	510.8084	412.0985	217.3539	79.2079	0.0000	0.0000	0.0000	0.0000	240.9088	473.2929	679.0300 (98)
Space heating												3268.1895 (98)
Space heating per m ²	(98) / (4) = 38.0908 (99)											

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8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3611.2592 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	655.4892	510.8084	412.0985	217.3539	79.2079	0.0000	0.0000	0.0000	0.0000	240.9088	473.2929	679.0300	(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)	724.2974	564.4292	455.3574	240.1701	87.5225	0.0000	0.0000	0.0000	0.0000	266.1976	522.9756	750.3094	(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	169.2451	148.4165	154.0772	135.6366	131.1185	114.5780	107.5936	121.4458	122.2981	140.7800	151.9788	164.3389	(64)
Efficiency of water heater (217)m	89.8243	89.7593	89.6062	89.2430	88.4782	87.3000	87.3000	87.3000	87.3000	89.2928	89.7008	87.3000	(216)
Fuel for water heating, kWh/month	188.4178	165.3495	171.9494	151.9857	148.1930	131.2463	123.2459	139.1132	140.0895	157.6611	169.4286	182.8869	(219)
Water heating fuel used												1869.5667	(219)
Annual totals kWh/year													
Space heating fuel - main system												3611.2592	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(MEVDecentralised, Database: total watage = 9.8800, total flow = 45.0000, SFP = 0.2196)													
mechanical ventilation fans (SFP = 0.2196)													58.0300 (230a)
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													133.0300 (231)
Electricity for lighting (calculated in Appendix L)													387.0660 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.60 * 908 * 1.00) =													-435.7701 (233)
Total delivered energy for all uses													5565.1518 (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	3611.2592	0.2160	780.0320 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1869.5667	0.2160	403.8264 (264)
Space and water heating			1183.8584 (265)
Pumps and fans	133.0300	0.5190	69.0426 (267)
Energy for lighting	387.0660	0.5190	200.8872 (268)
Energy saving/generation technologies			
PV Unit	-435.7701	0.5190	-226.1647 (269)
Total CO2, kg/year			1227.6236 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			14.3100 (273)

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

DER			14.3100 ZC1
Total Floor Area		TFA	85.8000
Assumed number of occupants		N	2.5638
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190
CO2 emissions from appliances, equation (L14)			15.9634 ZC2
CO2 emissions from cooking, equation (L16)			2.1041 ZC3
Total CO2 emissions			32.3775 ZC4
Residual CO2 emissions offset from biofuel CHP			0.0000 ZC5
Additional allowable electricity generation, kWh/m²/year			0.0000 ZC6
Resulting CO2 emissions offset from additional allowable electricity generation			0.0000 ZC7
Net CO2 emissions			32.3775 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	42.9000 (1b)	x 2.4500 (2b)	= 105.1050 (1b) - (3b)
First floor	42.9000 (1c)	x 2.6000 (2c)	= 111.5400 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	85.8000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 216.6450 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					30.0000 / (5) = 0.1385 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3885 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3302 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4210	0.4128	0.4045	0.3632	0.3550	0.3137	0.3137	0.3054	0.3302	0.3550	0.3715	0.3880 (22b)
Effective ac	0.5886	0.5852	0.5818	0.5660	0.5630	0.5492	0.5492	0.5466	0.5545	0.5630	0.5690	0.5753 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			2.0000	1.0000	2.0000		(26)
TER Opening Type (Uw = 1.40)			12.5000	1.3258	16.5720		(27)
ground			42.9000	0.1300	5.5770		(28a)
external	94.9400	14.5000	80.4400	0.1800	14.4792		(29a)
cd	42.9000		42.9000	0.1300	5.5770		(30)
Total net area of external elements Aum(A, m ²)			180.7400				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		44.2052		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.4920 (36)
Total fabric heat loss						(33) + (36) =	53.6972 (37)
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)							
(38)m	42.0825	41.8364	41.5953	40.4625	40.2506	39.2640	39.2640
Heat transfer coeff	95.7796	95.5336	95.2924	94.1597	93.9478	92.9612	92.9612
Average = Sum(39)m / 12 =							
HLP	1.1163	1.1134	1.1106	1.0974	1.0950	1.0835	1.0835
HLP (average)							
Days in month	31	28	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.5638 (42)
Average daily hot water use (litres/day)												95.0893 (43)
Daily hot water use	104.5983	100.7947	96.9911	93.1875	89.3840	85.5804	85.5804	89.3840	93.1875	96.9911	100.7947	104.5983 (44)
Energy conte	155.1162	135.6656	139.9948	122.0508	117.1107	101.0576	93.6447	107.4587	108.7421	126.7284	138.3340	150.2218 (45)
Energy content (annual)												Total = Sum(45)m = 1496.1255 (45)
Distribution loss (46)m = 0.15 x (45)m												
Water storage loss:	23.2674	20.3498	20.9992	18.3076	17.5666	15.1586	14.0467	16.1188	16.3113	19.0093	20.7501	22.5333 (46)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												

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Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Total heat required for water heating calculated for each month	50.9589	46.0274	49.4256	45.9555	45.5491	42.2040	43.6108	45.5491	45.9555	49.4256	49.3151	50.9589 (61)
Solar input	206.0751	181.6930	189.4204	168.0063	162.6598	143.2617	137.2556	153.0078	154.6976	176.1541	187.6491	201.1807 (62)
Output from w/h	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Heat gains from water heating, kWh/month	206.0751	181.6930	189.4204	168.0063	162.6598	143.2617	137.2556	153.0078	154.6976	176.1541	187.6491	201.1807 (64)
	64.3159	56.6157	58.9047	52.0708	50.3266	44.1527	42.0396	47.1173	47.6456	54.4936	58.3248	62.6885 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	128.1881	128.1881	128.1881	128.1881	128.1881	128.1881	128.1881	128.1881	128.1881	128.1881	128.1881	128.1881	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.9173	19.4667	15.8314	11.9854	8.9592	7.5638	8.1729	10.6234	14.2588	18.1048	21.1310	22.5264	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	231.1353	233.5338	227.4897	214.6227	198.3803	183.1148	172.9165	170.5180	176.5621	189.4291	205.6715	220.9370	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.8188	35.8188	35.8188	35.8188	35.8188	35.8188	35.8188	35.8188	35.8188	35.8188	35.8188	35.8188	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	(71)
Water heating gains (Table 5)	86.4461	84.2495	79.1729	72.3205	67.6432	61.3231	56.5048	63.3297	66.1745	73.2441	81.0067	84.2587	(72)
Total internal gains	403.9551	401.7064	386.9505	363.3850	339.4392	316.4581	302.0506	308.9276	321.4518	345.2344	372.2656	392.1785	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
East					4.3500	19.6403	0.6300	0.7000	0.7700		26.1101 (76)	
South					0.6500	46.7521	0.6300	0.7000	0.7700		9.2872 (78)	
West					7.5000	19.6403	0.6300	0.7000	0.7700		45.0174 (80)	
Solar gains	80.4147	154.3505	248.5195	356.0915	432.3858	441.2247	420.6133	363.7070	286.7440	181.5074	99.6961	66.5168 (83)
Total gains	484.3698	556.0570	635.4700	719.4765	771.8250	757.6828	722.6640	672.6346	608.1957	526.7418	471.9617	458.6953 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	62.2088	62.3690	62.5268	63.2790	63.4218	64.0949	64.0949	64.2211	63.8339	63.4218	63.1337	62.8352	
alpha	5.1473	5.1579	5.1685	5.2186	5.2281	5.2730	5.2730	5.2814	5.2556	5.2281	5.2089	5.1890	
util living area	0.9985	0.9966	0.9902	0.9645	0.8867	0.7248	0.5534	0.6122	0.8632	0.9814	0.9969	0.9989	(86)
MIT	19.7710	19.9158	20.1704	20.5078	20.7906	20.9493	20.9899	20.9834	20.8682	20.4912	20.0706	19.7476	(87)
Th 2	19.9875	19.9899	19.9922	20.0029	20.0049	20.0144	20.0144	20.0161	20.0107	20.0049	20.0009	19.9966	(88)
util rest of house	0.9980	0.9955	0.9866	0.9508	0.8439	0.6363	0.4360	0.4924	0.7966	0.9719	0.9956	0.9985	(89)
MIT 2	18.3436	18.5566	18.9284	19.4180	19.7963	19.9800	20.0106	20.0091	19.9017	19.4031	18.7912	18.3157	(90)
Living area fraction	18.5848	18.7863	19.1383	19.6022	19.9643	20.1438	20.1761	20.1737	20.0650	19.5870	19.0074	18.5577	(91)
MIT	18.5848	18.7863	19.1383	19.6022	19.9643	20.1438	20.1761	20.1737	20.0650	19.5870	19.0074	18.5577	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5848	18.7863	19.1383	19.6022	19.9643	20.1438	20.1761	20.1737	20.0650	19.5870	19.0074	18.5577	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	482.8740	552.3970	624.2285	679.0313	649.8118	491.6460	329.4218	344.6943	487.0794	508.9876	468.9642	457.6191	(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	1368.1932	1326.6096	1204.3342	1007.7140	776.4149	515.3589	332.4365	350.1223	556.7825	844.3062	1123.7804	1361.4651	(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	658.6775	520.2709	431.5986	236.6515	94.1927	0.0000	0.0000	0.0000	0.0000	249.4771	471.4677	672.4614	(98)
Space heating												3334.7973	(98)
Space heating per m2												38.8671	(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												3570.4468 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	658.6775	520.2709	431.5986	236.6515	94.1927	0.0000	0.0000	0.0000	0.0000	249.4771	471.4677	672.4614 (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)	705.2221	557.0352	462.0970	253.3742	100.8487	0.0000	0.0000	0.0000	0.0000	267.1061	504.7834	719.9801 (211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating requirement	206.0751	181.6930	189.4204	168.0063	162.6598	143.2617	137.2556	153.0078	154.6976	176.1541	187.6491	201.1807 (64)
Efficiency of water heater (217)m	87.7692	87.5497	87.0600	85.9135	83.7306	80.3000	80.3000	80.3000	80.3000	85.9270	87.2748	80.3000 (216)
Fuel for water heating, kWh/month	234.7920	207.5312	217.5745	195.5528	194.2656	178.4080	170.9285	190.5452	192.6496	205.0042	215.0095	87.8554 (217)
Water heating fuel used												228.9908 (219)
Annual totals kWh/year												2431.2519 (219)
Space heating fuel - main system												3570.4468 (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)												387.0660 (232)
Total delivered energy for all uses												6463.7647 (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	3570.4468	0.2160	771.2165 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2431.2519	0.2160	525.1504 (264)
Space and water heating			1296.3669 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	387.0660	0.5190	200.8872 (268)
Total CO2, kg/m2/year			1536.1792 (272)
Emissions per m2 for space and water heating			15.1092 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.3413 (272b)
Emissions per m2 for pumps and fans			0.4537 (272c)
Target Carbon Dioxide Emission Rate (TER) = (15.1092 * 1.00) + 2.3413 + 0.4537, rounded to 2 d.p.			17.9000 (273)

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CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

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

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1385 (8)
Pressure test					Yes
Measured/design AP50					4.6300
Infiltration rate					0.3700 (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) =	0.3145 (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	0.4010	0.3931	0.3852	0.3459	0.3381	0.2988	0.2988	0.2909	0.3145	0.3381	0.3538	0.3695 (22b)
Effective ac	0.5804	0.5773	0.5742	0.5598	0.5571	0.5446	0.5446	0.5423	0.5494	0.5571	0.5626	0.5683 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
entrance			2.0000	1.0000	2.0000		(26)
front (Uw = 1.40)			12.5000	1.3258	16.5720		(27)
ground			42.9000	0.1200	5.1480	75.0000	3217.5001 (28a)
external	94.9400	14.5000	80.4400	0.2700	21.7188	150.0000	12066.0004 (29a)
cd	42.9000		42.9000	0.1100	4.7190	9.0000	386.1000 (30)
Total net area of external elements Aum(A, m ²)			180.7400				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		50.1578		(33)
party			44.9500	0.0000	0.0000	45.0000	2022.7500 (32)
stud			156.4000			9.0000	1407.5999 (32c)
internal			42.9000			18.0000	772.2000 (32d)
internal			42.9000			9.0000	386.1000 (32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss
(28)...(30) + (32) + (32a)...(32e) = 20258.2505 (34)
236.1101 (35)
7.5500 (36)
(33) + (36) = 57.7078 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	41.4934	41.2702	41.0515	40.0240	39.8318	38.9370	38.9370	38.7712	39.2816	39.8318	40.2207	40.6272 (38)
Heat transfer coeff	99.2012	98.9780	98.7593	97.7319	97.5396	96.6448	96.6448	96.4791	96.9895	97.5396	97.9285	98.3351 (39)
Average = Sum(39)m / 12 =												97.7309 (39)
HLP	1.1562	1.1536	1.1510	1.1391	1.1368	1.1264	1.1264	1.1245	1.1304	1.1368	1.1414	1.1461 (40)
HLP (average)												1.1391 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.5638 (42)
Average daily hot water use (litres/day)												95.0893 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	104.5983	100.7947	96.9911	93.1875	89.3840	85.5804	85.5804	89.3840	93.1875	96.9911	100.7947	104.5983 (44)
Energy conte	155.1162	135.6656	139.9948	122.0508	117.1107	101.0576	93.6447	107.4587	108.7421	126.7284	138.3340	150.2218 (45)
Energy content (annual)												Total = Sum(45)m = 1496.1255 (45)
Distribution loss (46)m = 0.15 x (45)m												

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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	32.9622	28.8289	29.7489	25.9358	24.8860	21.4747	19.8995	22.8350	23.1077	26.9298	29.3960	31.9221 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	128.1881	128.1881	128.1881	128.1881	128.1881	128.1881	128.1881	128.1881	128.1881	128.1881	128.1881	128.1881	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.9173	19.4667	15.8314	11.9854	8.9592	7.5638	8.1729	10.6234	14.2588	18.1048	21.1310	22.5264	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	231.1353	233.5338	227.4897	214.6227	198.3803	183.1148	172.9165	170.5180	176.5621	189.4291	205.6715	220.9370	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.8188	35.8188	35.8188	35.8188	35.8188	35.8188	35.8188	35.8188	35.8188	35.8188	35.8188	35.8188	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	(71)
Water heating gains (Table 5)	44.3040	42.9002	39.9851	36.0219	33.4490	29.8260	26.7466	30.6922	32.0940	36.1960	40.8277	42.9061	(72)
Total internal gains	358.8130	357.3571	344.7626	324.0864	302.2449	281.9610	269.2925	273.2901	284.3713	305.1863	329.0866	347.8259	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c		Access factor Table 6d		Gains W	
East				4.3500	19.6403	0.4500	0.0000		0.7700		29.6033 (76)	
South				0.6500	46.7521	0.4500	0.0000		0.7700		10.5297 (78)	
West				7.5000	19.6403	0.4500	0.0000		0.7700		51.0401 (80)	
Solar gains	91.1731	175.0006	281.7681	403.7319	490.2333	500.2547	476.8858	412.3662	325.1065	205.7907	113.0342	75.4159 (83)
Total gains	449.9862	532.3577	626.5307	727.8183	792.4782	782.2157	746.1783	685.6563	609.4778	510.9770	442.1208	423.2418 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.7261	56.8540	56.9799	57.5789	57.6924	58.2265	58.2265	58.3266	58.0196	57.6924	57.4633	57.2257	
alpha	4.7817	4.7903	4.7987	4.8386	4.8462	4.8818	4.8818	4.8884	4.8680	4.8462	4.8309	4.8150	
util living area	0.9986	0.9965	0.9893	0.9610	0.8798	0.7205	0.5535	0.6178	0.8659	0.9818	0.9970	0.9989	(86)
MIT	19.6194	19.7838	20.0703	20.4457	20.7591	20.9368	20.9860	20.9767	20.8374	20.4115	19.9445	19.5916	(87)
Th 2	19.9552	19.9573	19.9594	19.9691	19.9709	19.9793	19.9793	19.9809	19.9761	19.9709	19.9672	19.9634	(88)
util rest of house	0.9981	0.9953	0.9855	0.9466	0.8363	0.6313	0.4333	0.4949	0.8006	0.9728	0.9959	0.9986	(89)
MIT 2	18.6929	18.8584	19.1446	19.5184	19.8056	19.9493	19.9756	19.9739	19.8819	19.4923	19.0271	18.6716	(90)
Living area fraction										fLA = Living area / (4) =		0.1690	(91)
MIT	18.8495	19.0148	19.3011	19.6751	19.9667	20.1162	20.1463	20.1433	20.0434	19.6476	19.1822	18.8271	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8495	19.0148	19.3011	19.6751	19.9667	20.1162	20.1463	20.1433	20.0434	19.6476	19.1822	18.8271	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9974	0.9939	0.9823	0.9415	0.8360	0.6442	0.4537	0.5156	0.8057	0.9689	0.9946	0.9980	(94)
Ext temp.	4.3000	4.9000	6.1500	6.8500	6.6250	503.9296	338.5367	353.5360	491.0379	495.0994	439.7303	422.4149	(95)
Heat loss rate W	1443.3238	1397.0576	1264.2233	1053.0712	806.3312	533.1129	342.7335	361.1546	576.4434	882.5027	1183.1874	1438.3566	(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	739.9196	583.2645	482.6800	264.8183	106.9725	0.0000	0.0000	0.0000	0.0000	288.2280	535.2891	755.8607	(98)
Space heating												3757.0326	(98)
Space heating per m2										(98) / (4) =		43.7883	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	908.4609	715.1714	733.2409	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8711	0.9281	0.9022	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	791.3680	663.7230	661.5606	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	1010.9760	966.8838	897.9634	0.0000	0.0000	0.0000	0.0000 (103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling kWh												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	158.1177	225.5517	175.8837	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												559.5531 (104)
Cooled fraction									fC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)												
Intermittency factor	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	39.5294	56.3879	43.9709	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												139.8883 (107)
Space cooling per m2												1.6304 (108)
Energy for space heating												43.7883 (99)
Energy for space cooling												1.6304 (108)
Total												45.4187 (109)
Dwelling Fabric Energy Efficiency (DFEE)												45.4 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

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

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					30.0000 / (5) = 0.1385 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3885 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3302 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4210	0.4128	0.4045	0.3632	0.3550	0.3137	0.3137	0.3054	0.3302	0.3550	0.3715	0.3880 (22b)
Effective ac	0.5886	0.5852	0.5818	0.5660	0.5630	0.5492	0.5492	0.5466	0.5545	0.5630	0.5690	0.5753 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opaque door			2.0000	1.0000	2.0000		(26)					
TER Opening Type (Uw = 1.40)			12.5000	1.3258	16.5720		(27)					
ground			42.9000	0.1300	5.5770		(28a)					
external	94.9400	14.5000	80.4400	0.1800	14.4792		(29a)					
cd	42.9000		42.9000	0.1300	5.5770		(30)					
Total net area of external elements Aum(A, m2)			180.7400				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		44.2052		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.4920 (36)					
Total fabric heat loss						(33) + (36) =	53.6972 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 42.0825	Feb 41.8364	Mar 41.5953	Apr 40.4625	May 40.2506	Jun 39.2640	Jul 39.2640	Aug 39.0813	Sep 39.6440	Oct 40.2506	Nov 40.6793	Dec 41.1276 (38)
Heat transfer coeff	95.7796	95.5336	95.2924	94.1597	93.9478	92.9612	92.9612	92.7785	93.3412	93.9478	94.3765	94.8247 (39)
Average = Sum(39)m / 12 =												94.1587 (39)
HLP	Jan 1.1163	Feb 1.1134	Mar 1.1106	Apr 1.0974	May 1.0950	Jun 1.0835	Jul 1.0835	Aug 1.0813	Sep 1.0879	Oct 1.0950	Nov 1.1000	Dec 1.1052 (40)
HLP (average)												1.0974 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.5638 (42)
Average daily hot water use (litres/day)												95.0893 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	104.5983	100.7947	96.9911	93.1875	89.3840	85.5804	85.5804	89.3840	93.1875	96.9911	100.7947	104.5983 (44)
Energy conte	155.1162	135.6656	139.9948	122.0508	117.1107	101.0576	93.6447	107.4587	108.7421	126.7284	138.3340	150.2218 (45)
Energy content (annual)											Total = Sum(45)m =	1496.1255 (45)
Distribution loss	(46)m = 0.15 x (45)m											
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Heat gains from water heating, kWh/month	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
	32.9622	28.8289	29.7489	25.9358	24.8860	21.4747	19.8995	22.8350	23.1077	26.9298	29.3960	31.9221 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	128.1881	128.1881	128.1881	128.1881	128.1881	128.1881	128.1881	128.1881	128.1881	128.1881	128.1881	128.1881	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.9173	19.4667	15.8314	11.9854	8.9592	7.5638	8.1729	10.6234	14.2588	18.1048	21.1310	22.5264	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	231.1353	233.5338	227.4897	214.6227	198.3803	183.1148	172.9165	170.5180	176.5621	189.4291	205.6715	220.9370	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.8188	35.8188	35.8188	35.8188	35.8188	35.8188	35.8188	35.8188	35.8188	35.8188	35.8188	35.8188	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	(71)
Water heating gains (Table 5)	44.3040	42.9002	39.9851	36.0219	33.4490	29.8260	26.7466	30.6922	32.0940	36.1960	40.8277	42.9061	(72)
Total internal gains	358.8130	357.3571	344.7626	324.0864	302.2449	281.9610	269.2925	273.2901	284.3713	305.1863	329.0866	347.8259	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W

East	4.3500	19.6403	0.6300	0.7000	0.7700	26.1101 (76)
South	0.6500	46.7521	0.6300	0.7000	0.7700	9.2872 (78)
West	7.5000	19.6403	0.6300	0.7000	0.7700	45.0174 (80)

Solar gains	80.4147	154.3505	248.5195	356.0915	432.3858	441.2247	420.6133	363.7070	286.7440	181.5074	99.6961	66.5168	(83)
Total gains	439.2277	511.7077	593.2821	680.1779	734.6307	723.1857	689.9058	636.9971	571.1153	486.6937	428.7828	414.3427	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	62.2088	62.3690	62.5268	63.2790	63.4218	64.0949	64.0949	64.2211	63.8339	63.4218	63.1337	62.8352	
alpha	5.1473	5.1579	5.1685	5.2186	5.2281	5.2730	5.2730	5.2814	5.2556	5.2281	5.2089	5.1890	
util living area	0.9991	0.9977	0.9927	0.9715	0.9026	0.7489	0.5769	0.6410	0.8861	0.9867	0.9980	0.9993	(86)
MIT	19.7217	19.8677	20.1260	20.4712	20.7671	20.9408	20.9878	20.9795	20.8472	20.4507	20.0236	19.6989	(87)
Th 2	19.9875	19.9899	19.9922	20.0029	20.0049	20.0144	20.0144	20.0161	20.0107	20.0049	20.0009	19.9966	(88)
util rest of house	0.9987	0.9969	0.9900	0.9602	0.8636	0.6611	0.4559	0.5181	0.8253	0.9796	0.9972	0.9991	(89)
MIT 2	18.8158	18.9635	19.2222	19.5693	19.8437	19.9864	20.0112	20.0100	19.9217	19.5552	19.1282	18.8004	(90)
Living area fraction									fLA = Living area / (4) =			0.1690	(91)
MIT	18.9689	19.1163	19.3750	19.7217	19.9998	20.1477	20.1762	20.1739	20.0781	19.7065	19.2795	18.9522	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9689	19.1163	19.3750	19.7217	19.9998	20.1477	20.1762	20.1739	20.0781	19.7065	19.2795	18.9522	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	438.4675	509.6271	586.0320	650.3238	634.2565	487.4507	328.7450	343.2901	474.1574	475.3645	427.1990	413.8142	(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	1404.9837	1358.1321	1226.8874	1018.9696	779.7468	515.7210	332.4498	350.1349	558.0067	855.5353	1149.4619	1398.8735	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	719.0881	570.1953	476.7965	265.4250	108.2448	0.0000	0.0000	0.0000	0.0000	282.8471	520.0293	732.8841	(98)
Space heating												3675.5102	(98)
Space heating per m2											(98) / (4) =	42.8381	(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	873.8351	687.9127	705.1165	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8704	0.9302	0.9049	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	760.5775	639.8785	638.0414	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	941.9798	901.1108	841.0890	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	130.6097	194.3568	151.0674	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												476.0339	(104)

FULL SAP CALCULATION PRINTOUT

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 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	32.6524	48.5892	37.7669	0.0000	0.0000	0.0000 (107)
Space cooling											119.0085 (107)
Space cooling per m2											1.3870 (108)
Energy for space heating											42.8381 (99)
Energy for space cooling											1.3870 (108)
Total											44.2252 (109)
Target Fabric Energy Efficiency (TFEE)											50.9 (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	42.9000 (1b)	x 2.4500 (2b)	= 105.1050 (1b) - (3b)
First floor	42.9000 (1c)	x 2.6000 (2c)	= 111.5400 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	85.8000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 216.6450 (5)

2. Ventilation rate

					main heating	secondary heating	other		total	m3 per hour		
Number of chimneys					0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues					0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans											0 * 10 =	0.0000 (7a)
Number of passive vents											0 * 10 =	0.0000 (7b)
Number of flueless gas fires											0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =											0.0000 / (5) =	0.0000 (8)
Pressure test											Yes	
Measured/design AP50												4.6300
Infiltration rate												0.2315 (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) =	0.1968 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind factor	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												
	0.2312	0.2165	0.2165	0.1968	0.2017	0.1919	0.1919	0.1869	0.1869	0.2017	0.1968	0.2017 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
entrance			2.0000	1.0000	2.0000		(26)
front (Uw = 1.40)			12.5000	1.3258	16.5720		(27)
ground			42.9000	0.1200	5.1480	75.0000	3217.5001 (28a)
external	94.9400	14.5000	80.4400	0.2700	21.7188	150.0000	12066.0004 (29a)
cd	42.9000		42.9000	0.1100	4.7190	9.0000	386.1000 (30)
Total net area of external elements Aum(A, m ²)			180.7400				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	50.1578			(33)
party			44.9500	0.0000	0.0000	45.0000	2022.7500 (32)
stud			156.4000			9.0000	1407.5999 (32c)
internal			42.9000			18.0000	772.2000 (32d)
internal			42.9000			9.0000	386.1000 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	20258.2505 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							236.1101 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.5500 (36)
Total fabric heat loss						(33) + (36) =	57.7078 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	35.7464	35.7464	35.7464	35.7464	35.7464	35.7464	35.7464	35.7464	35.7464	35.7464	35.7464	35.7464 (38)
Heat transfer coeff	93.4542	93.4542	93.4542	93.4542	93.4542	93.4542	93.4542	93.4542	93.4542	93.4542	93.4542	93.4542 (39)
Average = Sum(39)m / 12 =												93.4542 (39)
HLP	1.0892	1.0892	1.0892	1.0892	1.0892	1.0892	1.0892	1.0892	1.0892	1.0892	1.0892	1.0892 (40)
HLP (average)												1.0892 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.5638 (42)
Average daily hot water use (litres/day)												95.0893 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	104.5983	100.7947	96.9911	93.1875	89.3840	85.5804	85.5804	89.3840	93.1875	96.9911	100.7947	104.5983 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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Energy content (annual)	155.1162	135.6656	139.9948	122.0508	117.1107	101.0576	93.6447	107.4587	108.7421	126.7284	138.3340	150.2218 (45)
Distribution loss (46)m = 0.15 x (45)m	23.2674	20.3498	20.9992	18.3076	17.5666	15.1586	14.0467	16.1188	16.3113	19.0093	20.7501	22.5333 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.1288	12.7509	14.0824	13.5858	14.0078	13.5204	13.9489	13.9871	13.5560	14.0516	13.6448	14.1171 (61)
Total heat required for water heating calculated for each month	169.2451	148.4165	154.0772	135.6366	131.1185	114.5780	107.5936	121.4458	122.2981	140.7800	151.9788	164.3389 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	169.2451	148.4165	154.0772	135.6366	131.1185	114.5780	107.5936	121.4458	122.2981	140.7800	151.9788	164.3389 (64)
RHI water heating demand	55.1084	48.2965	50.0689	43.9783	42.4413	36.9817	34.6241	39.2268	39.5458	45.6501	49.4073	53.4780 (65)
Heat gains from water heating, kWh/month												
	55.1084	48.2965	50.0689	43.9783	42.4413	36.9817	34.6241	39.2268	39.5458	45.6501	49.4073	53.4780 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	153.8257	153.8257	153.8257	153.8257	153.8257	153.8257	153.8257	153.8257	153.8257	153.8257	153.8257	153.8257 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	54.7932	48.6668	39.5785	29.9635	22.3981	18.9094	20.4323	26.5586	35.6469	45.2620	52.8274	56.3161 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	344.9781	348.5579	339.5369	320.3323	296.0900	273.3057	258.0843	254.5045	263.5255	282.7301	306.9724	329.7567 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.9463	52.9463	52.9463	52.9463	52.9463	52.9463	52.9463	52.9463	52.9463	52.9463	52.9463	52.9463 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505 (71)
Water heating gains (Table 5)	74.0704	71.8699	67.2969	61.0810	57.0447	51.3635	46.5378	52.7242	54.9247	61.3577	68.6212	71.8790 (72)
Total internal gains	581.0632	576.3161	553.6339	518.5984	482.7543	450.8002	432.2759	441.0089	461.3186	496.5712	535.6425	565.1734 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
East				4.3500	25.1733	0.4500	0.0000	0.7700	37.9430 (76)			
South				0.6500	56.5862	0.4500	0.0000	0.7700	12.7446 (78)			
West				7.5000	25.1733	0.4500	0.0000	0.7700	65.4190 (80)			
Solar gains	116.1066	189.7030	310.3570	444.7487	506.6847	571.4649	523.6568	473.5276	374.3284	240.6065	143.4990	90.8924 (83)
Total gains	697.1698	766.0191	863.9909	963.3472	989.4390	1022.2651	955.9327	914.5365	835.6471	737.1778	679.1415	656.0658 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	60.2144	60.2144	60.2144	60.2144	60.2144	60.2144	60.2144	60.2144	60.2144	60.2144	60.2144	60.2144
alpha	5.0143	5.0143	5.0143	5.0143	5.0143	5.0143	5.0143	5.0143	5.0143	5.0143	5.0143	5.0143
util living area	0.9862	0.9775	0.9460	0.8561	0.6935	0.4608	0.3219	0.3262	0.6024	0.8797	0.9704	0.9890 (86)
MIT	20.1294	20.2436	20.4962	20.7754	20.9396	20.9935	20.9992	20.9991	20.9769	20.7878	20.4211	20.0954 (87)
Th 2	20.0097	20.0097	20.0097	20.0097	20.0097	20.0097	20.0097	20.0097	20.0097	20.0097	20.0097	20.0097 (88)
util rest of house	0.9819	0.9706	0.9298	0.8169	0.6237	0.3740	0.2257	0.2257	0.5063	0.8349	0.9595	0.9855 (89)
MIT 2	19.2427	19.3543	19.5968	19.8485	19.9765	20.0076	20.0095	20.0095	20.0008	19.8663	19.5294	19.2095 (90)
Living area fraction	19.3926	19.5046	19.7488	20.0051	20.1393	20.1742	20.1768	20.1768	20.1657	20.0220	19.6801	19.3593 (92)
MIT	19.3926	19.5046	19.7488	20.0051	20.1393	20.1742	20.1768	20.1768	20.1657	20.0220	19.6801	19.3593 (92)
Temperature adjustment												-0.1500
adjusted MIT	19.2426	19.3546	19.5988	19.8551	19.9893	20.0242	20.0268	20.0268	20.0157	19.8720	19.5301	19.2093 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	681.4393	738.9928	796.2172	780.2358	615.6314	383.6164	217.3480	208.0067	423.6389	610.0065	646.9809	643.9994 (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	1274.9577	1248.0458	1121.3393	911.6557	643.8341	385.4255	217.4482	208.1027	431.3605	726.3303	1021.4620	1262.4969 (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	441.5777	342.0837	241.8908	94.6223	20.9828	0.0000	0.0000	0.0000	0.0000	86.5449	269.6264	460.1621 (98)
Space heating												1957.4906 (98)
RHI space heating demand												1957 (98)

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CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

1. Overall dwelling dimensions

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

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					0 * 10 = 0.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					0.0000 / (5) = 0.0000 (8)
Pressure test					Yes
Measured/design AP50					4.6300
Infiltration rate					0.2315 (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) =		0.1968 (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	0.2509	0.2460	0.2410	0.2165	0.2115	0.1869	0.1869	0.1820	0.1968	0.2115	0.2214	0.2312 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5009	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
entrance			2.0000	1.0000	2.0000		(26)
front (Uw = 1.40)			12.5000	1.3258	16.5720		(27)
ground			42.9000	0.1200	5.1480	75.0000	3217.5001 (28a)
external	94.9400	14.5000	80.4400	0.2700	21.7188	150.0000	12066.0004 (29a)
cd	42.9000		42.9000	0.1100	4.7190	9.0000	386.1000 (30)
Total net area of external elements Aum(A, m ²)			180.7400				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	50.1578			(33)
party			44.9500	0.0000	0.0000	45.0000	2022.7500 (32)
stud			156.4000			9.0000	1407.5999 (32c)
internal			42.9000			18.0000	772.2000 (32d)
internal			42.9000			9.0000	386.1000 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	20258.2505 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							236.1101 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.5500 (36)
Total fabric heat loss						(33) + (36) =	57.7078 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	35.8099	35.7464	35.7464	35.7464	35.7464	35.7464	35.7464	35.7464	35.7464	35.7464	35.7464	35.7464 (38)
Heat transfer coeff	93.5177	93.4542	93.4542	93.4542	93.4542	93.4542	93.4542	93.4542	93.4542	93.4542	93.4542	93.4542 (39)
Average = Sum(39)m / 12 =												93.4595 (39)
HLP	1.0900	1.0892	1.0892	1.0892	1.0892	1.0892	1.0892	1.0892	1.0892	1.0892	1.0892	1.0892 (40)
HLP (average)												1.0893 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.5638 (42)
Average daily hot water use (litres/day)												95.0893 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	104.5983	100.7947	96.9911	93.1875	89.3840	85.5804	85.5804	89.3840	93.1875	96.9911	100.7947	104.5983 (44)

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Energy conte	155.1162	135.6656	139.9948	122.0508	117.1107	101.0576	93.6447	107.4587	108.7421	126.7284	138.3340	150.2218 (45)
Energy content (annual)	Total = Sum (45)m = 1496.1255 (45)											
Distribution loss (46)m = 0.15 x (45)m	23.2674	20.3498	20.9992	18.3076	17.5666	15.1586	14.0467	16.1188	16.3113	19.0093	20.7501	22.5333 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.1288	12.7509	14.0824	13.5858	14.0078	13.5204	13.9489	13.9871	13.5560	14.0516	13.6448	14.1171 (61)
Total heat required for water heating calculated for each month	169.2451	148.4165	154.0772	135.6366	131.1185	114.5780	107.5936	121.4458	122.2981	140.7800	151.9788	164.3389 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	169.2451	148.4165	154.0772	135.6366	131.1185	114.5780	107.5936	121.4458	122.2981	140.7800	151.9788	164.3389 (64)
Heat gains from water heating, kWh/month	55.1084	48.2965	50.0689	43.9783	42.4413	36.9817	34.6241	39.2268	39.5458	45.6501	49.4073	53.4780 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	153.8257	153.8257	153.8257	153.8257	153.8257	153.8257	153.8257	153.8257	153.8257	153.8257	153.8257	153.8257 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	54.7932	48.6668	39.5785	29.9635	22.3981	18.9094	20.4323	26.5586	35.6469	45.2620	52.8274	56.3161 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	344.9781	348.5579	339.5369	320.3323	296.0900	273.3057	258.0843	254.5045	263.5255	282.7301	306.9724	329.7567 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.9463	52.9463	52.9463	52.9463	52.9463	52.9463	52.9463	52.9463	52.9463	52.9463	52.9463	52.9463 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505 (71)
Water heating gains (Table 5)	74.0704	71.8699	67.2969	61.0810	57.0447	51.3635	46.5378	52.7242	54.9247	61.3577	68.6212	71.8790 (72)
Total internal gains	581.0632	576.3161	553.6339	518.5984	482.7543	450.8002	432.2759	441.0089	461.3186	496.5712	535.6425	565.1734 (73)

6. Solar gains

[Jan]													
				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
East				4.3500	19.6403		0.4500		0.0000		0.7700		29.6033 (76)
South				0.6500	46.7521		0.4500		0.0000		0.7700		10.5297 (78)
West				7.5000	19.6403		0.4500		0.0000		0.7700		51.0401 (80)
Solar gains	91.1731	175.0006	281.7681	403.7319	490.2333	500.2547	476.8858	412.3662	325.1065	205.7907	113.0342	75.4159	(83)
Total gains	672.2363	751.3167	835.4020	922.3303	972.9876	951.0549	909.1618	853.3751	786.4252	702.3619	648.6767	640.5893	(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	60.1735	60.2144	60.2144	60.2144	60.2144	60.2144	60.2144	60.2144	60.2144	60.2144	60.2144	60.2144
alpha	5.0116	5.0143	5.0143	5.0143	5.0143	5.0143	5.0143	5.0143	5.0143	5.0143	5.0143	5.0143
util living area	0.9916	0.9844	0.9641	0.9061	0.7834	0.6046	0.4476	0.4956	0.7417	0.9366	0.9844	0.9934 (86)
MIT	19.9633	20.1139	20.3633	20.6582	20.8762	20.9732	20.9951	20.9919	20.9287	20.6362	20.2350	19.9185 (87)
Th 2	20.0090	20.0097	20.0097	20.0097	20.0097	20.0097	20.0097	20.0097	20.0097	20.0097	20.0097	20.0097 (88)
util rest of house	0.9891	0.9798	0.9535	0.8789	0.7281	0.5209	0.3493	0.3930	0.6619	0.9120	0.9789	0.9914 (89)
MIT 2	19.0777	19.2267	19.4699	19.7461	19.9307	19.9979	20.0084	20.0074	19.9729	19.7330	19.3477	19.0339 (90)
Living area fraction	fLA = Living area / (4) = 0.1690 (91)											
MIT	19.2274	19.3766	19.6209	19.9002	20.0905	20.1627	20.1751	20.1738	20.1344	19.8857	19.4977	19.1834 (92)
Temperature adjustment	-0.1500											
adjusted MIT	19.0774	19.2266	19.4709	19.7502	19.9405	20.0127	20.0251	20.0238	19.9844	19.7357	19.3477	19.0334 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	662.7873	732.5404	790.4567	802.9771	704.2630	495.6213	318.9873	336.6659	518.7937	634.6211	631.8246	633.3384 (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	1381.9486	1338.8854	1212.1827	1013.9971	770.1077	505.8388	320.0947	338.6576	549.9245	853.7675	1144.5967	1386.2429 (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	535.0560	407.4639	313.7641	151.9344	48.9884	0.0000	0.0000	0.0000	0.0000	163.0449	369.1959	560.1610 (98)
Space heating	2549.6086 (98)											
Space heating per m ²	(98) / (4) = 29.7157 (99)											

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8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												90.5000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2817.2471	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	535.0560	407.4639	313.7641	151.9344	48.9884	0.0000	0.0000	0.0000	0.0000	163.0449	369.1959	560.1610	(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)	591.2221	450.2363	346.7007	167.8833	54.1309	0.0000	0.0000	0.0000	0.0000	180.1602	407.9513	618.9624	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	169.2451	148.4165	154.0772	135.6366	131.1185	114.5780	107.5936	121.4458	122.2981	140.7800	151.9788	164.3389	(64)
Efficiency of water heater	89.7098	89.6229	89.4205	88.9619	88.1478	87.3000	87.3000	87.3000	87.3000	88.9886	89.5429	87.3000	(216)
(217)m	89.7098	89.6229	89.4205	88.9619	88.1478	87.3000	87.3000	87.3000	87.3000	88.9886	89.5429	89.7537	(217)
Fuel for water heating, kWh/month	188.6584	165.6011	172.3063	152.4659	148.7485	131.2463	123.2459	139.1132	140.0895	158.2001	169.7274	183.0997	(219)
Water heating fuel used	1872.5021											1872.5021	(219)
Annual totals kWh/year													
Space heating fuel - main system												2817.2471	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 9.8800, total flow = 45.0000, SFP = 0.2196)													
mechanical ventilation fans (SFP = 0.2196)												58.0300	(230a)
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												133.0300	(231)
Electricity for lighting (calculated in Appendix L)												387.0660	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.60 * 908 * 1.00) =										-435.7701		-435.7701	(233)
Total delivered energy for all uses												4774.0752	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2817.2471	3.4800	98.0402	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1872.5021	3.4800	65.1631	(247)
Mechanical ventilation fans	58.0300	13.1900	7.6542	(249)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	387.0660	13.1900	51.0540	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-435.7701	13.1900	-57.4781	(252)
Total energy cost			294.3259	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):			0.4200	(256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$		0.9451	(257)
SAP value			86.8161	
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	2817.2471	0.2160	608.5254	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1872.5021	0.2160	404.4605	(264)
Space and water heating			1012.9858	(265)
Pumps and fans	133.0300	0.5190	69.0426	(267)
Energy for lighting	387.0660	0.5190	200.8872	(268)
Energy saving/generation technologies				
PV Unit	-435.7701	0.5190	-226.1647	(269)
Total kg/year			1056.7510	(272)
CO2 emissions per m2			12.3200	(273)
EI value			89.1740	
EI rating			89	(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	$3.48 / 0.8861 = 3.927$, stars = 4
Water heating environmental impact	$0.216 / 0.8861 = 0.2438$, stars = 4

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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

1. Overall dwelling dimensions

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

2. Ventilation rate

					main heating	secondary heating	other		total	m3 per hour		
Number of chimneys					0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues					0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans											0 * 10 =	0.0000 (7a)
Number of passive vents											0 * 10 =	0.0000 (7b)
Number of flueless gas fires											0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =											0.0000 / (5) =	0.0000 (8)
Pressure test											Yes	
Measured/design AP50												4.6300
Infiltration rate												0.2315 (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) =	0.1968 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind factor	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												
	0.2312	0.2165	0.2165	0.1968	0.2017	0.1919	0.1919	0.1869	0.1869	0.2017	0.1968	0.2017 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
entrance			2.0000	1.0000	2.0000		(26)
front (Uw = 1.40)			12.5000	1.3258	16.5720		(27)
ground			42.9000	0.1200	5.1480	75.0000	3217.5001 (28a)
external	94.9400	14.5000	80.4400	0.2700	21.7188	150.0000	12066.0004 (29a)
cd	42.9000		42.9000	0.1100	4.7190	9.0000	386.1000 (30)
Total net area of external elements Aum(A, m ²)			180.7400				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	50.1578			(33)
party			44.9500	0.0000	0.0000	45.0000	2022.7500 (32)
stud			156.4000			9.0000	1407.5999 (32c)
internal			42.9000			18.0000	772.2000 (32d)
internal			42.9000			9.0000	386.1000 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	20258.2505 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							236.1101 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.5500 (36)
Total fabric heat loss						(33) + (36) =	57.7078 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	35.7464	35.7464	35.7464	35.7464	35.7464	35.7464	35.7464	35.7464	35.7464	35.7464	35.7464	35.7464 (38)
Heat transfer coeff	93.4542	93.4542	93.4542	93.4542	93.4542	93.4542	93.4542	93.4542	93.4542	93.4542	93.4542	93.4542 (39)
Average = Sum(39)m / 12 =												93.4542 (39)
HLP	1.0892	1.0892	1.0892	1.0892	1.0892	1.0892	1.0892	1.0892	1.0892	1.0892	1.0892	1.0892 (40)
HLP (average)												1.0892 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.5638 (42)
Average daily hot water use (litres/day)												95.0893 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	104.5983	100.7947	96.9911	93.1875	89.3840	85.5804	85.5804	89.3840	93.1875	96.9911	100.7947	104.5983 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Energy conte	155.1162	135.6656	139.9948	122.0508	117.1107	101.0576	93.6447	107.4587	108.7421	126.7284	138.3340	150.2218 (45)
Energy content (annual)										Total =	Sum (45)m =	1496.1255 (45)
Distribution loss (46)m = 0.15 x (45)m												
	23.2674	20.3498	20.9992	18.3076	17.5666	15.1586	14.0467	16.1188	16.3113	19.0093	20.7501	22.5333 (46)
Water storage loss:												
Total storage loss												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.1288	12.7509	14.0824	13.5858	14.0078	13.5204	13.9489	13.9871	13.5560	14.0516	13.6448	14.1171 (61)
Total heat required for water heating calculated for each month												
	169.2451	148.4165	154.0772	135.6366	131.1185	114.5780	107.5936	121.4458	122.2981	140.7800	151.9788	164.3389 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) =	Sum (63)m =			0.0000 (63)
Output from w/h												
	169.2451	148.4165	154.0772	135.6366	131.1185	114.5780	107.5936	121.4458	122.2981	140.7800	151.9788	164.3389 (64)
Heat gains from water heating, kWh/month								Total per year (kWh/year) =	Sum (64)m =			1661.5070 (64)
	55.1084	48.2965	50.0689	43.9783	42.4413	36.9817	34.6241	39.2268	39.5458	45.6501	49.4073	53.4780 (65)

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

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	153.8257	153.8257	153.8257	153.8257	153.8257	153.8257	153.8257	153.8257	153.8257	153.8257	153.8257	153.8257 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	54.7932	48.6668	39.5785	29.9635	22.3981	18.9094	20.4323	26.5586	35.6469	45.2620	52.8274	56.3161 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	344.9781	348.5579	339.5369	320.3323	296.0900	273.3057	258.0843	254.5045	263.5255	282.7301	306.9724	329.7567 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	52.9463	52.9463	52.9463	52.9463	52.9463	52.9463	52.9463	52.9463	52.9463	52.9463	52.9463	52.9463 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)												
	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505 (71)
Water heating gains (Table 5)												
	74.0704	71.8699	67.2969	61.0810	57.0447	51.3635	46.5378	52.7242	54.9247	61.3577	68.6212	71.8790 (72)
Total internal gains												
	581.0632	576.3161	553.6339	518.5984	482.7543	450.8002	432.2759	441.0089	461.3186	496.5712	535.6425	565.1734 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
East				4.3500	25.1733		0.4500	0.0000	0.7700		37.9430 (76)	
South				0.6500	56.5862		0.4500	0.0000	0.7700		12.7446 (78)	
West				7.5000	25.1733		0.4500	0.0000	0.7700		65.4190 (80)	
Solar gains	116.1066	189.7030	310.3570	444.7487	506.6847	571.4649	523.6568	473.5276	374.3284	240.6065	143.4990	90.8924 (83)
Total gains	697.1698	766.0191	863.9909	963.3472	989.4390	1022.2651	955.9327	914.5365	835.6471	737.1778	679.1415	656.0658 (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	60.2144	60.2144	60.2144	60.2144	60.2144	60.2144	60.2144	60.2144	60.2144	60.2144	60.2144	60.2144
alpha	5.0143	5.0143	5.0143	5.0143	5.0143	5.0143	5.0143	5.0143	5.0143	5.0143	5.0143	5.0143
util living area												
	0.9862	0.9775	0.9460	0.8561	0.6935	0.4608	0.3219	0.3262	0.6024	0.8797	0.9704	0.9890 (86)
MIT	20.1294	20.2436	20.4962	20.7754	20.9396	20.9935	20.9992	20.9991	20.9769	20.7878	20.4211	20.0954 (87)
Th 2	20.0097	20.0097	20.0097	20.0097	20.0097	20.0097	20.0097	20.0097	20.0097	20.0097	20.0097	20.0097 (88)
util rest of house												
	0.9819	0.9706	0.9298	0.8169	0.6237	0.3740	0.2257	0.2257	0.5063	0.8349	0.9595	0.9855 (89)
MIT 2	19.2427	19.3543	19.5968	19.8485	19.9765	20.0076	20.0095	20.0095	20.0008	19.8663	19.5294	19.2095 (90)
Living area fraction									fLA =	Living area / (4) =		0.1690 (91)
MIT	19.3926	19.5046	19.7488	20.0051	20.1393	20.1742	20.1768	20.1768	20.1657	20.0220	19.6801	19.3593 (92)
Temperature adjustment												-0.1500
adjusted MIT	19.2426	19.3546	19.5988	19.8551	19.9893	20.0242	20.0268	20.0268	20.0157	19.8720	19.5301	19.2093 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9774	0.9647	0.9216	0.8099	0.6222	0.3753	0.2274	0.2274	0.5070	0.8275	0.9526	0.9816 (94)
Useful gains	681.4393	738.9928	796.2172	780.2358	615.6314	383.6164	217.3480	208.0067	423.6389	610.0065	646.9809	643.9994 (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												
	1274.9577	1248.0458	1121.3393	911.6557	643.8341	385.4255	217.4482	208.1027	431.3605	726.3303	1021.4620	1262.4969 (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												
	441.5777	342.0837	241.8908	94.6223	20.9828	0.0000	0.0000	0.0000	0.0000	86.5449	269.6264	460.1621 (98)
Space heating												1957.4906 (98)
Space heating per m2										(98) / (4) =		22.8146 (99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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													2162.9731 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	441.5777	342.0837	241.8908	94.6223	20.9828	0.0000	0.0000	0.0000	0.0000	86.5449	269.6264	460.1621	(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)	487.9311	377.9930	267.2826	104.5550	23.1854	0.0000	0.0000	0.0000	0.0000	95.6297	297.9297	508.4665	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	169.2451	148.4165	154.0772	135.6366	131.1185	114.5780	107.5936	121.4458	122.2981	140.7800	151.9788	164.3389	(64)
Efficiency of water heater	89.5901	89.5073	89.2273	88.5872	87.7279	87.3000	87.3000	87.3000	87.3000	88.4912	89.3198	87.3000	(216)
(217)m	89.5901	89.5073	89.2273	88.5872	87.7279	87.3000	87.3000	87.3000	87.3000	88.4912	89.3198	89.6354	(217)
Fuel for water heating, kWh/month	188.9105	165.8151	172.6794	153.1108	149.4604	131.2463	123.2459	139.1132	140.0895	159.0892	170.1513	183.3415	(219)
Water heating fuel used	188.9105	165.8151	172.6794	153.1108	149.4604	131.2463	123.2459	139.1132	140.0895	159.0892	170.1513	1876.2528	(219)
Annual totals kWh/year													
Space heating fuel - main system												2162.9731	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 9.8800, total flow = 45.0000, SFP = 0.2196)													
mechanical ventilation fans (SFP = 0.2196)												58.0300	(230a)
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												133.0300	(231)
Electricity for lighting (calculated in Appendix L)												387.0660	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.60 * 1030 * 1.00) =											-494.4285	-494.4285	(233)
Total delivered energy for all uses												4064.8934	(238)

10a. Fuel costs - using BEDF prices (528)

	Fuel	Fuel price	Fuel cost
	kWh/year	p/kWh	£/year
Space heating - main system 1	2162.9731	10.2300	221.2721 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1876.2528	10.2300	191.9407 (247)
Mechanical ventilation fans	58.0300	36.7200	21.3086 (249)
Pumps and fans for heating	75.0000	36.7200	27.5400 (249)
Energy for lighting	387.0660	36.7200	142.1306 (250)
Additional standing charges			103.0000 (251)
Energy saving/generation technologies			
PV Unit	-494.4285	36.7200	-181.5542 (252)
Total energy cost			525.6379 (255)

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

	Energy	Emission factor	Emissions
	kWh/year	kg CO2/kWh	kg CO2/year
Space heating - main system 1	2162.9731	0.2160	467.2022 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1876.2528	0.2160	405.2706 (264)
Space and water heating			872.4728 (265)
Pumps and fans	133.0300	0.5190	69.0426 (267)
Energy for lighting	387.0660	0.5190	200.8872 (268)
Energy saving/generation technologies			
PV Unit	-494.4285	0.5190	-256.6084 (269)
Total kg/year			885.7942 (272)

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

	Energy	Primary energy factor	Primary energy
	kWh/year	kg CO2/kWh	kWh/year
Space heating - main system 1	2162.9731	1.2200	2638.8272 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1876.2528	1.2200	2289.0285 (264)
Space and water heating			4927.8556 (265)
Pumps and fans	133.0300	3.0700	408.4023 (267)
Energy for lighting	387.0660	3.0700	1188.2925 (268)
Energy saving/generation technologies			

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

PV Unit	-494.4285	3.0700	-1517.8956 (269)
Primary energy kWh/year			5006.6548 (272)
Primary energy kWh/m2/year			58.3526 (273)

SAP 2012 EPC IMPROVEMENTS

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

(For testing purposes):

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

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.2	-£ 83	-189 kg (21.3%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£83 2.20 kg/m²	B 88	B 91
Total Savings	£83 2.20 kg/m²		
Potential energy efficiency rating:		B 88	
Potential environmental impact rating:			B 91

Fuel prices for cost data on this page from database revision number 528 TEST (04 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	£191	£209	-£18
Mains gas	£516	£415	£102
Space heating	£373	£373	£0
Water heating	£192	£109	£83
Lighting	£142	£142	£0
Generated (PV)	-£182	-£182	£0
Total cost of fuels	£525	£442	£84
Total cost of uses	£525	£442	£83
Delivered energy	47 kWh/m²	36 kWh/m²	11 kWh/m²
Carbon dioxide emissions	0.9 tonnes	0.7 tonnes	0.2 tonnes
CO2 emissions per m²	10 kg/m²	8 kg/m²	2 kg/m²
Primary energy	58 kWh/m²	46 kWh/m²	12 kWh/m²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

1. Overall dwelling dimensions

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

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					0 * 10 = 0.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					0.0000 / (5) = 0.0000 (8)
Pressure test					Yes
Measured/design AP50					4.6300
Infiltration rate					0.2315 (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) =		0.1968 (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	0.2509	0.2460	0.2410	0.2165	0.2115	0.1869	0.1869	0.1820	0.1968	0.2115	0.2214	0.2312 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5009	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
entrance			2.0000	1.0000	2.0000		(26)
front (Uw = 1.40)			12.5000	1.3258	16.5720		(27)
ground			42.9000	0.1200	5.1480	75.0000	3217.5001 (28a)
external	94.9400	14.5000	80.4400	0.2700	21.7188	150.0000	12066.0004 (29a)
cd	42.9000		42.9000	0.1100	4.7190	9.0000	386.1000 (30)
Total net area of external elements Aum(A, m ²)			180.7400				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	50.1578			(33)
party			44.9500	0.0000	0.0000	45.0000	2022.7500 (32)
stud			156.4000			9.0000	1407.5999 (32c)
internal			42.9000			18.0000	772.2000 (32d)
internal			42.9000			9.0000	386.1000 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	20258.2505 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							236.1101 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.5500 (36)
Total fabric heat loss						(33) + (36) =	57.7078 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	35.8099	35.7464	35.7464	35.7464	35.7464	35.7464	35.7464	35.7464	35.7464	35.7464	35.7464	35.7464 (38)
Heat transfer coeff	93.5177	93.4542	93.4542	93.4542	93.4542	93.4542	93.4542	93.4542	93.4542	93.4542	93.4542	93.4542 (39)
Average = Sum(39)m / 12 =												93.4595 (39)
HLP	1.0900	1.0892	1.0892	1.0892	1.0892	1.0892	1.0892	1.0892	1.0892	1.0892	1.0892	1.0892 (40)
HLP (average)												1.0893 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.5638 (42)
Average daily hot water use (litres/day)												95.0893 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	104.5983	100.7947	96.9911	93.1875	89.3840	85.5804	85.5804	89.3840	93.1875	96.9911	100.7947	104.5983 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Energy content (annual)	155.1162	135.6656	139.9948	122.0508	117.1107	101.0576	93.6447	107.4587	108.7421	126.7284	138.3340	150.2218 (45)
Distribution loss (46)m = 0.15 x (45)m	23.2674	20.3498	20.9992	18.3076	17.5666	15.1586	14.0467	16.1188	16.3113	19.0093	20.7501	22.5333 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.1288	12.7509	14.0824	13.5858	14.0078	13.5204	13.9489	13.9871	13.5560	14.0516	13.6448	14.1171 (61)
Total heat required for water heating calculated for each month	169.2451	148.4165	154.0772	135.6366	131.1185	114.5780	107.5936	121.4458	122.2981	140.7800	151.9788	164.3389 (62)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.7000 (H2)
Collector heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0050 (H3a)
Collector effective heat loss coefficient												1.8063 (H3b)
Collector performance ratio												2.5804 (H4)
Annual solar radiation per m2												1079.5246 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												1813.6014 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.2122 (H8)
Utilisation factor												0.5617 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												95.0893 (H14)
Volume ratio Veff/V												0.7887 (H15)
Solar storage volume factor												0.9525 (H16)
Solar input												-853.2830 (H17)
Solar input	-24.7435	-41.2898	-70.3213	-94.2443	-116.4309	-114.4702	-112.9574	-98.6914	-77.2952	-52.7835	-29.3494	-20.7061 (63)
Solar input (sum of months) = Sum (63)m =												-853.2830 (63)
Output from w/h	144.5015	107.1267	83.7560	41.3923	14.6875	0.1078	0.0000	22.7543	45.0029	87.9965	122.6294	143.6328 (64)
Total per year (kWh/year) = Sum (64)m =												813.5878 (64)
Heat gains from water heating, kWh/month	55.1084	48.2965	50.0689	43.9783	42.4413	36.9817	34.6241	39.2268	39.5458	45.6501	49.4073	53.4780 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	153.8257	153.8257	153.8257	153.8257	153.8257	153.8257	153.8257	153.8257	153.8257	153.8257	153.8257	153.8257 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	54.7932	48.6668	39.5785	29.9635	22.3981	18.9094	20.4323	26.5586	35.6469	45.2620	52.8274	56.3161 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	344.9781	348.5579	339.5369	320.3323	296.0900	273.3057	258.0843	254.5045	263.5255	282.7301	306.9724	329.7567 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.9463	52.9463	52.9463	52.9463	52.9463	52.9463	52.9463	52.9463	52.9463	52.9463	52.9463	52.9463 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505 (71)
Water heating gains (Table 5)	74.0704	71.8699	67.2969	61.0810	57.0447	51.3635	46.5378	52.7242	54.9247	61.3577	68.6212	71.8790 (72)
Total internal gains	581.0632	576.3161	553.6339	518.5984	482.7543	450.8002	432.2759	441.0089	461.3186	496.5712	535.6425	565.1734 (73)

6. Solar gains

[Jan]												
Area												
Solar flux												
Specific data												
Specific data												
Access factor												
Gains												
East	4.3500	19.6403	0.4500	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	29.6033 (76)
South	0.6500	46.7521	0.4500	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	10.5297 (78)
West	7.5000	19.6403	0.4500	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	51.0401 (80)
Solar gains	91.1731	175.0006	281.7681	403.7319	490.2333	500.2547	476.8858	412.3662	325.1065	205.7907	113.0342	75.4159 (83)
Total gains	672.2363	751.3167	835.4020	922.3303	972.9876	951.0549	909.1618	853.3751	786.4252	702.3619	648.6767	640.5893 (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	60.1735	60.2144	60.2144	60.2144	60.2144	60.2144	60.2144	60.2144	60.2144	60.2144	60.2144	60.2144 (86)
alpha	5.0116	5.0143	5.0143	5.0143	5.0143	5.0143	5.0143	5.0143	5.0143	5.0143	5.0143	5.0143 (86)
util living area	0.9916	0.9844	0.9641	0.9061	0.7834	0.6046	0.4476	0.4956	0.7417	0.9366	0.9844	0.9934 (86)
MIT	19.9633	20.1139	20.3633	20.6582	20.8762	20.9732	20.9951	20.9919	20.9287	20.6362	20.2350	19.9185 (87)
Th 2	20.0090	20.0097	20.0097	20.0097	20.0097	20.0097	20.0097	20.0097	20.0097	20.0097	20.0097	20.0097 (88)
util rest of house	0.9891	0.9798	0.9535	0.8789	0.7281	0.5209	0.3493	0.3930	0.6619	0.9120	0.9789	0.9914 (89)
MIT 2	19.0777	19.2267	19.4699	19.7461	19.9307	19.9979	20.0084	20.0074	19.9729	19.7330	19.3477	19.0339 (90)
Living area fraction									fLA = Living area / (4) =			0.1690 (91)
MIT	19.2274	19.3766	19.6209	19.9002	20.0905	20.1627	20.1751	20.1738	20.1344	19.8857	19.4977	19.1834 (92)
Temperature adjustment												-0.1500
adjusted MIT	19.0774	19.2266	19.4709	19.7502	19.9405	20.0127	20.0251	20.0238	19.9844	19.7357	19.3477	19.0334 (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	0.9859	0.9750	0.9462	0.8706	0.7238	0.5211	0.3509	0.3945	0.6597	0.9036	0.9740	0.9887	(94)
Useful gains	662.7873	732.5404	790.4567	802.9771	704.2630	495.6213	318.9873	336.6659	518.7937	634.6211	631.8246	633.3384	(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	1381.9486	1338.8854	1212.1827	1013.9971	770.1077	505.8388	320.0947	338.6576	549.9245	853.7675	1144.5967	1386.2429	(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	535.0560	407.4639	313.7641	151.9344	48.9884	0.0000	0.0000	0.0000	0.0000	163.0449	369.1959	560.1610	(98)
Space heating												2549.6086	(98)
Space heating per m2												29.7157	(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													2817.2471 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	535.0560	407.4639	313.7641	151.9344	48.9884	0.0000	0.0000	0.0000	0.0000	163.0449	369.1959	560.1610	(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)	591.2221	450.2363	346.7007	167.8833	54.1309	0.0000	0.0000	0.0000	0.0000	180.1602	407.9513	618.9624	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	144.5015	107.1267	83.7560	41.3923	14.6875	0.1078	0.0000	22.7543	45.0029	87.9965	122.6294	143.6328	(64)
Efficiency of water heater	(217)m	89.8001	89.8146	89.8064	89.7953	89.7412	87.3000	87.3000	87.3000	89.3520	89.6804	87.3000	(216)
Fuel for water heating, kWh/month	160.9147	119.2753	93.2628	46.0963	16.3665	0.1235	0.0000	26.0645	51.5497	98.4830	136.7406	159.8975	(219)
Water heating fuel used												908.7745	(219)
Annual totals kWh/year													
Space heating fuel - main system												2817.2471	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 9.8800, total flow = 45.0000, SFP = 0.2196)													
mechanical ventilation fans (SFP = 0.2196)													58.0300 (230a)
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
pump for solar water heating													50.0000 (230g)
Total electricity for the above, kWh/year													183.0300 (231)
Electricity for lighting (calculated in Appendix L)													387.0660 (232)
Energy saving/generation technologies (Appendices M, N and Q)													
PV Unit 0 (0.80 * 0.60 * 908 * 1.00) =									-435.7701			-435.7701	(233)
Total delivered energy for all uses												3860.3476	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2817.2471	3.4800	98.0402	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	908.7745	3.4800	31.6254	(247)
Mechanical ventilation fans	58.0300	13.1900	7.6542	(249)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Pump for solar water heating	50.0000	13.1900	6.5950	(249)
Energy for lighting	387.0660	13.1900	51.0540	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-435.7701	13.1900	-57.4781	(252)
Total energy cost			267.3831	(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] =	0.8586	(257)
SAP value		88.0230	
SAP rating (Section 12)		88	(258)
SAP band		B	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	2817.2471	0.2160	608.5254 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	908.7745	0.2160	196.2953 (264)
Space and water heating			804.8207 (265)
Pumps and fans	183.0300	0.5190	94.9926 (267)
Energy for lighting	387.0660	0.5190	200.8872 (268)
Energy saving/generation technologies			
PV Unit	-435.7701	0.5190	-226.1647 (269)
Total kg/year			874.5358 (272)
CO2 emissions per m2			10.1900 (273)
EI value			91.0407
EI rating			91 (274)
EI band			B

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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

1. Overall dwelling dimensions

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

2. Ventilation rate

					main heating	secondary heating	other		total	m3 per hour			
Number of chimneys					0	+	0	+	0	=	0 * 40 =	0.0000 (6a)	
Number of open flues					0	+	0	+	0	=	0 * 20 =	0.0000 (6b)	
Number of intermittent fans											0 * 10 =	0.0000 (7a)	
Number of passive vents											0 * 10 =	0.0000 (7b)	
Number of flueless gas fires											0 * 40 =	0.0000 (7c)	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =											Air changes per hour		
Pressure test											0.0000 / (5) =		0.0000 (8)
Measured/design AP50											Yes		
Infiltration rate											4.6300		
Number of sides sheltered											0.2315 (18)		
											2 (19)		
Shelter factor											(20) = 1 - [0.075 x (19)] =		0.8500 (20)
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =		0.1968 (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													
	0.2312	0.2165	0.2165	0.1968	0.2017	0.1919	0.1919	0.1869	0.1869	0.2017	0.1968	0.2017 (22b)	
Mechanical extract ventilation - decentralised													
If mechanical ventilation:													0.5000 (23a)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)	

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
entrance			2.0000	1.0000	2.0000		(26)
front (Uw = 1.40)			12.5000	1.3258	16.5720		(27)
ground			42.9000	0.1200	5.1480	75.0000	3217.5001 (28a)
external	94.9400	14.5000	80.4400	0.2700	21.7188	150.0000	12066.0004 (29a)
cd	42.9000		42.9000	0.1100	4.7190	9.0000	386.1000 (30)
Total net area of external elements Aum(A, m ²)			180.7400				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	50.1578			(33)
party			44.9500	0.0000	0.0000	45.0000	2022.7500 (32)
stud			156.4000			9.0000	1407.5999 (32c)
internal			42.9000			18.0000	772.2000 (32d)
internal			42.9000			9.0000	386.1000 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	20258.2505 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							236.1101 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.5500 (36)
Total fabric heat loss						(33) + (36) =	57.7078 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	35.7464	35.7464	35.7464	35.7464	35.7464	35.7464	35.7464	35.7464	35.7464	35.7464	35.7464	35.7464 (38)
Heat transfer coeff	93.4542	93.4542	93.4542	93.4542	93.4542	93.4542	93.4542	93.4542	93.4542	93.4542	93.4542	93.4542 (39)
Average = Sum(39)m / 12 =												93.4542 (39)
HLP	1.0892	1.0892	1.0892	1.0892	1.0892	1.0892	1.0892	1.0892	1.0892	1.0892	1.0892	1.0892 (40)
HLP (average)												1.0892 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.5638 (42)
Average daily hot water use (litres/day)												95.0893 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	104.5983	100.7947	96.9911	93.1875	89.3840	85.5804	85.5804	89.3840	93.1875	96.9911	100.7947	104.5983 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Energy content (annual)	155.1162	135.6656	139.9948	122.0508	117.1107	101.0576	93.6447	107.4587	108.7421	126.7284	138.3340	150.2218 (45)
Distribution loss (46)m = 0.15 x (45)m	23.2674	20.3498	20.9992	18.3076	17.5666	15.1586	14.0467	16.1188	16.3113	19.0093	20.7501	22.5333 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.1288	12.7509	14.0824	13.5858	14.0078	13.5204	13.9489	13.9871	13.5560	14.0516	13.6448	14.1171 (61)
Total heat required for water heating calculated for each month	169.2451	148.4165	154.0772	135.6366	131.1185	114.5780	107.5936	121.4458	122.2981	140.7800	151.9788	164.3389 (62)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.7000 (H2)
Collector heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0050 (H3a)
Collector effective heat loss coefficient												1.8063 (H3b)
Collector performance ratio												2.5804 (H4)
Annual solar radiation per m2												1206.0102 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												2026.0972 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.3542 (H8)
Utilisation factor												0.5221 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												95.0893 (H14)
Volume ratio Veff/V												0.7887 (H15)
Solar storage volume factor												0.9525 (H16)
Solar input												-886.0488 (H17)
Solar input	-28.9129	-41.1174	-71.3493	-95.9768	-111.5315	-121.3139	-115.0241	-104.8908	-82.0978	-56.7431	-34.1974	-22.8937 (63)
Solar input (sum of months) = Sum (63)m =												-886.0488 (63)
Output from w/h	140.3321	107.2991	82.7280	39.6598	19.5869	0.0000	0.0000	16.5549	40.2003	84.0369	117.7814	141.4452 (64)
Total per year (kWh/year) = Sum (64)m =												789.6247 (64)
Heat gains from water heating, kWh/month	55.1084	48.2965	50.0689	43.9783	42.4413	36.9817	34.6241	39.2268	39.5458	45.6501	49.4073	53.4780 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(66)
(66)m	153.8257	153.8257	153.8257	153.8257	153.8257	153.8257	153.8257	153.8257	153.8257	153.8257	153.8257	153.8257	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	54.7932	48.6668	39.5785	29.9635	22.3981	18.9094	20.4323	26.5586	35.6469	45.2620	52.8274	56.3161	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	344.9781	348.5579	339.5369	320.3323	296.0900	273.3057	258.0843	254.5045	263.5255	282.7301	306.9724	329.7567	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.9463	52.9463	52.9463	52.9463	52.9463	52.9463	52.9463	52.9463	52.9463	52.9463	52.9463	52.9463	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	-102.5505	(71)
Water heating gains (Table 5)	74.0704	71.8699	67.2969	61.0810	57.0447	51.3635	46.5378	52.7242	54.9247	61.3577	68.6212	71.8790	(72)
Total internal gains	581.0632	576.3161	553.6339	518.5984	482.7543	450.8002	432.2759	441.0089	461.3186	496.5712	535.6425	565.1734	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
East				4.3500	25.1733	0.4500	0.0000	0.7700	37.9430 (76)			
South				0.6500	56.5862	0.4500	0.0000	0.7700	12.7446 (78)			
West				7.5000	25.1733	0.4500	0.0000	0.7700	65.4190 (80)			
Solar gains	116.1066	189.7030	310.3570	444.7487	506.6847	571.4649	523.6568	473.5276	374.3284	240.6065	143.4990	90.8924 (83)
Total gains	697.1698	766.0191	863.9909	963.3472	989.4390	1022.2651	955.9327	914.5365	835.6471	737.1778	679.1415	656.0658 (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	60.2144	60.2144	60.2144	60.2144	60.2144	60.2144	60.2144	60.2144	60.2144	60.2144	60.2144	60.2144	
alpha	5.0143	5.0143	5.0143	5.0143	5.0143	5.0143	5.0143	5.0143	5.0143	5.0143	5.0143	5.0143	
util living area	0.9862	0.9775	0.9460	0.8561	0.6935	0.4608	0.3219	0.3262	0.6024	0.8797	0.9704	0.9890 (86)	
MIT	20.1294	20.2436	20.4962	20.7754	20.9396	20.9935	20.9992	20.9991	20.9769	20.7878	20.4211	20.0954 (87)	
Th 2	20.0097	20.0097	20.0097	20.0097	20.0097	20.0097	20.0097	20.0097	20.0097	20.0097	20.0097	20.0097 (88)	
util rest of house	0.9819	0.9706	0.9298	0.8169	0.6237	0.3740	0.2257	0.2257	0.5063	0.8349	0.9595	0.9855 (89)	
MIT 2	19.2427	19.3543	19.5968	19.8485	19.9765	20.0076	20.0095	20.0095	20.0008	19.8663	19.5294	19.2095 (90)	
Living area fraction									fLA = Living area / (4) =			0.1690 (91)	
MIT	19.3926	19.5046	19.7488	20.0051	20.1393	20.1742	20.1768	20.1768	20.1657	20.0220	19.6801	19.3593 (92)	
Temperature adjustment												-0.1500	
adjusted MIT	19.2426	19.3546	19.5988	19.8551	19.9893	20.0242	20.0268	20.0268	20.0157	19.8720	19.5301	19.2093 (93)	

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9774	0.9647	0.9216	0.8099	0.6222	0.3753	0.2274	0.2274	0.5070	0.8275	0.9526	0.9816	(94)
Useful gains	681.4393	738.9928	796.2172	780.2358	615.6314	383.6164	217.3480	208.0067	423.6389	610.0065	646.9809	643.9994	(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	1274.9577	1248.0458	1121.3393	911.6557	643.8341	385.4255	217.4482	208.1027	431.3605	726.3303	1021.4620	1262.4969	(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	441.5777	342.0837	241.8908	94.6223	20.9828	0.0000	0.0000	0.0000	0.0000	86.5449	269.6264	460.1621	(98)
Space heating												1957.4906	(98)
Space heating per m2											(98) / (4) =	22.8146	(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													2162.9731	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	441.5777	342.0837	241.8908	94.6223	20.9828	0.0000	0.0000	0.0000	0.0000	86.5449	269.6264	460.1621	(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)	487.9311	377.9930	267.2826	104.5550	23.1854	0.0000	0.0000	0.0000	0.0000	95.6297	297.9297	508.4665	(211)	
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)	
Water heating														
Water heating requirement	140.3321	107.2991	82.7280	39.6598	19.5869	0.0000	0.0000	16.5549	40.2003	84.0369	117.7814	141.4452	(64)	
Efficiency of water heater	89.7070	89.7148	89.6624	89.5307	88.9263	87.3000	87.3000	87.3000	87.3000	88.8947	89.5026	87.3000	(216)	
(217)m	89.7070	89.7148	89.6624	89.5307	88.9263	87.3000	87.3000	87.3000	87.3000	88.8947	89.5026	87.3000	(217)	
Fuel for water heating, kWh/month	156.4339	119.6002	92.2660	44.2974	22.0261	0.0000	0.0000	18.9633	46.0484	94.5353	131.5956	157.6400	(219)	
Water heating fuel used												883.4061	(219)	
Annual totals kWh/year														
Space heating fuel - main system												2162.9731	(211)	
Space heating fuel - secondary												0.0000	(215)	
Electricity for pumps and fans:														
(MEV)Decentralised, Database: total watage = 9.8800, total flow = 45.0000, SFP = 0.2196)														
mechanical ventilation fans (SFP = 0.2196)													58.0300	(230a)
central heating pump													30.0000	(230c)
main heating flue fan													45.0000	(230e)
pump for solar water heating													50.0000	(230g)
Total electricity for the above, kWh/year													183.0300	(231)
Electricity for lighting (calculated in Appendix L)													387.0660	(232)
Energy saving/generation technologies (Appendices M, N and Q)														
PV Unit 0 (0.80 * 0.60 * 1030 * 1.00) =										-494.4285			-494.4285	(233)
Total delivered energy for all uses													3122.0467	(238)

10a. Fuel costs - using BEDF prices (528)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2162.9731	10.2300	221.2721	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	883.4061	10.2300	90.3724	(247)
Mechanical ventilation fans	58.0300	36.7200	21.3086	(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	387.0660	36.7200	142.1306	(250)
Additional standing charges			103.0000	(251)
Energy saving/generation technologies				
PV Unit	-494.4285	36.7200	-181.5542	(252)
Total energy cost			442.4297	(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	2162.9731	0.2160	467.2022	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	883.4061	0.2160	190.8157	(264)
Space and water heating			658.0179	(265)
Pumps and fans	183.0300	0.5190	94.9926	(267)

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Energy for lighting	387.0660	0.5190	200.8872 (268)
Energy saving/generation technologies			
PV Unit	-494.4285	0.5190	-256.6084 (269)
Total kg/year			697.2893 (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	2162.9731	1.2200	2638.8272 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	883.4061	1.2200	1077.7555 (264)
Space and water heating			3716.5826 (265)
Pumps and fans	183.0300	3.0700	561.9023 (267)
Energy for lighting	387.0660	3.0700	1188.2925 (268)
Energy saving/generation technologies			
PV Unit	-494.4285	3.0700	-1517.8956 (269)
Primary energy kWh/year			3948.8818 (272)
Primary energy kWh/m2/year			46.0243 (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	East
Overshading	Average or unknown
Thermal mass parameter	236.1 (calculated from construction elements)
Night ventilation	No
Ventilation rate during hot weather (ach)	4.00 (Windows half open)

Overheating Calculation

Summer ventilation heat loss coefficient	285.97 (P1)
Transmission heat loss coefficient	57.71 (37)
Summer heat loss coefficient	343.68 (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	4.3500	125.2818	0.4500	0.0000	0.9000	220.7152
South	0.6500	118.5567	0.4500	0.0000	0.9000	31.2100
West	7.5000	125.2818	0.4500	0.0000	0.9000	380.5434
total:						632.4686

	Jun	Jul	Aug	
Solar gains	680	632	560	(P4)
Internal gains	448	429	438	
Total summer gains	1127	1062	998	(P5)
Summer gain/loss ratio	3.28	3.09	2.90	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 236.1)	0.35	0.35	0.35	
Threshold temperature	19.03	20.74	20.55	(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 81	Issued on Date	12/10/2023
Assessment Reference	plot 81 way	Prop Type Ref	21809
Property	3 Wayfaring Close, Southampton, SO30 0AT		
SAP Rating	87 B	DER	14.31
Environmental	89 B	TER	17.90
CO ₂ Emissions (t/year)	0.89	% DER<TER	20.07
General Requirements Compliance	Pass	DFEE	45.42
		TFEE	50.86
		% DFEE<TFEE	10.70
Assessor Details	Mr. Ben Tunningley, Ben Tunningley, Tel: 01904217325, ben.tunningley@jspsustainability.co.uk		Assessor ID
			AU36-0001
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)	17.90	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	14.31	kgCO ₂ /m ²	Pass
	-3.59 (-20.1%)	kgCO ₂ /m ²	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	50.86	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DFEE)	45.42	kWh/m ² /yr	
	-5.5 (-10.8%)	kWh/m ² /yr	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

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

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.63 (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

4.35 m², No overhang

Windows facing South

0.65 m², No overhang

Windows facing West

7.50 m², No overhang

Air change rate

0.00 ach

Blinds/curtains

None

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type

U-value

Filled Cavity with Edge Sealing

0.00

W/m²K

Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals

4.63 (measured in this dwelling)

Maximum

10.0

Pass

10 Key features

Party wall U-value

0.00

W/m²K

Roof U-value

0.11

W/m²K

Floor U-value

0.12

W/m²K

Door U-value

1.00

W/m²K

Photovoltaic array

0.60

kW

BASIC COMPLIANCE REPORT

Calculation Type: New Build (As Built)

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

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

Property Reference	Plot 81	Issued on Date	12/10/2023
Assessment Reference	plot 81 way	Prop Type Ref	21809
Property	3 Wayfaring Close, Southampton, SO30 0AT		
SAP Rating	87 B	DER	14.31
Environmental	89 B	TER	17.90
CO ₂ Emissions (t/year)	0.89	% DER<TER	20.07
General Requirements Compliance	Pass	DfEE	45.42
		TFEE	50.86
		% DfEE<TFEE	10.70
Assessor Details	Mr. Ben Tunningley, Ben Tunningley, Tel: 01904217325, ben.tunningley@jspsustainability.co.uk		Assessor ID
			AU36-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Built)

Orientation	East					
Property Tenure	Owner-occupied					
Transaction Type	Marketed sale					
Terrain Type	Suburban					
1.0 Property Type	House, Semi-Detached					
2.0 Number of Storeys	2					
3.0 Date Built	2021					
4.0 Sheltered Sides	2					
5.0 Sunlight/Shade	Average or unknown					
6.0 Measurements						
		Heat Loss Perimeter	Internal Floor Area	Average Storey Height		
	Ground Floor:	1.00 m	42.90 m ²	2.45 m		
	1st Storey:	1.00 m	42.90 m ²	2.60 m		
7.0 Living Area	14.50		m ²			
8.0 Thermal Mass Parameter	Precise calculation					
Thermal Mass	236.11		kJ/m ² K			
9.0 External Walls						
Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area (m ²)	Nett Area (m ²)
external	Cavity Wall	Cavity wall : plasterboard on dabs, dense block, filled cavity, any outside structure	0.27	150.00	94.94	80.44
9.1 Party Walls						
Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Area (m ²)	
party	Filled Cavity with Edge Sealing	Plasterboard on dabs mounted on cement render on both sides, AAC blocks, cavity	0.00	45.00	44.95	
9.2 Internal Walls						
Description	Construction				Kappa (kJ/m ² K)	Area (m ²)
stud	Plasterboard on timber frame				9.00	156.40
10.0 External Roofs						
Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area (m ²)	Nett Area (m ²)
cd	External Plane Roof	Plasterboard, insulated at ceiling level	0.11	9.00	42.90	42.90
10.2 Internal Ceilings						

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

Description	Construction	Kappa (kJ/m²K)	Area (m²)
internal	Other	9.00	42.90

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Area (m²)
ground	Ground Floor - Solid	Suspended concrete floor, carpeted	0.12	75.00	42.90

11.2 Internal Floors

Description	Construction	Kappa (kJ/m²K)	Area (m²)
internal	Plasterboard ceiling, carpeted chipboard floor	18.00	42.90

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
entrance	Manufacturer	Solid Door							1.00
front	BFRC data	Window	Double Low-E Soft 0.05			0.45			1.40

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
entrance	Solid Door	[1] external	East							2.00	
front	Window	[1] external	East	None	0.00					4.35	
rear	Window	[1] external	West	None	0.00					7.50	
side	Window	[1] external	South	None	0.00					0.65	

14.0 Conservatory

None

15.0 Draught Proofing

100

%

16.0 Draught Lobby

No

17.0 Thermal Bridging

Calculate Bridges

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	10.90	0.300	No
Independently assessed	E3 Sill	8.30	0.015	No
Independently assessed	E4 Jamb	21.90	0.011	No
Independently assessed	E5 Ground floor (normal)	18.80	0.020	No
Independently assessed	E6 Intermediate floor within a dwelling	18.80	0.000	No
Independently assessed	E10 Eaves (insulation at ceiling level)	7.70	0.060	No
Independently assessed	E12 Gable (insulation at ceiling level)	11.10	0.063	No
Independently assessed	E16 Corner (normal)	15.15	0.067	No
Independently assessed	E17 Corner (inverted – internal area greater than external area)	5.05	-0.090	No
Independently assessed	E18 Party wall between dwellings	10.20	0.042	No
Independently assessed	P1 Party wall - Ground floor	8.90	0.065	No
Table K1 - Default	P2 Party wall - Intermediate floor within a dwelling	8.90	0.000	No
Independently assessed	P4 Party wall - Roof (insulation at ceiling level)	8.90	0.091	No

Y-value	0.042	W/m²K
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18.0 Pressure Testing

Designed AP ₅₀	5.01	m³/(h.m²) @ 50 Pa
Property Tested ?	Yes	
As Built AP ₅₀	4.63	m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

Windows open in hot weather	Windows half open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	0.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	No
Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500229
Duct Type	Rigid

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count
0.16	Through Wall Fan Kitchen	1
0.18	In Room Fan Other Wet Room	4

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				0
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System

No

22.0 Lighting

Internal

Total number of light fittings	23	
Total number of L.E.L. fittings	23	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	No
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23.0 Electricity Tariff

Standard

24.0 Main Heating 1

	Database	
Percentage of Heat	100	%
Database Ref. No.	17929	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.5	
In Summer	87.3	
Controls	CBE Programmer, room thermostat and TRVs	
PCDF Controls	0	
Delayed Start Stat	Yes	
Sap Code	2106	

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

Flue Type	Balanced
Fan Assisted Flue	Yes
Is MHS Pumped	Pump in heated space
Heat Emitter	Radiators
Flow Temperature	Normal (> 45°C)
Combi boiler type	Standard Combi
Combi keep hot type	None
25.0 Main Heating 2	None

Community Heating	None
28.0 Water Heating	HWP From main heating 1
Water Heating	Main Heating 1
Flue Gas Heat Recovery System	No
Waste Water Heat Recovery Instantaneous System 1	No
Waste Water Heat Recovery Instantaneous System 2	No
Waste Water Heat Recovery Storage System	No
Solar Panel	No
Water use <= 125 litres/person/day	Yes
SAP Code	901

29.0 Hot Water Cylinder	None
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32.0 Photovoltaic Unit		One Dwelling		
PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
0.60	West	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£83	B 88	