



SAP Report Submission for Building Regulations Compliance

Client: Foreman Homes

Project: 17, Fieldfare Crescent
Botley, Southampton, SO32 2TW

Contact: Tobias Whiting
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Report Issue Date: 22/09/2023

EXCELLENCE
IN ENERGY
ASSESSMENT

BUILDING REGULATION COMPLIANCE

Calculation Type: New Build (As Built)

Property Reference	SAP 0645 Plot 43	Issued on Date	22/09/2023
Assessment Reference	As Built	Prop Type Ref	Dh
Property	17, Fieldfare Crescent, Botley, Southampton, SO32 2TW		
SAP Rating	89 B	DER	12.27
Environmental	89 B	TER	16.15
CO ₂ Emissions (t/year)	1.31	% DER<TER	24.02
General Requirements Compliance	Pass	DfEE	46.38
		TfEE	57.14
		% DfEE<TfEE	18.82
Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 07798936079, toby@abacusenergyuk.com		Assessor ID
			E477-0001
Client	Foreman Homes, FORE		

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)	16.15	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	12.27	kgCO ₂ /m ²	Pass
	-3.88 (-24.0%)	kgCO ₂ /m ²	

1b TfEE and DfEE

Target Fabric Energy Efficiency (TfEE)	57.14	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DfEE)	46.38	kWh/m ² /yr	
	-10.7 (-18.7%)	kWh/m ² /yr	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.24 (max. 0.30)	0.24 (max. 0.70)	Pass
Floor	0.11 (max. 0.25)	0.11 (max. 0.70)	Pass
Roof	0.10 (max. 0.20)	0.10 (max. 0.35)	Pass
Openings	1.19 (max. 2.00)	1.20 (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	4.66 (measured in this dwelling)	m ³ /(h.m ²) @ 50 Pa	
Maximum	10.0	m ³ /(h.m ²) @ 50 Pa	Pass

Limiting System Efficiencies

4 Heating efficiency

This report has been produced by an accredited Elmhurst member whose work is subject to quality assurance audits. The data used to produce the report has been verified by the Elmhurst members' portal.

BUILDING REGULATION COMPLIANCE

Calculation Type: New Build (As Built)

Main heating system

Boiler system with radiators or underfloor - Mains gas
Data from database
Worcester Greenstar 36CDi Compact ErP
Combi boiler
Efficiency: 89.8% 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

Not applicable

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 North

1.44 m², No overhang

Windows facing East

15.95 m², No overhang

Windows facing South East

0.72 m², No overhang

Windows facing South

2.08 m², No overhang

Windows facing South West

0.72 m², No overhang

Windows facing West

9.82 m², Overhang twice as wide as window, ratio 0.56

Air change rate

4.00 ach

Blinds/curtains

None

Criterion 4 – Building performance consistent with DER and DFEE rate

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals

4.66 (measured in this dwelling)

m³/(h.m²) @ 50 Pa

Maximum

10.0

m³/(h.m²) @ 50 Pa

Pass

10 Key features

Roof U-value

0.10

W/m²K

Floor U-value

0.11

W/m²K

Door U-value

1.10

W/m²K

Thermal bridging y-value

0.026

W/m²K

Photovoltaic array

1.30

kW

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THERMAL BRIDGING

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Environmental	89 B	TER	16.15
CO ₂ Emissions (t/year)	1.31	% DER<TER	24.02
General Requirements Compliance	Pass	DFEE	46.38
		TFEE	57.14
		% DFEE<TFEE	18.82
Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 07798936079, toby@abacusenergyuk.com		Assessor ID
			E477-0001
Client	Foreman Homes, FORE		

	Junction detail	Source Type	Psi (W/mK)	Length (m)	Result	Reference
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.077	1.26	0.10	Birtley Supatherm
External wall	E2 Other lintels (including other steel lintels)	Table K1 - Approved	0.300	2.24	0.67	
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.067	4.80	0.32	Birtley Supatherm
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.067	1.64	0.11	Birtley Supatherm
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.064	7.08	0.45	Birtley Supatherm
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.056	5.54	0.31	Birtley Supatherm
External wall	E3 Sill	Independently assessed	0.021	15.89	0.33	Knauf P 5
External wall	E4 Jamb	Independently assessed	0.016	38.70	0.62	Knauf P 6
External wall	E5 Ground floor (normal)	Independently assessed	0.062	37.47	2.32	BE-E5-23902
External wall	E6 Intermediate floor within a dwelling	Independently assessed	0.000	31.17	0.00	
External wall	E10 Eaves (insulation at ceiling level)	Table K1 - Approved	0.060	36.48	2.19	
External wall	E24 Eaves (insulation at ceiling level - inverted)	Table K1 - Default	0.240	4.13	0.99	
External wall	E12 Gable (insulation at ceiling level)	Independently assessed	0.044	4.97	0.22	Knauf P21
External wall	E16 Corner (normal)	Independently assessed	0.039	34.79	1.36	Knauf P23
External wall	E17 Corner (inverted – internal area greater than external area)	Independently assessed	-0.091	14.59	-1.33	Knauf P24

Total: **8.67** W/mK:
Y-Value: **0.026** W/m²K:

FULL SAP CALCULATION PRINTOUT

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Environmental	89 B	% DER<TER	24.02		
CO ₂ Emissions (t/year)	1.31	DFEE	46.38	TFEE	57.14
General Requirements Compliance	Pass	% DFEE<TFEE	18.82		
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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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DWELLING AS BUILT

Detached House, total floor area 146 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) 16.15 kgCO₂/m²

Dwelling Carbon Dioxide Emission Rate (DER) 12.27 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)57.1 kWh/m²/yr

Dwelling Fabric Energy Efficiency (DFEE)46.4 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.24 (max. 0.30)	0.24 (max. 0.70)	OK
Floor	0.11 (max. 0.25)	0.11 (max. 0.70)	OK
Roof	0.10 (max. 0.20)	0.10 (max. 0.35)	OK
Openings	1.19 (max. 2.00)	1.20 (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:	4.66 (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

Worcester Greenstar 36CDi Compact ErP

Combi boiler

Efficiency: 89.8% 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

Not applicable

9 Summertime temperature

Overheating risk (Southern England): Slight OK

Based on:

Overshading:	Average
Windows facing North:	1.44 m ² , No overhang
Windows facing East:	15.95 m ² , No overhang
Windows facing South East:	0.72 m ² , No overhang
Windows facing South:	2.08 m ² , No overhang
Windows facing South West:	0.72 m ² , No overhang
Windows facing West:	9.82 m ² , Overhang twice as wide as window, ratio 0.56
Air change rate:	4.00 ach
Blinds/curtains:	None

10 Key features

Roof U-value	0.10 W/m ² K
Floor U-value	0.11 W/m ² K
Door U-value	1.10 W/m ² K
Thermal bridging y-value	0.026 W/m ² K
Photovoltaic array	1.30 kW

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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	74.2900 (1b)	x 2.3900 (2b)	= 177.5531 (1b) - (3b)
First floor	72.1100 (1c)	x 2.6700 (2c)	= 192.5337 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	146.4000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 370.0868 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					40.0000 / (5) = 0.1081 (8)
Pressure test					Yes
Measured/design AP50					4.6600
Infiltration rate					0.3411 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3155 (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	0.4023	0.3944	0.3865	0.3471	0.3392	0.2997	0.2997	0.2918	0.3155	0.3392	0.3549	0.3707 (22b)
Effective ac	0.5809	0.5778	0.5747	0.5602	0.5575	0.5449	0.5449	0.5426	0.5498	0.5575	0.5630	0.5687 (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
Front Door			2.1200	1.1000	2.3320		(26a)
Windows (Uw = 1.20)			30.7300	1.1450	35.1870		(27)
Ground Floor			74.2900	0.1100	8.1719	140.0000	10400.6000 (28a)
Brick and Block	184.3100	32.8500	151.4600	0.2400	36.3504	42.2200	6394.6412 (29a)
Pitched Roof	74.2900		74.2900	0.1000	7.4290	9.0000	668.6100 (30)
Total net area of external elements Aum(A, m ²)			332.8900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	89.4703		(33)
Ground Floor Block			65.7800			75.0000	4933.5000 (32c)
Ground Floor Stud			44.4100			9.0000	399.6900 (32c)
First Floor Stud			109.4400			9.0000	984.9600 (32c)
First Floor Block			43.7900			75.0000	3284.2500 (32c)
Internal Floor 1			72.1100			18.0000	1297.9800 (32d)
Internal Ceiling 1			72.1100			18.0000	1297.9800 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 29662.2112 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							202.6107 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.6677 (36)
Total fabric heat loss							(33) + (36) = 98.1380 (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	70.9455	70.5618	70.1857	68.4192	68.0887	66.5501	66.5501	66.2652	67.1427	68.0887	68.7573	69.4563 (38)
Heat transfer coeff	169.0836	168.6999	168.3238	166.5572	166.2267	164.6881	164.6881	164.4032	165.2808	166.2267	166.8953	167.5943 (39)
Average = Sum(39)m / 12 =												166.5556 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1549	1.1523	1.1498	1.1377	1.1354	1.1249	1.1249	1.1230	1.1290	1.1354	1.1400	1.1448 (40)
HLP (average)												1.1377 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Assumed occupancy												2.9284 (42)
Average daily hot water use (litres/day)												103.7497 (43)
Daily hot water use	114.1247	109.9747	105.8247	101.6747	97.5247	93.3747	93.3747	97.5247	101.6747	105.8247	109.9747	114.1247 (44)
Energy conte	169.2436	148.0215	152.7449	133.1667	127.7767	110.2615	102.1735	117.2456	118.6459	138.2704	150.9329	163.9034 (45)

FULL SAP CALCULATION PRINTOUT

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Energy content (annual)												Total = Sum(45)m = 1632.3867 (45)
Distribution loss (46)m = 0.15 x (45)m												
	25.3865	22.2032	22.9117	19.9750	19.1665	16.5392	15.3260	17.5868	17.7969	20.7406	22.6399	24.5855 (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	27.5671	24.8979	27.5540	26.6466	27.5148	26.5972	27.4651	27.4973	26.6221	27.5302	26.6640	27.5588 (61)
Total heat required for water heating calculated for each month	196.8107	172.9194	180.2990	159.8134	155.2914	136.8588	129.6387	144.7429	145.2681	165.8006	177.5969	191.4621 (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	196.8107	172.9194	180.2990	159.8134	155.2914	136.8588	129.6387	144.7429	145.2681	165.8006	177.5969	191.4621 (64)
Heat gains from water heating, kWh/month	63.1653	55.4416	57.6762	50.9396	49.3644	43.3113	40.8390	45.8585	46.1053	52.8575	56.8512	61.3876 (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	146.4204	146.4204	146.4204	146.4204	146.4204	146.4204	146.4204	146.4204	146.4204	146.4204	146.4204	146.4204	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	28.3015	25.1372	20.4429	15.4766	11.5689	9.7670	10.5536	13.7179	18.4122	23.3785	27.2862	29.0881	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	316.5787	319.8638	311.5854	293.9619	271.7152	250.8065	236.8382	233.5531	241.8315	259.4551	281.7017	302.6104	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.6420	37.6420	37.6420	37.6420	37.6420	37.6420	37.6420	37.6420	37.6420	37.6420	37.6420	37.6420	(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)	-117.1363	-117.1363	-117.1363	-117.1363	-117.1363	-117.1363	-117.1363	-117.1363	-117.1363	-117.1363	-117.1363	-117.1363	(71)
Water heating gains (Table 5)	84.8995	82.5024	77.5218	70.7494	66.3500	60.1545	54.8911	61.6378	64.0351	71.0450	78.9600	82.5102	(72)
Total internal gains	499.7059	497.4295	479.4763	450.1140	419.5603	390.6542	372.2090	378.8350	394.2049	423.8047	457.8740	484.1348	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
North				1.4400	10.6334		0.6300		0.7000		0.7700		4.6796 (74)
East				15.9500	19.6403		0.6300		0.7000		0.7700		95.7370 (76)
Southeast				0.7200	36.7938		0.6300		0.7000		0.7700		8.0962 (77)
South				2.0800	46.7521		0.6300		0.7000		0.7700		29.7191 (78)
Southwest				0.7200	36.7938		0.6300		0.7000		0.7700		8.0962 (79)
West				9.8200	19.6403		0.6300		0.7000		0.7700		58.9428 (80)
Solar gains	205.2708	387.7832	613.2511	868.0071	1048.9546	1069.2361	1019.6939	884.3261	703.4625	452.6708	253.2623	170.6396	(83)
Total gains	704.9767	885.2127	1092.7273	1318.1211	1468.5149	1459.8903	1391.9029	1263.1611	1097.6674	876.4754	711.1363	654.7744	(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	48.7304	48.8412	48.9503	49.4695	49.5679	50.0310	50.0310	50.1177	49.8516	49.5679	49.3693	49.1634
alpha	4.2487	4.2561	4.2634	4.2980	4.3045	4.3354	4.3354	4.3412	4.3234	4.3045	4.2913	4.2776
util living area	0.9979	0.9943	0.9818	0.9376	0.8317	0.6626	0.5054	0.5710	0.8273	0.9728	0.9957	0.9985 (86)
MIT	19.4019	19.6153	19.9678	20.4103	20.7544	20.9343	20.9840	20.9734	20.8239	20.3368	19.7812	19.3669 (87)
Th 2	19.9562	19.9583	19.9604	19.9702	19.9720	19.9805	19.9805	19.9821	19.9772	19.9720	19.9683	19.9644 (88)
util rest of house	0.9973	0.9926	0.9764	0.9189	0.7839	0.5775	0.3954	0.4570	0.7595	0.9614	0.9942	0.9981 (89)
MIT 2	18.4908	18.7051	19.0558	19.4916	19.8025	19.9479	19.9757	19.9733	19.8728	19.4306	18.8789	18.4623 (90)
Living area fraction										fLA = Living area / (4) =		0.1344 (91)
MIT	18.6132	18.8274	19.1783	19.6150	19.9304	20.0805	20.1112	20.1077	20.0006	19.5524	19.0001	18.5838 (92)
Temperature adjustment												0.0000
adjusted MIT	18.6132	18.8274	19.1783	19.6150	19.9304	20.0805	20.1112	20.1077	20.0006	19.5524	19.0001	18.5838 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9962	0.9902	0.9710	0.9111	0.7817	0.5865	0.4100	0.4718	0.7613	0.9552	0.9921	0.9972	(94)
Useful gains	702.3255	876.5037	1061.0632	1200.8959	1147.9122	856.1579	570.6823	595.9343	835.6125	837.2092	705.5484	652.9646	(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	2420.1263	2349.5525	2134.0608	1784.6653	1368.1138	902.5660	578.2515	609.5508	975.2582	1488.1220	1986.0701	2410.6456	(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	1278.0438	989.8888	798.3103	420.3140	163.8301	0.0000	0.0000	0.0000	0.0000	484.2791	921.9757	1307.7146	(98)
Space heating												6364.3563	(98)
Space heating per m2											(98) / (4) =	43.4724	(99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.7000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													7016.9308 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1278.0438	989.8888	798.3103	420.3140	163.8301	0.0000	0.0000	0.0000	0.0000	484.2791	921.9757	1307.7146	(98)
Space heating efficiency (main heating system 1)	90.7000	90.7000	90.7000	90.7000	90.7000	0.0000	0.0000	0.0000	0.0000	90.7000	90.7000	90.7000	(210)
Space heating fuel (main heating system)	1409.0890	1091.3879	880.1657	463.4112	180.6285	0.0000	0.0000	0.0000	0.0000	533.9351	1016.5112	1441.8022	(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	196.8107	172.9194	180.2990	159.8134	155.2914	136.8588	129.6387	144.7429	145.2681	165.8006	177.5969	191.4621	(64)
Efficiency of water heater	90.3161	90.2724	90.1708	89.9110	89.3155	87.9000	87.9000	87.9000	87.9000	89.9691	90.2357	87.9000	(216)
Fuel for water heating, kWh/month	217.9132	191.5530	199.9527	177.7462	173.8684	155.6983	147.4843	164.6677	165.2651	184.2862	196.8144	211.9526	(219)
Water heating fuel used												2187.2020	(219)
Annual totals kWh/year													
Space heating fuel - main system												7016.9308	(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)												499.8140	(232)
Energy saving/generation technologies (Appendices M, N and Q)													
PV Unit 0 (0.80 * 1.30 * 908 * 1.00) =													-944.1684 (233)
Total delivered energy for all uses													8834.7785 (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	7016.9308	0.2160	1515.6571 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2187.2020	0.2160	472.4356 (264)
Space and water heating			1988.0927 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	499.8140	0.5190	259.4035 (268)
Energy saving/generation technologies			
PV Unit	-944.1684	0.5190	-490.0234 (269)
Total CO2, kg/year			1796.3978 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			12.2700 (273)

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

DER			12.2700 ZC1
Total Floor Area		TFA	146.4000
Assumed number of occupants		N	2.9284
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190
CO2 emissions from appliances, equation (L14)			12.8141 ZC2
CO2 emissions from cooking, equation (L16)			1.2929 ZC3
Total CO2 emissions			26.3770 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			26.3770 ZC8

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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	74.2900 (1b)	x 2.3900 (2b)	= 177.5531 (1b) - (3b)
First floor	72.1100 (1c)	x 2.6700 (2c)	= 192.5337 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	146.4000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 370.0868 (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					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.1081 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3581 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3312 (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	0.4223	0.4140	0.4058	0.3643	0.3561	0.3147	0.3147	0.3064	0.3312	0.3561	0.3726	0.3892 (22b)
Effective ac	0.5892	0.5857	0.5823	0.5664	0.5634	0.5495	0.5495	0.5469	0.5549	0.5634	0.5694	0.5757 (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 Semi-glazed door			2.1200	1.2000	2.5440		(26a)
TER Opening Type (Uw = 1.40)			30.7300	1.3258	40.7405		(27)
Ground Floor			74.2900	0.1300	9.6577		(28a)
Brick and Block	184.3100	32.8500	151.4600	0.1800	27.2628		(29a)
Pitched Roof	74.2900		74.2900	0.1300	9.6577		(30)
Total net area of external elements Aum(A, m ²)			332.8900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	89.8627		(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)							15.1489 (36)
Total fabric heat loss						(33) + (36) =	105.0116 (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	71.9551	71.5322	71.1177	69.1706	68.8064	67.1106	67.1106	66.7965	67.7638	68.8064	69.5433	70.3137 (38)
Heat transfer coeff	176.9667	176.5438	176.1293	174.1823	173.8180	172.1222	172.1222	171.8082	172.7754	173.8180	174.5549	175.3254 (39)
Average = Sum(39)m / 12 =												174.1805 (39)
HLP	1.2088	1.2059	1.2031	1.1898	1.1873	1.1757	1.1757	1.1736	1.1802	1.1873	1.1923	1.1976 (40)
HLP (average)												1.1898 (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												2.9284 (42)
Average daily hot water use (litres/day)												103.7497 (43)
Daily hot water use	114.1247	109.9747	105.8247	101.6747	97.5247	93.3747	93.3747	97.5247	101.6747	105.8247	109.9747	114.1247 (44)
Energy conte	169.2436	148.0215	152.7449	133.1667	127.7767	110.2615	102.1735	117.2456	118.6459	138.2704	150.9329	163.9034 (45)
Energy content (annual)										Total = Sum(45)m =		1632.3867 (45)
Distribution loss (46)m = 0.15 x (45)m	25.3865	22.2032	22.9117	19.9750	19.1665	16.5392	15.3260	17.5868	17.7969	20.7406	22.6399	24.5855 (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 EMISSIONS 09 Jan 2014

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	50.9589	49.3151	49.6975	46.0478	47.5827	49.6975	49.3151	50.9589	49.3151	50.9589 (61)
Solar input	220.2025	194.0489	203.7038	182.4818	177.4742	156.3094	149.7563	166.9431	167.9610	189.2293	200.2480	214.8623 (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	220.2025	194.0489	203.7038	182.4818	177.4742	156.3094	149.7563	166.9431	167.9610	189.2293	200.2480	214.8623 (64)
	69.0132	60.7240	63.5274	56.6067	54.9101	48.1739	45.8684	51.4085	51.7785	58.7146	62.5140	67.2376 (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	146.4204	146.4204	146.4204	146.4204	146.4204	146.4204	146.4204	146.4204	146.4204	146.4204	146.4204	146.4204	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	28.3015	25.1372	20.4429	15.4766	11.5689	9.7670	10.5536	13.7179	18.4122	23.3785	27.2862	29.0881	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	316.5787	319.8638	311.5854	293.9619	271.7152	250.8065	236.8382	233.5531	241.8315	259.4551	281.7017	302.6104	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.6420	37.6420	37.6420	37.6420	37.6420	37.6420	37.6420	37.6420	37.6420	37.6420	37.6420	37.6420	(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)	-117.1363	-117.1363	-117.1363	-117.1363	-117.1363	-117.1363	-117.1363	-117.1363	-117.1363	-117.1363	-117.1363	-117.1363	(71)
Water heating gains (Table 5)	92.7597	90.3631	85.3863	78.6204	73.8039	66.9082	61.6511	69.0975	71.9146	78.9175	86.8249	90.3731	(72)
Total internal gains	507.5661	505.2902	487.3408	457.9850	427.0142	397.4079	378.9690	386.2947	402.0844	431.6772	465.7389	491.9978	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	1.4400	10.6334	0.6300	0.7000	0.7700	4.6796 (74)
East	15.9500	19.6403	0.6300	0.7000	0.7700	95.7370 (76)
Southeast	0.7200	36.7938	0.6300	0.7000	0.7700	8.0962 (77)
South	2.0800	46.7521	0.6300	0.7000	0.7700	29.7191 (78)
Southwest	0.7200	36.7938	0.6300	0.7000	0.7700	8.0962 (79)
West	9.8200	19.6403	0.6300	0.7000	0.7700	58.9428 (80)

Solar gains	205.2708	387.7832	613.2511	868.0071	1048.9546	1069.2361	1019.6939	884.3261	703.4625	452.6708	253.2623	170.6396	(83)
Total gains	712.8369	893.0733	1100.5919	1325.9921	1475.9688	1466.6440	1398.6629	1270.6208	1105.5469	884.3480	719.0013	662.6373	(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	57.4496	57.5872	57.7228	58.3680	58.4903	59.0666	59.0666	59.1745	58.8433	58.4903	58.2434	57.9874	
alpha	4.8300	4.8391	4.8482	4.8912	4.8994	4.9378	4.9378	4.9450	4.9229	4.8994	4.8829	4.8658	
util living area	0.9992	0.9975	0.9903	0.9589	0.8659	0.6954	0.5291	0.5981	0.8609	0.9844	0.9981	0.9995	(86)
MIT	19.5763	19.7607	20.0699	20.4675	20.7844	20.9479	20.9890	20.9806	20.8466	20.4029	19.9123	19.5479	(87)
Th 2	19.9130	19.9153	19.9175	19.9282	19.9302	19.9395	19.9395	19.9412	19.9359	19.9302	19.9262	19.9219	(88)
util rest of house	0.9989	0.9966	0.9867	0.9430	0.8173	0.6018	0.4079	0.4722	0.7907	0.9760	0.9973	0.9993	(89)
MIT 2	18.0064	18.2775	18.7289	19.3028	19.7209	19.9054	19.9355	19.9333	19.8106	19.2222	18.5073	17.9711	(90)
Living area fraction	18.2173	18.4768	18.9091	19.4593	19.8637	20.0455	20.0771	20.0741	19.9498	19.3809	18.6960	18.1829	(91)
Temperature adjustment	18.2173	18.4768	18.9091	19.4593	19.8637	20.0455	20.0771	20.0741	19.9498	19.3809	18.6960	18.1829	(92)
adjusted MIT	18.2173	18.4768	18.9091	19.4593	19.8637	20.0455	20.0771	20.0741	19.9498	19.3809	18.6960	18.1829	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9982	0.9947	0.9818	0.9341	0.8137	0.6119	0.4242	0.4888	0.7918	0.9698	0.9959	0.9987	(94)
Useful gains	711.5658	888.3423	1080.5968	1238.5956	1201.0537	897.4187	593.2719	621.0843	875.4143	857.6176	716.0350	661.8055	(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	2462.9064	2396.8977	2185.6079	1839.2381	1419.0049	937.2924	598.4836	631.2318	1010.7013	1526.2705	2024.1463	2451.5648	(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	1302.9974	1013.7492	822.1283	432.4626	162.1557	0.0000	0.0000	0.0000	0.0000	497.4777	941.8402	1331.5809	(98)
Space heating												6504.3920	(98)
Space heating per m2											(98) / (4) =	44.4289	(99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.4000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													6964.0171 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1302.9974	1013.7492	822.1283	432.4626	162.1557	0.0000	0.0000	0.0000	0.0000	497.4777	941.8402	1331.5809	(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)	1395.0722	1085.3846	880.2230	463.0221	173.6143	0.0000	0.0000	0.0000	0.0000	532.6314	1008.3942	1425.6755	(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	220.2025	194.0489	203.7038	182.4818	177.4742	156.3094	149.7563	166.9431	167.9610	189.2293	200.2480	214.8623	(64)
Efficiency of water heater (217)m	88.7856	88.6094	88.1972	87.1473	84.8248	80.3000	80.3000	80.3000	80.3000	87.3717	88.4494	88.8473	(216)
Fuel for water heating, kWh/month	248.0160	218.9936	230.9642	209.3947	209.2243	194.6567	186.4960	207.8993	209.1668	216.5795	226.3984	241.8331	(219)
Water heating fuel used												2599.6227	(219)
Annual totals kWh/year													
Space heating fuel - main system												6964.0171	(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)												499.8140	(232)
Total delivered energy for all uses												10138.4538	(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	6964.0171	0.2160	1504.2277 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2599.6227	0.2160	561.5185 (264)
Space and water heating			2065.7462 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	499.8140	0.5190	259.4035 (268)
Total CO2, kg/m2/year			2364.0746 (272)
Emissions per m2 for space and water heating			14.1103 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			1.7719 (272b)
Emissions per m2 for pumps and fans			0.2659 (272c)
Target Carbon Dioxide Emission Rate (TER) = (14.1103 * 1.00) + 1.7719 + 0.2659, rounded to 2 d.p.			16.1500 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	74.2900 (1b)	x 2.3900 (2b)	= 177.5531 (1b) - (3b)
First floor	72.1100 (1c)	x 2.6700 (2c)	= 192.5337 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	146.4000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 370.0868 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				40.0000 / (5) =	0.1081 (8)
Pressure test					Yes
Measured/design AP50					4.6600
Infiltration rate					0.3411 (18)
Number of sides sheltered					1 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.9250 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3155 (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	0.4023	0.3944	0.3865	0.3471	0.3392	0.2997	0.2997	0.2918	0.3155	0.3392	0.3549	0.3707 (22b)
Effective ac	0.5809	0.5778	0.5747	0.5602	0.5575	0.5449	0.5449	0.5426	0.5498	0.5575	0.5630	0.5687 (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
Front Door			2.1200	1.1000	2.3320		(26a)
Windows (Uw = 1.20)			30.7300	1.1450	35.1870		(27)
Ground Floor			74.2900	0.1100	8.1719	140.0000	10400.6000 (28a)
Brick and Block	184.3100	32.8500	151.4600	0.2400	36.3504	42.2200	6394.6412 (29a)
Pitched Roof	74.2900		74.2900	0.1000	7.4290	9.0000	668.6100 (30)
Total net area of external elements Aum(A, m ²)			332.8900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	89.4703		(33)
Ground Floor Block			65.7800			75.0000	4933.5000 (32c)
Ground Floor Stud			44.4100			9.0000	399.6900 (32c)
First Floor Stud			109.4400			9.0000	984.9600 (32c)
First Floor Block			43.7900			75.0000	3284.2500 (32c)
Internal Floor 1			72.1100			18.0000	1297.9800 (32d)
Internal Ceiling 1			72.1100			9.0000	648.9900 (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) = 29013.2212 (34)
198.1777 (35)
8.6677 (36)
(33) + (36) = 98.1380 (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	70.9455	70.5618	70.1857	68.4192	68.0887	66.5501	66.5501	66.2652	67.1427	68.0887	68.7573	69.4563 (38)
Heat transfer coeff	169.0836	168.6999	168.3238	166.5572	166.2267	164.6881	164.6881	164.4032	165.2808	166.2267	166.8953	167.5943 (39)
Average = Sum(39)m / 12 =												166.5556 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1549	1.1523	1.1498	1.1377	1.1354	1.1249	1.1249	1.1230	1.1290	1.1354	1.1400	1.1448 (40)
HLP (average)												1.1377 (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
Average daily hot water use (litres/day)
2.9284 (42)
103.7497 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	114.1247	109.9747	105.8247	101.6747	97.5247	93.3747	93.3747	97.5247	101.6747	105.8247	109.9747	114.1247 (44)
Energy conte	169.2436	148.0215	152.7449	133.1667	127.7767	110.2615	102.1735	117.2456	118.6459	138.2704	150.9329	163.9034 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Energy content (annual)	Total = Sum(45)m = 1632.3867 (45)											
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	35.9643	31.4546	32.4583	28.2979	27.1525	23.4306	21.7119	24.9147	25.2123	29.3825	32.0732	34.8295 (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	146.4204	146.4204	146.4204	146.4204	146.4204	146.4204	146.4204	146.4204	146.4204	146.4204	146.4204	146.4204	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	28.3015	25.1372	20.4429	15.4766	11.5689	9.7670	10.5536	13.7179	18.4122	23.3785	27.2862	29.0881	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	316.5787	319.8638	311.5854	293.9619	271.7152	250.8065	236.8382	233.5531	241.8315	259.4551	281.7017	302.6104	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.6420	37.6420	37.6420	37.6420	37.6420	37.6420	37.6420	37.6420	37.6420	37.6420	37.6420	37.6420	(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)	-117.1363	-117.1363	-117.1363	-117.1363	-117.1363	-117.1363	-117.1363	-117.1363	-117.1363	-117.1363	-117.1363	-117.1363	(71)
Water heating gains (Table 5)	48.3391	46.8074	43.6267	39.3027	36.4954	32.5425	29.1826	33.4875	35.0170	39.4925	44.5462	46.8138	(72)
Total internal gains	460.1454	458.7345	442.5812	415.6673	386.7056	360.0421	343.5006	347.6847	362.1868	389.2523	420.4602	445.4384	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
North				1.4400	10.6334		0.6300		0.7000		0.7700		4.6796 (74)
East				15.9500	19.6403		0.6300		0.7000		0.7700		95.7370 (76)
Southeast				0.7200	36.7938		0.6300		0.7000		0.7700		8.0962 (77)
South				2.0800	46.7521		0.6300		0.7000		0.7700		29.7191 (78)
Southwest				0.7200	36.7938		0.6300		0.7000		0.7700		8.0962 (79)
West				9.8200	19.6403		0.6300		0.7000		0.7700		58.9428 (80)
Solar gains	205.2708	387.7832	613.2511	868.0071	1048.9546	1069.2361	1019.6939	884.3261	703.4625	452.6708	253.2623	170.6396	(83)
Total gains	665.4162	846.5176	1055.8323	1283.6744	1435.6602	1429.2783	1363.1944	1232.0108	1065.6493	841.9230	673.7225	616.0780	(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	47.6642	47.7726	47.8793	48.3871	48.4834	48.9363	48.9363	49.0211	48.7608	48.4834	48.2891	48.0877
alpha	4.1776	4.1848	4.1920	4.2258	4.2322	4.2624	4.2624	4.2681	4.2507	4.2322	4.2193	4.2058
util living area	0.9982	0.9948	0.9829	0.9404	0.8376	0.6712	0.5141	0.5819	0.8360	0.9750	0.9961	0.9987 (86)
MIT	19.3450	19.5629	19.9236	20.3783	20.7356	20.9270	20.9816	20.9696	20.8076	20.3012	19.7323	19.3099 (87)
Th 2	19.9562	19.9583	19.9604	19.9702	19.9720	19.9805	19.9805	19.9821	19.9772	19.9720	19.9683	19.9644 (88)
util rest of house	0.9977	0.9933	0.9778	0.9226	0.7910	0.5866	0.4030	0.4671	0.7703	0.9646	0.9948	0.9983 (89)
MIT 2	18.4362	18.6551	19.0141	19.4628	19.7878	19.9437	19.9749	19.9717	19.8612	19.3980	18.8323	18.4075 (90)
Living area fraction	18.5583	18.7771	19.1363	19.5858	19.9151	20.0758	20.1102	20.1058	19.9884	19.5194	18.9532	18.5287 (92)
Temperature adjustment	18.5583	18.7771	19.1363	19.5858	19.9151	20.0758	20.1102	20.1058	19.9884	19.5194	18.9532	18.5287 (93)
adjusted MIT	18.5583	18.7771	19.1363	19.5858	19.9151	20.0758	20.1102	20.1058	19.9884	19.5194	18.9532	18.5287 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9967	0.9909	0.9725	0.9144	0.7881	0.5951	0.4177	0.4818	0.7711	0.9584	0.9930	0.9976 (94)
Ext temp.	663.1889	838.8228	1026.8451	1173.8151	1131.4538	850.5181	569.3897	593.6157	821.7692	806.9392	668.9861	614.5773 (95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Month fracti	2410.8394	2341.0566	2126.9952	1779.7952	1365.5722	901.8027	578.0813	609.2472	973.2373	1482.6378	1978.2488	2401.4175 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating per m2	1300.2520	1009.5011	818.5117	436.3057	174.1840	0.0000	0.0000	0.0000	0.0000	502.7198	942.6692	1329.4091 (98)
												6513.5525 (98)
												(98) / (4) = 44.4915 (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
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FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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	1548.0682	1218.6920	1249.4642	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8647	0.9191	0.8888	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1338.6449	1120.1457	1110.5292	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1795.1216	1714.9735	1564.0641	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	328.6633	442.5519	337.4299	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling													
Cooled fraction									FC = cooled area / (4) =			1108.6451	(104)
Intermittency factor (Table 10b)												1.0000	(105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	82.1658	110.6380	84.3575	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling													
Space cooling per m2												277.1613	(107)
Energy for space heating												1.8932	(108)
Energy for space cooling												44.4915	(99)
Total												1.8932	(108)
Dwelling Fabric Energy Efficiency (DFEE)												46.3847	(109)
												46.4	(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	74.2900 (1b)	x 2.3900 (2b)	= 177.5531 (1b) - (3b)
First floor	72.1100 (1c)	x 2.6700 (2c)	= 192.5337 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	146.4000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	370.0868 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																4 * 10 =	40.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000	/ (5) =	0.1081 (8)
Pressure test										Yes							
Measured/design AP50										5.0000							
Infiltration rate										0.3581 (18)							
Number of sides sheltered										1 (19)							
Shelter factor										(20) = 1 - [0.075 x (19)] =					0.9250	(20)	
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =					0.3312	(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	0.4223	0.4140	0.4058	0.3643	0.3561	0.3147	0.3147	0.3064	0.3312	0.3561	0.3726	0.3892	(22b)				
Effective ac	0.5892	0.5857	0.5823	0.5664	0.5634	0.5495	0.5495	0.5469	0.5549	0.5634	0.5694	0.5757	(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 Semi-glazed door			2.1200	1.2000	2.5440			(26a)					
TER Opening Type (Uw = 1.40)			30.7300	1.3258	40.7405			(27)					
Ground Floor			74.2900	0.1300	9.6577			(28a)					
Brick and Block	184.3100	32.8500	151.4600	0.1800	27.2628			(29a)					
Pitched Roof	74.2900		74.2900	0.1300	9.6577			(30)					
Total net area of external elements Aum(A, m2)			332.8900					(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	89.8627			(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)								15.1489 (36)					
Total fabric heat loss						(33) + (36) =		105.0116 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 71.9551	Feb 71.5322	Mar 71.1177	Apr 69.1706	May 68.8064	Jun 67.1106	Jul 67.1106	Aug 66.7965	Sep 67.7638	Oct 68.8064	Nov 69.5433	Dec 70.3137	(38)
Heat transfer coeff	176.9667	176.5438	176.1293	174.1823	173.8180	172.1222	172.1222	171.8082	172.7754	173.8180	174.5549	175.3254	(39)
Average = Sum(39)m / 12 =												174.1805	(39)
HLP	Jan 1.2088	Feb 1.2059	Mar 1.2031	Apr 1.1898	May 1.1873	Jun 1.1757	Jul 1.1757	Aug 1.1736	Sep 1.1802	Oct 1.1873	Nov 1.1923	Dec 1.1976	(40)
HLP (average)												1.1898	(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												2.9284 (42)
Average daily hot water use (litres/day)												103.7497 (43)
Daily hot water use	Jan 114.1247	Feb 109.9747	Mar 105.8247	Apr 101.6747	May 97.5247	Jun 93.3747	Jul 93.3747	Aug 97.5247	Sep 101.6747	Oct 105.8247	Nov 109.9747	Dec 114.1247 (44)
Energy conte	169.2436	148.0215	152.7449	133.1667	127.7767	110.2615	102.1735	117.2456	118.6459	138.2704	150.9329	163.9034 (45)
Energy content (annual)										Total = Sum(45)m =		1632.3867 (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	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)
	35.9643	31.4546	32.4583	28.2979	27.1525	23.4306	21.7119	24.9147	25.2123	29.3825	32.0732	34.8295 (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	146.4204	146.4204	146.4204	146.4204	146.4204	146.4204	146.4204	146.4204	146.4204	146.4204	146.4204	146.4204	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	28.3015	25.1372	20.4429	15.4766	11.5689	9.7670	10.5536	13.7179	18.4122	23.3785	27.2862	29.0881	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	316.5787	319.8638	311.5854	293.9619	271.7152	250.8065	236.8382	233.5531	241.8315	259.4551	281.7017	302.6104	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.6420	37.6420	37.6420	37.6420	37.6420	37.6420	37.6420	37.6420	37.6420	37.6420	37.6420	37.6420	(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)	-117.1363	-117.1363	-117.1363	-117.1363	-117.1363	-117.1363	-117.1363	-117.1363	-117.1363	-117.1363	-117.1363	-117.1363	(71)
Water heating gains (Table 5)	48.3391	46.8074	43.6267	39.3027	36.4954	32.5425	29.1826	33.4875	35.0170	39.4925	44.5462	46.8138	(72)
Total internal gains	460.1454	458.7345	442.5812	415.6673	386.7056	360.0421	343.5006	347.6847	362.1868	389.2523	420.4602	445.4384	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	1.4400	10.6334	0.6300	0.7000	0.7700	4.6796	(74)
East	15.9500	19.6403	0.6300	0.7000	0.7700	95.7370	(76)
Southeast	0.7200	36.7938	0.6300	0.7000	0.7700	8.0962	(77)
South	2.0800	46.7521	0.6300	0.7000	0.7700	29.7191	(78)
Southwest	0.7200	36.7938	0.6300	0.7000	0.7700	8.0962	(79)
West	9.8200	19.6403	0.6300	0.7000	0.7700	58.9428	(80)

Solar gains	205.2708	387.7832	613.2511	868.0071	1048.9546	1069.2361	1019.6939	884.3261	703.4625	452.6708	253.2623	170.6396	(83)
Total gains	665.4162	846.5176	1055.8323	1283.6744	1435.6602	1429.2783	1363.1944	1232.0108	1065.6493	841.9230	673.7225	616.0780	(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	57.4496	57.5872	57.7228	58.3680	58.4903	59.0666	59.0666	59.1745	58.8433	58.4903	58.2434	57.9874		
alpha	4.8300	4.8391	4.8482	4.8912	4.8994	4.9378	4.9378	4.9450	4.9229	4.8994	4.8829	4.8658		
util living area	0.9994	0.9980	0.9919	0.9634	0.8757	0.7087	0.5416	0.6139	0.8742	0.9872	0.9986	0.9996	(86)	
MIT	19.5463	19.7315	20.0427	20.4454	20.7711	20.9434	20.9878	20.9783	20.8337	20.3778	19.8837	19.5184	(87)	
Th 2	19.9130	19.9153	19.9175	19.9282	19.9302	19.9395	19.9395	19.9412	19.9359	19.9302	19.9262	19.9219	(88)	
util rest of house	0.9992	0.9973	0.9888	0.9491	0.8290	0.6150	0.4182	0.4861	0.8074	0.9802	0.9980	0.9995	(89)	
MIT 2	18.5813	18.7680	19.0793	19.4807	19.7770	19.9140	19.9365	19.9351	19.8415	19.4227	18.9289	18.5605	(90)	
Living area fraction									fLA = Living area / (4) =			0.1344	(91)	
MIT	18.7110	18.8975	19.2088	19.6103	19.9106	20.0523	20.0777	20.0753	19.9748	19.5510	19.0572	18.6892	(92)	
Temperature adjustment												0.0000		
adjusted MIT	18.7110	18.8975	19.2088	19.6103	19.9106	20.0523	20.0777	20.0753	19.9748	19.5510	19.0572	18.6892	(93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Useful gains	0.9989	0.9963	0.9860	0.9437	0.8280	0.6258	0.4348	0.5032	0.8103	0.9767	0.9973	0.9992	(94)	
Ext temp.	664.6685	843.3927	1041.0509	1211.3536	1188.7420	894.4671	592.7836	619.9321	863.5116	822.3307	671.8950	615.6044	(95)	
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)	
Month fracti	2550.2613	2471.1636	2238.3893	1865.5462	1427.1468	938.4573	598.5969	631.4428	1015.0279	1555.8463	2087.1910	2540.3192	(97)	
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)	
Space heating	1402.8810	1093.8620	890.8198	471.0186	177.3732	0.0000	0.0000	0.0000	0.0000	545.7356	1019.0131	1431.9878	(98)	
Space heating per m2											(98) / (4) =	48.0375	(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	1617.9486	1273.7042	1305.7420	0.0000	0.0000	0.0000	0.0000	(100)	
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8717	0.9286	0.8972	0.0000	0.0000	0.0000	0.0000	(101)	
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1410.3375	1182.7051	1171.5218	0.0000	0.0000	0.0000	0.0000	(102)	
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1795.1216	1714.9735	1564.0641	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)	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	277.0446	396.0077	292.0514	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												965.1036 (104)
Cooled fraction									fC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	69.2611	99.0019	73.0129	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												241.2759 (107)
Space cooling per m2												1.6481 (108)
Energy for space heating												48.0375 (99)
Energy for space cooling												1.6481 (108)
Total												49.6856 (109)
Target Fabric Energy Efficiency (TFEE)												57.1 (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	74.2900 (1b)	x 2.3900 (2b)	= 177.5531 (1b) - (3b)
First floor	72.1100 (1c)	x 2.6700 (2c)	= 192.5337 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	146.4000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 370.0868 (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					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					40.0000 / (5) = 0.1081 (8)
Pressure test					Yes
Measured/design AP50					4.6600
Infiltration rate					0.3411 (18)
Number of sides sheltered					1 (19)
Shelter factor			(20) = 1 - [0.075 x (19)]	=	0.9250 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20)	=	0.3155 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000 (22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250 (22a)
Adj infilt rate	0.3313	0.3076	0.3155	0.2997	0.2997	0.2918	0.2840	0.2761	0.2682	0.2918	0.2761	0.2918 (22b)
Effective ac	0.5549	0.5473	0.5498	0.5449	0.5449	0.5426	0.5403	0.5381	0.5360	0.5426	0.5381	0.5426 (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
Front Door			2.1200	1.1000	2.3320		(26a)
Windows (Uw = 1.20)			30.7300	1.1450	35.1870		(27)
Ground Floor			74.2900	0.1100	8.1719	140.0000	10400.6000 (28a)
Brick and Block	184.3100	32.8500	151.4600	0.2400	36.3504	42.2200	6394.6412 (29a)
Pitched Roof	74.2900		74.2900	0.1000	7.4290	9.0000	668.6100 (30)
Total net area of external elements Aum(A, m ²)			332.8900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	89.4703		(33)
Ground Floor Block			65.7800			75.0000	4933.5000 (32c)
Ground Floor Stud			44.4100			9.0000	399.6900 (32c)
First Floor Stud			109.4400			9.0000	984.9600 (32c)
First Floor Block			43.7900			75.0000	3284.2500 (32c)
Internal Floor 1			72.1100			18.0000	1297.9800 (32d)
Internal Ceiling 1			72.1100			18.0000	1297.9800 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 29662.2112 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 202.6107 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 8.6677 (36)
Total fabric heat loss (33) + (36) = 98.1380 (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	67.7658	66.8426	67.1427	66.5501	66.5501	66.2652	65.9878	65.7181	65.4560	66.2652	65.7181	66.2652 (38)
Heat transfer coeff	165.9038	164.9806	165.2808	164.6881	164.6881	164.4032	164.1259	163.8561	163.5940	164.4032	163.8561	164.4032 (39)
Average = Sum(39)m / 12 =												164.5153 (39)
HLP	1.1332	1.1269	1.1290	1.1249	1.1249	1.1230	1.1211	1.1192	1.1174	1.1230	1.1192	1.1230 (40)
HLP (average)												1.1237 (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												2.9284 (42)
Average daily hot water use (litres/day)												103.7497 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	114.1247	109.9747	105.8247	101.6747	97.5247	93.3747	93.3747	97.5247	101.6747	105.8247	109.9747	114.1247 (44)
	169.2436	148.0215	152.7449	133.1667	127.7767	110.2615	102.1735	117.2456	118.6459	138.2704	150.9329	163.9034 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Energy content (annual)													Total = Sum(45)m =	1632.3867 (45)
Distribution loss (46)m = 0.15 x (45)m														
	25.3865	22.2032	22.9117	19.9750	19.1665	16.5392	15.3260	17.5868	17.7969	20.7406	22.6399	24.5855	(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	27.5671	24.8979	27.5540	26.6466	27.5148	26.5972	27.4651	27.4973	26.6221	27.5302	26.6640	27.5588	(61)	
Total heat required for water heating calculated for each month	196.8107	172.9194	180.2990	159.8134	155.2914	136.8588	129.6387	144.7429	145.2681	165.8006	177.5969	191.4621	(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	196.8107	172.9194	180.2990	159.8134	155.2914	136.8588	129.6387	144.7429	145.2681	165.8006	177.5969	191.4621	(64)	
													Total per year (kWh/year) = Sum(64)m =	1956.5019 (64)
RHI water heating demand														1957 (64)
Heat gains from water heating, kWh/month	63.1653	55.4416	57.6762	50.9396	49.3644	43.3113	40.8390	45.8585	46.1053	52.8575	56.8512	61.3876	(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	175.7045	175.7045	175.7045	175.7045	175.7045	175.7045	175.7045	175.7045	175.7045	175.7045	175.7045	175.7045	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	70.7538	62.8429	51.1073	38.6915	28.9224	24.4175	26.3839	34.2949	46.0305	58.4463	68.2154	72.7203	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	472.5055	477.4086	465.0529	438.7490	405.5451	374.3381	353.4899	348.5868	360.9425	387.2464	420.4503	451.6573	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.4989	55.4989	55.4989	55.4989	55.4989	55.4989	55.4989	55.4989	55.4989	55.4989	55.4989	55.4989	(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)	-117.1363	-117.1363	-117.1363	-117.1363	-117.1363	-117.1363	-117.1363	-117.1363	-117.1363	-117.1363	-117.1363	-117.1363	(71)
Water heating gains (Table 5)	84.8995	82.5024	77.5218	70.7494	66.3500	60.1545	54.8911	61.6378	64.0351	71.0450	78.9600	82.5102	(72)
Total internal gains	745.2259	739.8210	710.7490	665.2570	617.8845	575.9772	551.8320	561.5864	588.0752	633.8046	684.6928	723.9548	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data FF or Table 6c	Access factor Table 6d	Gains W
North	1.4400	13.4839	0.6300	0.7000	0.7700	5.9340 (74)
East	15.9500	25.1925	0.6300	0.7000	0.7700	122.8017 (76)
Southeast	0.7200	45.1778	0.6300	0.7000	0.7700	9.9410 (77)
South	2.0800	56.7559	0.6300	0.7000	0.7700	36.0783 (78)
Southwest	0.7200	45.1778	0.6300	0.7000	0.7700	9.9410 (79)
West	9.8200	25.1925	0.6300	0.7000	0.7700	75.6058 (80)

Solar gains	260.3019	418.8385	667.5801	949.4610	1089.2890	1205.6406	1140.9541	1014.7885	808.4381	527.5488	320.2101	212.6373	(83)
Total gains	1005.5278	1158.6595	1378.3291	1614.7180	1707.1736	1781.6178	1692.7861	1576.3749	1396.5132	1161.3534	1004.9028	936.5921	(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	49.6643	49.9422	49.8516	50.0310	50.0310	50.1177	50.2023	50.2850	50.3656	50.1177	50.2850	50.1177	
alpha	4.3110	4.3295	4.3234	4.3354	4.3354	4.3412	4.3468	4.3523	4.3577	4.3412	4.3523	4.3412	
util living area	0.9907	0.9828	0.9540	0.8711	0.7244	0.5101	0.3747	0.4006	0.6740	0.9134	0.9801	0.9927	(86)
MIT	19.7316	19.8993	20.2428	20.6303	20.8762	20.9786	20.9956	20.9943	20.9321	20.6073	20.1177	19.7092	(87)
Th 2	19.9738	19.9789	19.9772	19.9805	19.9805	19.9821	19.9837	19.9852	19.9866	19.9821	19.9852	19.9821	(88)
util rest of house	0.9881	0.9781	0.9416	0.8386	0.6624	0.4256	0.2788	0.2988	0.5877	0.8825	0.9736	0.9906	(89)
MIT 2	18.8324	19.0019	19.3352	19.6984	19.9038	19.9733	19.9826	19.9838	19.9530	19.6891	19.2241	18.8169	(90)
Living area fraction	18.9532	19.1224	19.4572	19.8236	20.0345	20.1084	20.1187	20.1196	fLA = Living area / (4) =	19.8125	19.3442	0.1344	(91)
MIT	18.9532	19.1224	19.4572	19.8236	20.0345	20.1084	20.1187	20.1196	20.0846	19.8125	19.3442	18.9368	(92)
Temperature adjustment	18.9532	19.1224	19.4572	19.8236	20.0345	20.1084	20.1187	20.1196	20.0846	19.8125	19.3442	0.0000	
adjusted MIT	18.9532	19.1224	19.4572	19.8236	20.0345	20.1084	20.1187	20.1196	20.0846	19.8125	19.3442	18.9368	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	990.1184	1127.4250	1287.2014	1344.9073	1136.8947	777.4271	493.7705	492.5829	833.1802	1017.6201	972.8933	925.1018	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W	2331.4803	2280.4365	2058.9289	1700.1749	1240.8399	790.5157	495.4522	494.7776	880.8832	1383.0355	1875.2019	2291.2486	(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	997.9733	774.8237	574.1653	255.7927	77.3352	0.0000	0.0000	0.0000	0.0000	271.8691	649.6622	1016.4133	(98)
Space heating												4618.0347	(98)
RHI space heating demand												4618	(98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	74.2900 (1b)	x 2.3900 (2b)	= 177.5531 (1b) - (3b)
First floor	72.1100 (1c)	x 2.6700 (2c)	= 192.5337 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	146.4000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 370.0868 (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					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					40.0000 / (5) = 0.1081 (8)
Pressure test					Yes
Measured/design AP50					4.6600
Infiltration rate					0.3411 (18)
Number of sides sheltered					1 (19)
Shelter factor			(20) = 1 - [0.075 x (19)]	=	0.9250 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20)	=	0.3155 (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	0.4023	0.3944	0.3865	0.3471	0.3392	0.2997	0.2997	0.2918	0.3155	0.3392	0.3549	0.3707 (22b)
Effective ac	0.5809	0.5778	0.5747	0.5602	0.5575	0.5449	0.5449	0.5426	0.5498	0.5575	0.5630	0.5687 (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
Front Door			2.1200	1.1000	2.3320		(26a)
Windows (Uw = 1.20)			30.7300	1.1450	35.1870		(27)
Ground Floor			74.2900	0.1100	8.1719	140.0000	10400.6000 (28a)
Brick and Block	184.3100	32.8500	151.4600	0.2400	36.3504	42.2200	6394.6412 (29a)
Pitched Roof	74.2900		74.2900	0.1000	7.4290	9.0000	668.6100 (30)
Total net area of external elements Aum(A, m ²)			332.8900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	89.4703		(33)
Ground Floor Block			65.7800			75.0000	4933.5000 (32c)
Ground Floor Stud			44.4100			9.0000	399.6900 (32c)
First Floor Stud			109.4400			9.0000	984.9600 (32c)
First Floor Block			43.7900			75.0000	3284.2500 (32c)
Internal Floor 1			72.1100			18.0000	1297.9800 (32d)
Internal Ceiling 1			72.1100			18.0000	1297.9800 (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) = 29662.2112 (34)
202.6107 (35)
8.6677 (36)
(33) + (36) = 98.1380 (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	70.9455	70.5618	70.1857	68.4192	68.0887	66.5501	66.5501	66.2652	67.1427	68.0887	68.7573	69.4563 (38)
Heat transfer coeff	169.0836	168.6999	168.3238	166.5572	166.2267	164.6881	164.6881	164.4032	165.2808	166.2267	166.8953	167.5943 (39)
Average = Sum(39)m / 12 =												166.5556 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1549	1.1523	1.1498	1.1377	1.1354	1.1249	1.1249	1.1230	1.1290	1.1354	1.1400	1.1448 (40)
HLP (average)												1.1377 (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
Average daily hot water use (litres/day)
2.9284 (42)
103.7497 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	114.1247	109.9747	105.8247	101.6747	97.5247	93.3747	93.3747	97.5247	101.6747	105.8247	109.9747	114.1247 (44)
Energy conte	169.2436	148.0215	152.7449	133.1667	127.7767	110.2615	102.1735	117.2456	118.6459	138.2704	150.9329	163.9034 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Energy content (annual)												Total = Sum(45)m = 1632.3867 (45)
Distribution loss (46)m = 0.15 x (45)m												
	25.3865	22.2032	22.9117	19.9750	19.1665	16.5392	15.3260	17.5868	17.7969	20.7406	22.6399	24.5855 (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	27.5671	24.8979	27.5540	26.6466	27.5148	26.5972	27.4651	27.4973	26.6221	27.5302	26.6640	27.5588 (61)
Total heat required for water heating calculated for each month	196.8107	172.9194	180.2990	159.8134	155.2914	136.8588	129.6387	144.7429	145.2681	165.8006	177.5969	191.4621 (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	196.8107	172.9194	180.2990	159.8134	155.2914	136.8588	129.6387	144.7429	145.2681	165.8006	177.5969	191.4621 (64)
Heat gains from water heating, kWh/month	63.1653	55.4416	57.6762	50.9396	49.3644	43.3113	40.8390	45.8585	46.1053	52.8575	56.8512	61.3876 (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	175.7045	175.7045	175.7045	175.7045	175.7045	175.7045	175.7045	175.7045	175.7045	175.7045	175.7045	175.7045	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	70.7538	62.8429	51.1073	38.6915	28.9224	24.4175	26.3839	34.2949	46.0305	58.4463	68.2154	72.7203	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	472.5055	477.4086	465.0529	438.7490	405.5451	374.3381	353.4899	348.5868	360.9425	387.2464	420.4503	451.6573	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.4989	55.4989	55.4989	55.4989	55.4989	55.4989	55.4989	55.4989	55.4989	55.4989	55.4989	55.4989	(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)	-117.1363	-117.1363	-117.1363	-117.1363	-117.1363	-117.1363	-117.1363	-117.1363	-117.1363	-117.1363	-117.1363	-117.1363	(71)
Water heating gains (Table 5)	84.8995	82.5024	77.5218	70.7494	66.3500	60.1545	54.8911	61.6378	64.0351	71.0450	78.9600	82.5102	(72)
Total internal gains	745.2259	739.8210	710.7490	665.2570	617.8845	575.9772	551.8320	561.5864	588.0752	633.8046	684.6928	723.9548	(73)

6. Solar gains

[Jan]				Area m2		Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
North				1.4400		10.6334		0.6300		0.7000		0.7700		4.6796 (74)
East				15.9500		19.6403		0.6300		0.7000		0.7700		95.7370 (76)
Southeast				0.7200		36.7938		0.6300		0.7000		0.7700		8.0962 (77)
South				2.0800		46.7521		0.6300		0.7000		0.7700		29.7191 (78)
Southwest				0.7200		36.7938		0.6300		0.7000		0.7700		8.0962 (79)
West				9.8200		19.6403		0.6300		0.7000		0.7700		58.9428 (80)
Solar gains	205.2708	387.7832	613.2511	868.0071	1048.9546	1069.2361	1019.6939	884.3261	703.4625	452.6708	253.2623	170.6396	(83)	
Total gains	950.4967	1127.6042	1324.0001	1533.2641	1666.8391	1645.2133	1571.5259	1445.9125	1291.5376	1086.4754	937.9551	894.5944	(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	48.7304	48.8412	48.9503	49.4695	49.5679	50.0310	50.0310	50.1177	49.8516	49.5679	49.3693	49.1634
alpha	4.2487	4.2561	4.2634	4.2980	4.3045	4.3354	4.3354	4.3412	4.3234	4.3045	4.2913	4.2776
util living area	0.9935	0.9860	0.9649	0.9034	0.7797	0.6038	0.4523	0.5076	0.7585	0.9450	0.9877	0.9949 (86)
MIT	19.5834	19.7901	20.1222	20.5233	20.8136	20.9540	20.9895	20.9830	20.8781	20.4686	19.9463	19.5454 (87)
Th 2	19.9562	19.9583	19.9604	19.9702	19.9720	19.9805	19.9805	19.9821	19.9772	19.9720	19.9683	19.9644 (88)
util rest of house	0.9917	0.9822	0.9553	0.8778	0.7263	0.5210	0.3517	0.4024	0.6824	0.9247	0.9837	0.9935 (89)
MIT 2	18.6713	18.8777	19.2051	19.5934	19.8476	19.9585	19.9775	19.9767	19.9090	19.5533	19.0420	18.6400 (90)
Living area fraction	18.7939	19.0003	19.3283	19.7183	19.9774	20.0923	20.1135	20.1119	20.0392	19.6763	19.1635	18.7617 (91)
MIT	18.7939	19.0003	19.3283	19.7183	19.9774	20.0923	20.1135	20.1119	20.0392	19.6763	19.1635	18.7617 (92)
Temperature adjustment	18.7939	19.0003	19.3283	19.7183	19.9774	20.0923	20.1135	20.1119	20.0392	19.6763	19.1635	18.7617 (93)
adjusted MIT	18.7939	19.0003	19.3283	19.7183	19.9774	20.0923	20.1135	20.1119	20.0392	19.6763	19.1635	18.7617 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9890	0.9776	0.9480	0.8704	0.7266	0.5305	0.3651	0.4162	0.6875	0.9174	0.9795	0.9913	(94)
Ext temp.	940.0207	1102.3682	1255.1052	1334.5798	1211.1996	872.7655	573.7963	601.8290	887.9668	996.7586	918.7260	886.8112	(95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Month fracti	2450.6739	2378.7187	2159.3117	1801.8735	1375.9247	904.5116	578.6253	610.2507	981.6362	1508.7169	2013.3359	2440.4526	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating	1123.9259	857.7075	672.7296	336.4515	122.5554	0.0000	0.0000	0.0000	0.0000	380.8970	788.1192	1155.9092	(98)
Space heating per m2													(98) / (4) = 37.1468 (99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.7000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													5995.9155 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1123.9259	857.7075	672.7296	336.4515	122.5554	0.0000	0.0000	0.0000	0.0000	380.8970	788.1192	1155.9092	(98)
Space heating efficiency (main heating system 1)	90.7000	90.7000	90.7000	90.7000	90.7000	0.0000	0.0000	0.0000	0.0000	90.7000	90.7000	90.7000	(210)
Space heating fuel (main heating system)	1239.1686	945.6533	741.7085	370.9498	135.1218	0.0000	0.0000	0.0000	0.0000	419.9526	868.9296	1274.4314	(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	196.8107	172.9194	180.2990	159.8134	155.2914	136.8588	129.6387	144.7429	145.2681	165.8006	177.5969	191.4621	(64)
Efficiency of water heater (217)m	90.2715	90.2178	90.0934	89.7790	89.1134	87.9000	87.9000	87.9000	87.9000	89.8322	90.1718	87.9000	(216)
Fuel for water heating, kWh/month	218.0208	191.6688	200.1245	178.0074	174.2626	155.6983	147.4843	164.6677	165.2651	184.5671	196.9540	212.0494	(219)
Water heating fuel used												2188.7700	(219)
Annual totals kWh/year													
Space heating fuel - main system												5995.9155	(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)												499.8140	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.30 * 908 * 1.00) =										-944.1684		-944.1684	(233)
Total delivered energy for all uses												7815.3311	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	5995.9155	3.4800	208.6579 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2188.7700	3.4800	76.1692 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	499.8140	13.1900	65.9255 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-944.1684	13.1900	-124.5358 (252)
Total energy cost			356.1092 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)		0.7814 (257)
SAP value	$[(255) \times (256)] / [(4) + 45.0] =$	89.0990
SAP rating (Section 12)		89 (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	5995.9155	0.2160	1295.1178 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2188.7700	0.2160	472.7743 (264)
Space and water heating			1767.8921 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	499.8140	0.5190	259.4035 (268)
Energy saving/generation technologies			
PV Unit	-944.1684	0.5190	-490.0234 (269)
Total kg/year			1576.1971 (272)
CO2 emissions per m2			10.7700 (273)
EI value			88.9650
EI rating			89 (274)
EI band			B

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Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Calculation of stars for heating and DHW

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9070 = 3.837$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9070 = 0.2381$, stars = 4
Water heating energy efficiency	$3.48 / 0.8928 = 3.898$, stars = 4
Water heating environmental impact	$0.216 / 0.8928 = 0.2419$, 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	74.2900 (1b)	x 2.3900 (2b)	= 177.5531 (1b) - (3b)
First floor	72.1100 (1c)	x 2.6700 (2c)	= 192.5337 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	146.4000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 370.0868 (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					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					40.0000 / (5) = 0.1081 (8)
Pressure test					Yes
Measured/design AP50					4.6600
Infiltration rate					0.3411 (18)
Number of sides sheltered					1 (19)
Shelter factor			(20) = 1 - [0.075 x (19)]	=	0.9250 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20)	=	0.3155 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000 (22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250 (22a)
Adj infilt rate	0.3313	0.3076	0.3155	0.2997	0.2997	0.2918	0.2840	0.2761	0.2682	0.2918	0.2761	0.2918 (22b)
Effective ac	0.5549	0.5473	0.5498	0.5449	0.5449	0.5426	0.5403	0.5381	0.5360	0.5426	0.5381	0.5426 (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
Front Door			2.1200	1.1000	2.3320		(26a)
Windows (Uw = 1.20)			30.7300	1.1450	35.1870		(27)
Ground Floor			74.2900	0.1100	8.1719	140.0000	10400.6000 (28a)
Brick and Block	184.3100	32.8500	151.4600	0.2400	36.3504	42.2200	6394.6412 (29a)
Pitched Roof	74.2900		74.2900	0.1000	7.4290	9.0000	668.6100 (30)
Total net area of external elements Aum(A, m ²)			332.8900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	89.4703		(33)
Ground Floor Block			65.7800			75.0000	4933.5000 (32c)
Ground Floor Stud			44.4100			9.0000	399.6900 (32c)
First Floor Stud			109.4400			9.0000	984.9600 (32c)
First Floor Block			43.7900			75.0000	3284.2500 (32c)
Internal Floor 1			72.1100			18.0000	1297.9800 (32d)
Internal Ceiling 1			72.1100			18.0000	1297.9800 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 29662.2112 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 202.6107 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 8.6677 (36)
Total fabric heat loss (33) + (36) = 98.1380 (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	67.7658	66.8426	67.1427	66.5501	66.5501	66.2652	65.9878	65.7181	65.4560	66.2652	65.7181	66.2652 (38)
Heat transfer coeff	165.9038	164.9806	165.2808	164.6881	164.6881	164.4032	164.1259	163.8561	163.5940	164.4032	163.8561	164.4032 (39)
Average = Sum(39)m / 12 =												164.5153 (39)
HLP	1.1332	1.1269	1.1290	1.1249	1.1249	1.1230	1.1211	1.1192	1.1174	1.1230	1.1192	1.1230 (40)
HLP (average)												1.1237 (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												2.9284 (42)
Average daily hot water use (litres/day)												103.7497 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	114.1247	109.9747	105.8247	101.6747	97.5247	93.3747	93.3747	97.5247	101.6747	105.8247	109.9747	114.1247 (44)
	169.2436	148.0215	152.7449	133.1667	127.7767	110.2615	102.1735	117.2456	118.6459	138.2704	150.9329	163.9034 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Energy content (annual)												Total = Sum (45)m =	1632.3867 (45)
Distribution loss (46)m = 0.15 x (45)m													
	25.3865	22.2032	22.9117	19.9750	19.1665	16.5392	15.3260	17.5868	17.7969	20.7406	22.6399	24.5855	(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	27.5671	24.8979	27.5540	26.6466	27.5148	26.5972	27.4651	27.4973	26.6221	27.5302	26.6640	27.5588	(61)
Total heat required for water heating calculated for each month	196.8107	172.9194	180.2990	159.8134	155.2914	136.8588	129.6387	144.7429	145.2681	165.8006	177.5969	191.4621	(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	196.8107	172.9194	180.2990	159.8134	155.2914	136.8588	129.6387	144.7429	145.2681	165.8006	177.5969	191.4621	(64)
Total per year (kWh/year) = Sum (64)m =												1956.5019	(64)
Heat gains from water heating, kWh/month	63.1653	55.4416	57.6762	50.9396	49.3644	43.3113	40.8390	45.8585	46.1053	52.8575	56.8512	61.3876	(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	175.7045	175.7045	175.7045	175.7045	175.7045	175.7045	175.7045	175.7045	175.7045	175.7045	175.7045	175.7045	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	70.7538	62.8429	51.1073	38.6915	28.9224	24.4175	26.3839	34.2949	46.0305	58.4463	68.2154	72.7203	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	472.5055	477.4086	465.0529	438.7490	405.5451	374.3381	353.4899	348.5868	360.9425	387.2464	420.4503	451.6573	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.4989	55.4989	55.4989	55.4989	55.4989	55.4989	55.4989	55.4989	55.4989	55.4989	55.4989	55.4989	(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)	-117.1363	-117.1363	-117.1363	-117.1363	-117.1363	-117.1363	-117.1363	-117.1363	-117.1363	-117.1363	-117.1363	-117.1363	(71)
Water heating gains (Table 5)	84.8995	82.5024	77.5218	70.7494	66.3500	60.1545	54.8911	61.6378	64.0351	71.0450	78.9600	82.5102	(72)
Total internal gains	745.2259	739.8210	710.7490	665.2570	617.8845	575.9772	551.8320	561.5864	588.0752	633.8046	684.6928	723.9548	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
North				1.4400	13.4839		0.6300		0.7000		0.7700		5.9340 (74)
East				15.9500	25.1925		0.6300		0.7000		0.7700		122.8017 (76)
Southeast				0.7200	45.1778		0.6300		0.7000		0.7700		9.9410 (77)
South				2.0800	56.7559		0.6300		0.7000		0.7700		36.0783 (78)
Southwest				0.7200	45.1778		0.6300		0.7000		0.7700		9.9410 (79)
West				9.8200	25.1925		0.6300		0.7000		0.7700		75.6058 (80)
Solar gains	260.3019	418.8385	667.5801	949.4610	1089.2890	1205.6406	1140.9541	1014.7885	808.4381	527.5488	320.2101	212.6373	(83)
Total gains	1005.5278	1158.6595	1378.3291	1614.7180	1707.1736	1781.6178	1692.7861	1576.3749	1396.5132	1161.3534	1004.9028	936.5921	(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	49.6643	49.9422	49.8516	50.0310	50.0310	50.1177	50.2023	50.2850	50.3656	50.1177	50.2850	50.1177	
alpha	4.3110	4.3295	4.3234	4.3354	4.3354	4.3412	4.3468	4.3523	4.3577	4.3412	4.3523	4.3412	
util living area	0.9907	0.9828	0.9540	0.8711	0.7244	0.5101	0.3747	0.4006	0.6740	0.9134	0.9801	0.9927	(86)
MIT	19.7316	19.8993	20.2428	20.6303	20.8762	20.9786	20.9956	20.9943	20.9321	20.6073	20.1177	19.7092	(87)
Th 2	19.9738	19.9789	19.9772	19.9805	19.9805	19.9821	19.9837	19.9852	19.9866	19.9821	19.9852	19.9821	(88)
util rest of house	0.9881	0.9781	0.9416	0.8386	0.6624	0.4256	0.2788	0.2988	0.5877	0.8825	0.9736	0.9906	(89)
MIT 2	18.8324	19.0019	19.3352	19.6984	19.9038	19.9733	19.9826	19.9838	19.9530	19.6891	19.2241	18.8169	(90)
Living area fraction	fLA = Living area / (4) =											0.1344	(91)
MIT	18.9532	19.1224	19.4572	19.8236	20.0345	20.1084	20.1187	20.1196	20.0846	19.8125	19.3442	18.9368	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9532	19.1224	19.4572	19.8236	20.0345	20.1084	20.1187	20.1196	20.0846	19.8125	19.3442	18.9368	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9847	0.9730	0.9339	0.8329	0.6660	0.4364	0.2917	0.3125	0.5966	0.8762	0.9681	0.9877	(94)
Ext temp.	990.1184	1127.4250	1287.2014	1344.9073	1136.8947	777.4271	493.7705	492.5829	833.1802	1017.6201	972.8933	925.1018	(95)
Heat loss rate W	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Month fracti	2331.4803	2280.4365	2058.9289	1700.1749	1240.8399	790.5157	495.4522	494.7776	880.8832	1383.0355	1875.2019	2291.2486	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating	997.9733	774.8237	574.1653	255.7927	77.3352	0.0000	0.0000	0.0000	0.0000	271.8691	649.6622	1016.4133	(98)
Space heating per m2												4618.0347	(98)
												(98) / (4) =	31.5440 (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 %)													90.7000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													5091.5487 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	997.9733	774.8237	574.1653	255.7927	77.3352	0.0000	0.0000	0.0000	0.0000	271.8691	649.6622	1016.4133	(98)
Space heating efficiency (main heating system 1)	90.7000	90.7000	90.7000	90.7000	90.7000	0.0000	0.0000	0.0000	0.0000	90.7000	90.7000	90.7000	(210)
Space heating fuel (main heating system)	1100.3013	854.2709	633.0378	282.0206	85.2649	0.0000	0.0000	0.0000	0.0000	299.7454	716.2759	1120.6320	(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	196.8107	172.9194	180.2990	159.8134	155.2914	136.8588	129.6387	144.7429	145.2681	165.8006	177.5969	191.4621	(64)
Efficiency of water heater (217)m	90.2266	90.1759	90.0148	89.6025	88.8115	87.9000	87.9000	87.9000	87.9000	89.6185	90.0840	87.9000	(216)
Fuel for water heating, kWh/month	218.1294	191.7579	200.2993	178.3582	174.8552	155.6983	147.4843	164.6677	165.2651	185.0070	197.1460	212.1597	(219)
Water heating fuel used												2190.8282	(219)
Annual totals kWh/year													
Space heating fuel - main system												5091.5487	(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)												499.8140	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.30 * 1031 * 1.00) =										-1072.2581		-1072.2581	(233)
Total delivered energy for all uses												6784.9327	(238)

10a. Fuel costs - using BEDF prices (526)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	5091.5487	10.2300	520.8654 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2190.8282	10.2300	224.1217 (247)
Pumps and fans for heating	75.0000	36.7200	27.5400 (249)
Energy for lighting	499.8140	36.7200	183.5317 (250)
Additional standing charges			103.0000 (251)
Energy saving/generation technologies			
PV Unit	-1072.2581	36.7200	-393.7332 (252)
Total energy cost			665.3257 (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	5091.5487	0.2160	1099.7745 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2190.8282	0.2160	473.2189 (264)
Space and water heating			1572.9934 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	499.8140	0.5190	259.4035 (268)
Energy saving/generation technologies			
PV Unit	-1072.2581	0.5190	-556.5020 (269)
Total kg/year			1314.8199 (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	5091.5487	1.2200	6211.6895 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2190.8282	1.2200	2672.8104 (264)
Space and water heating			8884.4998 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	499.8140	3.0700	1534.4289 (268)
Energy saving/generation technologies			
PV Unit	-1072.2581	3.0700	-3291.8325 (269)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Primary energy kWh/year
Primary energy kWh/m²/year

7357.3463 (272)
50.2551 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 89
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
F	Already installed
G	Not considered
H	Not considered
I	Not considered
J	Not considered
K	Not considered
M	Not considered
N	Solar water heating
O	SAP increase too small
P	Not considered
R	Not considered
S	Not considered
T	Not considered
U	Solar photovoltaic panels
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
L2	Not applicable
Q3	Not considered
O3	Not considered

Recommended measures: SAP change Cost change CO2 change
(none)

Measures omitted - SAP change or cost saving too small:
N Solar water heating + 0.9 -£ 88 -199 kg (15.1%)

Recommended measures Typical annual savings Energy Environmental
(none) efficiency impact
Total Savings £0 0.00 kg/m²

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

Fuel prices for cost data on this page from database revision number 526 TEST (30 Aug 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	£211	£211	£0
Mains gas	£848	£848	£0
Space heating	£651	£651	£0
Water heating	£224	£224	£0
Lighting	£184	£184	£0
Generated (PV)	-£394	-£394	£0
Total cost of fuels	£665	£665	£0
Total cost of uses	£665	£665	£0
Delivered energy	46 kWh/m ²	46 kWh/m ²	0 kWh/m ²
Carbon dioxide emissions	1.3 tonnes	1.3 tonnes	0.0 tonnes
CO2 emissions per m ²	9 kg/m ²	9 kg/m ²	0 kg/m ²
Primary energy	50 kWh/m ²	50 kWh/m ²	0 kWh/m ²

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

No improvements selected / applicable

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

No improvements selected / applicable

U-VALUE CALCULATOR REPORT

Property Reference	SAP 0645 Plot 43	Issued on Date	22/09/2023
Assessment Reference	As Built	Prop Type Ref	Dh
Project	17, Fieldfare Crescent, Botley, Southampton, SO32 2TW		
Calculation Type	New Build (As Built)		

SAP Rating	89 B	DER	12.27	TER	16.15
Environmental	89 B	% DER<TER	24.02		
CO ₂ Emissions (t/year)	1.31	DFEE	46.38	TFEE	57.14
General Requirements Compliance	Pass	% DFEE<TFEE	18.82		

Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 07798936079, toby@abacusenergyuk.com	Assessor ID	E477-0001
Client	Foreman Homes, FORE		

Building Elements

Roof 000002 - Mineral Wool between and above

Roof Type: Pitched Roof, insulated flat ceiling

Layer	Description	Thickness (mm)	Conductivity (W/m ² K)	Resistance (m ² K/W)	Fraction (%)
Ext surface				0.0400	
Layer 1	Mineral wool batt				
	Main construction	350	0.0380	9.2105	100.00
	Corrections - Air Gap: Level 1, Fasteners: None or plastic				
Layer 2	Mineral wool batt				
	Main construction	100	0.0380	2.6316	87.50
	Main construction	100	0.1300	0.7692	12.50
	Corrections - Air Gap: Level 1, Fasteners: None or plastic				
Layer 3	Plasterboard, standard				
	Main construction	12.5	0.2100	0.0595	100.00
Int surface				0.1000	

Total resistance: Upper limit = 11.772 m² K/W Lower limit = 11.430 m² K/W Average = 11.601 m² K/W
Total correction = 0.0096 m² K/W U-value (unrounded) = 0.1 W/m² K

Unheated space: None

Total thickness: 463 mm

U-value: 0.10 W/m² K

Kappa: n/a

U-VALUE CALCULATOR REPORT

Property Reference	SAP 0645 Plot 43	Issued on Date	22/09/2023
Assessment Reference	As Built	Prop Type Ref	Dh
Project	17, Fieldfare Crescent, Botley, Southampton, SO32 2TW		
Calculation Type	New Build (As Built)		

SAP Rating	89 B	DER	12.27	TER	16.15
Environmental	89 B	% DER<TER	24.02		
CO ₂ Emissions (t/year)	1.31	DFEE	46.38	TFEE	57.14
General Requirements Compliance	Pass	% DFEE<TFEE	18.82		

Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 07798936079, toby@abacusenergyuk.com	Assessor ID	E477-0001
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Client	Foreman Homes, FORE
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Building Elements

Wall 000003

Wall Type: Standard Wall

Layer	Description	Thickness (mm)	Conductivity (W/m ² K)	Resistance (m ² K/W)	Fraction (%)	Density (kg/m ³)	Heat Cap. (J/kgK)
Ext surface				0.0400			
Layer 1	Brick, outer leaf						
	Main construction	102	0.7700	0.1325	82.81		
	Main construction	102	0.9407	0.1084	17.19		
Layer 2	Supafil 34						
	Main construction	100	0.0340	2.9412	100.00		
	Corrections - Air Gap: Level 0, Fasteners: None or plastic						
Layer 3	Supabloc						
	Main construction	100	0.1100	0.9091	94.04	460	1000
	Main construction	100	0.8803	0.1136	5.96	460	1000
	Corrections - Air Gap: Level 1, Fasteners: None or plastic						
Layer 4	airspace/plaster dabs						
	Main construction	15	0.0882	0.1700	80.00		
	Main construction	15	0.0882	0.1700	20.00		
	Corrections - Cavity Unventilated, Emissivity: Normal						
Layer 5	Plasterboard, standard						
	Main construction	12.5	0.2100	0.0595	100.00	700	1000
Int surface				0.1300			

Total resistance:	Upper limit = 4.321 m ² K/W	Lower limit = 4.110 m ² K/W	Average = 4.215 m ² K/W
	Total correction = 0.0002 m ² K/W	U-value (unrounded) = 0.24 W/m ² K	

Unheated space: None

Total thickness: 330 mm

U-value: 0.24 W/m² K

Kappa: 42.22 kJ/m² K

U-VALUE CALCULATOR REPORT

Property Reference	SAP 0645 Plot 43	Issued on Date	22/09/2023
Assessment Reference	As Built	Prop Type Ref	Dh
Project	17, Fieldfare Crescent, Botley, Southampton, SO32 2TW		
Calculation Type	New Build (As Built)		

SAP Rating	89 B	DER	12.27	TER	16.15
Environmental	89 B	% DER<TER	24.02		
CO ₂ Emissions (t/year)	1.31	DFEE	46.38	TFEE	57.14
General Requirements Compliance	Pass	% DFEE<TFEE	18.82		

Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 07798936079, toby@abacusenergyuk.com	Assessor ID	E477-0001
Client	Foreman Homes, FORE		

Building Elements

Floor 000004 - Floor - suspended beam-and-block floor

Floor Type: Suspended Floor

Area = 74.63 m², Perimeter = 37.51 m, Wall thickness = 300.00 mm, Soil: Clay

Depth of underfloor space below ground: 0.200 m Floor wind shielding: Average (suburban)

Floor height above ground: h = 0.000 m

U-value of walls above ground: U_w = 1.500 m

Ventilation openings per perimeter length: e = 0.0015 %

Mean wind speed: v = 5.000 m/s

Resistance on solum: R_g = 0.000 m²K/W

Layer	Description	Thickness (mm)	Conductivity (W/m ² K)	Resistance (m ² K/W)	Fraction (%)	Density (kg/m ³)	Heat Cap. (J/kgK)
Ext surface				0.1700			
Layer 1	Extruded polystyrene						
	Main construction	100	0.0270	3.7037	100.00		
	Corrections - Air Gap: Level 1, Fasteners: None or plastic						
Layer 2	Extruded polystyrene						
	Main construction	200	0.0270	7.4074	91.67		
	Main construction	200	2.3000	0.0870	8.33		
	Corrections - Air Gap: Level 1, Fasteners: None or plastic						
Layer 3	Concrete, reinforced (1% steel)						
	Main construction	75	2.3000	0.0326	100.00	2000	1000
Layer 4	Screed						
	Main construction	75	1.1500	0.0652	100.00	1200	1000
Int surface				0.1700			

Total resistance:	Upper limit = 10.093 m ² K/W	Lower limit = 5.066 m ² K/W	Average = 7.579 m ² K/W
	Total correction = 0.0025 m ² K/W	U-value (unrounded) = 0.11 W/m ² K	

Unheated space: None

Total thickness: 450 mm

U-value: 0.11 W/m² K

Kappa: 140.00 kJ/m² K

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

Property Reference	SAP 0645 Plot 43	Issued on Date	22/09/2023
Assessment Reference	As Built	Prop Type Ref	Dh
Property	17, Fieldfare Crescent, Botley, Southampton, SO32 2TW		

SAP Rating	89 B	DER	12.27	TER	16.15
Environmental	89 B	% DER<TER	24.02		
CO ₂ Emissions (t/year)	1.31	DFEE	46.38	TFEE	57.14
General Requirements Compliance	Pass	% DFEE<TFEE	18.82		

Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 07798936079, toby@abacusenergyuk.com	Assessor ID	E477-0001
Client	Foreman Homes, FORE		

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

Orientation	West
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Suburban
1.0 Property Type	House, Detached
2.0 Number of Storeys	2
3.0 Date Built	2019
4.0 Sheltered Sides	1
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements		Heat Loss Perimeter	Internal Floor Area	Average Storey Height
	Ground Floor:	37.47 m	74.29 m ²	2.39 m
	1st Storey:	35.49 m	72.11 m ²	2.67 m

7.0 Living Area	19.67	m ²
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8.0 Thermal Mass Parameter	Precise calculation	
Thermal Mass	202.61	kJ/m ² K

9.0 External Walls			U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area (m ²)	Nett Area (m ²)
Description	Type	Construction				
Brick and Block	Cavity Wall	Other	0.24	42.22	184.31	151.46

9.2 Internal Walls		Construction	Kappa (kJ/m ² K)	Area (m ²)
Description				
Ground Floor Block		Dense block, plasterboard on dabs	75.00	65.78
Ground Floor Stud		Plasterboard on timber frame	9.00	44.41
First Floor Stud		Plasterboard on timber frame	9.00	109.44
First Floor Block		Dense block, plasterboard on dabs	75.00	43.79

10.0 External Roofs			U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area (m ²)	Nett Area (m ²)
Description	Type	Construction				
Pitched Roof	External Plane Roof	Plasterboard, insulated at ceiling level	0.10	9.00	74.29	74.29

10.2 Internal Ceilings		Construction	Kappa (kJ/m ² K)	Area (m ²)
Description				
Internal Ceiling 1		Plasterboard ceiling, carpeted chipboard floor	9.00	72.11

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Area (m²)
Ground Floor	Ground Floor - Solid	Other	0.11	140.00	74.29

11.2 Internal Floors

Description	Construction	Kappa (kJ/m²K)	Area (m²)
Internal Floor 1	Plasterboard ceiling, carpeted chipboard floor	18.00	72.11

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Front Door	Manufacturer	Half Glazed Door	Double Low-E Soft 0.1			0.63		0.70	1.10
Windows	Manufacturer	Window	Double Low-E Soft 0.1			0.63		0.70	1.20

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
West Elevation	Half Glazed Door	[1] Brick and Block	West							2.12	
West Elevation	Window	[1] Brick and Block	West	None	0.56	Yes				0.66	
West Elevation	Window	[1] Brick and Block	West	None	0.00					9.16	
South West Bay	Window	[1] Brick and Block	South West	None	0.00					0.72	
South East Bay	Window	[1] Brick and Block	South East	None	0.00					0.72	
South Elevation	Window	[1] Brick and Block	South	None	0.00					2.08	
East Elevation	Window	[1] Brick and Block	East	None	0.00					15.95	
North Elevation	Window	[1] Brick and Block	North	None	0.00					1.44	

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	Reference:
Independently assessed	E2 Other lintels (including other steel lintels)	1.26	0.077	No	Birtley Supatherm
Table K1 - Approved	E2 Other lintels (including other steel lintels)	2.24	0.300	No	
Independently assessed	E2 Other lintels (including other steel lintels)	4.80	0.067	No	Birtley Supatherm
Independently assessed	E2 Other lintels (including other steel lintels)	1.64	0.067	No	Birtley Supatherm
Independently assessed	E2 Other lintels (including other steel lintels)	7.08	0.064	No	Birtley Supatherm
Independently assessed	E2 Other lintels (including other steel lintels)	5.54	0.056	No	Birtley Supatherm
Independently assessed	E3 Sill	15.89	0.021	No	Knauf P 5
Independently assessed	E4 Jamb	38.70	0.016	No	Knauf P 6
Independently assessed	E5 Ground floor (normal)	37.47	0.062	No	BE-E5-23902
Independently assessed	E6 Intermediate floor within a dwelling	31.17	0.000	No	
Table K1 - Approved	E10 Eaves (insulation at ceiling level)	36.48	0.060	No	
Table K1 - Default	E24 Eaves (insulation at ceiling level - inverted)	4.13	0.240	No	
Independently assessed	E12 Gable (insulation at ceiling level)	4.97	0.044	No	Knauf P21
Independently assessed	E16 Corner (normal)	34.79	0.039	No	Knauf P23
Independently assessed	E17 Corner (inverted – internal area greater than external area)	14.59	-0.091	No	Knauf P24

Y-value 0.026 W/m²K

18.0 Pressure Testing

Designed AP ₅₀	Yes	
Property Tested ?	5.00	m³/(h.m²) @ 50 Pa
As Built AP ₅₀	Yes	
	4.66	m³/(h.m²) @ 50 Pa

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows half open
Cross ventilation possible	Yes
Night Ventilation	Yes
Air change rate	4.00

Mechanical Ventilation

Mechanical Ventilation System Present	No
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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				4
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	27	
Total number of L.E.L. fittings	27	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	Yes
Light and motion sensor	Yes

23.0 Electricity Tariff

Standard

24.0 Main Heating 1

0 Main Heating 1		Database	
Description		Combi Boiler	
Percentage of Heat		100	%
Database Ref. No.		17515	
Fuel Type		Mains gas	
Main Heating		BGW	
SAP Code		104	
In Winter		90.7	
In Summer		87.9	
Controls		CBE Programmer, room thermostat and TRVs	
PCDF Controls		0	
Delayed Start Stat		No	
Sap Code		2106	
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		Gas/Oil, time clock	

25.0 Main Heating 2

None

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

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			
32.0 Photovoltaic Unit	One Dwelling			
PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
1.30	East	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

None