



SAP Report Submission for Building Regulations Compliance

Client: Foreman Homes

Project:

Contact: Tobias Whiting
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Report Issue Date: 29/11/2023

EXCELLENCE
IN ENERGY
ASSESSMENT

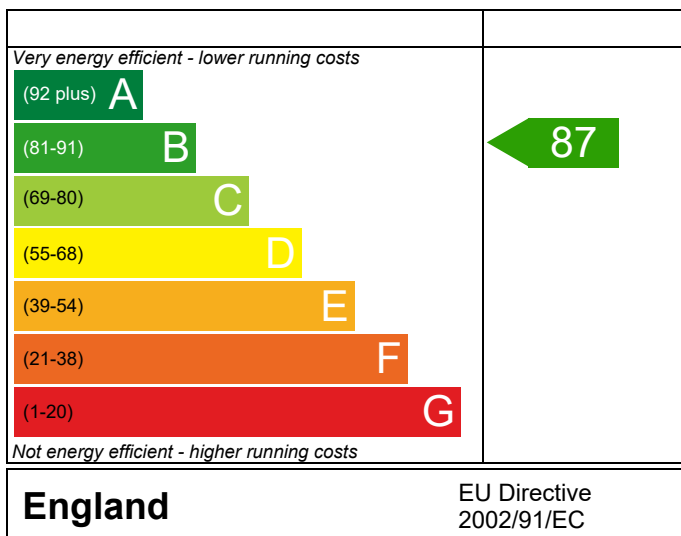
PREDICTED ENERGY ASSESSMENT

Dwelling type: House, End-Terrace
Date of assessment: 29/11/2023
Produced by: Abacus Energy (UK) Ltd
Total floor area: 85.72 m²
DRRN: 0821-1932-2972

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

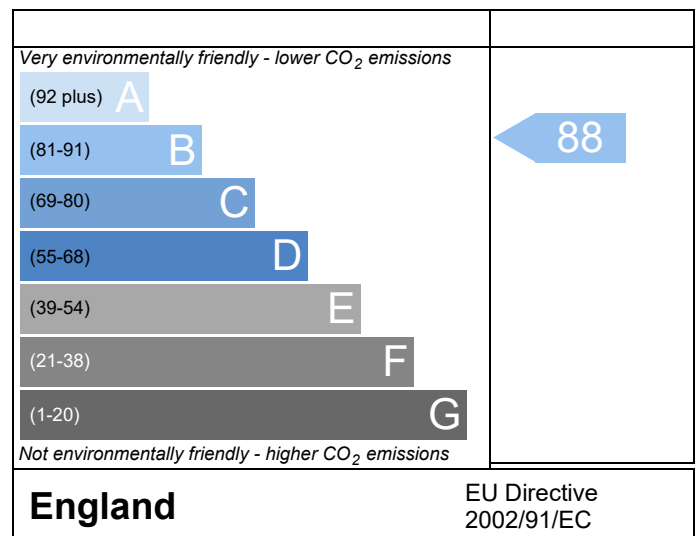
The energy performance has been assessed using the Government approved SAP2012 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO₂) emissions.

Energy Efficiency Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

Environmental Impact (CO₂) Rating



The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO₂) emissions. The higher the rating the less impact it has on the environment.

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 Designed)

Property Reference	SAP 0906 Plot 51	Issued on Date	29/11/2023
Assessment Reference	Rev B	Prop Type Ref	Block J
Property			
SAP Rating	87 B	DER	14.96
Environmental	88 B	TER	18.59
CO ₂ Emissions (t/year)	0.95	% DER<TER	19.55
General Requirements Compliance	Pass	DfEE	46.37
		TfEE	55.39
		% DfEE<TfEE	16.29
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 Designed)

Criterion 1 – Achieving the TER and TfEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	18.59	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	14.96	kgCO ₂ /m ²	Pass
	-3.63 (-19.5%)	kgCO ₂ /m ²	

1b TfEE and DfEE

Target Fabric Energy Efficiency (TfEE)	55.39	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DfEE)	46.37	kWh/m ² /yr	
	-9.0 (-16.2%)	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
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.12 (max. 0.25)	0.12 (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	5.00 (design value)	m ³ /(h.m ²) @ 50 Pa	
Maximum	10.0	m ³ /(h.m ²) @ 50 Pa	Pass

Limiting System Efficiencies

4 Heating efficiency

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BUILDING REGULATION COMPLIANCE

Calculation Type: New Build (As Designed)

Main heating system

Boiler system with radiators or underfloor - Mains gas
Data from database
Worcester Greenstar 32CDi 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

5.08 m², No overhang

Windows facing East

7.00 m², No overhang

Windows facing West

4.09 m², No overhang

Air change rate

4.00 ach

Blinds/curtains

None

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type

U-value

Filled Cavity with Edge Sealing

0.00

W/m²K

Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals

5.00 (design value)

m³/(h.m²) @ 50 Pa

Maximum

10.0

m³/(h.m²) @ 50 Pa

Pass

10 Key features

Party wall U-value

0.00

W/m²K

Roof U-value

0.10

W/m²K

Floor U-value

0.12

W/m²K

Door U-value

1.10

W/m²K

Photovoltaic array

1.05

kW

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RECOMMENDATIONS

	Typical cost	Typical savings per year	Energy efficiency	Environmental impact	Result
Low energy lights			0	0	Already installed
Solar water heating	£4,000 - £6,000	£86	B 88	B 90	Recommended
Photovoltaic			0	0	Already installed
Wind turbine			0	0	Not applicable
Totals	£4,000 - £6,000	£86	B 88	B 90	

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THERMAL BRIDGING

Calculation Type: New Build (As Designed)

Property Reference	SAP 0906 Plot 51	Issued on Date	29/11/2023
Assessment Reference	Rev B	Prop Type Ref	Block J
Property			

SAP Rating	87 B	DER	14.96	TER	18.59
Environmental	88 B	% DER<TER	19.55		
CO ₂ Emissions (t/year)	0.95	DFEE	46.37	TFEE	55.39
General Requirements Compliance	Pass	% DFEE<TFEE	16.29		

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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	Junction detail	Source Type	Psi (W/mK)	Length (m)	Result	Reference
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.077	0.69	0.05	Birtley Supatherm
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.071	7.28	0.52	Birtley Supatherm
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.071	1.02	0.07	Birtley Supatherm
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.064	1.25	0.08	Birtley Supatherm
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.067	1.59	0.11	Birtley Supatherm
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.061	1.81	0.11	Birtley Supatherm
External wall	E3 Sill	Independently assessed	0.021	11.02	0.23	Knauf P5
External wall	E4 Jamb	Independently assessed	0.016	33.90	0.54	Knauf P6
External wall	E5 Ground floor (normal)	Table K1 - Approved	0.160	19.38	3.10	
External wall	E6 Intermediate floor within a dwelling	Independently assessed	0.000	19.38	0.00	CD0029
External wall	E10 Eaves (insulation at ceiling level)	Independently assessed	0.071	8.83	0.63	Knauf P16
External wall	E12 Gable (insulation at ceiling level)	Independently assessed	0.044	9.80	0.43	Knauf P21
External wall	E16 Corner (normal)	Independently assessed	0.039	19.99	0.78	Knauf P23
External wall	E25 Staggered party wall between dwellings	Independently assessed	0.071	10.00	0.71	Knauf P27 Halved
Party wall	P1 Party wall - Ground floor	Table K1 - Default	0.160	8.83	1.41	
Party wall	P2 Party wall - Intermediate floor within a dwelling	Table K1 - Default	0.000	8.83	0.00	
Party wall	P5 Party wall - Roof (insulation at rafter level)	Independently assessed	0.035	8.83	0.31	Knauf P29 Halved

Total: **9.08** W/mK:
Y-Value: **0.050** W/m²K:

FULL SAP CALCULATION PRINTOUT

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Environmental	88 B	% DER<TER	19.55			
CO ₂ Emissions (t/year)	0.95	DFEE	46.37	TFEE	55.39	
General Requirements Compliance	Pass	% DFEE<TFEE	16.29			
Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 07798936079, toby@abacusenergyuk.com				Assessor ID	E477-0001
Client	Foreman Homes, FORE					

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

DWELLING AS DESIGNED

End-Terrace House, total floor area 86 m²

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

1a TER and DER

Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.59 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 14.96 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)55.4 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
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.12 (max. 0.25)	0.12 (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: 5.00 (design value)
Maximum 10.0 OK

4 Heating efficiency

Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Worcester Greenstar 32CDi 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: 5.08 m², No overhang
Windows facing East: 7.00 m², No overhang
Windows facing West: 4.09 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

10 Key features

Party wall U-value 0.00 W/m²K
Roof U-value 0.10 W/m²K
Floor U-value 0.12 W/m²K
Door U-value 1.10 W/m²K
Photovoltaic array 1.05 kW

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	42.8600 (1b)	x 2.3900 (2b)	= 102.4354 (1b) - (3b)
First floor	42.8600 (1c)	x 2.6100 (2c)	= 111.8646 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	85.7200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 214.3000 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1400 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3900 (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) =	0.3607 (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	0.4599	0.4509	0.4419	0.3968	0.3878	0.3427	0.3427	0.3337	0.3607	0.3878	0.4058	0.4239 (22b)
Effective ac	0.6058	0.6017	0.5976	0.5787	0.5752	0.5587	0.5587	0.5557	0.5651	0.5752	0.5824	0.5898 (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			2.1500	1.1000	2.3650		(26)
Windows (Uw = 1.20)			16.1700	1.1450	18.5153		(27)
Ground Floor			42.8600	0.1200	5.1432	84.0000	3600.2400 (28a)
Brick and Block	58.2400	13.2400	45.0000	0.2400	10.8000	42.2200	1899.9000 (29a)
Tile Hung	38.6600	5.0800	33.5800	0.2400	8.0592	42.2200	1417.7476 (29a)
Pitched Roof	42.8600		42.8600	0.1000	4.2860	9.1000	390.0260 (30)
Total net area of external elements Aum(A, m ²)			182.6200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	49.1687		(33)
Party Wall 1			39.4300	0.0000	0.0000	110.0000	4337.3000 (32)
Ground Floor Stud			84.0000			9.0000	756.0000 (32c)
Internal Wall 2			83.4900			9.0000	751.4100 (32c)
Internal Floor 1			42.8600			18.0000	771.4800 (32d)
Internal Ceiling 1			42.8600			18.0000	771.4800 (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) = 14695.5836 (34)
171.4370 (35)
9.0836 (36)
(33) + (36) = 58.2522 (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	42.8398	42.5493	42.2646	40.9273	40.6771	39.5123	39.5123	39.2966	39.9610	40.6771	41.1833	41.7124 (38)
Heat transfer coeff	101.0920	100.8016	100.5169	99.1795	98.9293	97.7646	97.7646	97.5489	98.2132	98.9293	99.4355	99.9647 (39)
Average = Sum(39)m / 12 =												99.1783 (39)
HLP	1.1793	1.1759	1.1726	1.1570	1.1541	1.1405	1.1405	1.1380	1.1457	1.1541	1.1600	1.1662 (40)
HLP (average)												1.1570 (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												2.5625 (42)
Average daily hot water use (litres/day)												95.0592 (43)
Daily hot water use	104.5651	100.7628	96.9604	93.1580	89.3556	85.5533	85.5533	89.3556	93.1580	96.9604	100.7628	104.5651 (44)
Energy conte	155.0671	135.6226	139.9504	122.0122	117.0736	101.0256	93.6151	107.4247	108.7076	126.6883	138.2902	150.1742 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Energy content (annual)												Total = Sum(45)m = 1495.6514 (45)
Distribution loss (46)m = 0.15 x (45)m												
	23.2601	20.3434	20.9926	18.3018	17.5610	15.1538	14.0423	16.1137	16.3061	19.0032	20.7435	22.5261 (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	25.3189	22.8674	25.2802	24.4170	25.1962	24.3435	25.1300	25.1729	24.3835	25.2454	24.4819	25.3061 (61)
Total heat required for water heating calculated for each month	180.3860	158.4900	165.2306	146.4292	142.2698	125.3691	118.7451	132.5976	133.0912	151.9337	162.7721	175.4803 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	180.3860	158.4900	165.2306	146.4292	142.2698	125.3691	118.7451	132.5976	133.0912	151.9337	162.7721	175.4803 (64)
Heat gains from water heating, kWh/month	57.8895	50.8114	52.8535	46.6733	45.2260	39.6769	37.4095	42.0119	42.2412	48.4352	52.1020	56.2594 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	128.1246	128.1246	128.1246	128.1246	128.1246	128.1246	128.1246	128.1246	128.1246	128.1246	128.1246	128.1246	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	20.8853	18.5501	15.0860	11.4210	8.5374	7.2076	7.7881	10.1232	13.5874	17.2523	20.1360	21.4657	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	230.9798	233.3766	227.3367	214.4783	198.2468	182.9916	172.8002	170.4033	176.4433	189.3017	205.5331	220.7883	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.8125	35.8125	35.8125	35.8125	35.8125	35.8125	35.8125	35.8125	35.8125	35.8125	35.8125	35.8125	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-102.4997	-102.4997	-102.4997	-102.4997	-102.4997	-102.4997	-102.4997	-102.4997	-102.4997	-102.4997	-102.4997	-102.4997	(71)
Water heating gains (Table 5)	77.8085	75.6122	71.0397	64.8240	60.7877	55.1068	50.2816	56.4677	58.6683	65.1011	72.3638	75.6175	(72)
Total internal gains	394.1109	391.9763	377.8997	355.1607	332.0093	309.7434	295.3072	301.4316	313.1363	336.0925	362.4703	382.3090	(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													5.0800	10.6334		0.6300	0.7000		0.7700		16.5085 (74)	
East													7.0000	19.6403		0.6300	0.7000		0.7700		42.0162 (76)	
West													4.0900	19.6403		0.6300	0.7000		0.7700		24.5495 (80)	
Solar gains	83.0742	161.7653	268.0571	398.8695	499.2965	516.5534	489.4934	412.8607	313.8674	192.0675	103.3650	68.5027	(83)									
Total gains	477.1852	553.7416	645.9568	754.0302	831.3057	826.2968	784.8007	714.2923	627.0037	528.1600	465.8353	450.8117	(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	40.3801	40.4965	40.6112	41.1588	41.2629	41.7544	41.7544	41.8468	41.5637	41.2629	41.0528	40.8355
alpha	3.6920	3.6998	3.7074	3.7439	3.7509	3.7836	3.7836	3.7898	3.7709	3.7509	3.7369	3.7224
util living area	0.9932	0.9876	0.9721	0.9267	0.8276	0.6700	0.5211	0.5832	0.8200	0.9583	0.9885	0.9945 (86)
MIT	19.2424	19.4412	19.7973	20.2704	20.6620	20.8946	20.9691	20.9530	20.7613	20.2388	19.6597	19.2124 (87)
Th 2	19.9366	19.9393	19.9420	19.9545	19.9569	19.9679	19.9679	19.9699	19.9636	19.9569	19.9521	19.9472 (88)
util rest of house	0.9916	0.9846	0.9651	0.9074	0.7825	0.5882	0.4103	0.4706	0.7556	0.9437	0.9852	0.9932 (89)
MIT 2	18.3334	18.5330	18.8869	19.3547	19.7147	19.9112	19.9573	19.9522	19.8146	19.3347	18.7611	18.3115 (90)
Living area fraction	18.4809	18.6803	19.0346	19.5033	19.8684	20.0708	20.1215	20.1146	19.9682	19.4814	18.9069	18.4577 (91)
MIT	18.4809	18.6803	19.0346	19.5033	19.8684	20.0708	20.1215	20.1146	19.9682	19.4814	18.9069	18.4577 (92)
Temperature adjustment												0.0000
adjusted MIT	18.4809	18.6803	19.0346	19.5033	19.8684	20.0708	20.1215	20.1146	19.9682	19.4814	18.9069	18.4577 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	471.6694	542.5089	618.3232	676.6496	646.9142	493.2754	335.5519	348.1702	473.9394	493.8799	456.8394	446.5465	(94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1433.5761	1389.0803	1259.9400	1051.6337	808.0945	534.8495	344.2744	362.3572	576.3358	878.6338	1174.0280	1425.2668	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	715.6585	568.8960	477.3629	269.9885	119.9182	0.0000	0.0000	0.0000	0.0000	286.2569	516.3757	728.1679	(98)
Space heating												3682.6247	(98)
Space heating per m2												42.9611	(99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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													4060.2257	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	715.6585	568.8960	477.3629	269.9885	119.9182	0.0000	0.0000	0.0000	0.0000	286.2569	516.3757	728.1679	(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)	789.0392	627.2282	526.3097	297.6720	132.2141	0.0000	0.0000	0.0000	0.0000	315.6085	569.3228	802.8312	(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	180.3860	158.4900	165.2306	146.4292	142.2698	125.3691	118.7451	132.5976	133.0912	151.9337	162.7721	175.4803	(64)	
Efficiency of water heater (217)m	89.9730	89.9137	89.7735	89.4377	88.7667	87.2000	87.2000	87.2000	87.2000	89.4551	89.8358	89.9985	(216)	
Fuel for water heating, kWh/month	200.4890	176.2692	184.0527	163.7220	160.2739	143.7719	136.1755	152.0615	152.6275	169.8436	181.1885	194.9813	(219)	
Water heating fuel used												2015.4565	(219)	
Annual totals kWh/year														
Space heating fuel - main system													4060.2257	(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)													368.8404	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 1.05 * 597 * 1.00) =										-501.7837			-501.7837	(233)
Total delivered energy for all uses													6017.7389	(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	4060.2257	0.2160	877.0088	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2015.4565	0.2160	435.3386	(264)
Space and water heating			1312.3474	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	368.8404	0.5190	191.4282	(268)
Energy saving/generation technologies				
PV Unit	-501.7837	0.5190	-260.4258	(269)
Total CO2, kg/year			1282.2748	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			14.9600	(273)

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

DER			14.9600	ZC1
Total Floor Area		TFA	85.7200	
Assumed number of occupants		N	2.5625	
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190	
CO2 emissions from appliances, equation (L14)			15.9675	ZC2
CO2 emissions from cooking, equation (L16)			2.1057	ZC3
Total CO2 emissions			33.0332	ZC4
Residual CO2 emissions offset from biofuel CHP			0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year			0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation			0.0000	ZC7
Net CO2 emissions			33.0332	ZC8

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	42.8600 (1b)	x 2.3900 (2b)	= 102.4354 (1b) - (3b)
First floor	42.8600 (1c)	x 2.6100 (2c)	= 111.8646 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	85.7200		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 214.3000 (5)
Dwelling volume			

2. Ventilation rate

					main heating	+	secondary heating	+	other	=	total	m3 per hour
Number of chimneys					0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues					0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans											3 * 10 =	30.0000 (7a)
Number of passive vents											0 * 10 =	0.0000 (7b)
Number of flueless gas fires											0 * 40 =	0.0000 (7c)
												Air changes per hour
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =										30.0000 / (5) =	0.1400 (8)
Pressure test											Yes	
Measured/design AP50											5.0000	
Infiltration rate											0.3900 (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) =	0.3607 (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	0.4599	0.4509	0.4419	0.3968	0.3878	0.3427	0.3427	0.3337	0.3607	0.3878	0.4058	0.4239 (22b)
Effective ac	0.6058	0.6017	0.5976	0.5787	0.5752	0.5587	0.5587	0.5557	0.5651	0.5752	0.5824	0.5898 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K						
TER Opaque door			2.1500	1.0000	2.1500			(26)					
TER Opening Type (Uw = 1.40)			16.1700	1.3258	21.4375			(27)					
Ground Floor			42.8600	0.1300	5.5718			(28a)					
Brick and Block	58.2400	13.2400	45.0000	0.1800	8.1000			(29a)					
Tile Hung	38.6600	5.0800	33.5800	0.1800	6.0444			(29a)					
Pitched Roof	42.8600		42.8600	0.1300	5.5718			(30)					
Total net area of external elements Aum(A, m2)			182.6200					(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	48.8755		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.9585	(36)					
Total fabric heat loss						(33) + (36) =	59.8340	(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 42.8398	Feb 42.5493	Mar 42.2646	Apr 40.9273	May 40.6771	Jun 39.5123	Jul 39.5123	Aug 39.2966	Sep 39.9610	Oct 40.6771	Nov 41.1833	Dec 41.7124	(38)
Heat transfer coeff	102.6738	102.3833	102.0986	100.7613	100.5111	99.3463	99.3463	99.1306	99.7950	100.5111	101.0173	101.5464	(39)
Average = Sum(39)m / 12 =												100.7601	(39)
HLP	Jan 1.1978	Feb 1.1944	Mar 1.1911	Apr 1.1755	May 1.1726	Jun 1.1590	Jul 1.1590	Aug 1.1564	Sep 1.1642	Oct 1.1726	Nov 1.1785	Dec 1.1846	(40)
HLP (average)												1.1755	(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												2.5625 (42)
Average daily hot water use (litres/day)												95.0592 (43)
Daily hot water use	Jan 104.5651	Feb 100.7628	Mar 96.9604	Apr 93.1580	May 89.3556	Jun 85.5533	Jul 85.5533	Aug 89.3556	Sep 93.1580	Oct 96.9604	Nov 100.7628	Dec 104.5651 (44)
Energy conte	155.0671	135.6226	139.9504	122.0122	117.0736	101.0256	93.6151	107.4247	108.7076	126.6883	138.2902	150.1742 (45)
Energy content (annual)												Total = Sum(45)m = 1495.6514 (45)
Distribution loss (46)m = 0.15 x (45)m	23.2601	20.3434	20.9926	18.3018	17.5610	15.1538	14.0423	16.1137	16.3061	19.0032	20.7435	22.5261 (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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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	0.0000	(57)
Combi loss	50.9589	46.0274	49.4099	45.9409	45.5347	42.1907	43.5970	45.5347	45.9409	49.4099	49.3151	50.9589	(61)	
Total heat required for water heating calculated for each month	206.0260	181.6500	189.3604	167.9531	162.6082	143.2163	137.2121	152.9593	154.6486	176.0982	187.6052	201.1331	(62)	
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)	
Output from w/h	206.0260	181.6500	189.3604	167.9531	162.6082	143.2163	137.2121	Solar input (sum of months) = Sum (63)m =					0.0000 (63)	
	206.0260	181.6500	189.3604	167.9531	162.6082	143.2163	137.2121	152.9593	154.6486	176.0982	187.6052	201.1331	(64)	
	Total per year (kWh/year) = Sum (64)m =												2060.4704 (64)	
Heat gains from water heating, kWh/month	64.2995	56.6014	58.8860	52.0543	50.3106	44.1387	42.0263	47.1024	47.6305	54.4763	58.3102	62.6726	(65)	

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	128.1246	128.1246	128.1246	128.1246	128.1246	128.1246	128.1246	128.1246	128.1246	128.1246	128.1246	128.1246	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	20.8853	18.5501	15.0860	11.4210	8.5374	7.2076	7.7881	10.1232	13.5874	17.2523	20.1360	21.4657	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	230.9798	233.3766	227.3367	214.4783	198.2468	182.9916	172.8002	170.4033	176.4433	189.3017	205.5331	220.7883	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.8125	35.8125	35.8125	35.8125	35.8125	35.8125	35.8125	35.8125	35.8125	35.8125	35.8125	35.8125	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-102.4997	-102.4997	-102.4997	-102.4997	-102.4997	-102.4997	-102.4997	-102.4997	-102.4997	-102.4997	-102.4997	-102.4997	(71)
Water heating gains (Table 5)	86.4241	84.2282	79.1478	72.2976	67.6218	61.3037	56.4869	63.3096	66.1535	73.2209	80.9865	84.2374	(72)
Total internal gains	402.7265	400.5924	386.0079	362.6343	338.8434	315.9403	301.5125	308.2735	320.6216	344.2123	371.0929	390.9289	(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				5.0800	10.6334	0.6300	0.7000	0.7700	16.5085 (74)			
East				7.0000	19.6403	0.6300	0.7000	0.7700	42.0162 (76)			
West				4.0900	19.6403	0.6300	0.7000	0.7700	24.5495 (80)			
Solar gains	83.0742	161.7653	268.0571	398.8695	499.2965	516.5534	489.4934	412.8607	313.8674	192.0675	103.3650	68.5027 (83)
Total gains	485.8007	562.3576	654.0649	761.5038	838.1399	832.4937	791.0060	721.1343	634.4889	536.2798	474.4579	459.4316 (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	57.9776	58.1421	58.3042	59.0780	59.2251	59.9194	59.9194	60.0498	59.6501	59.2251	58.9283	58.6212	
alpha	4.8652	4.8761	4.8869	4.9385	4.9483	4.9946	4.9946	5.0033	4.9767	4.9483	4.9286	4.9081	
util living area	0.9984	0.9965	0.9896	0.9609	0.8738	0.7051	0.5395	0.6073	0.8648	0.9817	0.9968	0.9988	(86)
MIT	19.6645	19.8176	20.0940	20.4684	20.7792	20.9466	20.9886	20.9802	20.8472	20.4339	19.9850	19.6422	(87)
Th 2	19.9218	19.9245	19.9271	19.9397	19.9420	19.9530	19.9530	19.9550	19.9487	19.9420	19.9373	19.9323	(88)
util rest of house	0.9979	0.9953	0.9858	0.9457	0.8270	0.6124	0.4179	0.4816	0.7961	0.9722	0.9955	0.9984	(89)
MIT 2	18.1414	18.3668	18.7706	19.3132	19.7258	19.9178	19.9488	19.9469	19.8230	19.2746	18.6211	18.1163	(90)
Living area fraction									fLA = Living area / (4) =			0.1623	(91)
MIT	18.3885	18.6022	18.9853	19.5007	19.8968	20.0847	20.1176	20.1145	19.9892	19.4627	18.8424	18.3639	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3885	18.6022	18.9853	19.5007	19.8968	20.0847	20.1176	20.1145	19.9892	19.4627	18.8424	18.3639	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9967	0.9930	0.9810	0.9377	0.8247	0.6250	0.4376	0.5018	0.7993	0.9660	0.9934	0.9975	(94)
Ext temp.	484.2012	558.4339	641.6065	714.0323	691.1813	520.2836	346.1349	361.8715	507.1259	518.0640	471.3324	458.2754	(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	1446.5219	1402.8807	1274.7339	1068.1390	823.8655	544.8865	349.4571	368.2252	587.7142	890.8033	1186.1887	1438.2928	(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	715.9666	567.4683	471.0468	254.9568	98.7171	0.0000	0.0000	0.0000	0.0000	277.3181	514.6965	729.1329	(98)
												3629.3031	(98)
												42.3390	(99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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													3885.7635 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	715.9666	567.4683	471.0468	254.9568	98.7171	0.0000	0.0000	0.0000	0.0000	277.3181	514.6965	729.1329	(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)	766.5596	607.5677	504.3328	272.9730	105.6928	0.0000	0.0000	0.0000	0.0000	296.9145	551.0669	780.6563	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	206.0260	181.6500	189.3604	167.9531	162.6082	143.2163	137.2121	152.9593	154.6486	176.0982	187.6052	201.1331	(64)
Efficiency of water heater (217)m	87.9287	87.7245	87.2532	86.0992	83.8384	80.3000	80.3000	80.3000	80.3000	86.1896	87.4614	88.0067	(216)
Fuel for water heating, kWh/month	234.3103	207.0689	217.0239	195.0692	193.9544	178.3515	170.8743	190.4848	192.5885	204.3148	214.5006	228.5429	(219)
Water heating fuel used												2427.0842	(219)
Annual totals kWh/year													
Space heating fuel - main system												3885.7635	(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)												368.8404	(232)
Total delivered energy for all uses												6756.6881	(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	3885.7635	0.2160	839.3249 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2427.0842	0.2160	524.2502 (264)
Space and water heating			1363.5751 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	368.8404	0.5190	191.4282 (268)
Total CO2, kg/m2/year			1593.9283 (272)
Emissions per m2 for space and water heating			15.9073 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.2332 (272b)
Emissions per m2 for pumps and fans			0.4541 (272c)
Target Carbon Dioxide Emission Rate (TER) = (15.9073 * 1.00) + 2.2332 + 0.4541, rounded to 2 d.p.			18.5900 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	42.8600 (1b)	x 2.3900 (2b)	= 102.4354 (1b) - (3b)
First floor	42.8600 (1c)	x 2.6100 (2c)	= 111.8646 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	85.7200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 214.3000 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					30.0000 / (5) = 0.1400 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3900 (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) =	0.3607 (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	0.4599	0.4509	0.4419	0.3968	0.3878	0.3427	0.3427	0.3337	0.3607	0.3878	0.4058	0.4239 (22b)
Effective ac	0.6058	0.6017	0.5976	0.5787	0.5752	0.5587	0.5587	0.5557	0.5651	0.5752	0.5824	0.5898 (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			2.1500	1.1000	2.3650		(26)
Windows (Uw = 1.20)			16.1700	1.1450	18.5153		(27)
Ground Floor			42.8600	0.1200	5.1432	84.0000	3600.2400 (28a)
Brick and Block	58.2400	13.2400	45.0000	0.2400	10.8000	42.2200	1899.9000 (29a)
Tile Hung	38.6600	5.0800	33.5800	0.2400	8.0592	42.2200	1417.7476 (29a)
Pitched Roof	42.8600		42.8600	0.1000	4.2860	9.1000	390.0260 (30)
Total net area of external elements Aum(A, m ²)			182.6200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	49.1687		(33)
Party Wall 1			39.4300	0.0000	0.0000	110.0000	4337.3000 (32)
Ground Floor Stud			84.0000			9.0000	756.0000 (32c)
Internal Wall 2			83.4900			9.0000	751.4100 (32c)
Internal Floor 1			42.8600			18.0000	771.4800 (32d)
Internal Ceiling 1			42.8600			9.0000	385.7400 (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) = 14309.8436 (34)
166.9370 (35)
9.0836 (36)
(33) + (36) = 58.2522 (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	42.8398	42.5493	42.2646	40.9273	40.6771	39.5123	39.5123	39.2966	39.9610	40.6771	41.1833	41.7124 (38)
Heat transfer coeff	101.0920	100.8016	100.5169	99.1795	98.9293	97.7646	97.7646	97.5489	98.2132	98.9293	99.4355	99.9647 (39)
Average = Sum(39)m / 12 =												99.1783 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1793	1.1759	1.1726	1.1570	1.1541	1.1405	1.1405	1.1380	1.1457	1.1541	1.1600	1.1662 (40)
HLP (average)												1.1570 (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)
2.5625 (42)
95.0592 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	104.5651	100.7628	96.9604	93.1580	89.3556	85.5533	85.5533	89.3556	93.1580	96.9604	100.7628	104.5651 (44)
Energy conte	155.0671	135.6226	139.9504	122.0122	117.0736	101.0256	93.6151	107.4247	108.7076	126.6883	138.2902	150.1742 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Energy content (annual)	Total = Sum(45)m = 1495.6514 (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	32.9517	28.8198	29.7395	25.9276	24.8781	21.4679	19.8932	22.8277	23.1004	26.9213	29.3867	31.9120 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	128.1246	128.1246	128.1246	128.1246	128.1246	128.1246	128.1246	128.1246	128.1246	128.1246	128.1246	128.1246	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	20.8853	18.5501	15.0860	11.4210	8.5374	7.2076	7.7881	10.1232	13.5874	17.2523	20.1360	21.4657	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	230.9798	233.3766	227.3367	214.4783	198.2468	182.9916	172.8002	170.4033	176.4433	189.3017	205.5331	220.7883	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.8125	35.8125	35.8125	35.8125	35.8125	35.8125	35.8125	35.8125	35.8125	35.8125	35.8125	35.8125	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-102.4997	-102.4997	-102.4997	-102.4997	-102.4997	-102.4997	-102.4997	-102.4997	-102.4997	-102.4997	-102.4997	-102.4997	(71)
Water heating gains (Table 5)	44.2900	42.8866	39.9724	36.0105	33.4384	29.8166	26.7382	30.6824	32.0839	36.1845	40.8148	42.8925	(72)
Total internal gains	357.5924	356.2508	343.8324	323.3472	301.6599	281.4532	268.7638	272.6464	283.5519	304.1759	327.9213	346.5840	(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				5.0800	10.6334		0.6300	0.7000	0.7700		16.5085 (74)		
East				7.0000	19.6403		0.6300	0.7000	0.7700		42.0162 (76)		
West				4.0900	19.6403		0.6300	0.7000	0.7700		24.5495 (80)		

Solar gains	83.0742	161.7653	268.0571	398.8695	499.2965	516.5534	489.4934	412.8607	313.8674	192.0675	103.3650	68.5027 (83)	
Total gains	440.6666	518.0160	611.8895	722.2167	800.9564	798.0066	758.2572	685.5071	597.4193	496.2434	431.2863	415.0867 (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	39.3202	39.4335	39.5452	40.0784	40.1798	40.6584	40.6584	40.7484	40.4727	40.1798	39.9752	39.7636	
alpha	3.6213	3.6289	3.6363	3.6719	3.6787	3.7106	3.7106	3.7166	3.6982	3.6787	3.6650	3.6509	
util living area	0.9943	0.9891	0.9748	0.9320	0.8371	0.6834	0.5351	0.6004	0.8337	0.9634	0.9903	0.9954	(86)
MIT	19.1559	19.3604	19.7278	20.2183	20.6296	20.8804	20.9636	20.9447	20.7329	20.1824	19.5844	19.1260	(87)
Th 2	19.9366	19.9393	19.9420	19.9545	19.9569	19.9679	19.9679	19.9699	19.9636	19.9569	19.9521	19.9472	(88)
util rest of house	0.9929	0.9865	0.9685	0.9141	0.7939	0.6024	0.4229	0.4870	0.7725	0.9505	0.9876	0.9943	(89)
MIT 2	18.2501	18.4556	18.8211	19.3075	19.6883	19.9023	19.9551	19.9484	19.7935	19.2830	18.6892	18.2283	(90)
Living area fraction	18.3971	18.6024	18.9683	19.4553	19.8410	20.0610	20.1187	20.1101	19.9459	19.4289	18.8345	18.3739	(91)
MIT	18.3971	18.6024	18.9683	19.4553	19.8410	20.0610	20.1187	20.1101	19.9459	19.4289	18.8345	18.3739	(92)
Temperature adjustment	18.3971	18.6024	18.9683	19.4553	19.8410	20.0610	20.1187	20.1101	19.9459	19.4289	18.8345	18.3739	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	436.3071	508.6999	587.9334	652.6284	631.4951	487.0721	333.7518	345.1863	460.7548	467.4191	424.1347	411.7572	(94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1425.1051	1381.2228	1253.2698	1046.8690	805.3867	533.8911	344.0082	361.9163	574.1471	873.4419	1166.8235	1416.8931	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	735.6657	586.3354	495.0103	283.8533	129.3753	0.0000	0.0000	0.0000	0.0000	302.0809	534.7360	747.8211	(98)
Space heating												3814.8780	(98)
Space heating per m2												44.5039	(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	918.9871	723.4579	741.3716	0.0000	0.0000	0.0000	0.0000	(100)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8298	0.8885	0.8559	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	762.5570	642.8062	634.5441	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1028.9084	980.4415	897.0756	0.0000	0.0000	0.0000	0.0000 (103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling kWh												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	191.7730	251.2007	195.3234	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												638.2972 (104)
Cooled fraction									FC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)												
Intermittency factor	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	47.9433	62.8002	48.8309	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												159.5743 (107)
Space cooling per m2												1.8616 (108)
Energy for space heating												44.5039 (99)
Energy for space cooling												1.8616 (108)
Total												46.3655 (109)
Dwelling Fabric Energy Efficiency (DFEE)												46.4 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	42.8600 (1b)	x 2.3900 (2b)	= 102.4354 (1b) - (3b)
First floor	42.8600 (1c)	x 2.6100 (2c)	= 111.8646 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	85.7200		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 214.3000 (5)
Dwelling volume			

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1400 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3900 (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) =	0.3607 (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	0.4599	0.4509	0.4419	0.3968	0.3878	0.3427	0.3427	0.3337	0.3607	0.3878	0.4058	0.4239 (22b)
Effective ac	0.6058	0.6017	0.5976	0.5787	0.5752	0.5587	0.5587	0.5557	0.5651	0.5752	0.5824	0.5898 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			2.1500	1.0000	2.1500		(26)
TER Opening Type (Uw = 1.40)			16.1700	1.3258	21.4375		(27)
Ground Floor			42.8600	0.1300	5.5718		(28a)
Brick and Block	58.2400	13.2400	45.0000	0.1800	8.1000		(29a)
Tile Hung	38.6600	5.0800	33.5800	0.1800	6.0444		(29a)
Pitched Roof	42.8600		42.8600	0.1300	5.5718		(30)
Total net area of external elements Aum(A, m ²)			182.6200				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	48.8755	(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)							10.9585 (36)
Total fabric heat loss						(33) + (36) =	59.8340 (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	42.8398	42.5493	42.2646	40.9273	40.6771	39.5123	39.5123	39.2966	39.9610	40.6771	41.1833	41.7124 (38)
Heat transfer coeff	102.6738	102.3833	102.0986	100.7613	100.5111	99.3463	99.3463	99.1306	99.7950	100.5111	101.0173	101.5464 (39)
Average = Sum(39)m / 12 =												100.7601 (39)
HLP	1.1978	1.1944	1.1911	1.1755	1.1726	1.1590	1.1590	1.1564	1.1642	1.1726	1.1785	1.1846 (40)
HLP (average)												1.1755 (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												2.5625 (42)
Average daily hot water use (litres/day)												95.0592 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	104.5651	100.7628	96.9604	93.1580	89.3556	85.5533	85.5533	89.3556	93.1580	96.9604	100.7628	104.5651 (44)
Energy content (annual)	155.0671	135.6226	139.9504	122.0122	117.0736	101.0256	93.6151	107.4247	108.7076	126.6883	138.2902	150.1742 (45)
Distribution loss (46)m = 0.15 x (45)m												1495.6514 (45)
Water storage loss:	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)

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Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	32.9517	28.8198	29.7395	25.9276	24.8781	21.4679	19.8932	22.8277	23.1004	26.9213	29.3867	31.9120 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	128.1246	128.1246	128.1246	128.1246	128.1246	128.1246	128.1246	128.1246	128.1246	128.1246	128.1246	128.1246	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	20.8853	18.5501	15.0860	11.4210	8.5374	7.2076	7.7881	10.1232	13.5874	17.2523	20.1360	21.4657	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	230.9798	233.3766	227.3367	214.4783	198.2468	182.9916	172.8002	170.4033	176.4433	189.3017	205.5331	220.7883	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.8125	35.8125	35.8125	35.8125	35.8125	35.8125	35.8125	35.8125	35.8125	35.8125	35.8125	35.8125	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-102.4997	-102.4997	-102.4997	-102.4997	-102.4997	-102.4997	-102.4997	-102.4997	-102.4997	-102.4997	-102.4997	-102.4997	(71)
Water heating gains (Table 5)	44.2900	42.8866	39.9724	36.0105	33.4384	29.8166	26.7382	30.6824	32.0839	36.1845	40.8148	42.8925	(72)
Total internal gains	357.5924	356.2508	343.8324	323.3472	301.6599	281.4532	268.7638	272.6464	283.5519	304.1759	327.9213	346.5840	(73)

6. Solar gains

[Jan]													
	Area			Solar flux		g		FF		Access		Gains	
	m2			Table 6a		Specific data		Specific data		factor		W	
				W/m2		or Table 6b		or Table 6c		Table 6d			
North	5.0800			10.6334		0.6300		0.7000		0.7700		16.5085 (74)	
East	7.0000			19.6403		0.6300		0.7000		0.7700		42.0162 (76)	
West	4.0900			19.6403		0.6300		0.7000		0.7700		24.5495 (80)	

Solar gains	83.0742	161.7653	268.0571	398.8695	499.2965	516.5534	489.4934	412.8607	313.8674	192.0675	103.3650	68.5027	(83)
Total gains	440.6666	518.0160	611.8895	722.2167	800.9564	798.0066	758.2572	685.5071	597.4193	496.2434	431.2863	415.0867	(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	57.9776	58.1421	58.3042	59.0780	59.2251	59.9194	59.9194	60.0498	59.6501	59.2251	58.9283	58.6212	
alpha	4.8652	4.8761	4.8869	4.9385	4.9483	4.9946	4.9946	5.0033	4.9767	4.9483	4.9286	4.9081	
util living area	0.9990	0.9976	0.9921	0.9679	0.8891	0.7268	0.5603	0.6335	0.8859	0.9867	0.9979	0.9993	(86)
MIT	19.6158	19.7701	20.0502	20.4327	20.7571	20.9389	20.9866	20.9762	20.8259	20.3937	19.9387	19.5942	(87)
Th 2	19.9218	19.9245	19.9271	19.9397	19.9420	19.9530	19.9530	19.9550	19.9487	19.9420	19.9373	19.9323	(88)
util rest of house	0.9986	0.9967	0.9892	0.9550	0.8456	0.6343	0.4352	0.5050	0.8228	0.9794	0.9971	0.9990	(89)
MIT 2	18.6576	18.8138	19.0945	19.4787	19.7771	19.9250	19.9496	19.9482	19.8481	19.4478	18.9925	18.6445	(90)
Living area fraction									fLA = Living area / (4) =			0.1623	(91)
MIT	18.8131	18.9690	19.2496	19.6335	19.9361	20.0895	20.1179	20.1150	20.0068	19.6013	19.1461	18.7986	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8131	18.9690	19.2496	19.6335	19.9361	20.0895	20.1179	20.1150	20.0068	19.6013	19.1461	18.7986	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9981	0.9956	0.9866	0.9503	0.8453	0.6474	0.4557	0.5258	0.8271	0.9762	0.9961	0.9986	(94)
Useful gains	439.8387	515.7456	603.6883	686.2897	677.0527	516.6377	345.5132	360.4714	494.0980	484.4380	429.6057	414.5081	(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	1490.1150	1440.4305	1301.7187	1081.5248	827.8233	545.3606	349.4867	368.2688	589.4663	904.7305	1216.8596	1482.4329	(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	781.4055	621.3883	519.3346	284.5693	112.1733	0.0000	0.0000	0.0000	0.0000	312.6976	566.8228	794.5360	(98)
Space heating												3992.9274	(98)
Space heating per m2										(98) / (4) =		46.5810	(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	933.8556	735.1629	753.3929	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8708	0.9277	0.8970	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	813.2229	682.0457	675.7960	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1028.9084	980.4415	897.0756	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	155.2936	222.0065	164.6320	0.0000	0.0000	0.0000	0.0000	(104)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling												541.9321 (104)
Cooled fraction												1.0000 (105)
Intermittency factor (Table 10b)												
	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	38.8234	55.5016	41.1580	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												135.4830 (107)
Space cooling per m2												1.5805 (108)
Energy for space heating												46.5810 (99)
Energy for space cooling												1.5805 (108)
Total												48.1616 (109)
Target Fabric Energy Efficiency (TFEE)												55.4 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	42.8600 (1b)	x 2.3900 (2b)	= 102.4354 (1b) - (3b)
First floor	42.8600 (1c)	x 2.6100 (2c)	= 111.8646 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	85.7200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 214.3000 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					30.0000 / (5) = 0.1400 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3900 (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)	=	0.3607 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	4.7000	4.6000	4.3000	4.3000	4.0000	4.0000	3.9000	4.0000	4.5000	4.4000	4.7000 (22)
Wind factor	1.2750	1.1750	1.1500	1.0750	1.0750	1.0000	1.0000	0.9750	1.0000	1.1250	1.1000	1.1750 (22a)
Adj infilt rate	0.4599	0.4239	0.4149	0.3878	0.3878	0.3607	0.3607	0.3517	0.3607	0.4058	0.3968	0.4239 (22b)
Effective ac	0.6058	0.5898	0.5861	0.5752	0.5752	0.5651	0.5651	0.5619	0.5651	0.5824	0.5787	0.5898 (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			2.1500	1.1000	2.3650		(26)
Windows (Uw = 1.20)			16.1700	1.1450	18.5153		(27)
Ground Floor			42.8600	0.1200	5.1432	84.0000	3600.2400 (28a)
Brick and Block	58.2400	13.2400	45.0000	0.2400	10.8000	42.2200	1899.9000 (29a)
Tile Hung	38.6600	5.0800	33.5800	0.2400	8.0592	42.2200	1417.7476 (29a)
Pitched Roof	42.8600		42.8600	0.1000	4.2860	9.1000	390.0260 (30)
Total net area of external elements Aum(A, m ²)			182.6200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	49.1687		(33)
Party Wall 1			39.4300	0.0000	0.0000	110.0000	4337.3000 (32)
Ground Floor Stud			84.0000			9.0000	756.0000 (32c)
Internal Wall 2			83.4900			9.0000	751.4100 (32c)
Internal Floor 1			42.8600			18.0000	771.4800 (32d)
Internal Ceiling 1			42.8600			18.0000	771.4800 (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) = 14695.5836 (34)
171.4370 (35)
9.0836 (36)
(33) + (36) = 58.2522 (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	42.8398	41.7124	41.4450	40.6771	40.6771	39.9610	39.9610	39.7338	39.9610	41.1833	40.9273	41.7124 (38)
Heat transfer coeff	101.0920	99.9647	99.6972	98.9293	98.9293	98.2132	98.2132	97.9860	98.2132	99.4355	99.1795	99.9647 (39)
Average = Sum(39)m / 12 =												99.1515 (39)
HLP	1.1793	1.1662	1.1631	1.1541	1.1541	1.1457	1.1457	1.1431	1.1457	1.1600	1.1570	1.1662 (40)
HLP (average)												1.1567 (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												2.5625 (42)
Average daily hot water use (litres/day)												95.0592 (43)
Daily hot water use	104.5651	100.7628	96.9604	93.1580	89.3556	85.5533	85.5533	89.3556	93.1580	96.9604	100.7628	104.5651 (44)
Energy conte	155.0671	135.6226	139.9504	122.0122	117.0736	101.0256	93.6151	107.4247	108.7076	126.6883	138.2902	150.1742 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Energy content (annual)												Total = Sum(45)m = 1495.6514 (45)
Distribution loss (46)m = 0.15 x (45)m												
	23.2601	20.3434	20.9926	18.3018	17.5610	15.1538	14.0423	16.1137	16.3061	19.0032	20.7435	22.5261 (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	25.3189	22.8674	25.2802	24.4170	25.1962	24.3435	25.1300	25.1729	24.3835	25.2454	24.4819	25.3061 (61)
Total heat required for water heating calculated for each month	180.3860	158.4900	165.2306	146.4292	142.2698	125.3691	118.7451	132.5976	133.0912	151.9337	162.7721	175.4803 (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	180.3860	158.4900	165.2306	146.4292	142.2698	125.3691	118.7451	132.5976	133.0912	151.9337	162.7721	175.4803 (64)
												Total per year (kWh/year) = Sum(64)m = 1792.7945 (64)
RHI water heating demand												1793 (64)
Heat gains from water heating, kWh/month	57.8895	50.8114	52.8535	46.6733	45.2260	39.6769	37.4095	42.0119	42.2412	48.4352	52.1020	56.2594 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	153.7496	153.7496	153.7496	153.7496	153.7496	153.7496	153.7496	153.7496	153.7496	153.7496	153.7496	153.7496	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	52.2132	46.3753	37.7149	28.5526	21.3434	18.0190	19.4702	25.3081	33.9684	43.1307	50.3399	53.6643	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	344.7459	348.3233	339.3084	320.1168	295.8908	273.1218	257.9107	254.3333	263.3482	282.5398	306.7658	329.5348	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.9374	52.9374	52.9374	52.9374	52.9374	52.9374	52.9374	52.9374	52.9374	52.9374	52.9374	52.9374	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-102.4997	-102.4997	-102.4997	-102.4997	-102.4997	-102.4997	-102.4997	-102.4997	-102.4997	-102.4997	-102.4997	-102.4997	(71)
Water heating gains (Table 5)	77.8085	75.6122	71.0397	64.8240	60.7877	55.1068	50.2816	56.4677	58.6683	65.1011	72.3638	75.6175	(72)
Total internal gains	581.9549	577.4981	555.2504	520.6807	485.2092	453.4349	434.8498	443.2963	463.1722	497.9589	536.6569	566.0040	(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				5.0800	13.8645	0.6300	0.7000	0.7700	21.5249 (74)			
East				7.0000	25.9136	0.6300	0.7000	0.7700	55.4368 (76)			
West				4.0900	25.9136	0.6300	0.7000	0.7700	32.3909 (80)			
Solar gains	109.3527	182.2813	300.3811	453.8668	541.1242	605.0243	559.9444	483.5149	372.5886	228.9579	134.9019	86.0418 (83)
Total gains	691.3076	759.7794	855.6315	974.5475	1026.3333	1058.4592	994.7941	926.8112	835.7608	726.9169	671.5588	652.0458 (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	40.3801	40.8355	40.9450	41.2629	41.2629	41.5637	41.5637	41.6601	41.5637	41.0528	41.1588	40.8355
alpha	3.6920	3.7224	3.7297	3.7509	3.7509	3.7709	3.7709	3.7773	3.7709	3.7369	3.7439	3.7224
util living area	0.9727	0.9614	0.9267	0.8430	0.6994	0.4975	0.3600	0.3842	0.6364	0.8689	0.9523	0.9765 (86)
MIT	19.6906	19.8397	20.1674	20.5540	20.8352	20.9658	20.9924	20.9906	20.9163	20.5882	20.1120	19.6747 (87)
Th 2	19.9366	19.9472	19.9497	19.9569	19.9569	19.9636	19.9636	19.9658	19.9636	19.9521	19.9545	19.9472 (88)
util rest of house	0.9663	0.9526	0.9100	0.8088	0.6385	0.4137	0.2617	0.2801	0.5488	0.8296	0.9392	0.9709 (89)
MIT 2	18.7764	18.9300	19.2485	19.6127	19.8513	19.9486	19.9618	19.9635	19.9216	19.6503	19.2047	18.7693 (90)
Living area fraction	18.9247	19.0776	19.3976	19.7654	20.0110	20.1137	20.1291	20.1302	20.0830	19.8025	19.3519	18.9162 (91)
MIT	18.9247	19.0776	19.3976	19.7654	20.0110	20.1137	20.1291	20.1302	20.0830	19.8025	19.3519	18.9162 (92)
Temperature adjustment												0.0000
adjusted MIT	18.9247	19.0776	19.3976	19.7654	20.0110	20.1137	20.1291	20.1302	20.0830	19.8025	19.3519	18.9162 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9584	0.9434	0.8994	0.8017	0.6419	0.4263	0.2777	0.2970	0.5596	0.8230	0.9297	0.9637	(94)
Useful gains	662.5780	716.8051	769.5622	781.3276	658.8235	451.2006	276.2145	275.2726	467.7278	598.2601	624.3721	628.3920	(95)
Ext temp.	5.4000	5.7000	7.3000	9.6000	12.6000	15.4000	17.3000	17.3000	15.0000	11.8000	8.4000	5.5000	(96)
Heat loss rate W	1367.2442	1337.2923	1206.0946	1005.6572	733.1652	462.9479	277.8504	277.3168	499.2200	795.7299	1086.2086	1341.1498	(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	524.2716	416.9674	324.7801	161.5173	55.3102	0.0000	0.0000	0.0000	0.0000	146.9175	332.5223	530.2918	(98)
Space heating												2492.5783	(98)
RHI space heating demand												2493	(98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	42.8600 (1b)	x 2.3900 (2b)	= 102.4354 (1b) - (3b)
First floor	42.8600 (1c)	x 2.6100 (2c)	= 111.8646 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	85.7200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 214.3000 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					30.0000 / (5) = 0.1400 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3900 (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)	=	0.3607 (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	0.4599	0.4509	0.4419	0.3968	0.3878	0.3427	0.3427	0.3337	0.3607	0.3878	0.4058	0.4239 (22b)
Effective ac	0.6058	0.6017	0.5976	0.5787	0.5752	0.5587	0.5587	0.5557	0.5651	0.5752	0.5824	0.5898 (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			2.1500	1.1000	2.3650		(26)
Windows (Uw = 1.20)			16.1700	1.1450	18.5153		(27)
Ground Floor			42.8600	0.1200	5.1432	84.0000	3600.2400 (28a)
Brick and Block	58.2400	13.2400	45.0000	0.2400	10.8000	42.2200	1899.9000 (29a)
Tile Hung	38.6600	5.0800	33.5800	0.2400	8.0592	42.2200	1417.7476 (29a)
Pitched Roof	42.8600		42.8600	0.1000	4.2860	9.1000	390.0260 (30)
Total net area of external elements Aum(A, m ²)			182.6200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	49.1687		(33)
Party Wall 1			39.4300	0.0000	0.0000	110.0000	4337.3000 (32)
Ground Floor Stud			84.0000			9.0000	756.0000 (32c)
Internal Wall 2			83.4900			9.0000	751.4100 (32c)
Internal Floor 1			42.8600			18.0000	771.4800 (32d)
Internal Ceiling 1			42.8600			18.0000	771.4800 (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) = 14695.5836 (34)
171.4370 (35)
9.0836 (36)
(33) + (36) = 58.2522 (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	42.8398	42.5493	42.2646	40.9273	40.6771	39.5123	39.5123	39.2966	39.9610	40.6771	41.1833	41.7124 (38)
Heat transfer coeff	101.0920	100.8016	100.5169	99.1795	98.9293	97.7646	97.7646	97.5489	98.2132	98.9293	99.4355	99.9647 (39)
Average = Sum(39)m / 12 =												99.1783 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1793	1.1759	1.1726	1.1570	1.1541	1.1405	1.1405	1.1380	1.1457	1.1541	1.1600	1.1662 (40)
HLP (average)												1.1570 (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)
2.5625 (42)
95.0592 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	104.5651	100.7628	96.9604	93.1580	89.3556	85.5533	85.5533	89.3556	93.1580	96.9604	100.7628	104.5651 (44)
Energy conte	155.0671	135.6226	139.9504	122.0122	117.0736	101.0256	93.6151	107.4247	108.7076	126.6883	138.2902	150.1742 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Energy content (annual)												Total = Sum(45)m = 1495.6514 (45)
Distribution loss (46)m = 0.15 x (45)m												
	23.2601	20.3434	20.9926	18.3018	17.5610	15.1538	14.0423	16.1137	16.3061	19.0032	20.7435	22.5261 (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	25.3189	22.8674	25.2802	24.4170	25.1962	24.3435	25.1300	25.1729	24.3835	25.2454	24.4819	25.3061 (61)
Total heat required for water heating calculated for each month	180.3860	158.4900	165.2306	146.4292	142.2698	125.3691	118.7451	132.5976	133.0912	151.9337	162.7721	175.4803 (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	180.3860	158.4900	165.2306	146.4292	142.2698	125.3691	118.7451	132.5976	133.0912	151.9337	162.7721	175.4803 (64)
	Total per year (kWh/year) = Sum(64)m = 1792.7945 (64)											
Heat gains from water heating, kWh/month	57.8895	50.8114	52.8535	46.6733	45.2260	39.6769	37.4095	42.0119	42.2412	48.4352	52.1020	56.2594 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	153.7496	153.7496	153.7496	153.7496	153.7496	153.7496	153.7496	153.7496	153.7496	153.7496	153.7496	153.7496	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	52.2132	46.3753	37.7149	28.5526	21.3434	18.0190	19.4702	25.3081	33.9684	43.1307	50.3399	53.6643	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	344.7459	348.3233	339.3084	320.1168	295.8908	273.1218	257.9107	254.3333	263.3482	282.5398	306.7658	329.5348	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.9374	52.9374	52.9374	52.9374	52.9374	52.9374	52.9374	52.9374	52.9374	52.9374	52.9374	52.9374	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-102.4997	-102.4997	-102.4997	-102.4997	-102.4997	-102.4997	-102.4997	-102.4997	-102.4997	-102.4997	-102.4997	-102.4997	(71)
Water heating gains (Table 5)	77.8085	75.6122	71.0397	64.8240	60.7877	55.1068	50.2816	56.4677	58.6683	65.1011	72.3638	75.6175	(72)
Total internal gains	581.9549	577.4981	555.2504	520.6807	485.2092	453.4349	434.8498	443.2963	463.1722	497.9589	536.6569	566.0040	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	5.0800	10.6334	0.6300	0.7000	0.7700	16.5085	(74)
East	7.0000	19.6403	0.6300	0.7000	0.7700	42.0162	(76)
West	4.0900	19.6403	0.6300	0.7000	0.7700	24.5495	(80)

Solar gains	83.0742	161.7653	268.0571	398.8695	499.2965	516.5534	489.4934	412.8607	313.8674	192.0675	103.3650	68.5027	(83)
Total gains	665.0291	739.2633	823.3074	919.5502	984.5056	969.9883	924.3432	856.1570	777.0396	690.0265	640.0219	634.5067	(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	40.3801	40.4965	40.6112	41.1588	41.2629	41.7544	41.7544	41.8468	41.5637	41.2629	41.0528	40.8355
alpha	3.6920	3.6998	3.7074	3.7439	3.7509	3.7836	3.7836	3.7898	3.7709	3.7509	3.7369	3.7224
util living area	0.9803	0.9696	0.9438	0.8797	0.7620	0.5954	0.4512	0.5015	0.7333	0.9134	0.9690	0.9832 (86)
MIT	19.5000	19.6873	20.0135	20.4308	20.7526	20.9296	20.9809	20.9717	20.8425	20.4195	19.8919	19.4673 (87)
Th 2	19.9366	19.9393	19.9420	19.9545	19.9569	19.9679	19.9679	19.9699	19.9636	19.9569	19.9521	19.9472 (88)
util rest of house	0.9759	0.9628	0.9310	0.8525	0.7104	0.5154	0.3516	0.3987	0.6596	0.8876	0.9608	0.9794 (89)
MIT 2	18.5879	18.7742	19.0944	19.4998	19.7859	19.9315	19.9616	19.9598	19.8712	19.5008	18.9880	18.5638 (90)
Living area fraction	18.7359	18.9224	19.2435	19.6508	19.9427	20.0935	20.1270	20.1240	20.0288	fLA = Living area / (4) =		0.1623 (91)
MIT	18.7359	18.9224	19.2435	19.6508	19.9427	20.0935	20.1270	20.1240	20.0288	19.6499	19.1347	18.7104 (92)
Temperature adjustment												0.0000
adjusted MIT	18.7359	18.9224	19.2435	19.6508	19.9427	20.0935	20.1270	20.1240	20.0288	19.6499	19.1347	18.7104 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9693	0.9545	0.9207	0.8433	0.7097	0.5256	0.3674	0.4147	0.6647	0.8784	0.9527	0.9736	(94)
Useful gains	644.6338	705.6111	758.0305	775.4712	698.6568	509.8567	339.5880	355.0198	516.5203	606.1090	609.7384	617.7268	(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	1459.3556	1413.4801	1280.9405	1066.2636	815.4497	537.0677	344.8169	363.2730	582.2901	895.2962	1196.6722	1450.5257	(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	606.1530	475.6880	389.0450	209.3705	86.8939	0.0000	0.0000	0.0000	0.0000	215.1553	422.5923	619.6024	(98)
Space heating												3024.5004	(98)
Space heating per m2												35.2835	(99)
	(98) / (4) =												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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													3334.6201	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	606.1530	475.6880	389.0450	209.3705	86.8939	0.0000	0.0000	0.0000	0.0000	215.1553	422.5923	619.6024	(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)	668.3054	524.4630	428.9361	230.8385	95.8037	0.0000	0.0000	0.0000	0.0000	237.2164	465.9232	683.1338	(211)	
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)	
Water heating														
Water heating requirement	180.3860	158.4900	165.2306	146.4292	142.2698	125.3691	118.7451	132.5976	133.0912	151.9337	162.7721	175.4803	(64)	
Efficiency of water heater	89.8727	89.7992	89.6276	89.2261	88.4949	87.2000	87.2000	87.2000	87.2000	89.2179	89.6989	89.9036	(216)	
Fuel for water heating, kWh/month	200.7127	176.4938	184.3523	164.1102	160.7662	143.7719	136.1755	152.0615	152.6275	170.2952	181.4650	195.1872	(219)	
Annual totals kWh/year														
Space heating fuel - main system													3334.6201	(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)													368.8404	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 1.05 * 597 * 1.00) =										-501.7837			-501.7837	(233)
Total delivered energy for all uses													5294.6958	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3334.6201	3.4800	116.0448 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2018.0190	3.4800	70.2271 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	368.8404	13.1900	48.6501 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-501.7837	13.1900	-66.1853 (252)
Total energy cost			298.6291 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.9595 (257)
SAP value		86.6151
SAP rating (Section 12)		87 (258)
SAP band		B

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	3334.6201	0.2160	720.2779 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2018.0190	0.2160	435.8921 (264)
Space and water heating			1156.1700 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	368.8404	0.5190	191.4282 (268)
Energy saving/generation technologies			
PV Unit	-501.7837	0.5190	-260.4258 (269)
Total kg/year			1126.0975 (272)
CO2 emissions per m2			13.1400 (273)
EI value			88.4565
EI rating			88 (274)
EI band			B

Calculation of stars for heating and DHW

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

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	$3.48 / 0.8872 = 3.922$, stars = 4
Water heating environmental impact	$0.216 / 0.8872 = 0.2435$, stars = 4

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	42.8600 (1b)	x 2.3900 (2b)	= 102.4354 (1b) - (3b)
First floor	42.8600 (1c)	x 2.6100 (2c)	= 111.8646 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	85.7200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 214.3000 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					30.0000 / (5) = 0.1400 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3900 (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)	=	0.3607 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	4.7000	4.6000	4.3000	4.3000	4.0000	4.0000	3.9000	4.0000	4.5000	4.4000	4.7000 (22)
Wind factor	1.2750	1.1750	1.1500	1.0750	1.0750	1.0000	1.0000	0.9750	1.0000	1.1250	1.1000	1.1750 (22a)
Adj infilt rate	0.4599	0.4239	0.4149	0.3878	0.3878	0.3607	0.3607	0.3517	0.3607	0.4058	0.3968	0.4239 (22b)
Effective ac	0.6058	0.5898	0.5861	0.5752	0.5752	0.5651	0.5651	0.5619	0.5651	0.5824	0.5787	0.5898 (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			2.1500	1.1000	2.3650		(26)
Windows (Uw = 1.20)			16.1700	1.1450	18.5153		(27)
Ground Floor			42.8600	0.1200	5.1432	84.0000	3600.2400 (28a)
Brick and Block	58.2400	13.2400	45.0000	0.2400	10.8000	42.2200	1899.9000 (29a)
Tile Hung	38.6600	5.0800	33.5800	0.2400	8.0592	42.2200	1417.7476 (29a)
Pitched Roof	42.8600		42.8600	0.1000	4.2860	9.1000	390.0260 (30)
Total net area of external elements Aum(A, m ²)			182.6200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	49.1687		(33)
Party Wall 1			39.4300	0.0000	0.0000	110.0000	4337.3000 (32)
Ground Floor Stud			84.0000			9.0000	756.0000 (32c)
Internal Wall 2			83.4900			9.0000	751.4100 (32c)
Internal Floor 1			42.8600			18.0000	771.4800 (32d)
Internal Ceiling 1			42.8600			18.0000	771.4800 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	14695.5836 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							171.4370 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.0836 (36)
Total fabric heat loss						(33) + (36) =	58.2522 (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	42.8398	41.7124	41.4450	40.6771	40.6771	39.9610	39.9610	39.7338	39.9610	41.1833	40.9273	41.7124 (38)
Heat transfer coeff	101.0920	99.9647	99.6972	98.9293	98.9293	98.2132	98.2132	97.9860	98.2132	99.4355	99.1795	99.9647 (39)
Average = Sum(39)m / 12 =												99.1515 (39)
HLP	1.1793	1.1662	1.1631	1.1541	1.1541	1.1457	1.1457	1.1431	1.1457	1.1600	1.1570	1.1662 (40)
HLP (average)												1.1567 (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												2.5625 (42)
Average daily hot water use (litres/day)												95.0592 (43)
Daily hot water use	104.5651	100.7628	96.9604	93.1580	89.3556	85.5533	85.5533	89.3556	93.1580	96.9604	100.7628	104.5651 (44)
Energy conte	155.0671	135.6226	139.9504	122.0122	117.0736	101.0256	93.6151	107.4247	108.7076	126.6883	138.2902	150.1742 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Energy content (annual)												Total = Sum(45)m = 1495.6514 (45)
Distribution loss (46)m = 0.15 x (45)m												
	23.2601	20.3434	20.9926	18.3018	17.5610	15.1538	14.0423	16.1137	16.3061	19.0032	20.7435	22.5261 (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	25.3189	22.8674	25.2802	24.4170	25.1962	24.3435	25.1300	25.1729	24.3835	25.2454	24.4819	25.3061 (61)
Total heat required for water heating calculated for each month	180.3860	158.4900	165.2306	146.4292	142.2698	125.3691	118.7451	132.5976	133.0912	151.9337	162.7721	175.4803 (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	180.3860	158.4900	165.2306	146.4292	142.2698	125.3691	118.7451	132.5976	133.0912	151.9337	162.7721	175.4803 (64)
	Total per year (kWh/year) = Sum(64)m = 1792.7945 (64)											
Heat gains from water heating, kWh/month	57.8895	50.8114	52.8535	46.6733	45.2260	39.6769	37.4095	42.0119	42.2412	48.4352	52.1020	56.2594 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	153.7496	153.7496	153.7496	153.7496	153.7496	153.7496	153.7496	153.7496	153.7496	153.7496	153.7496	153.7496	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	52.2132	46.3753	37.7149	28.5526	21.3434	18.0190	19.4702	25.3081	33.9684	43.1307	50.3399	53.6643	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	344.7459	348.3233	339.3084	320.1168	295.8908	273.1218	257.9107	254.3333	263.3482	282.5398	306.7658	329.5348	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.9374	52.9374	52.9374	52.9374	52.9374	52.9374	52.9374	52.9374	52.9374	52.9374	52.9374	52.9374	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-102.4997	-102.4997	-102.4997	-102.4997	-102.4997	-102.4997	-102.4997	-102.4997	-102.4997	-102.4997	-102.4997	-102.4997	(71)
Water heating gains (Table 5)	77.8085	75.6122	71.0397	64.8240	60.7877	55.1068	50.2816	56.4677	58.6683	65.1011	72.3638	75.6175	(72)
Total internal gains	581.9549	577.4981	555.2504	520.6807	485.2092	453.4349	434.8498	443.2963	463.1722	497.9589	536.6569	566.0040	(73)

6. Solar gains

[Jan]												
				Area m2	Solar flux Table 6a		g Specific data or Table 6b	FF Specific data or Table 6c		Access factor Table 6d	Gains W	
North				5.0800	13.8645		0.6300	0.7000		0.7700	21.5249 (74)	
East				7.0000	25.9136		0.6300	0.7000		0.7700	55.4368 (76)	
West				4.0900	25.9136		0.6300	0.7000		0.7700	32.3909 (80)	
Solar gains	109.3527	182.2813	300.3811	453.8668	541.1242	605.0243	559.9444	483.5149	372.5886	228.9579	134.9019	86.0418 (83)
Total gains	691.3076	759.7794	855.6315	974.5475	1026.3333	1058.4592	994.7941	926.8112	835.7608	726.9169	671.5588	652.0458 (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	40.3801	40.8355	40.9450	41.2629	41.2629	41.5637	41.5637	41.6601	41.5637	41.0528	41.1588	40.8355
alpha	3.6920	3.7224	3.7297	3.7509	3.7509	3.7709	3.7709	3.7773	3.7709	3.7369	3.7439	3.7224
util living area	0.9727	0.9614	0.9267	0.8430	0.6994	0.4975	0.3600	0.3842	0.6364	0.8689	0.9523	0.9765 (86)
MIT	19.6906	19.8397	20.1674	20.5540	20.8352	20.9658	20.9924	20.9906	20.9163	20.5882	20.1120	19.6747 (87)
Th 2	19.9366	19.9472	19.9497	19.9569	19.9569	19.9636	19.9636	19.9658	19.9636	19.9521	19.9545	19.9472 (88)
util rest of house	0.9663	0.9526	0.9100	0.8088	0.6385	0.4137	0.2617	0.2801	0.5488	0.8296	0.9392	0.9709 (89)
MIT 2	18.7764	18.9300	19.2485	19.6127	19.8513	19.9486	19.9618	19.9635	19.9216	19.6503	19.2047	18.7693 (90)
Living area fraction	18.9247	19.0776	19.3976	19.7654	20.0110	20.1137	20.1291	20.1302	20.0830	19.8025	19.3519	18.9162 (91)
MIT	18.9247	19.0776	19.3976	19.7654	20.0110	20.1137	20.1291	20.1302	20.0830	19.8025	19.3519	18.9162 (92)
Temperature adjustment												0.0000
adjusted MIT	18.9247	19.0776	19.3976	19.7654	20.0110	20.1137	20.1291	20.1302	20.0830	19.8025	19.3519	18.9162 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9584	0.9434	0.8994	0.8017	0.6419	0.4263	0.2777	0.2970	0.5596	0.8230	0.9297	0.9637	(94)
Useful gains	662.5780	716.8051	769.5622	781.3276	658.8235	451.2006	276.2145	275.2726	467.7278	598.2601	624.3721	628.3920	(95)
Ext temp.	5.4000	5.7000	7.3000	9.6000	12.6000	15.4000	17.3000	17.3000	15.0000	11.8000	8.4000	5.5000	(96)
Heat loss rate W	1367.2442	1337.2923	1206.0946	1005.6572	733.1652	462.9479	277.8504	277.3168	499.2200	795.7299	1086.2086	1341.1498	(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	524.2716	416.9674	324.7801	161.5173	55.3102	0.0000	0.0000	0.0000	0.0000	146.9175	332.5223	530.2918	(98)
Space heating												2492.5783	(98)
Space heating per m2												29.0781	(99)
	(98) / (4) =												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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													2748.1569 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	524.2716	416.9674	324.7801	161.5173	55.3102	0.0000	0.0000	0.0000	0.0000	146.9175	332.5223	530.2918	(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)	578.0283	459.7215	358.0817	178.0786	60.9815	0.0000	0.0000	0.0000	0.0000	161.9818	366.6177	584.6657	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	180.3860	158.4900	165.2306	146.4292	142.2698	125.3691	118.7451	132.5976	133.0912	151.9337	162.7721	175.4803	(64)
Efficiency of water heater (217)m	89.7775	89.7083	89.4888	89.0014	88.1523	87.2000	87.2000	87.2000	87.2000	88.8862	89.5192	87.2000	(216)
Fuel for water heating, kWh/month	200.9255	176.6726	184.6382	164.5246	161.3910	143.7719	136.1755	152.0615	152.6275	170.9306	181.8293	195.4041	(219)
Annual totals kWh/year												2020.9522	(219)
Space heating fuel - main system												2748.1569	(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)													368.8404 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.05 * 713 * 1.00) =										-599.0031		-599.0031	(233)
Total delivered energy for all uses												4613.9464	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2748.1569	10.2300	281.1364 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2020.9522	10.2300	206.7434 (247)
Pumps and fans for heating	75.0000	36.7200	27.5400 (249)
Energy for lighting	368.8404	36.7200	135.4382 (250)
Additional standing charges			103.0000 (251)
Energy saving/generation technologies			
PV Unit	-599.0031	36.7200	-219.9539 (252)
Total energy cost			533.9041 (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	2748.1569	0.2160	593.6019 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2020.9522	0.2160	436.5257 (264)
Space and water heating			1030.1276 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	368.8404	0.5190	191.4282 (268)
Energy saving/generation technologies			
PV Unit	-599.0031	0.5190	-310.8826 (269)
Total kg/year			949.5981 (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	2748.1569	1.2200	3352.7514 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2020.9522	1.2200	2465.5617 (264)
Space and water heating			5818.3131 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	368.8404	3.0700	1132.3401 (268)
Energy saving/generation technologies			
PV Unit	-599.0031	3.0700	-1838.9395 (269)
Primary energy kWh/year			5341.9636 (272)
Primary energy kWh/m2/year			62.3188 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 87
Current environmental impact rating: B 88

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

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.2	-£ 86	-193 kg (20.4%)

		Typical annual savings	Energy efficiency	Environmental impact
Recommended measures				
Solar water heating	£86	2.26 kg/m²	B 88	B 90
Total Savings	£86	2.26 kg/m²		
Potential energy efficiency rating:			B 88	
Potential environmental impact rating:				B 90

Fuel prices for cost data on this page from database revision number 531 TEST (31 Oct 2023)
Recommendation texts revision number 4.9c (22 Feb 2014)

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

	Current	Potential	Saving
Electricity	£163	£181	-£18
Mains gas	£591	£487	£104
Space heating	£412	£412	£0
Water heating	£207	£121	£86
Lighting	£135	£135	£0
Generated (PV)	-£220	-£220	£0
Total cost of fuels	£534	£448	£86
Total cost of uses	£534	£448	£86
Delivered energy	54 kWh/m²	43 kWh/m²	11 kWh/m²
Carbon dioxide emissions	0.9 tonnes	0.8 tonnes	0.2 tonnes
CO2 emissions per m²	11 kg/m²	9 kg/m²	2 kg/m²
Primary energy	62 kWh/m²	50 kWh/m²	13 kWh/m²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	42.8600 (1b)	x 2.3900 (2b)	= 102.4354 (1b) - (3b)
First floor	42.8600 (1c)	x 2.6100 (2c)	= 111.8646 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	85.7200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 214.3000 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1400 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3900 (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) =	0.3607 (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	0.4599	0.4509	0.4419	0.3968	0.3878	0.3427	0.3427	0.3337	0.3607	0.3878	0.4058	0.4239 (22b)
Effective ac	0.6058	0.6017	0.5976	0.5787	0.5752	0.5587	0.5587	0.5557	0.5651	0.5752	0.5824	0.5898 (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			2.1500	1.1000	2.3650		(26)
Windows (Uw = 1.20)			16.1700	1.1450	18.5153		(27)
Ground Floor			42.8600	0.1200	5.1432	84.0000	3600.2400 (28a)
Brick and Block	58.2400	13.2400	45.0000	0.2400	10.8000	42.2200	1899.9000 (29a)
Tile Hung	38.6600	5.0800	33.5800	0.2400	8.0592	42.2200	1417.7476 (29a)
Pitched Roof	42.8600		42.8600	0.1000	4.2860	9.1000	390.0260 (30)
Total net area of external elements Aum(A, m ²)			182.6200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	49.1687		(33)
Party Wall 1			39.4300	0.0000	0.0000	110.0000	4337.3000 (32)
Ground Floor Stud			84.0000			9.0000	756.0000 (32c)
Internal Wall 2			83.4900			9.0000	751.4100 (32c)
Internal Floor 1			42.8600			18.0000	771.4800 (32d)
Internal Ceiling 1			42.8600			18.0000	771.4800 (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) = 14695.5836 (34)
171.4370 (35)
9.0836 (36)
(33) + (36) = 58.2522 (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	42.8398	42.5493	42.2646	40.9273	40.6771	39.5123	39.5123	39.2966	39.9610	40.6771	41.1833	41.7124 (38)
Heat transfer coeff	101.0920	100.8016	100.5169	99.1795	98.9293	97.7646	97.7646	97.5489	98.2132	98.9293	99.4355	99.9647 (39)
Average = Sum(39)m / 12 =												99.1783 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1793	1.1759	1.1726	1.1570	1.1541	1.1405	1.1405	1.1380	1.1457	1.1541	1.1600	1.1662 (40)
HLP (average)												1.1570 (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												2.5625 (42)
Average daily hot water use (litres/day)												95.0592 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	104.5651	100.7628	96.9604	93.1580	89.3556	85.5533	85.5533	89.3556	93.1580	96.9604	100.7628	104.5651 (44)
Energy conte	155.0671	135.6226	139.9504	122.0122	117.0736	101.0256	93.6151	107.4247	108.7076	126.6883	138.2902	150.1742 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Energy content (annual)												Total = Sum(45)m = 1495.6514 (45)
Distribution loss (46)m = 0.15 x (45)m												
	23.2601	20.3434	20.9926	18.3018	17.5610	15.1538	14.0423	16.1137	16.3061	19.0032	20.7435	22.5261 (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	25.3189	22.8674	25.2802	24.4170	25.1962	24.3435	25.1300	25.1729	24.3835	25.2454	24.4819	25.3061 (61)
Total heat required for water heating calculated for each month	180.3860	158.4900	165.2306	146.4292	142.2698	125.3691	118.7451	132.5976	133.0912	151.9337	162.7721	175.4803 (62)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.7000 (H2)
Collector heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0050 (H3a)
Collector effective heat loss coefficient												1.8063 (H3b)
Collector performance ratio												2.5804 (H4)
Annual solar radiation per m2												1079.5246 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												1813.6014 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.2126 (H8)
Utilisation factor												0.5616 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												95.0592 (H14)
Volume ratio Veff/V												0.7890 (H15)
Solar storage volume factor												0.9526 (H16)
Solar input												-853.1657 (H17)
Solar input	-24.7401	-41.2841	-70.3116	-94.2314	-116.4149	-114.4544	-112.9419	-98.6779	-77.2846	-52.7763	-29.3453	-20.7032 (63)
												Solar input (sum of months) = Sum(63)m = -853.1657 (63)
Output from w/h	155.6459	117.2059	94.9190	52.1978	25.8549	10.9146	5.8032	33.9197	55.8066	99.1574	133.4268	154.7770 (64)
												Total per year (kWh/year) = Sum(64)m = 939.6288 (64)
Heat gains from water heating, kWh/month	57.8895	50.8114	52.8535	46.6733	45.2260	39.6769	37.4095	42.0119	42.2412	48.4352	52.1020	56.2594 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	153.7496	153.7496	153.7496	153.7496	153.7496	153.7496	153.7496	153.7496	153.7496	153.7496	153.7496	153.7496	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	52.2132	46.3753	37.7149	28.5526	21.3434	18.0190	19.4702	25.3081	33.9684	43.1307	50.3399	53.6643	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	344.7459	348.3233	339.3084	320.1168	295.8908	273.1218	257.9107	254.3333	263.3482	282.5398	306.7658	329.5348	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.9374	52.9374	52.9374	52.9374	52.9374	52.9374	52.9374	52.9374	52.9374	52.9374	52.9374	52.9374	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-102.4997	-102.4997	-102.4997	-102.4997	-102.4997	-102.4997	-102.4997	-102.4997	-102.4997	-102.4997	-102.4997	-102.4997	(71)
Water heating gains (Table 5)	77.8085	75.6122	71.0397	64.8240	60.7877	55.1068	50.2816	56.4677	58.6683	65.1011	72.3638	75.6175	(72)
Total internal gains	581.9549	577.4981	555.2504	520.6807	485.2092	453.4349	434.8498	443.2963	463.1722	497.9589	536.6569	566.0040	(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	5.0800	10.6334	0.6300	0.7000	0.7700	16.5085 (74)
East	7.0000	19.6403	0.6300	0.7000	0.7700	42.0162 (76)
West	4.0900	19.6403	0.6300	0.7000	0.7700	24.5495 (80)

Solar gains	83.0742	161.7653	268.0571	398.8695	499.2965	516.5534	489.4934	412.8607	313.8674	192.0675	103.3650	68.5027 (83)
Total gains	665.0291	739.2633	823.3074	919.5502	984.5056	969.9883	924.3432	856.1570	777.0396	690.0265	640.0219	634.5067 (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	40.3801	40.4965	40.6112	41.1588	41.2629	41.7544	41.7544	41.8468	41.5637	41.2629	41.0528	40.8355
alpha	3.6920	3.6998	3.7074	3.7439	3.7509	3.7836	3.7836	3.7898	3.7709	3.7509	3.7369	3.7224
util living area	0.9803	0.9696	0.9438	0.8797	0.7620	0.5954	0.4512	0.5015	0.7333	0.9134	0.9690	0.9832 (86)
MIT	19.5000	19.6873	20.0135	20.4308	20.7526	20.9296	20.9809	20.9717	20.8425	20.4195	19.8919	19.4673 (87)
Th 2	19.9366	19.9393	19.9420	19.9545	19.9569	19.9679	19.9679	19.9699	19.9636	19.9569	19.9521	19.9472 (88)
util rest of house	0.9759	0.9628	0.9310	0.8525	0.7104	0.5154	0.3516	0.3987	0.6596	0.8876	0.9608	0.9794 (89)
MIT 2	18.5879	18.7742	19.0944	19.4998	19.7859	19.9315	19.9616	19.9598	19.8712	19.5008	18.9880	18.5638 (90)
Living area fraction												fLA = Living area / (4) = 0.1623 (91)
MIT	18.7359	18.9224	19.2435	19.6508	19.9427	20.0935	20.1270	20.1240	20.0288	19.6499	19.1347	18.7104 (92)
Temperature adjustment												0.0000
adjusted MIT	18.7359	18.9224	19.2435	19.6508	19.9427	20.0935	20.1270	20.1240	20.0288	19.6499	19.1347	18.7104 (93)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9693	0.9545	0.9207	0.8433	0.7097	0.5256	0.3674	0.4147	0.6647	0.8784	0.9527	0.9736	(94)
Useful gains	644.6338	705.6111	758.0305	775.4712	698.6568	509.8567	339.5880	355.0198	516.5203	606.1090	609.7384	617.7268	(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	1459.3556	1413.4801	1280.9405	1066.2636	815.4497	537.0677	344.8169	363.2730	582.2901	895.2962	1196.6722	1450.5257	(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	606.1530	475.6880	389.0450	209.3705	86.8939	0.0000	0.0000	0.0000	0.0000	215.1553	422.5923	619.6024	(98)
Space heating												3024.5004	(98)
Space heating per m2											(98) / (4) =	35.2835	(99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000	(201)
Fraction of space heat from main system(s)													1.0000	(202)
Efficiency of main space heating system 1 (in %)													90.7000	(206)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement													3334.6201	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	606.1530	475.6880	389.0450	209.3705	86.8939	0.0000	0.0000	0.0000	0.0000	215.1553	422.5923	619.6024	(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)	668.3054	524.4630	428.9361	230.8385	95.8037	0.0000	0.0000	0.0000	0.0000	237.2164	465.9232	683.1338	(211)	
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)	
Water heating														
Water heating requirement	155.6459	117.2059	94.9190	52.1978	25.8549	10.9146	5.8032	33.9197	55.8066	99.1574	133.4268	154.7770	(64)	
Efficiency of water heater	89.9623	89.9860	89.9916	89.9793	89.8728	87.2000	87.2000	87.2000	87.2000	89.5659	89.8347	89.9782	(217)	
Fuel for water heating, kWh/month	173.0124	130.2491	105.4754	58.0109	28.7683	12.5168	6.6551	38.8988	63.9984	110.7089	148.5247	172.0162	(219)	
Water heating fuel used												1048.8349	(219)	
Annual totals kWh/year														
Space heating fuel - main system												3334.6201	(211)	
Space heating fuel - secondary												0.0000	(215)	
Electricity for pumps and fans:														
central heating pump													30.0000	(230c)
main heating flue fan													45.0000	(230e)
pump for solar water heating													50.0000	(230g)
Total electricity for the above, kWh/year													125.0000	(231)
Electricity for lighting (calculated in Appendix L)													368.8404	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 1.05 * 597 * 1.00) =										-501.7837		-501.7837	(233)	
Total delivered energy for all uses												4375.5117	(238)	

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3334.6201	3.4800	116.0448	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1048.8349	3.4800	36.4995	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Pump for solar water heating	50.0000	13.1900	6.5950	(249)
Energy for lighting	368.8404	13.1900	48.6501	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-501.7837	13.1900	-66.1853	(252)
Total energy cost			271.4965	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.8723	(257)
SAP value		87.8313	
SAP rating (Section 12)		88	(258)
SAP band		B	

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	3334.6201	0.2160	720.2779 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1048.8349	0.2160	226.5483 (264)
Space and water heating			946.8263 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	368.8404	0.5190	191.4282 (268)
Energy saving/generation technologies			
PV Unit	-501.7837	0.5190	-260.4258 (269)
Total kg/year			942.7037 (272)
CO2 emissions per m2			11.0000 (273)
EI value			90.3364
EI rating			90 (274)
EI band			B

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	42.8600 (1b)	x 2.3900 (2b)	= 102.4354 (1b) - (3b)
First floor	42.8600 (1c)	x 2.6100 (2c)	= 111.8646 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	85.7200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 214.3000 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1400 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3900 (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) =	0.3607 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	4.7000	4.6000	4.3000	4.3000	4.0000	4.0000	3.9000	4.0000	4.5000	4.4000	4.7000 (22)
Wind factor	1.2750	1.1750	1.1500	1.0750	1.0750	1.0000	1.0000	0.9750	1.0000	1.1250	1.1000	1.1750 (22a)
Adj infilt rate	0.4599	0.4239	0.4149	0.3878	0.3878	0.3607	0.3607	0.3517	0.3607	0.4058	0.3968	0.4239 (22b)
Effective ac	0.6058	0.5898	0.5861	0.5752	0.5752	0.5651	0.5651	0.5619	0.5651	0.5824	0.5787	0.5898 (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			2.1500	1.1000	2.3650		(26)
Windows (Uw = 1.20)			16.1700	1.1450	18.5153		(27)
Ground Floor			42.8600	0.1200	5.1432	84.0000	3600.2400 (28a)
Brick and Block	58.2400	13.2400	45.0000	0.2400	10.8000	42.2200	1899.9000 (29a)
Tile Hung	38.6600	5.0800	33.5800	0.2400	8.0592	42.2200	1417.7476 (29a)
Pitched Roof	42.8600		42.8600	0.1000	4.2860	9.1000	390.0260 (30)
Total net area of external elements Aum(A, m ²)			182.6200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	49.1687		(33)
Party Wall 1			39.4300	0.0000	0.0000	110.0000	4337.3000 (32)
Ground Floor Stud			84.0000			9.0000	756.0000 (32c)
Internal Wall 2			83.4900			9.0000	751.4100 (32c)
Internal Floor 1			42.8600			18.0000	771.4800 (32d)
Internal Ceiling 1			42.8600			18.0000	771.4800 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	14695.5836 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							171.4370 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.0836 (36)
Total fabric heat loss						(33) + (36) =	58.2522 (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	42.8398	41.7124	41.4450	40.6771	40.6771	39.9610	39.9610	39.7338	39.9610	41.1833	40.9273	41.7124 (38)
Heat transfer coeff	101.0920	99.9647	99.6972	98.9293	98.9293	98.2132	98.2132	97.9860	98.2132	99.4355	99.1795	99.9647 (39)
Average = Sum(39)m / 12 =												99.1515 (39)
HLP	1.1793	1.1662	1.1631	1.1541	1.1541	1.1457	1.1457	1.1431	1.1457	1.1600	1.1570	1.1662 (40)
HLP (average)												1.1567 (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												2.5625 (42)
Average daily hot water use (litres/day)												95.0592 (43)
Daily hot water use	104.5651	100.7628	96.9604	93.1580	89.3556	85.5533	85.5533	89.3556	93.1580	96.9604	100.7628	104.5651 (44)
Energy conte	155.0671	135.6226	139.9504	122.0122	117.0736	101.0256	93.6151	107.4247	108.7076	126.6883	138.2902	150.1742 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Energy content (annual)												Total = Sum (45)m = 1495.6514 (45)
Distribution loss (46)m = 0.15 x (45)m												
	23.2601	20.3434	20.9926	18.3018	17.5610	15.1538	14.0423	16.1137	16.3061	19.0032	20.7435	22.5261 (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	25.3189	22.8674	25.2802	24.4170	25.1962	24.3435	25.1300	25.1729	24.3835	25.2454	24.4819	25.3061 (61)
Total heat required for water heating calculated for each month												
	180.3860	158.4900	165.2306	146.4292	142.2698	125.3691	118.7451	132.5976	133.0912	151.9337	162.7721	175.4803 (62)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.7000 (H2)
Collector heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0050 (H3a)
Collector effective heat loss coefficient												1.8063 (H3b)
Collector performance ratio												2.5804 (H4)
Annual solar radiation per m2												1234.4649 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												2073.9010 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.3866 (H8)
Utilisation factor												0.5138 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												95.0592 (H14)
Volume ratio Veff/V												0.7890 (H15)
Solar storage volume factor												0.9526 (H16)
Solar input												-892.5714 (H17)
Solar input	-29.2913	-41.8142	-70.8679	-96.7037	-114.1315	-121.4575	-116.9733	-104.3556	-82.5914	-56.5501	-34.4377	-23.3972 (63)
												-892.5714 (63)
Output from w/h												
	151.0947	116.6759	94.3626	49.7255	28.1383	3.9116	1.7717	28.2420	50.4998	95.3836	128.3343	152.0831 (64)
												900.2231 (64)
Heat gains from water heating, kWh/month												
	57.8895	50.8114	52.8535	46.6733	45.2260	39.6769	37.4095	42.0119	42.2412	48.4352	52.1020	56.2594 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	153.7496	153.7496	153.7496	153.7496	153.7496	153.7496	153.7496	153.7496	153.7496	153.7496	153.7496	153.7496	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	52.2132	46.3753	37.7149	28.5526	21.3434	18.0190	19.4702	25.3081	33.9684	43.1307	50.3399	53.6643	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	344.7459	348.3233	339.3084	320.1168	295.8908	273.1218	257.9107	254.3333	263.3482	282.5398	306.7658	329.5348	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.9374	52.9374	52.9374	52.9374	52.9374	52.9374	52.9374	52.9374	52.9374	52.9374	52.9374	52.9374	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-102.4997	-102.4997	-102.4997	-102.4997	-102.4997	-102.4997	-102.4997	-102.4997	-102.4997	-102.4997	-102.4997	-102.4997	(71)
Water heating gains (Table 5)	77.8085	75.6122	71.0397	64.8240	60.7877	55.1068	50.2816	56.4677	58.6683	65.1011	72.3638	75.6175	(72)
Total internal gains	581.9549	577.4981	555.2504	520.6807	485.2092	453.4349	434.8498	443.2963	463.1722	497.9589	536.6569	566.0040	(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				5.0800	13.8645	0.6300	0.7000	0.7700	21.5249 (74)			
East				7.0000	25.9136	0.6300	0.7000	0.7700	55.4368 (76)			
West				4.0900	25.9136	0.6300	0.7000	0.7700	32.3909 (80)			
Solar gains	109.3527	182.2813	300.3811	453.8668	541.1242	605.0243	559.9444	483.5149	372.5886	228.9579	134.9019	86.0418 (83)
Total gains	691.3076	759.7794	855.6315	974.5475	1026.3333	1058.4592	994.7941	926.8112	835.7608	726.9169	671.5588	652.0458 (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	40.3801	40.8355	40.9450	41.2629	41.2629	41.5637	41.5637	41.6601	41.5637	41.0528	41.1588	40.8355
alpha	3.6920	3.7224	3.7297	3.7509	3.7509	3.7709	3.7709	3.7773	3.7709	3.7369	3.7439	3.7224
util living area	0.9727	0.9614	0.9267	0.8430	0.6994	0.4975	0.3600	0.3842	0.6364	0.8689	0.9523	0.9765 (86)
MIT	19.6906	19.8397	20.1674	20.5540	20.8352	20.9658	20.9924	20.9906	20.9163	20.5882	20.1120	19.6747 (87)
Th 2	19.9366	19.9472	19.9497	19.9569	19.9569	19.9636	19.9636	19.9658	19.9636	19.9521	19.9545	19.9472 (88)
util rest of house	0.9663	0.9526	0.9100	0.8088	0.6385	0.4137	0.2617	0.2801	0.5488	0.8296	0.9392	0.9709 (89)
MIT 2	18.7764	18.9300	19.2485	19.6127	19.8513	19.9486	19.9618	19.9635	19.9216	19.6503	19.2047	18.7693 (90)
Living area fraction												0.1623 (91)
MIT	18.9247	19.0776	19.3976	19.7654	20.0110	20.1137	20.1291	20.1302	20.0830	19.8025	19.3519	18.9162 (92)
Temperature adjustment												0.0000
adjusted MIT	18.9247	19.0776	19.3976	19.7654	20.0110	20.1137	20.1291	20.1302	20.0830	19.8025	19.3519	18.9162 (93)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9584	0.9434	0.8994	0.8017	0.6419	0.4263	0.2777	0.2970	0.5596	0.8230	0.9297	0.9637	(94)
Useful gains	662.5780	716.8051	769.5622	781.3276	658.8235	451.2006	276.2145	275.2726	467.7278	598.2601	624.3721	628.3920	(95)
Ext temp.	5.4000	5.7000	7.3000	9.6000	12.6000	15.4000	17.3000	17.3000	15.0000	11.8000	8.4000	5.5000	(96)
Heat loss rate W	1367.2442	1337.2923	1206.0946	1005.6572	733.1652	462.9479	277.8504	277.3168	499.2200	795.7299	1086.2086	1341.1498	(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	524.2716	416.9674	324.7801	161.5173	55.3102	0.0000	0.0000	0.0000	0.0000	146.9175	332.5223	530.2918	(98)
Space heating												2492.5783	(98)
Space heating per m2											(98) / (4) =	29.0781	(99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000	(201)
Fraction of space heat from main system(s)													1.0000	(202)
Efficiency of main space heating system 1 (in %)													90.7000	(206)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement													2748.1569	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	524.2716	416.9674	324.7801	161.5173	55.3102	0.0000	0.0000	0.0000	0.0000	146.9175	332.5223	530.2918	(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)	578.0283	459.7215	358.0817	178.0786	60.9815	0.0000	0.0000	0.0000	0.0000	161.9818	366.6177	584.6657	(211)	
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)	
Water heating														
Water heating requirement	151.0947	116.6759	94.3626	49.7255	28.1383	3.9116	1.7717	28.2420	50.4998	95.3836	128.3343	152.0831	(64)	
Efficiency of water heater	89.8928	89.9110	89.8877	89.8511	89.4888	87.2000	87.2000	87.2000	87.2000	89.2892	89.6974	89.8958	(217)	
Fuel for water heating, kWh/month	168.0832	129.7682	104.9783	55.3421	31.4434	4.4858	2.0318	32.3876	57.9126	106.8255	143.0747	169.1770	(219)	
Water heating fuel used												1005.5102	(219)	
Annual totals kWh/year														
Space heating fuel - main system												2748.1569	(211)	
Space heating fuel - secondary												0.0000	(215)	
Electricity for pumps and fans:														
central heating pump													30.0000	(230c)
main heating flue fan													45.0000	(230e)
pump for solar water heating													50.0000	(230g)
Total electricity for the above, kWh/year													125.0000	(231)
Electricity for lighting (calculated in Appendix L)													368.8404	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 1.05 * 713 * 1.00) =										-599.0031		-599.0031	(233)	
Total delivered energy for all uses												3648.5044	(238)	

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2748.1569	10.2300	281.1364	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1005.5102	10.2300	102.8637	(247)
Pumps and fans for heating	75.0000	36.7200	27.5400	(249)
Pump for solar water heating	50.0000	36.7200	18.3600	(249)
Energy for lighting	368.8404	36.7200	135.4382	(250)
Additional standing charges			103.0000	(251)
Energy saving/generation technologies				
PV Unit	-599.0031	36.7200	-219.9539	(252)
Total energy cost			448.3844	(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	2748.1569	0.2160	593.6019	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1005.5102	0.2160	217.1902	(264)
Space and water heating			810.7921	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	368.8404	0.5190	191.4282	(268)
Energy saving/generation technologies				
PV Unit	-599.0031	0.5190	-310.8826	(269)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Total kg/year

756.2127 (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	2748.1569	1.2200	3352.7514 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1005.5102	1.2200	1226.7225 (264)
Space and water heating			4579.4738 (265)
Pumps and fans	125.0000	3.0700	383.7500 (267)
Energy for lighting	368.8404	3.0700	1132.3401 (268)
Energy saving/generation technologies			
PV Unit	-599.0031	3.0700	-1838.9395 (269)
Primary energy kWh/year			4256.6244 (272)
Primary energy kWh/m2/year			49.6573 (273)

U-VALUE CALCULATOR REPORT

Property Reference	SAP 0906 Plot 51	Issued on Date	29/11/2023
Assessment Reference	Rev B	Prop Type Ref	Block J
Project			
Calculation Type	New Build (As Designed)		

SAP Rating	87 B	DER	14.96	TER	18.59
Environmental	88 B	% DER<TER	19.55		
CO ₂ Emissions (t/year)	0.95	DFEE	46.37	TFEE	55.39
General Requirements Compliance	Pass	% DFEE<TFEE	16.29		

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 (%)	Density (kg/m ³)	Heat Cap. (J/kgK)
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	700	1000
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: 9.10 kJ/m² K

U-VALUE CALCULATOR REPORT

Property Reference	SAP 0906 Plot 51	Issued on Date	29/11/2023
Assessment Reference	Rev B	Prop Type Ref	Block J
Project			
Calculation Type	New Build (As Designed)		

SAP Rating	87 B	DER	14.96	TER	18.59
Environmental	88 B	% DER<TER	19.55		
CO ₂ Emissions (t/year)	0.95	DFEE	46.37	TFEE	55.39
General Requirements Compliance	Pass	% DFEE<TFEE	16.29		

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 000001

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 0906 Plot 51	Issued on Date	29/11/2023
Assessment Reference	Rev B	Prop Type Ref	Block J
Project			
Calculation Type	New Build (As Designed)		

SAP Rating	87 B	DER	14.96	TER	18.59
Environmental	88 B	% DER<TER	19.55		
CO ₂ Emissions (t/year)	0.95	DFEE	46.37	TFEE	55.39
General Requirements Compliance	Pass	% DFEE<TFEE	16.29		

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

Building Elements

Wall Tile Hung

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				0.1300			
Layer 1	Tiling						
	Main construction	30	1.5000	0.0000	100.00		
Layer 2	Standard cavity						
	Main construction	25	0.0000	0.0000	90.50		
	Main construction	25	0.1300	0.0000	9.50		
	Corrections - Cavity Ventilated, Emissivity: Normal						
Layer 3	Blockwork, dense						
	Main construction	100	1.5900	0.0629	92.97		
	Main construction	100	0.8800	0.1136	7.03		
Layer 4	Supafil 34						
	Main construction	100	0.0340	2.9412	100.00		
	Corrections - Air Gap: Level 0, Fasteners: None or plastic						
Layer 5	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 6	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 7	Plasterboard, standard						
	Main construction	12.5	0.2100	0.0595	100.00	700	1000
Int surface				0.1300			

Total resistance: Upper limit = 4.349 m² K/W Lower limit = 4.137 m² K/W Average = 4.243 m² K/W
Total correction = 0.0002 m² K/W U-value (unrounded) = 0.24 W/m² K

Unheated space: None

Total thickness: 383 mm

U-value: 0.24 W/m² K

Kappa: 42.22 kJ/m² K

U-VALUE CALCULATOR REPORT

Property Reference	SAP 0906 Plot 51	Issued on Date	29/11/2023
Assessment Reference	Rev B	Prop Type Ref	Block J
Project			
Calculation Type	New Build (As Designed)		

SAP Rating	87 B	DER	14.96	TER	18.59
Environmental	88 B	% DER<TER	19.55		
CO ₂ Emissions (t/year)	0.95	DFEE	46.37	TFEE	55.39
General Requirements Compliance	Pass	% DFEE<TFEE	16.29		

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 000003 - Worst Case Slab

Floor Type: Slab On Ground Floor

Area = 42.27 m², Perimeter = 18.36 m, Wall thickness = 275.00 mm, Soil: Unknown

Horizontal edge insulation: none

Vertical edge insulation: none

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	Concrete, medium density						
	Main construction	100	1.3500	0.0741	100.00		
Layer 2	Polythene, 1000 gauge						
	Main construction	0.5	0.0000	0.0000	100.00		
Layer 3	Celotex XR4000						
	Main construction	150	0.0220	6.8182	100.00		
	Corrections - Air Gap: Level 1, Fasteners: None or plastic						
Layer 4	Polythene, 500 gauge						
	Main construction	0.5	0.0000	0.0000	100.00		
Layer 5	Screed						
	Main construction	70	1.1500	0.0609	100.00	1200	1000
Int surface				0.1700			

Total resistance: Upper limit = 6.953 m² K/W Lower limit = 6.953 m² K/W Average = 6.953 m² K/W

Total correction = 0.0096 m² K/W

U-value (unrounded) = 0.12 W/m² K

Unheated space: None

Total thickness: 321 mm

U-value: 0.12 W/m² K

Kappa: 84.00 kJ/m² K

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

Property Reference	SAP 0906 Plot 51				Issued on Date	29/11/2023
Assessment Reference	Rev B	Prop Type Ref		Block J		
Property						
SAP Rating	87 B	DER	14.96	TER	18.59	
Environmental	88 B	% DER<TER	19.55			
CO ₂ Emissions (t/year)	0.95	DFEE	46.37	TFEE	55.39	
General Requirements Compliance	Pass	% DFEE<TFEE	16.29			
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 Designed)

Orientation	North						
Property Tenure	Unknown						
Transaction Type	New dwelling						
Terrain Type	Urban						
1.0 Property Type	House, End-Terrace						
2.0 Number of Storeys	2						
3.0 Date Built	2022						
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:		19.38 m	42.86 m²	2.39 m		
	1st Storey:		19.38 m	42.86 m²	2.61 m		
7.0 Living Area	13.91			m²			
8.0 Thermal Mass Parameter	Precise calculation						
Thermal Mass	171.44			kJ/m²K			
9.0 External Walls							
Description	Type	Construction		U-Value (W/m²K)	Kappa (kJ/m²K)	Gross Area (m²)	Nett Area (m²)
Brick and Block	Cavity Wall	Other		0.24	42.22	58.24	45.00
Tile Hung	Cavity Wall	Other		0.24	42.22	38.66	33.58
9.1 Party Walls							
Description	Type	Construction		U-Value (W/m²K)	Kappa (kJ/m²K)	Area (m²)	
Party Wall 1	Filled Cavity with Edge Sealing	Single plasterboard on dabs both sides, lightweight aggregate blocks, cavity or cavity fill		0.00	110.00	39.43	
9.2 Internal Walls							
Description	Construction				Kappa (kJ/m²K)	Area (m²)	
Ground Floor Stud	Plasterboard on timber frame				9.00	84.00	
Internal Wall 2	Plasterboard on timber frame				9.00	83.49	
10.0 External Roofs							
Description	Type	Construction		U-Value (W/m²K)	Kappa (kJ/m²K)	Gross Area (m²)	Nett Area (m²)
Pitched Roof	External Plane Roof	Other		0.10	9.10	42.86	42.86

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

10.2 Internal Ceilings

Description	Construction	Kappa (kJ/m²K)	Area (m²)
Internal Ceiling 1	Plasterboard ceiling, carpeted chipboard floor	9.00	42.86

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Area (m²)
Ground Floor	Ground Floor - Solid	Other	0.12	84.00	42.86

11.2 Internal Floors

Description	Construction	Kappa (kJ/m²K)	Area (m²)
Internal Floor 1	Plasterboard ceiling, carpeted chipboard floor	18.00	42.86

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	Manufacture	Solid Door							1.10
Windows	Manufacture	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
Front Door	Solid Door	[1] Brick and Block	North							2.15	
Front Elevation	Window	[1] Brick and Block	North	None	0.00					2.18	
Side Elevation	Window	[1] Brick and Block	West	None	0.00					1.91	
Rear Elevation	Window	[1] Brick and Block	East	None	0.00					7.00	
Front Tiled	Window	[2] Tile Hung	North	None	0.00					2.90	
Side Tiled	Window	[2] Tile Hung	West	None	0.00					2.18	

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)	0.69	0.077	No	Birtley Supatherm
Independently assessed	E2 Other lintels (including other steel lintels)	7.28	0.071	No	Birtley Supatherm
Independently assessed	E2 Other lintels (including other steel lintels)	1.02	0.071	No	Birtley Supatherm
Independently assessed	E2 Other lintels (including other steel lintels)	1.25	0.064	No	Birtley Supatherm
Independently assessed	E2 Other lintels (including other steel lintels)	1.59	0.067	No	Birtley Supatherm
Independently assessed	E2 Other lintels (including other steel lintels)	1.81	0.061	No	Birtley Supatherm
Independently assessed	E3 Sill	11.02	0.021	No	Knauf P5
Independently assessed	E4 Jamb	33.90	0.016	No	Knauf P6
Table K1 - Approved	E5 Ground floor (normal)	19.38	0.160	No	
Independently assessed	E6 Intermediate floor within a dwelling	19.38	0.000	No	CD0029
Independently assessed	E10 Eaves (insulation at ceiling level)	8.83	0.071	No	Knauf P16
Independently assessed	E12 Gable (insulation at ceiling level)	9.80	0.044	No	Knauf P21
Independently assessed	E16 Corner (normal)	19.99	0.039	No	Knauf P23
Independently assessed	E25 Staggered party wall between dwellings	10.00	0.071	No	Knauf P27 Halved
Table K1 - Default	P1 Party wall - Ground floor	8.83	0.160	No	
Table K1 - Default	P2 Party wall - Intermediate floor within a dwelling	8.83	0.000	No	
Independently assessed	P5 Party wall - Roof (insulation at rafter level)	8.83	0.035	No	Knauf P29 Halved

Y-value 0.050 W/m²K

18.0 Pressure Testing

Yes

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

Designed AP ₅₀	5.00	m ³ /(h.m ²) @ 50 Pa
Property Tested ?		
As Built AP ₅₀		m ³ /(h.m ²) @ 50 Pa

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
---------------------------------------	----

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				3
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	16	
Total number of L.E.L. fittings	16	
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

	Database	
Description	Mains Gas Combi	
Percentage of Heat	100	%
Database Ref. No.	17513	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.7	
In Summer	87.2	
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)	

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

Combi boiler type	Standard Combi			
Combi keep hot type	Gas/Oil, time clock			
25.0 Main Heating 2				
None				
28.0 Water Heating				
Community Heating	None			
Water Heating	HWP From main heating 1			
Flue Gas Heat Recovery System	Main Heating 1			
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				
PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
1.05	North	45°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£86	B 88	