



SAP Report Submission for Building Regulations Compliance

Client: Foreman Homes

Project:

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Report Issue Date: 29/11/2023

EXCELLENCE
IN ENERGY
ASSESSMENT

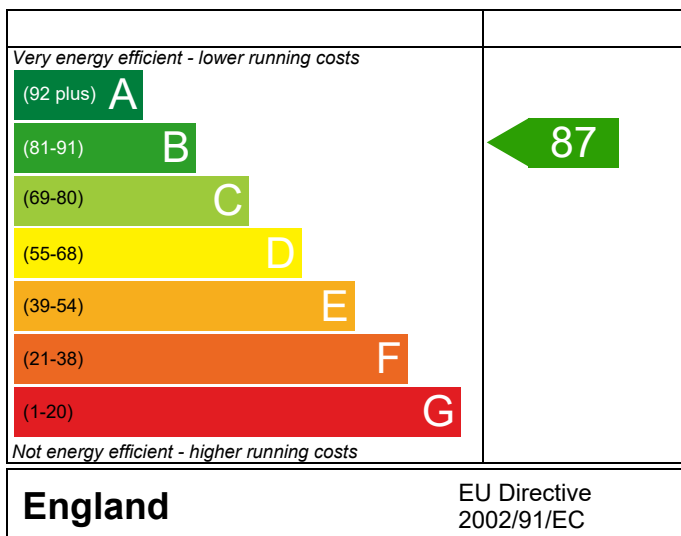
PREDICTED ENERGY ASSESSMENT

Dwelling type: House, End-Terrace
Date of assessment: 29/11/2023
Produced by: Abacus Energy (UK) Ltd
Total floor area: 84.54 m²
DRRN: 7992-3921-7283

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.

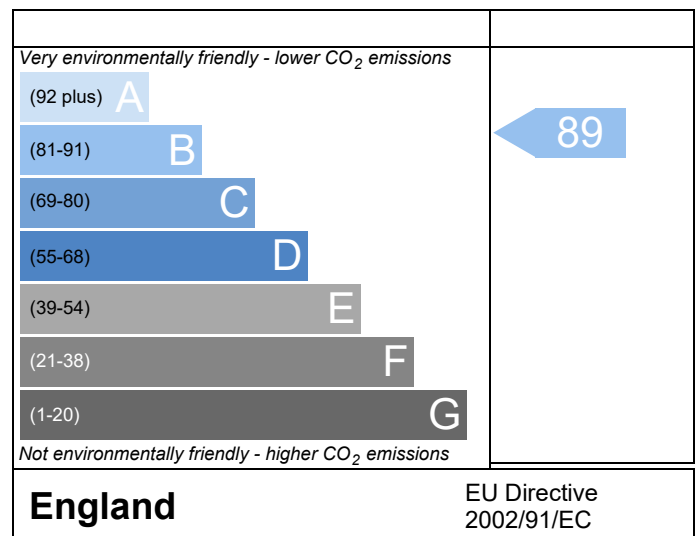
The energy performance has been assessed using the Government approved SAP2012 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO₂) emissions.

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 42				Issued on Date	29/11/2023
Assessment Reference	Rev B	Prop Type Ref	Block Cv			
Property						
SAP Rating	87 B	DER	14.98	TER	18.64	
Environmental	89 B	% DER<TER	19.65			
CO ₂ Emissions (t/year)	0.94	DFEE	44.80	TFEE	54.00	
General Requirements Compliance	Pass	% DFEE<TFEE	17.04			
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)	18.64	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	14.98	kgCO ₂ /m ²	Pass
	-3.66 (-19.6%)	kgCO ₂ /m ²	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	54.00	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DFEE)	44.80	kWh/m ² /yr	
	-9.2 (-17.0%)	kWh/m ² /yr	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.24 (max. 0.30)	0.26 (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

7.72 m², No overhang

Windows facing South

3.62 m², No overhang

Windows facing West

1.44 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

0.75

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	£85	B 88	B 90	Recommended
Photovoltaic			0	0	Already installed
Wind turbine			0	0	Not applicable
Totals	£4,000 - £6,000	£85	B 88	B 90	

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THERMAL BRIDGING

Calculation Type: New Build (As Designed)

Property Reference	SAP 0906 Plot 42	Issued on Date	29/11/2023
Assessment Reference	Rev B	Prop Type Ref	Block Cv
Property			

SAP Rating	87 B	DER	14.98	TER	18.64
Environmental	89 B	% DER<TER	19.65		
CO ₂ Emissions (t/year)	0.94	DFEE	44.80	TFEE	54.00
General Requirements Compliance	Pass	% DFEE<TFEE	17.04		

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	0.093	0.46	0.04	Birtley Supatherm
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.077	2.06	0.16	Birtley Supatherm
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.071	3.75	0.27	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	8.30	0.17	Knauf P5
External wall	E4 Jamb	Independently assessed	0.016	28.50	0.46	Knauf P6
External wall	E5 Ground floor (normal)	Table K1 - Approved	0.160	27.20	4.35	
External wall	E6 Intermediate floor within a dwelling	Independently assessed	0.000	18.71	0.00	CD0029
External wall	E10 Eaves (insulation at ceiling level)	Independently assessed	0.071	13.89	0.99	Knauf P16
External wall	E12 Gable (insulation at ceiling level)	Independently assessed	0.044	4.82	0.21	Knauf P21
External wall	E16 Corner (normal)	Independently assessed	0.039	15.89	0.62	Knauf P23
External wall	E18 Party wall between dwellings	Independently assessed	0.036	4.55	0.16	Knauf P25 Halved
External wall	E25 Staggered party wall between dwellings	Independently assessed	0.055	4.55	0.25	Knauf P27 Halved
Party wall	P6 Party wall - Ground floor (inverted)	Independently assessed	0.000	8.45	0.00	
Party wall	P2 Party wall - Intermediate floor within a dwelling	Table K1 - Default	0.000	8.45	0.00	
Party wall	P4 Party wall - Roof (insulation at ceiling level)	Independently assessed	0.035	8.45	0.30	Knauf P29 Halved

Total: **8.27** W/mK:
Y-Value: **0.046** W/m²K:

FULL SAP CALCULATION PRINTOUT

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General Requirements Compliance	Pass	% DFEE<TFEE	17.04			
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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 85 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) 18.64 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 14.98 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)54.0 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)44.8 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.24 (max. 0.30)	0.26 (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: 7.72 m², No overhang
Windows facing South: 3.62 m², No overhang
Windows facing West: 1.44 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 0.75 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	42.2700 (1b)	x 2.3900 (2b)	= 101.0253 (1b) - (3b)
First floor	42.2700 (1c)	x 2.6100 (2c)	= 110.3247 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	84.5400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 211.3500 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.1893 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4393 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3734 (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												
Effective ac	0.4760	0.4667	0.4574	0.4107	0.4014	0.3547	0.3547	0.3454	0.3734	0.4014	0.4200	0.4387 (22b)
	0.6133	0.6089	0.6046	0.5843	0.5806	0.5629	0.5629	0.5596	0.5697	0.5806	0.5882	0.5962 (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)			12.7800	1.1450	14.6336		(27)
Ground Floor			42.2700	0.1200	5.0724	84.0000	3550.6800 (28a)
Brick and Block	75.7100	12.7500	62.9600	0.2400	15.1104	42.2200	2658.1712 (29a)
Tile Hung	17.8000	2.1800	15.6200	0.2400	3.7488	42.2200	659.4764 (29a)
Step Party Wall	3.8000		3.8000	0.2600	0.9880	58.0600	220.6280 (29a)
Pitched Roof	42.2700		42.2700	0.1000	4.2270	9.1000	384.6570 (30)
Total net area of external elements Aum(A, m ²)			181.8500				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	46.1452		(33)
Party Wall 1			38.4300	0.0000	0.0000	110.0000	4227.3000 (32)
Ground Floor Stud			62.1500			9.0000	559.3500 (32c)
First Floor Stud			92.8300			9.0000	835.4700 (32c)
Internal Floor 1			42.2700			18.0000	760.8600 (32d)
Internal Ceiling 1			42.2700			18.0000	760.8600 (32e)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		14617.4526 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							172.9058 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.2747 (36)
Total fabric heat loss						(33) + (36) =	54.4199 (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	42.7757	42.4688	42.1680	40.7551	40.4908	39.2602	39.2602	39.0323	39.7342	40.4908	41.0255	41.5846 (38)
Heat transfer coeff	97.1955	96.8886	96.5878	95.1750	94.9106	93.6801	93.6801	93.4522	94.1541	94.9106	95.4454	96.0045 (39)
Average = Sum(39)m / 12 =												95.1737 (39)
HLP	1.1497	1.1461	1.1425	1.1258	1.1227	1.1081	1.1081	1.1054	1.1137	1.1227	1.1290	1.1356 (40)
HLP (average)												1.1258 (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												2.5434 (42)
Average daily hot water use (litres/day)												94.6054 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	104.0659	100.2817	96.4975	92.7132	88.9290	85.1448	85.1448	88.9290	92.7132	96.4975	100.2817	104.0659 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Energy conte	154.3267	134.9751	139.2822	121.4296	116.5146	100.5433	93.1681	106.9118	108.1886	126.0834	137.6299	149.4572 (45)
Energy content (annual)										Total =	Sum(45)m =	1488.5106 (45)
Distribution loss (46)m = 0.15 x (45)m												
23.1490	20.2463	20.8923	18.2144	17.4772	15.0815	13.9752	16.0368	16.2283	18.9125	20.6445	22.4186 (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	25.3185	22.8670	25.2767	24.4141	25.1935	24.3412	25.1280	25.1705	24.3809	25.2423	24.4815	25.3057 (61)
Total heat required for water heating calculated for each month												
179.6452	157.8421	164.5589	145.8437	141.7081	124.8845	118.2961	132.0822	132.5696	151.3257	162.1114	174.7629 (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 (63)	
									Solar input (sum of months) =	Sum(63)m =	0.0000 (63)	
Output from w/h												
179.6452	157.8421	164.5589	145.8437	141.7081	124.8845	118.2961	132.0822	132.5696	151.3257	162.1114	174.7629 (64)	
									Total per year (kWh/year) =	Sum(64)m =	1785.6304 (64)	
Heat gains from water heating, kWh/month												
57.6433	50.5960	52.6305	46.4789	45.0395	39.5159	37.2604	41.8408	42.0680	48.2333	51.8823	56.0209 (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	127.1692	127.1692	127.1692	127.1692	127.1692	127.1692	127.1692	127.1692	127.1692	127.1692	127.1692	127.1692 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	21.5148	19.1093	15.5407	11.7653	8.7947	7.4249	8.0228	10.4284	13.9969	17.7723	20.7429	22.1128 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	228.6671	231.0400	225.0605	212.3308	196.2619	181.1594	171.0700	168.6972	174.6767	187.4063	203.4752	218.5777 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	35.7169	35.7169	35.7169	35.7169	35.7169	35.7169	35.7169	35.7169	35.7169	35.7169	35.7169	35.7169 (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)												
	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353 (71)
Water heating gains (Table 5)												
	77.4775	75.2916	70.7399	64.5540	60.5370	54.8833	50.0812	56.2376	58.4277	64.8297	72.0588	75.2970 (72)
Total internal gains												
	391.8102	389.5916	375.4918	352.8009	329.7443	307.6183	293.3247	299.5139	311.2521	334.1591	360.4277	380.1382 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W		
North				7.7200	10.6334	0.6300	0.7000	0.7700		25.0877 (74)		
South				3.6200	46.7521	0.6300	0.7000	0.7700		51.7227 (78)		
West				1.4400	19.6403	0.6300	0.7000	0.7700		8.6433 (80)		

Solar gains	85.4537	149.5606	217.2173	293.4244	353.1334	361.9618	344.1877	297.4938	243.0548	168.5000	103.0352	72.7154 (83)
Total gains	477.2639	539.1522	592.7092	646.2253	682.8777	669.5801	637.5124	597.0077	554.3068	502.6591	463.4629	452.8536 (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	41.7756	41.9079	42.0385	42.6625	42.7813	43.3433	43.3433	43.4490	43.1251	42.7813	42.5416	42.2939	
alpha	3.7850	3.7939	3.8026	3.8442	3.8521	3.8896	3.8896	3.8966	3.8750	3.8521	3.8361	3.8196	
util living area													
	0.9931	0.9883	0.9777	0.9493	0.8817	0.7494	0.5990	0.6500	0.8527	0.9621	0.9884	0.9944 (86)	
MIT	19.3117	19.4898	19.7917	20.2048	20.5851	20.8549	20.9550	20.9379	20.7377	20.2555	19.7175	19.2862 (87)	
Th 2	19.9605	19.9634	19.9663	19.9798	19.9824	19.9942	19.9942	19.9964	19.9896	19.9824	19.9772	19.9719 (88)	
util rest of house													
	0.9915	0.9855	0.9719	0.9350	0.8457	0.6718	0.4815	0.5351	0.7950	0.9487	0.9851	0.9930 (89)	
MIT 2	18.4194	18.5986	18.8999	19.3144	19.6740	19.9118	19.9779	19.9717	19.8209	19.3707	18.8366	18.4027 (90)	
Living area fraction									fLA = Living area / (4) =				0.2110 (91)
MIT	18.6077	18.7867	19.0881	19.5023	19.8662	20.1109	20.1841	20.1756	20.0144	19.5574	19.0225	18.5891 (92)	
Temperature adjustment												0.0000	
adjusted MIT	18.6077	18.7867	19.0881	19.5023	19.8662	20.1109	20.1841	20.1756	20.0144	19.5574	19.0225	18.5891 (93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9885	0.9811	0.9656	0.9267	0.8409	0.6818	0.5051	0.5573	0.7967	0.9414	0.9809	0.9905 (94)
Useful gains	471.7582	528.9657	572.2919	598.8584	574.2416	456.5109	322.0341	332.7131	441.6148	473.2217	454.5903	448.5347 (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												
	1390.6445	1345.4595	1215.8557	1009.0759	775.0623	516.2575	335.7555	352.8347	556.8642	850.1543	1137.9468	1381.4186 (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												
	683.6514	548.6839	478.8115	295.3566	149.4106	0.0000	0.0000	0.0000	0.0000	280.4379	492.0167	694.0656 (98)
Space heating												3622.4341 (98)
Space heating per m2												(98) / (4) = 42.8488 (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													3993.8634 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	683.6514	548.6839	478.8115	295.3566	149.4106	0.0000	0.0000	0.0000	0.0000	280.4379	492.0167	694.0656	(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)	753.7502	604.9436	527.9068	325.6412	164.7306	0.0000	0.0000	0.0000	0.0000	309.1928	542.4660	765.2322	(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	179.6452	157.8421	164.5589	145.8437	141.7081	124.8845	118.2961	132.0822	132.5696	151.3257	162.1114	174.7629	(64)
Efficiency of water heater	89.9487	89.8939	89.7783	89.5124	88.9619	87.2000	87.2000	87.2000	87.2000	89.4418	89.8067	87.2000	(216)
(217)m	89.9487	89.8939	89.7783	89.5124	88.9619	87.2000	87.2000	87.2000	87.2000	89.4418	89.8067	89.9736	(217)
Fuel for water heating, kWh/month	199.7196	175.5871	183.2947	162.9314	159.2909	143.2162	135.6606	151.4705	152.0293	169.1891	180.5115	194.2380	(219)
Water heating fuel used												2007.1387	(219)
Annual totals kWh/year													
Space heating fuel - main system												3993.8634	(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)												379.9583	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.75 * 853 * 1.00) =										-511.8180		-511.8180	(233)
Total delivered energy for all uses												5944.1425	(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	3993.8634	0.2160	862.6745	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2007.1387	0.2160	433.5420	(264)
Space and water heating			1296.2165	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	379.9583	0.5190	197.1983	(268)
Energy saving/generation technologies				
PV Unit	-511.8180	0.5190	-265.6335	(269)
Total CO2, kg/year			1266.7063	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			14.9800	(273)

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

DER			14.9800	ZC1
Total Floor Area		TFA	84.5400	
Assumed number of occupants		N	2.5434	
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190	
CO2 emissions from appliances, equation (L14)			16.0283	ZC2
CO2 emissions from cooking, equation (L16)			2.1297	ZC3
Total CO2 emissions			33.1380	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			33.1380	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	42.2700 (1b)	x 2.3900 (2b)	= 101.0253 (1b) - (3b)
First floor	42.2700 (1c)	x 2.6100 (2c)	= 110.3247 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	84.5400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 211.3500 (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) = 0.1419 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3919 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3332 (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	0.4248	0.4164	0.4081	0.3665	0.3581	0.3165	0.3165	0.3082	0.3332	0.3581	0.3748	0.3915 (22b)
Effective ac	0.5902	0.5867	0.5833	0.5671	0.5641	0.5501	0.5501	0.5475	0.5555	0.5641	0.5702	0.5766 (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)			12.7800	1.3258	16.9432		(27)
Ground Floor			42.2700	0.1300	5.4951		(28a)
Brick and Block	75.7100	12.7500	62.9600	0.1800	11.3328		(29a)
Tile Hung	17.8000	2.1800	15.6200	0.1800	2.8116		(29a)
Step Party Wall	3.8000		3.8000	0.1800	0.6840		(29a)
Pitched Roof	42.2700		42.2700	0.1300	5.4951		(30)
Total net area of external elements Aum(A, m ²)			181.8500				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	44.9118		(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)							11.4422 (36)
Total fabric heat loss						(33) + (36) =	56.3540 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	41.1648	40.9205	40.6810	39.5561	39.3457	38.3659	38.3659	38.1845	38.7433	39.3457	39.7714	40.2165 (38)
Average = Sum(39)m / 12 =	97.5188	97.2745	97.0350	95.9101	95.6996	94.7199	94.7199	94.5385	95.0973	95.6996	96.1254	96.5705 (39)
												95.9091 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1535	1.1506	1.1478	1.1345	1.1320	1.1204	1.1204	1.1183	1.1249	1.1320	1.1370	1.1423 (40)
Days in month												1.1345 (40)
	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.5434 (42)
Average daily hot water use (litres/day)												94.6054 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												
Energy conte	104.0659	100.2817	96.4975	92.7132	88.9290	85.1448	85.1448	88.9290	92.7132	96.4975	100.2817	104.0659 (44)
Energy content (annual)	154.3267	134.9751	139.2822	121.4296	116.5146	100.5433	93.1681	106.9118	108.1886	126.0834	137.6299	149.4572 (45)
Distribution loss	Total = Sum(45)m = 1488.5106 (45)											
	23.1490	20.2463	20.8923	18.2144	17.4772	15.0815	13.9752	16.0368	16.2283	18.9125	20.6445	22.4186 (46)
Water storage loss:												
Total storage loss:												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (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	50.9589	46.0274	49.1740	45.7216	45.3173	41.9892	43.3889	45.3173	45.7216	49.1740	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month	205.2856	181.0025	188.4563	167.1512	161.8319	142.5325	136.5570	152.2290	153.9102	175.2575	186.9450	200.4161 (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	205.2856	181.0025	188.4563	167.1512	161.8319	142.5325	136.5570	152.2290	153.9102	175.2575	186.9450	200.4161 (64)
Heat gains from water heating, kWh/month	64.0534	56.3861	58.6049	51.8058	50.0704	43.9279	41.8256	46.8775	47.4031	54.2162	58.0907	62.4342 (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	127.1692	127.1692	127.1692	127.1692	127.1692	127.1692	127.1692	127.1692	127.1692	127.1692	127.1692	127.1692	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.5148	19.1093	15.5407	11.7653	8.7947	7.4249	8.0228	10.4284	13.9969	17.7723	20.7429	22.1128	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	228.6671	231.0400	225.0605	212.3308	196.2619	181.1594	171.0700	168.6972	174.6767	187.4063	203.4752	218.5777	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.7169	35.7169	35.7169	35.7169	35.7169	35.7169	35.7169	35.7169	35.7169	35.7169	35.7169	35.7169	(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)	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	(71)
Water heating gains (Table 5)	86.0932	83.9079	78.7700	71.9524	67.2990	61.0110	56.2172	63.0074	65.8377	72.8713	80.6815	83.9170	(72)
Total internal gains	400.4259	398.2078	383.5219	360.1993	336.5063	313.7460	299.4608	306.2836	318.6620	342.2007	369.0504	388.7582	(73)

6. Solar gains

[Jan]													
	Area m2			Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W	
North	7.7200			10.6334		0.6300		0.7000		0.7700		25.0877 (74)	
South	3.6200			46.7521		0.6300		0.7000		0.7700		51.7227 (78)	
West	1.4400			19.6403		0.6300		0.7000		0.7700		8.6433 (80)	
Solar gains	85.4537	149.5606	217.2173	293.4244	353.1334	361.9618	344.1877	297.4938	243.0548	168.5000	103.0352	72.7154	(83)
Total gains	485.8797	547.7684	600.7392	653.6237	689.6398	675.7079	643.6485	603.7775	561.7168	510.7007	472.0856	461.4736	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	60.2021	60.3533	60.5022	61.2118	61.3464	61.9810	61.9810	62.0999	61.7350	61.3464	61.0747	60.7932	
alpha	5.0135	5.0236	5.0335	5.0808	5.0898	5.1321	5.1321	5.1400	5.1157	5.0898	5.0716	5.0529	
util living area	0.9984	0.9967	0.9921	0.9756	0.9220	0.7884	0.6211	0.6772	0.8940	0.9834	0.9967	0.9988	(86)
MIT	19.7305	19.8668	20.0986	20.4176	20.7168	20.9179	20.9810	20.9710	20.8282	20.4505	20.0361	19.7079	(87)
Th 2	19.9574	19.9597	19.9620	19.9728	19.9748	19.9842	19.9842	19.9859	19.9806	19.9748	19.9707	19.9664	(88)
util rest of house	0.9978	0.9955	0.9891	0.9655	0.8878	0.7016	0.4909	0.5484	0.8346	0.9747	0.9953	0.9983	(89)
MIT 2	18.2629	18.4636	18.8029	19.2697	19.6815	19.9254	19.9767	19.9730	19.8328	19.3228	18.7192	18.2363	(90)
Living area fraction									fLA = Living area / (4) =			0.2110	(91)
MIT	18.5726	18.7597	19.0763	19.5119	19.9000	20.1349	20.1887	20.1836	20.0428	19.5608	18.9971	18.5468	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5726	18.7597	19.0763	19.5119	19.9000	20.1349	20.1887	20.1836	20.0428	19.5608	18.9971	18.5468	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	484.2603	544.2277	592.0072	627.1865	610.1307	483.7742	333.7388	347.3972	471.2928	495.2734	468.9524	460.2816	(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	1391.8478	1348.1950	1220.3415	1017.7899	784.7328	524.2634	339.9185	357.6986	565.1482	857.5434	1143.6164	1385.4782	(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	675.2452	540.2660	467.4807	281.2344	129.9040	0.0000	0.0000	0.0000	0.0000	269.5289	485.7581	688.3463	(98)
Space heating												3537.7636	(98)
Space heating per m2												(98) / (4) =	41.8472 (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												3787.7554 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	675.2452	540.2660	467.4807	281.2344	129.9040	0.0000	0.0000	0.0000	0.0000	269.5289	485.7581	688.3463 (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)	722.9605	578.4433	500.5147	301.1075	139.0835	0.0000	0.0000	0.0000	0.0000	288.5748	520.0836	736.9874 (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	205.2856	181.0025	188.4563	167.1512	161.8319	142.5325	136.5570	152.2290	153.9102	175.2575	186.9450	200.4161 (64)
Efficiency of water heater (217)m	87.8247	87.6339	87.2471	86.3511	84.5040	80.3000	80.3000	80.3000	80.3000	86.1313	87.3469	80.3000 (216)
Fuel for water heating, kWh/month	233.7449	206.5439	216.0028	193.5715	191.5079	177.5000	170.0585	189.5754	191.6690	203.4770	214.0259	227.9873 (219)
Water heating fuel used												2415.6642 (219)
Annual totals kWh/year												
Space heating fuel - main system												3787.7554 (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)												379.9583 (232)
Total delivered energy for all uses												6658.3779 (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	3787.7554	0.2160	818.1552 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2415.6642	0.2160	521.7835 (264)
Space and water heating			1339.9386 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	379.9583	0.5190	197.1983 (268)
Total CO2, kg/m2/year			1576.0620 (272)
Emissions per m2 for space and water heating			15.8498 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.3326 (272b)
Emissions per m2 for pumps and fans			0.4604 (272c)
Target Carbon Dioxide Emission Rate (TER) = (15.8498 * 1.00) + 2.3326 + 0.4604, rounded to 2 d.p.			18.6400 (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	42.2700 (1b)	x 2.3900 (2b)	= 101.0253 (1b) - (3b)
First floor	42.2700 (1c)	x 2.6100 (2c)	= 110.3247 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	84.5400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 211.3500 (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) = 0.1419 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3919 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3332 (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	0.4248	0.4164	0.4081	0.3665	0.3581	0.3165	0.3165	0.3082	0.3332	0.3581	0.3748	0.3915 (22b)
Effective ac	0.5902	0.5867	0.5833	0.5671	0.5641	0.5501	0.5501	0.5475	0.5555	0.5641	0.5702	0.5766 (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)			12.7800	1.1450	14.6336		(27)
Ground Floor			42.2700	0.1200	5.0724	84.0000	3550.6800 (28a)
Brick and Block	75.7100	12.7500	62.9600	0.2400	15.1104	42.2200	2658.1712 (29a)
Tile Hung	17.8000	2.1800	15.6200	0.2400	3.7488	42.2200	659.4764 (29a)
Step Party Wall	3.8000		3.8000	0.2600	0.9880	58.0600	220.6280 (29a)
Pitched Roof	42.2700		42.2700	0.1000	4.2270	9.1000	384.6570 (30)
Total net area of external elements Aum(A, m ²)			181.8500				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	46.1452		(33)
Party Wall 1			38.4300	0.0000	0.0000	110.0000	4227.3000 (32)
Ground Floor Stud			62.1500			9.0000	559.3500 (32c)
First Floor Stud			92.8300			9.0000	835.4700 (32c)
Internal Floor 1			42.2700			18.0000	760.8600 (32d)
Internal Ceiling 1			42.2700			9.0000	380.4300 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	14237.0226 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							168.4058 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.2747 (36)
Total fabric heat loss						(33) + (36) =	54.4199 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	41.1648	40.9205	40.6810	39.5561	39.3457	38.3659	38.3659	38.1845	38.7433	39.3457	39.7714	40.2165 (38)
Heat transfer coeff	95.5847	95.3404	95.1009	93.9760	93.7655	92.7858	92.7858	92.6044	93.1632	93.7655	94.1913	94.6364 (39)
Average = Sum(39)m / 12 =												93.9750 (39)
HLP	1.1306	1.1278	1.1249	1.1116	1.1091	1.0975	1.0975	1.0954	1.1020	1.1091	1.1142	1.1194 (40)
HLP (average)												1.1116 (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												2.5434 (42)
Average daily hot water use (litres/day)												94.6054 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	104.0659	100.2817	96.4975	92.7132	88.9290	85.1448	85.1448	88.9290	92.7132	96.4975	100.2817	104.0659 (44)

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Energy content (annual)	154.3267	134.9751	139.2822	121.4296	116.5146	100.5433	93.1681	106.9118	108.1886	126.0834	137.6299	149.4572 (45)
Distribution loss (46)m = 0.15 x (45)m										Total =	Sum(45)m =	1488.5106 (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)
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	32.7944	28.6822	29.5975	25.8038	24.7594	21.3654	19.7982	22.7188	22.9901	26.7927	29.2464	31.7596 (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	127.1692	127.1692	127.1692	127.1692	127.1692	127.1692	127.1692	127.1692	127.1692	127.1692	127.1692	127.1692 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.5148	19.1093	15.5407	11.7653	8.7947	7.4249	8.0228	10.4284	13.9969	17.7723	20.7429	22.1128 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	228.6671	231.0400	225.0605	212.3308	196.2619	181.1594	171.0700	168.6972	174.6767	187.4063	203.4752	218.5777 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.7169	35.7169	35.7169	35.7169	35.7169	35.7169	35.7169	35.7169	35.7169	35.7169	35.7169	35.7169 (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)	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353 (71)
Water heating gains (Table 5)	44.0785	42.6819	39.7816	35.8386	33.2787	29.6742	26.6105	30.5360	31.9307	36.0117	40.6199	42.6877 (72)
Total internal gains	355.4112	353.9819	341.5335	321.0855	299.4861	279.4092	266.8541	270.8122	281.7550	302.3411	325.9888	344.5290 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	7.7200	10.6334	0.6300	0.7000	0.7700	25.0877 (74)
South	3.6200	46.7521	0.6300	0.7000	0.7700	51.7227 (78)
West	1.4400	19.6403	0.6300	0.7000	0.7700	8.6433 (80)

Solar gains	85.4537	149.5606	217.2173	293.4244	353.1334	361.9618	344.1877	297.4938	243.0548	168.5000	103.0352	72.7154 (83)
Total gains	440.8650	503.5424	558.7508	614.5099	652.6195	641.3711	611.0418	568.3061	524.8098	470.8411	429.0240	417.2443 (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	41.3741	41.4801	41.5846	42.0823	42.1768	42.6221	42.6221	42.7056	42.4495	42.1768	41.9861	41.7887
alpha	3.7583	3.7653	3.7723	3.8055	3.8118	3.8415	3.8415	3.8470	3.8300	3.8118	3.7991	3.7859
util living area	0.9942	0.9898	0.9800	0.9534	0.8892	0.7618	0.6132	0.6673	0.8648	0.9668	0.9903	0.9953 (86)
MIT	19.2581	19.4395	19.7476	20.1668	20.5588	20.8404	20.9491	20.9290	20.7137	20.2136	19.6641	19.2281 (87)
Th 2	19.9759	19.9782	19.9805	19.9914	19.9934	20.0028	20.0028	20.0046	19.9992	19.9934	19.9893	19.9850 (88)
util rest of house	0.9929	0.9874	0.9749	0.9403	0.8553	0.6865	0.4961	0.5535	0.8108	0.9550	0.9875	0.9942 (89)
MIT 2	18.3803	18.5626	18.8699	19.2893	19.6615	19.9103	19.9837	19.9754	19.8113	19.3414	18.7954	18.3573 (90)
Living area fraction									fLA = Living area / (4) =			0.2110 (91)
MIT	18.5655	18.7476	19.0551	19.4745	19.8509	20.1066	20.1875	20.1766	20.0017	19.5254	18.9787	18.5411 (92)
Temperature adjustment												0.0000
adjusted MIT	18.5655	18.7476	19.0551	19.4745	19.8509	20.1066	20.1875	20.1766	20.0017	19.5254	18.9787	18.5411 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	436.5620	495.1935	541.3388	572.7088	554.5157	445.9295	317.3526	326.7717	425.6209	446.3085	422.0209	413.9096 (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	1363.5649	1320.2392	1193.9982	993.7494	764.2704	510.9355	332.8656	349.7333	549.8208	836.8991	1118.8704	1357.1858 (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	689.6902	554.4307	485.5786	303.1492	156.0575	0.0000	0.0000	0.0000	0.0000	290.5994	501.7317	701.7975 (98)
Space heating												3683.0347 (98)
Space heating per m2										(98) / (4) =		43.5656 (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												

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Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	872.1864	686.6148	703.7931	0.0000	0.0000	0.0000	0.0000 (100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.7809	0.8526	0.8229	0.0000	0.0000	0.0000	0.0000 (101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	681.0743	585.3912	579.1590	0.0000	0.0000	0.0000	0.0000 (102)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	845.3672	807.9646	759.7851	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	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	0.0000	0.0000	0.0000	0.0000	0.0000	118.2909	165.5946	134.3858	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction									fC = cooled area / (4) =			418.2713 (104)
Intermittency factor (Table 10b)												1.0000 (105)
Space cooling kWh	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	0.0000	0.0000	0.0000	0.0000	0.0000	29.5727	41.3986	33.5964	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling per m2												104.5678 (107)
Energy for space heating												1.2369 (108)
Energy for space cooling												43.5656 (99)
Total												1.2369 (108)
Dwelling Fabric Energy Efficiency (DFEE)												44.8025 (109)
												44.8 (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	42.2700 (1b)	x 2.3900 (2b)	= 101.0253 (1b) - (3b)
First floor	42.2700 (1c)	x 2.6100 (2c)	= 110.3247 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	84.5400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 211.3500 (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) = 0.1419 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3919 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3332 (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	0.4248	0.4164	0.4081	0.3665	0.3581	0.3165	0.3165	0.3082	0.3332	0.3581	0.3748	0.3915 (22b)
Effective ac	0.5902	0.5867	0.5833	0.5671	0.5641	0.5501	0.5501	0.5475	0.5555	0.5641	0.5702	0.5766 (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)			12.7800	1.3258	16.9432		(27)
Ground Floor			42.2700	0.1300	5.4951		(28a)
Brick and Block	75.7100	12.7500	62.9600	0.1800	11.3328		(29a)
Tile Hung	17.8000	2.1800	15.6200	0.1800	2.8116		(29a)
Step Party Wall	3.8000		3.8000	0.1800	0.6840		(29a)
Pitched Roof	42.2700		42.2700	0.1300	5.4951		(30)
Total net area of external elements Aum(A, m ²)			181.8500				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	44.9118		(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)							11.4422 (36)
Total fabric heat loss						(33) + (36) =	56.3540 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	41.1648	40.9205	40.6810	39.5561	39.3457	38.3659	38.3659	38.1845	38.7433	39.3457	39.7714	40.2165 (38)
Heat transfer coeff	97.5188	97.2745	97.0350	95.9101	95.6996	94.7199	94.7199	94.5385	95.0973	95.6996	96.1254	96.5705 (39)
Average = Sum(39)m / 12 =												95.9091 (39)
HLP	1.1535	1.1506	1.1478	1.1345	1.1320	1.1204	1.1204	1.1183	1.1249	1.1320	1.1370	1.1423 (40)
HLP (average)												1.1345 (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												2.5434 (42)
Average daily hot water use (litres/day)												94.6054 (43)
Daily hot water use	104.0659	100.2817	96.4975	92.7132	88.9290	85.1448	85.1448	88.9290	92.7132	96.4975	100.2817	104.0659 (44)
Energy conte	154.3267	134.9751	139.2822	121.4296	116.5146	100.5433	93.1681	106.9118	108.1886	126.0834	137.6299	149.4572 (45)
Energy content (annual)												1488.5106 (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												

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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 (56)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Heat gains from water heating, kWh/month	32.7944	28.6822	29.5975	25.8038	24.7594	21.3654	19.7982	22.7188	22.9901	26.7927	29.2464	31.7596 (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	127.1692	127.1692	127.1692	127.1692	127.1692	127.1692	127.1692	127.1692	127.1692	127.1692	127.1692	127.1692 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.5148	19.1093	15.5407	11.7653	8.7947	7.4249	8.0228	10.4284	13.9969	17.7723	20.7429	22.1128 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	228.6671	231.0400	225.0605	212.3308	196.2619	181.1594	171.0700	168.6972	174.6767	187.4063	203.4752	218.5777 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.7169	35.7169	35.7169	35.7169	35.7169	35.7169	35.7169	35.7169	35.7169	35.7169	35.7169	35.7169 (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)	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353 (71)
Water heating gains (Table 5)	44.0785	42.6819	39.7816	35.8386	33.2787	29.6742	26.6105	30.5360	31.9307	36.0117	40.6199	42.6877 (72)
Total internal gains	355.4112	353.9819	341.5335	321.0855	299.4861	279.4092	266.8541	270.8122	281.7550	302.3411	325.9888	344.5290 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	Access factor Table 6d	Gains W
North	7.7200	10.6334	0.6300	0.7000	0.7700	25.0877 (74)
South	3.6200	46.7521	0.6300	0.7000	0.7700	51.7227 (78)
West	1.4400	19.6403	0.6300	0.7000	0.7700	8.6433 (80)

Solar gains	85.4537	149.5606	217.2173	293.4244	353.1334	361.9618	344.1877	297.4938	243.0548	168.5000	103.0352	72.7154 (83)
Total gains	440.8650	503.5424	558.7508	614.5099	652.6195	641.3711	611.0418	568.3061	524.8098	470.8411	429.0240	417.2443 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	60.2021	60.3533	60.5022	61.2118	61.3464	61.9810	61.9810	62.0999	61.7350	61.3464	61.0747	60.7932
alpha	5.0135	5.0236	5.0335	5.0808	5.0898	5.1321	5.1321	5.1400	5.1157	5.0898	5.0716	5.0529
util living area	0.9990	0.9977	0.9942	0.9810	0.9352	0.8124	0.6484	0.7089	0.9143	0.9882	0.9979	0.9992 (86)
MIT	19.6809	19.8184	20.0537	20.3787	20.6883	20.9049	20.9770	20.9643	20.8032	20.4093	19.9889	19.6590 (87)
Th 2	19.9574	19.9597	19.9620	19.9728	19.9748	19.9842	19.9842	19.9859	19.9806	19.9748	19.9707	19.9664 (88)
util rest of house	0.9986	0.9969	0.9920	0.9729	0.9051	0.7286	0.5153	0.5789	0.8619	0.9818	0.9970	0.9990 (89)
MIT 2	18.7510	18.8901	19.1262	19.4557	19.7505	19.9365	19.9779	19.9747	19.8612	19.4901	19.0693	18.7363 (90)
Living area fraction									fLA = Living area / (4) =			0.2110 (91)
MIT	18.9472	19.0860	19.3220	19.6505	19.9484	20.1409	20.1887	20.1835	20.0600	19.6840	19.2634	18.9310 (92)
Temperature adjustment												0.0000
adjusted MIT	18.9472	19.0860	19.3220	19.6505	19.9484	20.1409	20.1887	20.1835	20.0600	19.6840	19.2634	18.9310 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9981	0.9960	0.9901	0.9696	0.9041	0.7432	0.5438	0.6065	0.8669	0.9793	0.9961	0.9986 (94)
Useful gains	440.0239	501.5173	553.2324	595.8017	590.0393	476.6764	332.2761	344.6601	454.9546	461.0882	427.3388	416.6442 (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	1428.3792	1379.9356	1244.1782	1031.0777	789.3681	524.8311	339.9226	357.6907	566.7818	869.3397	1169.2080	1422.5813 (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	735.3363	590.2971	514.0637	313.3987	148.3006	0.0000	0.0000	0.0000	0.0000	303.7390	534.1459	748.4172 (98)
Space heating												3887.6986 (98)
Space heating per m2										(98) / (4) =		45.9865 (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	890.3672	700.9273	718.4924	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8145	0.8902	0.8596	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	725.1790	623.9432	617.6108	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	845.3672	807.9646	759.7851	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												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	86.5355	136.9119	105.7777	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												329.2252 (104)
Cooled fraction									FC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	21.6339	34.2280	26.4444	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												82.3063 (107)
Space cooling per m2												0.9736 (108)
Energy for space heating												45.9865 (99)
Energy for space cooling												0.9736 (108)
Total												46.9601 (109)
Target Fabric Energy Efficiency (TFEE)												54.0 (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	42.2700 (1b)	x 2.3900 (2b)	= 101.0253 (1b) - (3b)
First floor	42.2700 (1c)	x 2.6100 (2c)	= 110.3247 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	84.5400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 211.3500 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.1893 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4393 (18)
Number of sides sheltered					2 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.8500 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3734 (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	0.4760	0.4387	0.4294	0.4014	0.4014	0.3734	0.3734	0.3640	0.3734	0.4200	0.4107	0.4387 (22b)
Effective ac	0.6133	0.5962	0.5922	0.5806	0.5806	0.5697	0.5697	0.5663	0.5697	0.5882	0.5843	0.5962 (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)			12.7800	1.1450	14.6336		(27)
Ground Floor			42.2700	0.1200	5.0724	84.0000	3550.6800 (28a)
Brick and Block	75.7100	12.7500	62.9600	0.2400	15.1104	42.2200	2658.1712 (29a)
Tile Hung	17.8000	2.1800	15.6200	0.2400	3.7488	42.2200	659.4764 (29a)
Step Party Wall	3.8000		3.8000	0.2600	0.9880	58.0600	220.6280 (29a)
Pitched Roof	42.2700		42.2700	0.1000	4.2270	9.1000	384.6570 (30)
Total net area of external elements Aum(A, m ²)			181.8500				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	46.1452		(33)
Party Wall 1			38.4300	0.0000	0.0000	110.0000	4227.3000 (32)
Ground Floor Stud			62.1500			9.0000	559.3500 (32c)
First Floor Stud			92.8300			9.0000	835.4700 (32c)
Internal Floor 1			42.2700			18.0000	760.8600 (32d)
Internal Ceiling 1			42.2700			18.0000	760.8600 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	14617.4526 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							172.9058 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.2747 (36)
Total fabric heat loss						(33) + (36) =	54.4199 (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	42.7757	41.5846	41.3020	40.4908	40.4908	39.7342	39.7342	39.4942	39.7342	41.0255	40.7551	41.5846 (38)
Heat transfer coeff	97.1955	96.0045	95.7219	94.9106	94.9106	94.1541	94.1541	93.9140	94.1541	95.4454	95.1750	96.0045 (39)
Average = Sum(39)m / 12 =												95.1453 (39)
HLP	1.1497	1.1356	1.1323	1.1227	1.1227	1.1137	1.1137	1.1109	1.1137	1.1290	1.1258	1.1356 (40)
HLP (average)												1.1254 (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												2.5434 (42)
Average daily hot water use (litres/day)												94.6054 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	104.0659	100.2817	96.4975	92.7132	88.9290	85.1448	85.1448	88.9290	92.7132	96.4975	100.2817	104.0659 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Energy content (annual)	154.3267	134.9751	139.2822	121.4296	116.5146	100.5433	93.1681	106.9118	108.1886	126.0834	137.6299	149.4572 (45)
Distribution loss (46)m = 0.15 x (45)m	23.1490	20.2463	20.8923	18.2144	17.4772	15.0815	13.9752	16.0368	16.2283	18.9125	20.6445	1488.5106 (45)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	25.3185	22.8670	25.2767	24.4141	25.1935	24.3412	25.1280	25.1705	24.3809	25.2423	24.4815	25.3057 (61)
Total heat required for water heating calculated for each month	179.6452	157.8421	164.5589	145.8437	141.7081	124.8845	118.2961	132.0822	132.5696	151.3257	162.1114	174.7629 (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	179.6452	157.8421	164.5589	145.8437	141.7081	124.8845	118.2961	132.0822	132.5696	151.3257	162.1114	174.7629 (64)
RHI water heating demand	57.6433	50.5960	52.6305	46.4789	45.0395	39.5159	37.2604	41.8408	42.0680	48.2333	51.8823	1785.6304 (64)
Heat gains from water heating, kWh/month												1786 (64)
	57.6433	50.5960	52.6305	46.4789	45.0395	39.5159	37.2604	41.8408	42.0680	48.2333	51.8823	56.0209 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	152.6030	152.6030	152.6030	152.6030	152.6030	152.6030	152.6030	152.6030	152.6030	152.6030	152.6030	152.6030 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	53.7870	47.7732	38.8517	29.4133	21.9868	18.5622	20.0571	26.0709	34.9923	44.4308	51.8573	55.2819 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	341.2942	344.8358	335.9112	316.9117	292.9282	270.3872	255.3284	251.7868	260.7114	279.7109	303.6944	326.2354 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.8037	52.8037	52.8037	52.8037	52.8037	52.8037	52.8037	52.8037	52.8037	52.8037	52.8037	52.8037 (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)	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353 (71)
Water heating gains (Table 5)	77.4775	75.2916	70.7399	64.5540	60.5370	54.8833	50.0812	56.2376	58.4277	64.8297	72.0588	75.2970 (72)
Total internal gains	579.2301	574.5719	552.1742	517.5503	482.1233	450.5039	432.1379	440.7667	460.8028	495.6428	534.2818	563.4857 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
North				7.7200	13.8645	0.6300	0.7000	0.7700	32.7111 (74)			
South				3.6200	58.2505	0.6300	0.7000	0.7700	64.4437 (78)			
West				1.4400	25.9136	0.6300	0.7000	0.7700	11.4041 (80)			
Solar gains	108.5589	162.9554	237.1425	329.0917	380.3359	422.5692	391.9599	344.7213	282.3756	194.6452	129.8102	88.1438 (83)
Total gains	687.7890	737.5273	789.3167	846.6420	862.4592	873.0731	824.0978	785.4880	743.1784	690.2880	664.0920	651.6295 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	41.7756	42.2939	42.4188	42.7813	42.7813	43.1251	43.1251	43.2353	43.1251	42.5416	42.6625	42.2939
alpha	3.7850	3.8196	3.8279	3.8521	3.8521	3.8750	3.8750	3.8824	3.8750	3.8361	3.8442	3.8196
util living area	0.9719	0.9628	0.9376	0.8785	0.7616	0.5669	0.4139	0.4318	0.6747	0.8764	0.9512	0.9756 (86)
MIT	19.7545	19.8815	20.1571	20.4998	20.7924	20.9521	20.9892	20.9877	20.9059	20.5968	20.1614	19.7435 (87)
Th 2	19.9605	19.9719	19.9746	19.9824	19.9824	19.9896	19.9896	19.9920	19.9896	19.9772	19.9798	19.9719 (88)
util rest of house	0.9654	0.9543	0.9229	0.8494	0.7046	0.4780	0.3051	0.3192	0.5881	0.8389	0.9380	0.9698 (89)
MIT 2	18.8568	18.9896	19.2594	19.5886	19.8449	19.9677	19.9869	19.9888	19.9411	19.6799	19.2717	18.8553 (90)
Living area fraction	19.0463	19.1778	19.4488	19.7809	20.0448	20.1755	20.1985	20.1996	fLA = Living area / (4) =	20.1447	19.8733	19.4595 (91)
MIT	19.0463	19.1778	19.4488	19.7809	20.0448	20.1755	20.1985	20.1996	20.1447	19.8733	19.4595	19.0427 (92)
Temperature adjustment												0.0000
adjusted MIT	19.0463	19.1778	19.4488	19.7809	20.0448	20.1755	20.1985	20.1996	20.1447	19.8733	19.4595	19.0427 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	658.9713	697.8362	721.3165	713.5629	611.0001	432.2792	270.3696	269.3859	447.7321	575.9996	617.3447	627.5353 (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	1326.3554	1293.9320	1162.9090	966.2788	706.5930	449.6281	272.9014	272.3134	484.3977	770.5635	1052.5840	1300.1612 (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	496.5338	400.5764	328.5448	181.9554	71.1211	0.0000	0.0000	0.0000	0.0000	144.7555	313.3723	500.4337 (98)
Space heating												2437.2930 (98)
RHI space heating demand												2437 (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	42.2700 (1b)	x 2.3900 (2b)	= 101.0253 (1b) - (3b)
First floor	42.2700 (1c)	x 2.6100 (2c)	= 110.3247 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	84.5400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 211.3500 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.1893 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4393 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3734 (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	0.4760	0.4667	0.4574	0.4107	0.4014	0.3547	0.3547	0.3454	0.3734	0.4014	0.4200	0.4387 (22b)
Effective ac	0.6133	0.6089	0.6046	0.5843	0.5806	0.5629	0.5629	0.5596	0.5697	0.5806	0.5882	0.5962 (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)			12.7800	1.1450	14.6336		(27)
Ground Floor			42.2700	0.1200	5.0724	84.0000	3550.6800 (28a)
Brick and Block	75.7100	12.7500	62.9600	0.2400	15.1104	42.2200	2658.1712 (29a)
Tile Hung	17.8000	2.1800	15.6200	0.2400	3.7488	42.2200	659.4764 (29a)
Step Party Wall	3.8000		3.8000	0.2600	0.9880	58.0600	220.6280 (29a)
Pitched Roof	42.2700		42.2700	0.1000	4.2270	9.1000	384.6570 (30)
Total net area of external elements Aum(A, m ²)			181.8500				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	46.1452		(33)
Party Wall 1			38.4300	0.0000	0.0000	110.0000	4227.3000 (32)
Ground Floor Stud			62.1500			9.0000	559.3500 (32c)
First Floor Stud			92.8300			9.0000	835.4700 (32c)
Internal Floor 1			42.2700			18.0000	760.8600 (32d)
Internal Ceiling 1			42.2700			18.0000	760.8600 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	14617.4526 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							172.9058 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.2747 (36)
Total fabric heat loss						(33) + (36) =	54.4199 (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	42.7757	42.4688	42.1680	40.7551	40.4908	39.2602	39.2602	39.0323	39.7342	40.4908	41.0255	41.5846 (38)
Heat transfer coeff	97.1955	96.8886	96.5878	95.1750	94.9106	93.6801	93.6801	93.4522	94.1541	94.9106	95.4454	96.0045 (39)
Average = Sum(39)m / 12 =												95.1737 (39)
HLP	1.1497	1.1461	1.1425	1.1258	1.1227	1.1081	1.1081	1.1054	1.1137	1.1227	1.1290	1.1356 (40)
HLP (average)												1.1258 (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												2.5434 (42)
Average daily hot water use (litres/day)												94.6054 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	104.0659	100.2817	96.4975	92.7132	88.9290	85.1448	85.1448	88.9290	92.7132	96.4975	100.2817	104.0659 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Energy conte	154.3267	134.9751	139.2822	121.4296	116.5146	100.5433	93.1681	106.9118	108.1886	126.0834	137.6299	149.4572 (45)
Energy content (annual)										Total =	Sum (45)m =	1488.5106 (45)
Distribution loss (46)m = 0.15 x (45)m	23.1490	20.2463	20.8923	18.2144	17.4772	15.0815	13.9752	16.0368	16.2283	18.9125	20.6445	22.4186 (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	25.3185	22.8670	25.2767	24.4141	25.1935	24.3412	25.1280	25.1705	24.3809	25.2423	24.4815	25.3057 (61)
Total heat required for water heating calculated for each month												
Solar input	179.6452	157.8421	164.5589	145.8437	141.7081	124.8845	118.2961	132.0822	132.5696	151.3257	162.1114	174.7629 (62)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) =	Sum (63)m =			0.0000 (63)
Output from w/h	179.6452	157.8421	164.5589	145.8437	141.7081	124.8845	118.2961	132.0822	132.5696	151.3257	162.1114	174.7629 (64)
								Total per year (kWh/year) =	Sum (64)m =			1785.6304 (64)
Heat gains from water heating, kWh/month												
	57.6433	50.5960	52.6305	46.4789	45.0395	39.5159	37.2604	41.8408	42.0680	48.2333	51.8823	56.0209 (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	152.6030	152.6030	152.6030	152.6030	152.6030	152.6030	152.6030	152.6030	152.6030	152.6030	152.6030	152.6030 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	53.7870	47.7732	38.8517	29.4133	21.9868	18.5622	20.0571	26.0709	34.9923	44.4308	51.8573	55.2819 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	341.2942	344.8358	335.9112	316.9117	292.9282	270.3872	255.3284	251.7868	260.7114	279.7109	303.6944	326.2354 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.8037	52.8037	52.8037	52.8037	52.8037	52.8037	52.8037	52.8037	52.8037	52.8037	52.8037	52.8037 (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)	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353 (71)
Water heating gains (Table 5)	77.4775	75.2916	70.7399	64.5540	60.5370	54.8833	50.0812	56.2376	58.4277	64.8297	72.0588	75.2970 (72)
Total internal gains	579.2301	574.5719	552.1742	517.5503	482.1233	450.5039	432.1379	440.7667	460.8028	495.6428	534.2818	563.4857 (73)

6. Solar gains

[Jan]				Area m ²	Solar flux Table 6a W/m ²	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W		
North				7.7200	10.6334	0.6300	0.7000	0.7700		25.0877 (74)		
South				3.6200	46.7521	0.6300	0.7000	0.7700		51.7227 (78)		
West				1.4400	19.6403	0.6300	0.7000	0.7700		8.6433 (80)		

Solar gains	85.4537	149.5606	217.2173	293.4244	353.1334	361.9618	344.1877	297.4938	243.0548	168.5000	103.0352	72.7154 (83)
Total gains	664.6838	724.1325	769.3915	810.9747	835.2567	812.4658	776.3256	738.2605	703.8576	664.1428	637.3170	636.2011 (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	41.7756	41.9079	42.0385	42.6625	42.7813	43.3433	43.3433	43.4490	43.1251	42.7813	42.5416	42.2939
alpha	3.7850	3.7939	3.8026	3.8442	3.8521	3.8896	3.8896	3.8966	3.8750	3.8521	3.8361	3.8196
util living area	0.9796	0.9701	0.9510	0.9060	0.8152	0.6613	0.5087	0.5505	0.7619	0.9167	0.9679	0.9825 (86)
MIT	19.5719	19.7392	20.0157	20.3840	20.7017	20.9076	20.9744	20.9651	20.8319	20.4407	19.9519	19.5438 (87)
Th 2	19.9605	19.9634	19.9663	19.9798	19.9824	19.9942	19.9942	19.9964	19.9896	19.9824	19.9772	19.9719 (88)
util rest of house	0.9750	0.9635	0.9397	0.8831	0.7692	0.5809	0.4020	0.4434	0.6913	0.8918	0.9595	0.9785 (89)
MIT 2	18.6764	18.8432	19.1161	19.4798	19.7699	19.9446	19.9854	19.9835	19.8889	19.5414	19.0654	18.6575 (90)
Living area fraction									fLA = Living area / (4) =			0.2110 (91)
MIT	18.8654	19.0323	19.3059	19.6706	19.9666	20.1478	20.1941	20.1906	20.0879	19.7312	19.2525	18.8445 (92)
Temperature adjustment												0.0000
adjusted MIT	18.8654	19.0323	19.3059	19.6706	19.9666	20.1478	20.1941	20.1906	20.0879	19.7312	19.2525	18.8445 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9688	0.9559	0.9308	0.8749	0.7684	0.5940	0.4240	0.4652	0.6989	0.8844	0.9521	0.9729 (94)
Useful gains	643.9691	692.1932	716.1289	709.5530	641.7727	482.6036	329.1739	343.4057	491.9523	587.3644	606.7584	618.9736 (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	1415.6884	1369.2582	1236.8970	1025.0937	784.5845	519.7225	336.6991	354.2416	563.7890	866.6433	1159.8998	1405.9389 (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	574.1592	454.9877	387.4514	227.1893	106.2520	0.0000	0.0000	0.0000	0.0000	207.7835	398.2618	585.5022 (98)
Space heating												2941.5871 (98)
Space heating per m ²										(98) / (4) =		34.7952 (99)

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													3243.2052 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	574.1592	454.9877	387.4514	227.1893	106.2520	0.0000	0.0000	0.0000	0.0000	207.7835	398.2618	585.5022	(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)	633.0310	501.6402	427.1791	250.4844	117.1466	0.0000	0.0000	0.0000	0.0000	229.0888	439.0980	645.5371	(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	179.6452	157.8421	164.5589	145.8437	141.7081	124.8845	118.2961	132.0822	132.5696	151.3257	162.1114	174.7629	(64)
Efficiency of water heater	89.8406	89.7719	89.6276	89.2987	88.6661	87.2000	87.2000	87.2000	87.2000	89.1914	89.6589	87.2000	(216)
(217)m												89.8708	(217)
Fuel for water heating, kWh/month	199.9599	175.8256	183.6030	163.3212	159.8222	143.2162	135.6606	151.4705	152.0293	169.6639	180.8090	194.4602	(219)
Water heating fuel used												2009.8415	(219)
Annual totals kWh/year													
Space heating fuel - main system												3243.2052	(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)												379.9583	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.75 * 853 * 1.00) =										-511.8180		-511.8180	(233)
Total delivered energy for all uses												5196.1870	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3243.2052	3.4800	112.8635 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2009.8415	3.4800	69.9425 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	379.9583	13.1900	50.1165 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-511.8180	13.1900	-67.5088 (252)
Total energy cost			295.3062 (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] =	0.9575 (257)
SAP value	86.6435	
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	3243.2052	0.2160	700.5323 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2009.8415	0.2160	434.1258 (264)
Space and water heating			1134.6581 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	379.9583	0.5190	197.1983 (268)
Energy saving/generation technologies			
PV Unit	-511.8180	0.5190	-265.6335 (269)
Total kg/year			1105.1479 (272)
CO2 emissions per m2			13.0700 (273)
EI value			88.5680
EI rating			89 (274)
EI band			B

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

Calculation of stars for heating and DHW

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9070 = 3.837$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9070 = 0.2381$, stars = 4
Water heating energy efficiency	$3.48 / 0.8873 = 3.922$, stars = 4
Water heating environmental impact	$0.216 / 0.8873 = 0.2434$, 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	42.2700 (1b)	x 2.3900 (2b)	= 101.0253 (1b) - (3b)
First floor	42.2700 (1c)	x 2.6100 (2c)	= 110.3247 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	84.5400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 211.3500 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.1893 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4393 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3734 (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												
Effective ac	0.4760	0.4387	0.4294	0.4014	0.4014	0.3734	0.3734	0.3640	0.3734	0.4200	0.4107	0.4387 (22b)
	0.6133	0.5962	0.5922	0.5806	0.5806	0.5697	0.5697	0.5663	0.5697	0.5882	0.5843	0.5962 (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)			12.7800	1.1450	14.6336		(27)
Ground Floor			42.2700	0.1200	5.0724	84.0000	3550.6800 (28a)
Brick and Block	75.7100	12.7500	62.9600	0.2400	15.1104	42.2200	2658.1712 (29a)
Tile Hung	17.8000	2.1800	15.6200	0.2400	3.7488	42.2200	659.4764 (29a)
Step Party Wall	3.8000		3.8000	0.2600	0.9880	58.0600	220.6280 (29a)
Pitched Roof	42.2700		42.2700	0.1000	4.2270	9.1000	384.6570 (30)
Total net area of external elements Aum(A, m ²)			181.8500				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	46.1452		(33)
Party Wall 1			38.4300	0.0000	0.0000	110.0000	4227.3000 (32)
Ground Floor Stud			62.1500			9.0000	559.3500 (32c)
First Floor Stud			92.8300			9.0000	835.4700 (32c)
Internal Floor 1			42.2700			18.0000	760.8600 (32d)
Internal Ceiling 1			42.2700			18.0000	760.8600 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	14617.4526 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							172.9058 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.2747 (36)
Total fabric heat loss						(33) + (36) =	54.4199 (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	42.7757	41.5846	41.3020	40.4908	40.4908	39.7342	39.7342	39.4942	39.7342	41.0255	40.7551	41.5846 (38)
Heat transfer coeff	97.1955	96.0045	95.7219	94.9106	94.9106	94.1541	94.1541	93.9140	94.1541	95.4454	95.1750	96.0045 (39)
Average = Sum(39)m / 12 =												95.1453 (39)
HLP	1.1497	1.1356	1.1323	1.1227	1.1227	1.1137	1.1137	1.1109	1.1137	1.1290	1.1258	1.1356 (40)
HLP (average)												1.1254 (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												2.5434 (42)
Average daily hot water use (litres/day)												94.6054 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	104.0659	100.2817	96.4975	92.7132	88.9290	85.1448	85.1448	88.9290	92.7132	96.4975	100.2817	104.0659 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Energy conte	154.3267	134.9751	139.2822	121.4296	116.5146	100.5433	93.1681	106.9118	108.1886	126.0834	137.6299	149.4572 (45)
Energy content (annual)										Total =	Sum(45)m =	1488.5106 (45)
Distribution loss (46)m = 0.15 x (45)m	23.1490	20.2463	20.8923	18.2144	17.4772	15.0815	13.9752	16.0368	16.2283	18.9125	20.6445	22.4186 (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	0.0000 (57)
Combi loss	25.3185	22.8670	25.2767	24.4141	25.1935	24.3412	25.1280	25.1705	24.3809	25.2423	24.4815	25.3057 (61)
Total heat required for water heating calculated for each month												
Solar input	179.6452	157.8421	164.5589	145.8437	141.7081	124.8845	118.2961	132.0822	132.5696	151.3257	162.1114	174.7629 (62)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Solar input (sum of months) =										Sum(63)m =		0.0000 (63)
Output from w/h	179.6452	157.8421	164.5589	145.8437	141.7081	124.8845	118.2961	132.0822	132.5696	151.3257	162.1114	174.7629 (64)
Total per year (kWh/year) =										Sum(64)m =		1785.6304 (64)
Heat gains from water heating, kWh/month												
57.6433	50.5960	52.6305	46.4789	45.0395	39.5159	37.2604	41.8408	42.0680	48.2333	51.8823	56.0209	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	152.6030	152.6030	152.6030	152.6030	152.6030	152.6030	152.6030	152.6030	152.6030	152.6030	152.6030	152.6030 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	53.7870	47.7732	38.8517	29.4133	21.9868	18.5622	20.0571	26.0709	34.9923	44.4308	51.8573	55.2819 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	341.2942	344.8358	335.9112	316.9117	292.9282	270.3872	255.3284	251.7868	260.7114	279.7109	303.6944	326.2354 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.8037	52.8037	52.8037	52.8037	52.8037	52.8037	52.8037	52.8037	52.8037	52.8037	52.8037	52.8037 (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)	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353 (71)
Water heating gains (Table 5)	77.4775	75.2916	70.7399	64.5540	60.5370	54.8833	50.0812	56.2376	58.4277	64.8297	72.0588	75.2970 (72)
Total internal gains	579.2301	574.5719	552.1742	517.5503	482.1233	450.5039	432.1379	440.7667	460.8028	495.6428	534.2818	563.4857 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c		Access factor Table 6d		Gains W	
North				7.7200	13.8645	0.6300	0.7000		0.7700		32.7111 (74)	
South				3.6200	58.2505	0.6300	0.7000		0.7700		64.4437 (78)	
West				1.4400	25.9136	0.6300	0.7000		0.7700		11.4041 (80)	
Solar gains	108.5589	162.9554	237.1425	329.0917	380.3359	422.5692	391.9599	344.7213	282.3756	194.6452	129.8102	88.1438 (83)
Total gains	687.7890	737.5273	789.3167	846.6420	862.4592	873.0731	824.0978	785.4880	743.1784	690.2880	664.0920	651.6295 (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	41.7756	42.2939	42.4188	42.7813	42.7813	43.1251	43.1251	43.2353	43.1251	42.5416	42.6625	42.2939	
alpha	3.7850	3.8196	3.8279	3.8521	3.8521	3.8750	3.8750	3.8824	3.8750	3.8361	3.8442	3.8196	
util living area	0.9719	0.9628	0.9376	0.8785	0.7616	0.5669	0.4139	0.4318	0.6747	0.8764	0.9512	0.9756 (86)	
MIT	19.7545	19.8815	20.1571	20.4998	20.7924	20.9521	20.9892	20.9877	20.9059	20.5968	20.1614	19.7435 (87)	
Th 2	19.9605	19.9719	19.9746	19.9824	19.9824	19.9896	19.9896	19.9920	19.9896	19.9772	19.9798	19.9719 (88)	
util rest of house	0.9654	0.9543	0.9229	0.8494	0.7046	0.4780	0.3051	0.3192	0.5881	0.8389	0.9380	0.9698 (89)	
MIT 2	18.8568	18.9896	19.2594	19.5886	19.8449	19.9677	19.9869	19.9888	19.9411	19.6799	19.2717	18.8553 (90)	
Living area fraction									fLA = Living area / (4) =				0.2110 (91)
MIT	19.0463	19.1778	19.4488	19.7809	20.0448	20.1755	20.1985	20.1996	20.1447	19.8733	19.4595	19.0427 (92)	
Temperature adjustment												0.0000	
adjusted MIT	19.0463	19.1778	19.4488	19.7809	20.0448	20.1755	20.1985	20.1996	20.1447	19.8733	19.4595	19.0427 (93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9581	0.9462	0.9138	0.8428	0.7084	0.4951	0.3281	0.3430	0.6025	0.8344	0.9296	0.9630 (94)
Useful gains	658.9713	697.8362	721.3165	713.5629	611.0001	432.2792	270.3696	269.3859	447.7321	575.9996	617.3447	627.5353 (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	1326.3554	1293.9320	1162.9090	966.2788	706.5930	449.6281	272.9014	272.3134	484.3977	770.5635	1052.5840	1300.1612 (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	496.5338	400.5764	328.5448	181.9554	71.1211	0.0000	0.0000	0.0000	0.0000	144.7555	313.3723	500.4337 (98)
Space heating												2437.2930 (98)
Space heating per m2										(98) / (4) =		28.8301 (99)

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													2687.2029 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	496.5338	400.5764	328.5448	181.9554	71.1211	0.0000	0.0000	0.0000	0.0000	144.7555	313.3723	500.4337	(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)	547.4463	441.6498	362.2324	200.6124	78.4136	0.0000	0.0000	0.0000	0.0000	159.5981	345.5042	551.7461	(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	179.6452	157.8421	164.5589	145.8437	141.7081	124.8845	118.2961	132.0822	132.5696	151.3257	162.1114	174.7629	(64)
Efficiency of water heater	89.7430	89.6825	89.5012	89.1087	88.3392	87.2000	87.2000	87.2000	87.2000	88.8768	89.4756	87.2000	(216)
(217)m												89.7674	(217)
Fuel for water heating, kWh/month	200.1774	176.0009	183.8623	163.6694	160.4138	143.2162	135.6606	151.4705	152.0293	170.2646	181.1795	194.6841	(219)
Water heating fuel used												2012.6286	(219)
Annual totals kWh/year													
Space heating fuel - main system												2687.2029	(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)												379.9583	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.75 * 989 * 1.00) =										-593.1804		-593.1804	(233)
Total delivered energy for all uses												4561.6094	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2687.2029	10.2300	274.9009 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2012.6286	10.2300	205.8919 (247)
Pumps and fans for heating	75.0000	36.7200	27.5400 (249)
Energy for lighting	379.9583	36.7200	139.5207 (250)
Additional standing charges			103.0000 (251)
Energy saving/generation technologies			
PV Unit	-593.1804	36.7200	-217.8158 (252)
Total energy cost			533.0376 (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	2687.2029	0.2160	580.4358 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2012.6286	0.2160	434.7278 (264)
Space and water heating			1015.1636 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	379.9583	0.5190	197.1983 (268)
Energy saving/generation technologies			
PV Unit	-593.1804	0.5190	-307.8606 (269)
Total kg/year			943.4263 (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	2687.2029	1.2200	3278.3875 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2012.6286	1.2200	2455.4069 (264)
Space and water heating			5733.7944 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	379.9583	3.0700	1166.4719 (268)
Energy saving/generation technologies			
PV Unit	-593.1804	3.0700	-1821.0637 (269)
Primary energy kWh/year			5309.4526 (272)
Primary energy kWh/m2/year			62.8040 (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 89

(For testing purposes):

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

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.2	-£ 85	-193 kg (20.4%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£85 2.28 kg/m²	B 88	B 90
Total Savings	£85 2.28 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	£167	£185	-£18
Mains gas	£584	£480	£104
Space heating	£405	£405	£0
Water heating	£206	£121	£85
Lighting	£140	£140	£0
Generated (PV)	-£218	-£218	£0
Total cost of fuels	£533	£447	£86
Total cost of uses	£533	£448	£85
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	63 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	42.2700 (1b)	x 2.3900 (2b)	= 101.0253 (1b) - (3b)
First floor	42.2700 (1c)	x 2.6100 (2c)	= 110.3247 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	84.5400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 211.3500 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.1893 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4393 (18)
Number of sides sheltered					2 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.8500 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3734 (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	0.4760	0.4667	0.4574	0.4107	0.4014	0.3547	0.3547	0.3454	0.3734	0.4014	0.4200	0.4387 (22b)
Effective ac	0.6133	0.6089	0.6046	0.5843	0.5806	0.5629	0.5629	0.5596	0.5697	0.5806	0.5882	0.5962 (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)			12.7800	1.1450	14.6336		(27)
Ground Floor			42.2700	0.1200	5.0724	84.0000	3550.6800 (28a)
Brick and Block	75.7100	12.7500	62.9600	0.2400	15.1104	42.2200	2658.1712 (29a)
Tile Hung	17.8000	2.1800	15.6200	0.2400	3.7488	42.2200	659.4764 (29a)
Step Party Wall	3.8000		3.8000	0.2600	0.9880	58.0600	220.6280 (29a)
Pitched Roof	42.2700		42.2700	0.1000	4.2270	9.1000	384.6570 (30)
Total net area of external elements Aum(A, m ²)			181.8500				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	46.1452		(33)
Party Wall 1			38.4300	0.0000	0.0000	110.0000	4227.3000 (32)
Ground Floor Stud			62.1500			9.0000	559.3500 (32c)
First Floor Stud			92.8300			9.0000	835.4700 (32c)
Internal Floor 1			42.2700			18.0000	760.8600 (32d)
Internal Ceiling 1			42.2700			18.0000	760.8600 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	14617.4526 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							172.9058 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.2747 (36)
Total fabric heat loss						(33) + (36) =	54.4199 (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	42.7757	42.4688	42.1680	40.7551	40.4908	39.2602	39.2602	39.0323	39.7342	40.4908	41.0255	41.5846 (38)
Heat transfer coeff	97.1955	96.8886	96.5878	95.1750	94.9106	93.6801	93.6801	93.4522	94.1541	94.9106	95.4454	96.0045 (39)
Average = Sum(39)m / 12 =												95.1737 (39)
HLP	1.1497	1.1461	1.1425	1.1258	1.1227	1.1081	1.1081	1.1054	1.1137	1.1227	1.1290	1.1356 (40)
HLP (average)												1.1258 (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												2.5434 (42)
Average daily hot water use (litres/day)												94.6054 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	104.0659	100.2817	96.4975	92.7132	88.9290	85.1448	85.1448	88.9290	92.7132	96.4975	100.2817	104.0659 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Energy content (annual)	154.3267	134.9751	139.2822	121.4296	116.5146	100.5433	93.1681	106.9118	108.1886	126.0834	137.6299	149.4572 (45)
Distribution loss (46)m = 0.15 x (45)m	23.1490	20.2463	20.8923	18.2144	17.4772	15.0815	13.9752	16.0368	16.2283	18.9125	20.6445	22.4186 (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	25.3185	22.8670	25.2767	24.4141	25.1935	24.3412	25.1280	25.1705	24.3809	25.2423	24.4815	25.3057 (61)
Total heat required for water heating calculated for each month	179.6452	157.8421	164.5589	145.8437	141.7081	124.8845	118.2961	132.0822	132.5696	151.3257	162.1114	174.7629 (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												1.2184 (H8)
Utilisation factor												0.5599 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												94.6054 (H14)
Volume ratio Veff/V												0.7928 (H15)
Solar storage volume factor												0.9536 (H16)
Solar input												-851.3931 (H17)
Solar input	-24.6887	-41.1983	-70.1655	-94.0356	-116.1731	-114.2166	-112.7072	-98.4729	-77.1240	-52.6666	-29.2844	-20.6602 (63)
Solar input (sum of months) = Sum (63)m =												-851.3931 (63)
Output from w/h	154.9565	116.6437	94.3934	51.8081	25.5351	10.6679	5.5888	33.6094	55.4456	98.6591	132.8270	154.1027 (64)
Total per year (kWh/year) = Sum (64)m =												934.2373 (64)
Heat gains from water heating, kWh/month	57.6433	50.5960	52.6305	46.4789	45.0395	39.5159	37.2604	41.8408	42.0680	48.2333	51.8823	56.0209 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(66)
(66)m	152.6030	152.6030	152.6030	152.6030	152.6030	152.6030	152.6030	152.6030	152.6030	152.6030	152.6030	152.6030	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	53.7870	47.7732	38.8517	29.4133	21.9868	18.5622	20.0571	26.0709	34.9923	44.4308	51.8573	55.2819	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	341.2942	344.8358	335.9112	316.9117	292.9282	270.3872	255.3284	251.7868	260.7114	279.7109	303.6944	326.2354	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.8037	52.8037	52.8037	52.8037	52.8037	52.8037	52.8037	52.8037	52.8037	52.8037	52.8037	52.8037	(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)	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	(71)
Water heating gains (Table 5)	77.4775	75.2916	70.7399	64.5540	60.5370	54.8833	50.0812	56.2376	58.4277	64.8297	72.0588	75.2970	(72)
Total internal gains	579.2301	574.5719	552.1742	517.5503	482.1233	450.5039	432.1379	440.7667	460.8028	495.6428	534.2818	563.4857	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
North				7.7200	10.6334	0.6300	0.7000	0.7700	25.0877 (74)			
South				3.6200	46.7521	0.6300	0.7000	0.7700	51.7227 (78)			
West				1.4400	19.6403	0.6300	0.7000	0.7700	8.6433 (80)			
Solar gains	85.4537	149.5606	217.2173	293.4244	353.1334	361.9618	344.1877	297.4938	243.0548	168.5000	103.0352	72.7154 (83)
Total gains	664.6838	724.1325	769.3915	810.9747	835.2567	812.4658	776.3256	738.2605	703.8576	664.1428	637.3170	636.2011 (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	41.7756	41.9079	42.0385	42.6625	42.7813	43.3433	43.3433	43.4490	43.1251	42.7813	42.5416	42.2939		
alpha	3.7850	3.7939	3.8026	3.8442	3.8521	3.8896	3.8896	3.8966	3.8750	3.8521	3.8361	3.8196		
util living area	0.9796	0.9701	0.9510	0.9060	0.8152	0.6613	0.5087	0.5505	0.7619	0.9167	0.9679	0.9825	(86)	
MIT	19.5719	19.7392	20.0157	20.3840	20.7017	20.9076	20.9744	20.9651	20.8319	20.4407	19.9519	19.5438	(87)	
Th 2	19.9605	19.9634	19.9663	19.9798	19.9824	19.9942	19.9942	19.9964	19.9896	19.9824	19.9772	19.9719	(88)	
util rest of house	0.9750	0.9635	0.9397	0.8831	0.7692	0.5809	0.4020	0.4434	0.6913	0.8918	0.9595	0.9785	(89)	
MIT 2	18.6764	18.8432	19.1161	19.4798	19.7699	19.9446	19.9854	19.9835	19.8889	19.5414	19.0654	18.6575	(90)	
Living area fraction									fLA = Living area / (4) =			0.2110	(91)	
MIT	18.8654	19.0323	19.3059	19.6706	19.9666	20.1478	20.1941	20.1906	20.0879	19.7312	19.2525	18.8445	(92)	
Temperature adjustment												0.0000		
adjusted MIT	18.8654	19.0323	19.3059	19.6706	19.9666	20.1478	20.1941	20.1906	20.0879	19.7312	19.2525	18.8445	(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	0.9688	0.9559	0.9308	0.8749	0.7684	0.5940	0.4240	0.4652	0.6989	0.8844	0.9521	0.9729	(94)
Useful gains	643.9691	692.1932	716.1289	709.5530	641.7727	482.6036	329.1739	343.4057	491.9523	587.3644	606.7584	618.9736	(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	1415.6884	1369.2582	1236.8970	1025.0937	784.5845	519.7225	336.6991	354.2416	563.7890	866.6433	1159.8998	1405.9389	(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	574.1592	454.9877	387.4514	227.1893	106.2520	0.0000	0.0000	0.0000	0.0000	207.7835	398.2618	585.5022	(98)
Space heating												2941.5871	(98)
Space heating per m2											(98) / (4) =	34.7952	(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													3243.2052 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	574.1592	454.9877	387.4514	227.1893	106.2520	0.0000	0.0000	0.0000	0.0000	207.7835	398.2618	585.5022	(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)	633.0310	501.6402	427.1791	250.4844	117.1466	0.0000	0.0000	0.0000	0.0000	229.0888	439.0980	645.5371	(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	154.9565	116.6437	94.3934	51.8081	25.5351	10.6679	5.5888	33.6094	55.4456	98.6591	132.8270	154.1027	(64)
Efficiency of water heater	(217)m	89.9328	89.9924	90.0290	90.0001	87.2000	87.2000	87.2000	87.2000	89.5429	89.7986	87.2000	(216)
Fuel for water heating, kWh/month	172.3025	129.6572	104.8904	57.5460	28.3723	12.2338	6.4092	38.5429	63.5844	110.1808	147.9167	171.3246	(219)
Water heating fuel used												1042.9607	(219)
Annual totals kWh/year													
Space heating fuel - main system												3243.2052	(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)												379.9583	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.75 * 853 * 1.00) =										-511.8180		-511.8180	(233)
Total delivered energy for all uses												4279.3063	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3243.2052	3.4800	112.8635	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1042.9607	3.4800	36.2950	(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	379.9583	13.1900	50.1165	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-511.8180	13.1900	-67.5088	(252)
Total energy cost			268.2538	(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] =	0.8697 (257)
SAP value			87.8671
SAP rating (Section 12)			88 (258)
SAP band			B

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

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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	3243.2052	0.2160	700.5323	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1042.9607	0.2160	225.2795	(264)
Space and water heating			925.8118	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	379.9583	0.5190	197.1983	(268)
Energy saving/generation technologies				
PV Unit	-511.8180	0.5190	-265.6335	(269)
Total kg/year			922.2517	(272)
CO2 emissions per m2			10.9100	(273)
EI value			90.4600	
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	42.2700 (1b)	x 2.3900 (2b)	= 101.0253 (1b) - (3b)
First floor	42.2700 (1c)	x 2.6100 (2c)	= 110.3247 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	84.5400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 211.3500 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.1893 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4393 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3734 (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	0.4760	0.4387	0.4294	0.4014	0.4014	0.3734	0.3734	0.3640	0.3734	0.4200	0.4107	0.4387 (22b)
Effective ac	0.6133	0.5962	0.5922	0.5806	0.5806	0.5697	0.5697	0.5663	0.5697	0.5882	0.5843	0.5962 (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)			12.7800	1.1450	14.6336		(27)
Ground Floor			42.2700	0.1200	5.0724	84.0000	3550.6800 (28a)
Brick and Block	75.7100	12.7500	62.9600	0.2400	15.1104	42.2200	2658.1712 (29a)
Tile Hung	17.8000	2.1800	15.6200	0.2400	3.7488	42.2200	659.4764 (29a)
Step Party Wall	3.8000		3.8000	0.2600	0.9880	58.0600	220.6280 (29a)
Pitched Roof	42.2700		42.2700	0.1000	4.2270	9.1000	384.6570 (30)
Total net area of external elements Aum(A, m ²)			181.8500				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	46.1452		(33)
Party Wall 1			38.4300	0.0000	0.0000	110.0000	4227.3000 (32)
Ground Floor Stud			62.1500			9.0000	559.3500 (32c)
First Floor Stud			92.8300			9.0000	835.4700 (32c)
Internal Floor 1			42.2700			18.0000	760.8600 (32d)
Internal Ceiling 1			42.2700			18.0000	760.8600 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	14617.4526 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							172.9058 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.2747 (36)
Total fabric heat loss						(33) + (36) =	54.4199 (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	42.7757	41.5846	41.3020	40.4908	40.4908	39.7342	39.7342	39.4942	39.7342	41.0255	40.7551	41.5846 (38)
Heat transfer coeff	97.1955	96.0045	95.7219	94.9106	94.9106	94.1541	94.1541	93.9140	94.1541	95.4454	95.1750	96.0045 (39)
Average = Sum(39)m / 12 =												95.1453 (39)
HLP	1.1497	1.1356	1.1323	1.1227	1.1227	1.1137	1.1137	1.1109	1.1137	1.1290	1.1258	1.1356 (40)
HLP (average)												1.1254 (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												2.5434 (42)
Average daily hot water use (litres/day)												94.6054 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	104.0659	100.2817	96.4975	92.7132	88.9290	85.1448	85.1448	88.9290	92.7132	96.4975	100.2817	104.0659 (44)

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)	154.3267	134.9751	139.2822	121.4296	116.5146	100.5433	93.1681	106.9118	108.1886	126.0834	137.6299	149.4572 (45)
Distribution loss (46)m = 0.15 x (45)m	23.1490	20.2463	20.8923	18.2144	17.4772	15.0815	13.9752	16.0368	16.2283	18.9125	20.6445	1488.5106 (45)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	25.3185	22.8670	25.2767	24.4141	25.1935	24.3412	25.1280	25.1705	24.3809	25.2423	24.4815	25.3057 (61)
Total heat required for water heating calculated for each month	179.6452	157.8421	164.5589	145.8437	141.7081	124.8845	118.2961	132.0822	132.5696	151.3257	162.1114	174.7629 (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												1.3933 (H8)
Utilisation factor												0.5121 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												94.6054 (H14)
Volume ratio Veff/V												0.7928 (H15)
Solar storage volume factor												0.9536 (H16)
Solar input												-890.5523 (H17)
Solar input	-29.2250	-41.7196	-70.7076	-96.4849	-113.8733	-121.1827	-116.7087	-104.1196	-82.4045	-56.4222	-34.3598	-23.3443 (63)
Solar input (sum of months) = Sum (63)m =												-890.5523 (63)
Output from w/h	150.4202	116.1225	93.8513	49.3588	27.8348	3.7018	1.5873	27.9627	50.1650	94.9035	127.7515	151.4187 (64)
Total per year (kWh/year) = Sum (64)m =												895.0781 (64)
Heat gains from water heating, kWh/month	57.6433	50.5960	52.6305	46.4789	45.0395	39.5159	37.2604	41.8408	42.0680	48.2333	51.8823	56.0209 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(66)
(66)m	152.6030	152.6030	152.6030	152.6030	152.6030	152.6030	152.6030	152.6030	152.6030	152.6030	152.6030	152.6030	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	53.7870	47.7732	38.8517	29.4133	21.9868	18.5622	20.0571	26.0709	34.9923	44.4308	51.8573	55.2819	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	341.2942	344.8358	335.9112	316.9117	292.9282	270.3872	255.3284	251.7868	260.7114	279.7109	303.6944	326.2354	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.8037	52.8037	52.8037	52.8037	52.8037	52.8037	52.8037	52.8037	52.8037	52.8037	52.8037	52.8037	(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)	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	(71)
Water heating gains (Table 5)	77.4775	75.2916	70.7399	64.5540	60.5370	54.8833	50.0812	56.2376	58.4277	64.8297	72.0588	75.2970	(72)
Total internal gains	579.2301	574.5719	552.1742	517.5503	482.1233	450.5039	432.1379	440.7667	460.8028	495.6428	534.2818	563.4857	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
North					7.7200	13.8645		0.6300	0.7000	0.7700		32.7111 (74)	
South					3.6200	58.2505		0.6300	0.7000	0.7700		64.4437 (78)	
West					1.4400	25.9136		0.6300	0.7000	0.7700		11.4041 (80)	

Solar gains	108.5589	162.9554	237.1425	329.0917	380.3359	422.5692	391.9599	344.7213	282.3756	194.6452	129.8102	88.1438 (83)	
Total gains	687.7890	737.5273	789.3167	846.6420	862.4592	873.0731	824.0978	785.4880	743.1784	690.2880	664.0920	651.6295 (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	41.7756	42.2939	42.4188	42.7813	42.7813	43.1251	43.1251	43.2353	43.1251	42.5416	42.6625	42.2939		
alpha	3.7850	3.8196	3.8279	3.8521	3.8521	3.8750	3.8750	3.8824	3.8750	3.8361	3.8442	3.8196		
util living area	0.9719	0.9628	0.9376	0.8785	0.7616	0.5669	0.4139	0.4318	0.6747	0.8764	0.9512	0.9756	(86)	
MIT	19.7545	19.8815	20.1571	20.4998	20.7924	20.9521	20.9892	20.9877	20.9059	20.5968	20.1614	19.7435	(87)	
Th 2	19.9605	19.9719	19.9746	19.9824	19.9824	19.9896	19.9896	19.9920	19.9896	19.9772	19.9798	19.9719	(88)	
util rest of house	0.9654	0.9543	0.9229	0.8494	0.7046	0.4780	0.3051	0.3192	0.5881	0.8389	0.9380	0.9698	(89)	
MIT 2	18.8568	18.8986	19.2594	19.5886	19.8449	19.9677	19.9869	19.9888	19.9411	19.6799	19.2717	18.8553	(90)	
Living area fraction									fLA = Living area / (4) =			0.2110	(91)	
MIT	19.0463	19.1778	19.4488	19.7809	20.0448	20.1755	20.1985	20.1996	20.1447	19.8733	19.4595	19.0427	(92)	
Temperature adjustment												0.0000		
adjusted MIT	19.0463	19.1778	19.4488	19.7809	20.0448	20.1755	20.1985	20.1996	20.1447	19.8733	19.4595	19.0427	(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	0.9581	0.9462	0.9138	0.8428	0.7084	0.4951	0.3281	0.3430	0.6025	0.8344	0.9296	0.9630	(94)
Useful gains	658.9713	697.8362	721.3165	713.5629	611.0001	432.2792	270.3696	269.3859	447.7321	575.9996	617.3447	627.5353	(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	1326.3554	1293.9320	1162.9090	966.2788	706.5930	449.6281	272.9014	272.3134	484.3977	770.5635	1052.5840	1300.1612	(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	496.5338	400.5764	328.5448	181.9554	71.1211	0.0000	0.0000	0.0000	0.0000	144.7555	313.3723	500.4337	(98)
Space heating												2437.2930	(98)
Space heating per m2											(98) / (4) =	28.8301	(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													2687.2029	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	496.5338	400.5764	328.5448	181.9554	71.1211	0.0000	0.0000	0.0000	0.0000	144.7555	313.3723	500.4337	(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)	547.4463	441.6498	362.2324	200.6124	78.4136	0.0000	0.0000	0.0000	0.0000	159.5981	345.5042	551.7461	(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	150.4202	116.1225	93.8513	49.3588	27.8348	3.7018	1.5873	27.9627	50.1650	94.9035	127.7515	151.4187	(64)	
Efficiency of water heater	89.8614	89.8892	89.8983	89.9298	89.6874	87.2000	87.2000	87.2000	87.2000	89.2809	89.6578	89.8622	(216)	
Fuel for water heating, kWh/month	167.3913	129.1841	104.3972	54.8859	31.0354	4.2452	1.8203	32.0673	57.5287	106.2976	142.4879	168.5010	(219)	
Water heating fuel used												999.8419	(219)	
Annual totals kWh/year												2687.2029	(211)	
Space heating fuel - main system												0.0000	(215)	
Space heating fuel - secondary														
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)													379.9583	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 0.75 * 989 * 1.00) =										-593.1804			-593.1804	(233)
Total delivered energy for all uses													3598.8227	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2687.2029	10.2300	274.9009	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	999.8419	10.2300	102.2838	(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	379.9583	36.7200	139.5207	(250)
Additional standing charges			103.0000	(251)
Energy saving/generation technologies				
PV Unit	-593.1804	36.7200	-217.8158	(252)
Total energy cost			447.7895	(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	2687.2029	0.2160	580.4358	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	999.8419	0.2160	215.9658	(264)
Space and water heating			796.4017	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	379.9583	0.5190	197.1983	(268)
Energy saving/generation technologies				

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

PV Unit	-593.1804	0.5190	-307.8606 (269)
Total kg/year			750.6144 (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	2687.2029	1.2200	3278.3875 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	999.8419	1.2200	1219.8071 (264)
Space and water heating			4498.1946 (265)
Pumps and fans	125.0000	3.0700	383.7500 (267)
Energy for lighting	379.9583	3.0700	1166.4719 (268)
Energy saving/generation technologies			
PV Unit	-593.1804	3.0700	-1821.0637 (269)
Primary energy kWh/year			4227.3528 (272)
Primary energy kWh/m2/year			50.0042 (273)

U-VALUE CALCULATOR REPORT

Property Reference	SAP 0906 Plot 42	Issued on Date	29/11/2023
Assessment Reference	Rev B	Prop Type Ref	Block Cv
Project			
Calculation Type	New Build (As Designed)		

SAP Rating	87 B	DER	14.98	TER	18.64
Environmental	89 B	% DER<TER	19.65		
CO ₂ Emissions (t/year)	0.94	DFEE	44.80	TFEE	54.00
General Requirements Compliance	Pass	% DFEE<TFEE	17.04		

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 42	Issued on Date	29/11/2023
Assessment Reference	Rev B	Prop Type Ref	Block Cv
Project			
Calculation Type	New Build (As Designed)		

SAP Rating	87 B	DER	14.98	TER	18.64
Environmental	89 B	% DER<TER	19.65		
CO ₂ Emissions (t/year)	0.94	DFEE	44.80	TFEE	54.00
General Requirements Compliance	Pass	% DFEE<TFEE	17.04		

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 42	Issued on Date	29/11/2023
Assessment Reference	Rev B	Prop Type Ref	Block Cv
Project			
Calculation Type	New Build (As Designed)		

SAP Rating	87 B	DER	14.98	TER	18.64
Environmental	89 B	% DER<TER	19.65		
CO ₂ Emissions (t/year)	0.94	DFEE	44.80	TFEE	54.00
General Requirements Compliance	Pass	% DFEE<TFEE	17.04		

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 42	Issued on Date	29/11/2023
Assessment Reference	Rev B	Prop Type Ref	Block Cv
Project			
Calculation Type	New Build (As Designed)		

SAP Rating	87 B	DER	14.98	TER	18.64
Environmental	89 B	% DER<TER	19.65		
CO ₂ Emissions (t/year)	0.94	DFEE	44.80	TFEE	54.00
General Requirements Compliance	Pass	% DFEE<TFEE	17.04		

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 000004

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	Supabloc *7						
	Main construction	100	0.1900	0.5263	94.04		
	Main construction	100	0.8803	0.1136	5.96		
	Corrections - Air Gap: Level 1, Fasteners: None or plastic						
Layer 2	Supafil Party Wall						
	Main construction	100	0.0400	2.5000	100.00		
	Corrections - Air Gap: Level 0, Fasteners: None or plastic						
Layer 3	Supabloc *7						
	Main construction	100	0.1900	0.5263	94.04	680	1000
	Main construction	100	0.8803	0.1136	5.96	680	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 = 3.898 m ² K/W	Lower limit = 3.765 m ² K/W	Average = 3.831 m ² K/W
	Total correction = 0.0003 m ² K/W	U-value (unrounded) = 0.26 W/m ² K	

Unheated space: None		
Total thickness: 328 mm	U-value: 0.26 W/m² K	Kappa: 58.06 kJ/m² K

U-VALUE CALCULATOR REPORT

Property Reference	SAP 0906 Plot 42	Issued on Date	29/11/2023
Assessment Reference	Rev B	Prop Type Ref	Block Cv
Project			
Calculation Type	New Build (As Designed)		

SAP Rating	87 B	DER	14.98	TER	18.64
Environmental	89 B	% DER<TER	19.65		
CO ₂ Emissions (t/year)	0.94	DFEE	44.80	TFEE	54.00
General Requirements Compliance	Pass	% DFEE<TFEE	17.04		

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 42				Issued on Date	29/11/2023
Assessment Reference	Rev B	Prop Type Ref	Block Cv			
Property						
SAP Rating	87 B	DER	14.98	TER	18.64	
Environmental	89 B	% DER<TER	19.65			
CO ₂ Emissions (t/year)	0.94	DFEE	44.80	TFEE	54.00	
General Requirements Compliance	Pass	% DFEE<TFEE	17.04			
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	South					
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	2					
5.0 Sunlight/Shade	Average or unknown					
6.0 Measurements						
			Heat Loss Perimeter	Internal Floor Area	Average Storey Height	
		Ground Floor:	27.20 m	42.27 m ²	2.39 m	
		1st Storey:	18.71 m	42.27 m ²	2.61 m	
7.0 Living Area	17.84			m ²		
8.0 Thermal Mass Parameter	Precise calculation					
Thermal Mass	172.91			kJ/m ² K		
9.0 External Walls						
Description	Type	Construction		U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area (m ²) Nett Area (m ²)
Brick and Block	Cavity Wall	Other		0.24	42.22	75.71 62.96
Tile Hung	Cavity Wall	Other		0.24	42.22	17.80 15.62
Step Party Wall	Cavity Wall	Other		0.26	58.06	3.80 3.80
9.1 Party Walls						
Description	Type	Construction		U-Value (W/m ² K)	Kappa (kJ/m ² K)	Area (m ²)
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	38.43
9.2 Internal Walls						
Description	Construction				Kappa (kJ/m ² K)	Area (m ²)
Ground Floor Stud	Plasterboard on timber frame				9.00	62.15
First Floor Stud	Plasterboard on timber frame				9.00	92.83
10.0 External Roofs						

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

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	42.27	42.27

10.2 Internal Ceilings

Description	Construction	Kappa (kJ/m²K)	Area (m²)
Internal Ceiling 1	Plasterboard ceiling, carpeted chipboard floor	9.00	42.27

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	42.27

11.2 Internal Floors

Description	Construction	Kappa (kJ/m²K)	Area (m²)
Internal Floor 1	Plasterboard ceiling, carpeted chipboard floor	18.00	42.27

12.0 Opening Types

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

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
Front Door	Solid Door	[1] Brick and Block	South							2.15	
Front Elevation	Window	[1] Brick and Block	South	None	0.00					1.44	
Side Elevation	Window	[1] Brick and Block	West	None	0.00					1.44	
Rear Elevation	Window	[1] Brick and Block	North	None	0.00					7.72	
Front Tiled	Window	[2] Tile Hung	South	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)	0.46	0.093	No	Birtley Supatherm
Independently assessed	E2 Other lintels (including other steel lintels)	2.06	0.077	No	Birtley Supatherm
Independently assessed	E2 Other lintels (including other steel lintels)	3.75	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	8.30	0.021	No	Knauf P5
Independently assessed	E4 Jamb	28.50	0.016	No	Knauf P6
Table K1 - Approved	E5 Ground floor (normal)	27.20	0.160	No	
Independently assessed	E6 Intermediate floor within a dwelling	18.71	0.000	No	CD0029
Independently assessed	E10 Eaves (insulation at ceiling level)	13.89	0.071	No	Knauf P16
Independently assessed	E12 Gable (insulation at ceiling level)	4.82	0.044	No	Knauf P21
Independently assessed	E16 Corner (normal)	15.89	0.039	No	Knauf P23
Independently assessed	E18 Party wall between dwellings	4.55	0.036	No	Knauf P25 Halved
Independently assessed	E25 Staggered party wall between dwellings	4.55	0.055	No	Knauf P27 Halved
Independently assessed	P6 Party wall - Ground floor (inverted)	8.45	0.000	No	
Table K1 - Default	P2 Party wall - Intermediate floor within a dwelling	8.45	0.000	No	
Independently assessed	P4 Party wall - Roof (insulation at ceiling level)	8.45	0.035	No	Knauf P29 Halved

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

Y-value	0.046	W/m ² K
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18.0 Pressure Testing	Yes	
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				4
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No
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22.0 Lighting	
Internal	
Total number of light fittings	19
Total number of L.E.L. fittings	19
Percentage of L.E.L. fittings	100.00 %
External	
External lights fitted	Yes
Light and motion sensor	Yes

23.0 Electricity Tariff	Standard
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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

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

Is MHS Pumped	Pump in heated space
Heat Emitter	Radiators
Flow Temperature	Normal (> 45°C)
Combi boiler type	Standard Combi
Combi keep hot type	Gas/Oil, time clock
25.0 Main Heating 2	None

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

29.0 Hot Water Cylinder	None
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32.0 Photovoltaic Unit		One Dwelling		
PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
0.75	West	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	£85	B 88	