



SAP Report Submission for Building Regulations Compliance

Client: Foreman Homes

Project:

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

EXCELLENCE
IN ENERGY
ASSESSMENT

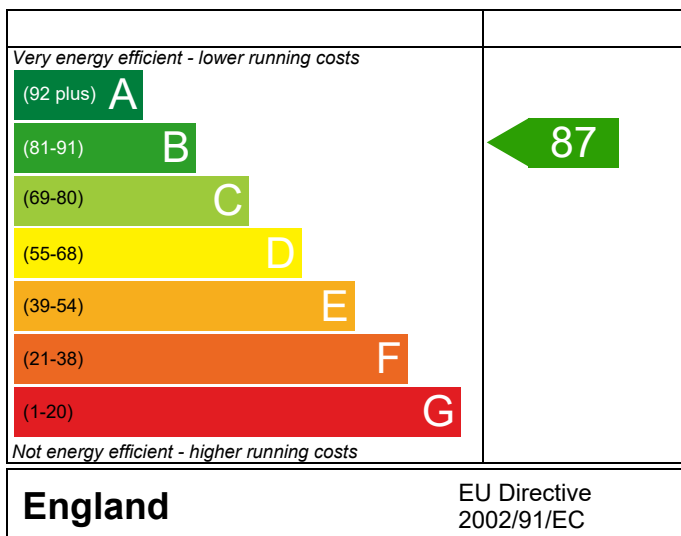
PREDICTED ENERGY ASSESSMENT

Dwelling type: House, End-Terrace
Date of assessment: 29/11/2023
Produced by: Abacus Energy (UK) Ltd
Total floor area: 84.54 m²
DRRN: 9420-1948-2976

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.

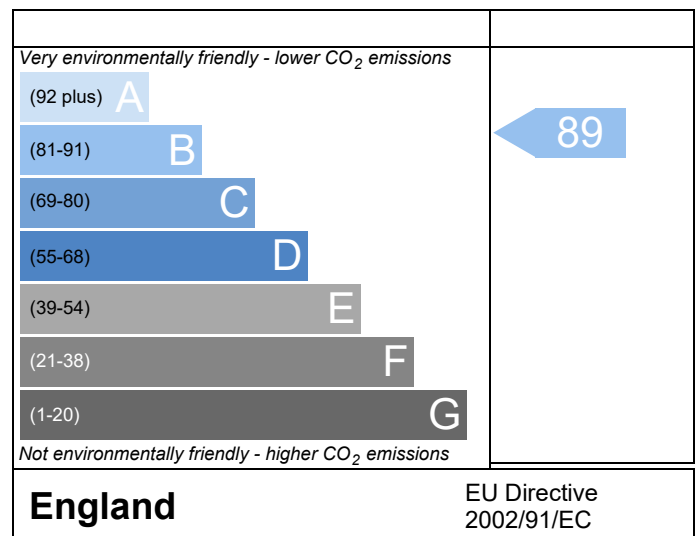
The energy performance has been assessed using the Government approved SAP2012 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO₂) emissions.

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 48				Issued on Date	29/11/2023
Assessment Reference	Rev B	Prop Type Ref	Block C			
Property						
SAP Rating	87 B	DER	14.31	TER	18.04	
Environmental	89 B	% DER<TER	20.67			
CO ₂ Emissions (t/year)	0.90	DFEE	43.35	TFEE	51.26	
General Requirements Compliance	Pass	% DFEE<TFEE	15.43			
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)	18.04	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	14.31	kgCO ₂ /m ²	Pass
	-3.73 (-20.7%)	kgCO ₂ /m ²	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	51.26	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DFEE)	43.35	kWh/m ² /yr	
	-8.0 (-15.6%)	kWh/m ² /yr	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.24 (max. 0.30)	0.24 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.12 (max. 0.25)	0.12 (max. 0.70)	Pass
Roof	0.10 (max. 0.20)	0.10 (max. 0.35)	Pass
Openings	1.19 (max. 2.00)	1.20 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	m ³ /(h.m ²) @ 50 Pa	
Maximum	10.0	m ³ /(h.m ²) @ 50 Pa	Pass

Limiting System Efficiencies

4 Heating efficiency

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BUILDING REGULATION COMPLIANCE

Calculation Type: New Build (As Designed)

Main heating system

Boiler system with radiators or underfloor - Mains gas
Data from database
Worcester Greenstar 32CDi Compact ErP
Combi boiler
Efficiency: 89.8% SEDBUK2009
Minimum: 88.0%

Pass

Secondary heating system

None

5 Cylinder insulation

Hot water storage

No cylinder

6 Controls

Space heating controls

Programmer, room thermostat and TRVs

Pass

Hot water controls

No cylinder

Boiler interlock

Yes

Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings

100 %

Minimum

75 %

Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)

Slight

Pass

Based on:

Overshading

Average

Windows facing East

3.62 m², No overhang

Windows facing South

1.44 m², No overhang

Windows facing West

7.82 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

0.60

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 91	Recommended
Photovoltaic			0	0	Already installed
Wind turbine			0	0	Not applicable
Totals	£4,000 - £6,000	£85	B 88	B 91	

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THERMAL BRIDGING

Calculation Type: New Build (As Designed)

Property Reference	SAP 0906 Plot 48	Issued on Date	29/11/2023
Assessment Reference	Rev B	Prop Type Ref	Block C
Property			

SAP Rating	87 B	DER	14.31	TER	18.04
Environmental	89 B	% DER<TER	20.67		
CO ₂ Emissions (t/year)	0.90	DFEE	43.35	TFEE	51.26
General Requirements Compliance	Pass	% DFEE<TFEE	15.43		

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	1.37	0.11	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	3.74	0.24	Birtley Supatherm
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.067	1.59	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	28.80	0.46	Knauf P6
External wall	E5 Ground floor (normal)	Table K1 - Approved	0.160	18.73	3.00	
External wall	E6 Intermediate floor within a dwelling	Independently assessed	0.000	18.73	0.00	CD0029
External wall	E10 Eaves (insulation at ceiling level)	Independently assessed	0.071	13.91	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	14.99	0.58	Knauf P23
External wall	E18 Party wall between dwellings	Independently assessed	0.036	5.00	0.18	Knauf P25 Halved
External wall	E25 Staggered party wall between dwellings	Independently assessed	0.055	5.00	0.28	Knauf P27 Halved
Party wall	P1 Party wall - Ground floor	Table K1 - Default	0.160	8.47	1.36	
Party wall	P2 Party wall - Intermediate floor within a dwelling	Table K1 - Default	0.000	8.47	0.00	
Party wall	P4 Party wall - Roof (insulation at ceiling level)	Independently assessed	0.035	8.47	0.30	Knauf P29 Halved

Total: **8.28** W/mK:
Y-Value: **0.046** W/m²K:

FULL SAP CALCULATION PRINTOUT

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General Requirements Compliance	Pass	% DFEE<TFEE	15.43			
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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) 18.04 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 14.31 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)51.3 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)43.3 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.24 (max. 0.30)	0.24 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.12 (max. 0.25)	0.12 (max. 0.70)	OK
Roof	0.10 (max. 0.20)	0.10 (max. 0.35)	OK
Openings	1.19 (max. 2.00)	1.20 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals: 5.00 (design value)
Maximum 10.0 OK

4 Heating efficiency

Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Worcester Greenstar 32CDi Compact ErP
Combi boiler
Efficiency: 89.8% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls: Programmer, room thermostat and TRVs OK

Hot water controls: No cylinder

Boiler interlock Yes OK

7 Low energy lights

Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Southern England): Slight OK
Based on:
Overshading: Average
Windows facing East: 3.62 m², No overhang
Windows facing South: 1.44 m², No overhang
Windows facing West: 7.82 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 0.60 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	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)			12.8800	1.1450	14.7481		(27)
Ground Floor			42.2700	0.1200	5.0724	84.0000	3550.6800 (28a)
Brick and Block	75.5000	12.8500	62.6500	0.2400	15.0360	42.2200	2645.0830 (29a)
Tile Hung	18.1500	2.1800	15.9700	0.2400	3.8328	42.2200	674.2534 (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)			178.1900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	45.2813		(33)
Party Wall 1			42.3300	0.0000	0.0000	110.0000	4656.3000 (32)
Ground Floor Stud			69.2600			9.0000	623.3400 (32c)
First Floor Stud			90.7800			9.0000	817.0200 (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)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss
(28)...(30) + (32) + (32a)...(32e) = 14873.0534 (34)
175.9292 (35)
8.2833 (36)
(33) + (36) = 53.5646 (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	94.7294	94.4850	94.2456	93.1207	92.9102	91.9305	91.9305	91.7490	92.3079	92.9102	93.3360	93.7811 (39)
Average = Sum(39)m / 12 =												93.1197 (39)
HLP	1.1205	1.1176	1.1148	1.1015	1.0990	1.0874	1.0874	1.0853	1.0919	1.0990	1.1040	1.1093 (40)
HLP (average)												1.1015 (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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Energy content (annual)												Total = Sum(45)m = 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)
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	21.4800	19.0784	15.5156	11.7463	8.7805	7.4129	8.0098	10.4115	13.9743	17.7436	20.7094	22.0770 (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	391.7754	389.5607	375.4667	352.7818	329.7301	307.6063	293.3118	299.4970	311.2294	334.1304	360.3941	380.1025 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
East				3.6200	19.6403	0.6300	0.7000	0.7700	21.7284 (76)			
South				1.4400	46.7521	0.6300	0.7000	0.7700	20.5748 (78)			
West				7.8200	19.6403	0.6300	0.7000	0.7700	46.9381 (80)			
Solar gains	89.2413	168.0225	264.1393	371.1431	445.9489	453.4085	432.8806	377.1692	302.1218	195.7340	110.0072	74.2465 (83)
Total gains	481.0167	557.5832	639.6060	723.9249	775.6790	761.0148	726.1924	676.6662	613.3512	529.8643	470.4013	454.3490 (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	43.6127	43.7255	43.8366	44.3661	44.4666	44.9405	44.9405	45.0294	44.7568	44.4666	44.2638	44.0537
alpha	3.9075	3.9150	3.9224	3.9577	3.9644	3.9960	3.9960	4.0020	3.9838	3.9644	3.9509	3.9369
util living area	0.9933	0.9875	0.9723	0.9301	0.8392	0.6864	0.5318	0.5845	0.8141	0.9561	0.9883	0.9947 (86)
MIT	19.3869	19.5810	19.9106	20.3346	20.6870	20.9028	20.9731	20.9609	20.7976	20.3249	19.7790	19.3541 (87)
Th 2	19.9841	19.9865	19.9888	19.9996	20.0016	20.0111	20.0111	20.0129	20.0075	20.0016	19.9975	19.9932 (88)
util rest of house	0.9917	0.9844	0.9652	0.9117	0.7963	0.6066	0.4231	0.4751	0.7498	0.9408	0.9850	0.9934 (89)
MIT 2	18.5104	18.7050	19.0322	19.4513	19.7760	19.9584	20.0018	19.9981	19.8819	19.4510	18.9115	18.4848 (90)
Living area fraction												
MIT	18.6990	18.8935	19.2212	19.6414	19.9721	20.1616	20.2108	20.2053	20.0789	19.6390	19.0981	18.6718 (92)
Temperature adjustment												
adjusted MIT	18.6990	18.8935	19.2212	19.6414	19.9721	20.1616	20.2108	20.2053	20.0789	19.6390	19.0981	18.6718 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation	0.9889	0.9800	0.9584	0.9038	0.7949	0.6197	0.4460	0.4976	0.7551	0.9338	0.9809	0.9910	(94)	
Useful gains	475.6815	546.4486	613.0230	654.2771	616.5628	471.6062	323.8903	336.7179	463.1474	494.8011	461.4160	450.2629	(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	1364.0105	1322.1736	1198.9133	1000.2421	768.5583	511.2832	331.9434	349.1323	551.8991	839.8167	1119.8578	1357.1814	(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	660.9168	521.2872	435.9024	249.0949	113.0846	0.0000	0.0000	0.0000	0.0000	256.6916	474.0781	674.7474	(98)	
Space heating												3385.8030	(98)	
Space heating per m2												(98) / (4) =	40.0497	(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													3732.9692	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	660.9168	521.2872	435.9024	249.0949	113.0846	0.0000	0.0000	0.0000	0.0000	256.6916	474.0781	674.7474	(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)	728.6844	574.7378	480.5981	274.6360	124.6799	0.0000	0.0000	0.0000	0.0000	283.0117	522.6881	743.9332	(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	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 (217)m	89.9286	89.8617	89.7132	89.3753	88.7195	87.2000	87.2000	87.2000	87.2000	89.3696	89.7817	89.9572	(216)	
Fuel for water heating, kWh/month	199.7643	175.6500	183.4278	163.1813	159.7261	143.2162	135.6606	151.4705	152.0293	169.3257	180.5616	194.2734	(219)	
Water heating fuel used												2008.2867	(219)	
Annual totals kWh/year														
Space heating fuel - main system													3732.9692	(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)													379.3436	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 0.60 * 1068 * 1.00) =										-512.6738			-512.6738	(233)
Total delivered energy for all uses													5682.9257	(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	3732.9692	0.2160	806.3213	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2008.2867	0.2160	433.7899	(264)
Space and water heating			1240.1113	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	379.3436	0.5190	196.8793	(268)
Energy saving/generation technologies				
PV Unit	-512.6738	0.5190	-266.0777	(269)
Total CO2, kg/year			1209.8379	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			14.3100	(273)

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

DER			14.3100	ZC1
Total Floor Area		TFA	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			32.4680	ZC4
Residual CO2 emissions offset from biofuel CHP			0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year			0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation			0.0000	ZC7
Net CO2 emissions			32.4680	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		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 211.3500 (5)
Dwelling volume			

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1419 (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)			12.8800	1.3258	17.0758		(27)
Ground Floor			42.2700	0.1300	5.4951		(28a)
Brick and Block	75.5000	12.8500	62.6500	0.1800	11.2770		(29a)
Tile Hung	18.1500	2.1800	15.9700	0.1800	2.8746		(29a)
Pitched Roof	42.2700		42.2700	0.1300	5.4951		(30)
Total net area of external elements Aum(A, m ²)			178.1900				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	44.3676	(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.1642 (36)
Total fabric heat loss						(33) + (36) =	54.5318 (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	95.6966	95.4523	95.2128	94.0879	93.8774	92.8977	92.8977	92.7163	93.2751	93.8774	94.3032	94.7483 (39)
Average = Sum(39)m / 12 =												94.0869 (39)
HLP	1.1320	1.1291	1.1262	1.1129	1.1104	1.0989	1.0989	1.0967	1.1033	1.1104	1.1155	1.1208 (40)
HLP (average)												1.1129 (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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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 (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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (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	21.4800	19.0784	15.5156	11.7463	8.7805	7.4129	8.0098	10.4115	13.9743	17.7436	20.7094	22.0770 (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	400.3911	398.1769	383.4967	360.1803	336.4921	313.7340	299.4478	306.2668	318.6394	342.1719	369.0169	388.7225 (73)

6. Solar gains

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

East	3.6200	19.6403	0.6300	0.7000	0.7700	21.7284 (76)
South	1.4400	46.7521	0.6300	0.7000	0.7700	20.5748 (78)
West	7.8200	19.6403	0.6300	0.7000	0.7700	46.9381 (80)

Solar gains	89.2413	168.0225	264.1393	371.1431	445.9489	453.4085	432.8806	377.1692	302.1218	195.7340	110.0072	74.2465 (83)
Total gains	489.6324	566.1994	647.6360	731.3233	782.4410	767.1425	732.3284	683.4359	620.7612	537.9059	479.0241	462.9690 (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	61.3484	61.5054	61.6602	62.3973	62.5372	63.1968	63.1968	63.3204	62.9411	62.5372	62.2549	61.9624
alpha	5.0899	5.1004	5.1107	5.1598	5.1691	5.2131	5.2131	5.2214	5.1961	5.1691	5.1503	5.1308
util living area	0.9983	0.9961	0.9888	0.9610	0.8801	0.7169	0.5460	0.6029	0.8534	0.9789	0.9964	0.9987 (86)
MIT	19.7636	19.9152	20.1741	20.5127	20.7936	20.9500	20.9900	20.9838	20.8724	20.4967	20.0682	19.7386 (87)
Th 2	19.9748	19.9772	19.9795	19.9903	19.9923	20.0018	20.0018	20.0035	19.9981	19.9923	19.9882	19.9839 (88)
util rest of house	0.9977	0.9948	0.9847	0.9462	0.8358	0.6275	0.4284	0.4828	0.7841	0.9682	0.9950	0.9983 (89)
MIT 2	18.3236	18.5465	18.9243	19.4145	19.7882	19.9682	19.9981	19.9968	19.8940	19.4008	18.7785	18.2936 (90)
Living area fraction	18.6334	18.8410	19.1933	19.6508	20.0046	20.1794	20.2115	20.2091	20.1045	19.6366	19.0560	18.6045 (92)
Temperature adjustment	18.6334	18.8410	19.1933	19.6508	20.0046	20.1794	20.2115	20.2091	20.1045	19.6366	19.0560	18.6045 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	487.9658	562.0131	634.9595	687.3638	654.4185	494.4554	332.3685	347.6436	492.0107	518.0319	475.6534	461.7746 (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	1371.6600	1330.7016	1208.5596	1011.5184	779.6098	518.3163	335.4995	353.1683	560.0744	848.3308	1127.4917	1364.8063 (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	657.4684	516.5587	426.7585	233.3913	93.1424	0.0000	0.0000	0.0000	0.0000	245.7424	469.3236	671.8556 (98)
Space heating												3314.2408 (98)
Space heating per m2												39.2032 (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													3548.4377 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	657.4684	516.5587	426.7585	233.3913	93.1424	0.0000	0.0000	0.0000	0.0000	245.7424	469.3236	671.8556	(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)	703.9277	553.0607	456.9149	249.8836	99.7242	0.0000	0.0000	0.0000	0.0000	263.1075	502.4878	719.3315	(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	87.7731	87.5429	87.0462	85.8916	83.7168	80.3000	80.3000	80.3000	80.3000	85.9022	87.2731	87.8609	(216)
Fuel for water heating, kWh/month	233.8821	206.7587	216.5015	194.6071	193.3088	177.5000	170.0585	189.5754	191.6690	204.0199	214.2069	228.1061	(219)
Water heating fuel used												2420.1940	(219)
Annual totals kWh/year													
Space heating fuel - main system												3548.4377	(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)												379.3436	(232)
Total delivered energy for all uses												6422.9753	(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	3548.4377	0.2160	766.4625 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2420.1940	0.2160	522.7619 (264)
Space and water heating			1289.2244 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	379.3436	0.5190	196.8793 (268)
Total CO2, kg/m2/year			1525.0288 (272)
Emissions per m2 for space and water heating			15.2499 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.3288 (272b)
Emissions per m2 for pumps and fans			0.4604 (272c)
Target Carbon Dioxide Emission Rate (TER) = (15.2499 * 1.00) + 2.3288 + 0.4604, rounded to 2 d.p.			18.0400 (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)			12.8800	1.1450	14.7481		(27)
Ground Floor			42.2700	0.1200	5.0724	84.0000	3550.6800 (28a)
Brick and Block	75.5000	12.8500	62.6500	0.2400	15.0360	42.2200	2645.0830 (29a)
Tile Hung	18.1500	2.1800	15.9700	0.2400	3.8328	42.2200	674.2534 (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)			178.1900				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		45.2813		(33)
Party Wall 1			42.3300	0.0000	0.0000	110.0000	4656.3000 (32)
Ground Floor Stud			69.2600			9.0000	623.3400 (32c)
First Floor Stud			90.7800			9.0000	817.0200 (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)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss
(28)...(30) + (32) + (32a)...(32e) = 14492.6234 (34)
171.4292 (35)
8.2833 (36)
(33) + (36) = 53.5646 (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	94.7294	94.4850	94.2456	93.1207	92.9102	91.9305	91.9305	91.7490	92.3079	92.9102	93.3360	93.7811 (39)
Average = Sum(39)m / 12 =												93.1197 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1205	1.1176	1.1148	1.1015	1.0990	1.0874	1.0874	1.0853	1.0919	1.0990	1.1040	1.1093 (40)
HLP (average)												1.1015 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy
Average daily hot water use (litres/day)
2.5434 (42)
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)
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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Energy content (annual)	Total = Sum(45)m = 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	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	21.4800	19.0784	15.5156	11.7463	8.7805	7.4129	8.0098	10.4115	13.9743	17.7436	20.7094	22.0770	(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	355.3764	353.9509	341.5083	321.0664	299.4718	279.3972	266.8411	270.7954	281.7324	302.3124	325.9553	344.4932	(73)

6. Solar gains

[Jan]			Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W				
East			3.6200	19.6403	0.6300	0.7000	0.7700	21.7284 (76)				
South			1.4400	46.7521	0.6300	0.7000	0.7700	20.5748 (78)				
West			7.8200	19.6403	0.6300	0.7000	0.7700	46.9381 (80)				
Solar gains	89.2413	168.0225	264.1393	371.1431	445.9489	453.4085	432.8806	377.1692	302.1218	195.7340	110.0072	74.2465 (83)
Total gains	444.6177	521.9734	605.6476	692.2095	745.4208	732.8057	699.7217	647.9645	583.8542	498.0464	435.9625	418.7397 (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	42.4972	42.6070	42.7153	43.2313	43.3292	43.7910	43.7910	43.8776	43.6120	43.3292	43.1316	42.9269	
alpha	3.8331	3.8405	3.8477	3.8821	3.8886	3.9194	3.9194	3.9252	3.9075	3.8886	3.8754	3.8618	
util living area	0.9944	0.9891	0.9752	0.9359	0.8497	0.7015	0.5476	0.6033	0.8293	0.9617	0.9903	0.9956	(86)
MIT	19.3030	19.5028	19.8432	20.2836	20.6547	20.8885	20.9679	20.9533	20.7710	20.2707	19.7060	19.2703	(87)
Th 2	19.9841	19.9865	19.9888	19.9996	20.0016	20.0111	20.0111	20.0129	20.0075	20.0016	19.9975	19.9932	(88)
util rest of house	0.9931	0.9865	0.9689	0.9189	0.8088	0.6227	0.4373	0.4929	0.7682	0.9483	0.9875	0.9945	(89)
MIT 2	18.4295	18.6299	18.9684	19.4050	19.7496	19.9494	19.9997	19.9947	19.8623	19.4012	18.8416	18.4038	(90)
Living area fraction	18.6175	18.8178	19.1566	19.5940	19.9443	20.1515	20.2080	20.2010	20.0579	19.5883	19.0276	18.5903	(91)
MIT	18.6175	18.8178	19.1566	19.5940	19.9443	20.1515	20.2080	20.2010	20.0579	19.5883	19.0276	18.5903	(92)
Temperature adjustment	18.6175	18.8178	19.1566	19.5940	19.9443	20.1515	20.2080	20.2010	20.0579	19.5883	19.0276	18.5903	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	440.4412	512.8137	582.8244	630.2922	600.8993	465.2125	322.0905	333.8779	450.5930	468.7692	428.8788	415.5820	(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	1356.2845	1315.0201	1192.8292	995.8365	765.9824	510.3495	331.6896	348.7336	549.9568	835.1020	1113.2721	1349.5347	(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	681.3874	539.0827	453.8436	263.1919	122.8218	0.0000	0.0000	0.0000	0.0000	272.5516	492.7632	694.8608	(98)
Space heating												3520.5030	(98)
Space heating per m2												41.6430	(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	864.1465	680.2855	697.2928	0.0000	0.0000	0.0000	0.0000	(100)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8335	0.8944	0.8685	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	720.2254	608.4503	605.5856	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	952.2229	911.5992	852.8699	0.0000	0.0000	0.0000	0.0000 (103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling kWh												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	167.0382	225.5428	183.9795	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												576.5605 (104)
Cooled fraction									FC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)												
Intermittency factor	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	41.7595	56.3857	45.9949	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												144.1401 (107)
Space cooling per m2												1.7050 (108)
Energy for space heating												41.6430 (99)
Energy for space cooling												1.7050 (108)
Total												43.3480 (109)
Dwelling Fabric Energy Efficiency (DFEE)												43.3 (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)			12.8800	1.3258	17.0758		(27)
Ground Floor			42.2700	0.1300	5.4951		(28a)
Brick and Block	75.5000	12.8500	62.6500	0.1800	11.2770		(29a)
Tile Hung	18.1500	2.1800	15.9700	0.1800	2.8746		(29a)
Pitched Roof	42.2700		42.2700	0.1300	5.4951		(30)
Total net area of external elements Aum(A, m ²)			178.1900				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	44.3676	(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.1642 (36)
Total fabric heat loss						(33) + (36) =	54.5318 (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	95.6966	95.4523	95.2128	94.0879	93.8774	92.8977	92.8977	92.7163	93.2751	93.8774	94.3032	94.7483 (39)
Average = Sum(39)m / 12 =												94.0869 (39)
HLP	1.1320	1.1291	1.1262	1.1129	1.1104	1.0989	1.0989	1.0967	1.1033	1.1104	1.1155	1.1208 (40)
HLP (average)												1.1129 (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)										Total = Sum(45)m =		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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	32.7944	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	21.4800	19.0784	15.5156	11.7463	8.7805	7.4129	8.0098	10.4115	13.9743	17.7436	20.7094	22.0770	(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	355.3764	353.9509	341.5083	321.0664	299.4718	279.3972	266.8411	270.7954	281.7324	302.3124	325.9553	344.4932	(73)

6. Solar gains

[Jan]						Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W
East						3.6200	19.6403	0.6300	0.7000	0.7700		21.7284 (76)
South						1.4400	46.7521	0.6300	0.7000	0.7700		20.5748 (78)
West						7.8200	19.6403	0.6300	0.7000	0.7700		46.9381 (80)
Solar gains	89.2413	168.0225	264.1393	371.1431	445.9489	453.4085	432.8806	377.1692	302.1218	195.7340	110.0072	74.2465 (83)
Total gains	444.6177	521.9734	605.6476	692.2095	745.4208	732.8057	699.7217	647.9645	583.8542	498.0464	435.9625	418.7397 (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	61.3484	61.5054	61.6602	62.3973	62.5372	63.1968	63.1968	63.3204	62.9411	62.5372	62.2549	61.9624
alpha	5.0899	5.1004	5.1107	5.1598	5.1691	5.2131	5.2131	5.2214	5.1961	5.1691	5.1503	5.1308
util living area	0.9989	0.9973	0.9916	0.9684	0.8963	0.7406	0.5689	0.6308	0.8765	0.9847	0.9977	0.9992 (86)
MIT	19.7138	19.8668	20.1297	20.4765	20.7707	20.9418	20.9880	20.9801	20.8523	20.4563	20.0209	19.6895 (87)
Th 2	19.9748	19.9772	19.9795	19.9903	19.9923	20.0018	20.0018	20.0035	19.9981	19.9923	19.9882	19.9839 (88)
util rest of house	0.9986	0.9964	0.9885	0.9560	0.8555	0.6516	0.4477	0.5076	0.8127	0.9766	0.9967	0.9990 (89)
MIT 2	18.7978	18.9523	19.2155	19.5633	19.8348	19.9745	19.9987	19.9977	19.9133	19.5499	19.1153	18.7808 (90)
Living area fraction									fLA = Living area / (4) =			0.2152 (91)
MIT	18.9949	19.1490	19.4122	19.7598	20.0362	20.1827	20.2115	20.2091	20.1154	19.7449	19.3101	18.9764 (92)
Temperature adjustment												0.0000
adjusted MIT	18.9949	19.1490	19.4122	19.7598	20.0362	20.1827	20.2115	20.2091	20.1154	19.7449	19.3101	18.9764 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9981	0.9953	0.9862	0.9524	0.8576	0.6691	0.4740	0.5344	0.8215	0.9739	0.9958	0.9986 (94)
Useful gains	443.7508	519.5340	597.2933	659.2818	639.2546	490.3128	331.6793	346.2490	479.6219	485.0630	434.1364	418.1395 (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	1406.2487	1360.1017	1229.4056	1021.7769	782.5796	518.6168	335.5031	353.1642	561.0843	858.5043	1151.4519	1400.0351 (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	716.0985	564.8615	470.2916	260.9965	106.6338	0.0000	0.0000	0.0000	0.0000	277.8403	516.4671	730.5303 (98)
Space heating												3643.7196 (98)
Space heating per m2										(98) / (4) =		43.1005 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000
Heat loss rate W												
	0.0000	0.0000	0.0000	0.0000	0.0000	873.2382	687.4429	704.6435	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8731	0.9317	0.9077	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	762.3943	640.4956	639.6233	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	952.2229	911.5992	852.8699	0.0000	0.0000	0.0000	0.0000 (103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	136.6766	201.7011	158.6555	0.0000	0.0000	0.0000	0.0000 (104)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling												497.0331 (104)
Cooled fraction												1.0000 (105)
Intermittency factor (Table 10b)												
	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)	
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	34.1691	50.4253	39.6639	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												124.2583 (107)
Space cooling per m2												1.4698 (108)
Energy for space heating												43.1005 (99)
Energy for space cooling												1.4698 (108)
Total												44.5704 (109)
Target Fabric Energy Efficiency (TFEE)												51.3 (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	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					30.0000 / (5) = 0.1419 (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	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	0.4248	0.3915	0.3831	0.3581	0.3581	0.3332	0.3332	0.3248	0.3332	0.3748	0.3665	0.3915 (22b)
Effective ac	0.5902	0.5766	0.5734	0.5641	0.5641	0.5555	0.5555	0.5528	0.5555	0.5702	0.5671	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)			12.8800	1.1450	14.7481		(27)
Ground Floor			42.2700	0.1200	5.0724	84.0000	3550.6800 (28a)
Brick and Block	75.5000	12.8500	62.6500	0.2400	15.0360	42.2200	2645.0830 (29a)
Tile Hung	18.1500	2.1800	15.9700	0.2400	3.8328	42.2200	674.2534 (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)			178.1900				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		45.2813		(33)
Party Wall 1			42.3300	0.0000	0.0000	110.0000	4656.3000 (32)
Ground Floor Stud			69.2600			9.0000	623.3400 (32c)
First Floor Stud			90.7800			9.0000	817.0200 (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)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss
(28)...(30) + (32) + (32a)...(32e) = 14873.0534 (34)
175.9292 (35)
8.2833 (36)
(33) + (36) = 53.5646 (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	40.2165	39.9916	39.3457	39.3457	38.7433	38.7433	38.5522	38.7433	39.7714	39.5561	40.2165 (38)
Heat transfer coeff	94.7294	93.7811	93.5561	92.9102	92.9102	92.3079	92.3079	92.1168	92.3079	93.3360	93.1207	93.7811 (39)
Average = Sum(39)m / 12 =												93.0971 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1205	1.1093	1.1066	1.0990	1.0990	1.0919	1.0919	1.0896	1.0919	1.1040	1.1015	1.1093 (40)
HLP (average)												1.1012 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy
Average daily hot water use (litres/day)
2.5434 (42)
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)
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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

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)
RHI water heating demand												
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	53.7000	47.6959	38.7889	29.3657	21.9512	18.5321	20.0246	26.0288	34.9357	44.3589	51.7734	55.1925 (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	579.1431	574.4946	552.1113	517.5027	482.0877	450.4739	432.1055	440.7245	460.7462	495.5709	534.1979	563.3962 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c		Access factor Table 6d		Gains W	
East				3.6200	25.9136	0.6300	0.7000		0.7700		28.6688 (76)	
South				1.4400	58.2505	0.6300	0.7000		0.7700		25.6350 (78)	
West				7.8200	25.9136	0.6300	0.7000		0.7700		61.9309 (80)	
Solar gains	116.2347	187.0789	292.1841	417.1395	478.1558	525.9631	490.1865	436.5571	354.0448	230.4322	141.9964	92.3190 (83)
Total gains	695.3777	761.5735	844.2954	934.6421	960.2436	976.4370	922.2920	877.2816	814.7910	726.0031	676.1943	655.7152 (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	43.6127	44.0537	44.1596	44.4666	44.4666	44.7568	44.7568	44.8496	44.7568	44.2638	44.3661	44.0537
alpha	3.9075	3.9369	3.9440	3.9644	3.9644	3.9838	3.9838	3.9900	3.9838	3.9509	3.9577	3.9369
util living area	0.9715	0.9595	0.9247	0.8452	0.7087	0.5088	0.3658	0.3830	0.6250	0.8589	0.9488	0.9756 (86)
MIT	19.8280	19.9685	20.2656	20.6047	20.8532	20.9704	20.9939	20.9929	20.9344	20.6552	20.2196	19.8078 (87)
Th 2	19.9841	19.9932	19.9954	20.0016	20.0016	20.0075	20.0075	20.0093	20.0075	19.9975	19.9996	19.9932 (88)
util rest of house	0.9648	0.9503	0.9077	0.8117	0.6493	0.4265	0.2699	0.2831	0.5400	0.8184	0.9350	0.9698 (89)
MIT 2	18.9459	19.0899	19.3777	19.6965	19.9074	19.9944	20.0060	20.0076	19.9748	19.7468	19.3423	18.9337 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	19.1357	19.2789	19.5688	19.8919	20.1109	20.2044	20.2186	20.2196	20.1812	19.9422	19.5310	19.1218 (92)
Temperature adjustment	0.0000											
adjusted MIT	19.1357	19.2789	19.5688	19.8919	20.1109	20.2044	20.2186	20.2196	20.1812	19.9422	19.5310	19.1218 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9578	0.9423	0.8992	0.8076	0.6563	0.4433	0.2906	0.3047	0.5558	0.8158	0.9271	0.9634	(94)
Useful gains	666.0378	717.6543	759.1506	754.7967	630.1654	432.8401	267.9860	267.2703	452.8277	592.2995	626.9153	631.7179	(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	1301.1752	1273.4453	1147.8171	956.2243	697.8378	443.4813	269.4055	268.9417	478.2695	759.9631	1036.5309	1277.4679	(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	472.5423	373.4915	289.1679	145.0279	50.3483	0.0000	0.0000	0.0000	0.0000	124.7417	294.9232	480.4380	(98)
Space heating												2230.6808	(98)
RHI space heating demand												2231	(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	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					30.0000 / (5) = 0.1419 (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)			12.8800	1.1450	14.7481		(27)
Ground Floor			42.2700	0.1200	5.0724	84.0000	3550.6800 (28a)
Brick and Block	75.5000	12.8500	62.6500	0.2400	15.0360	42.2200	2645.0830 (29a)
Tile Hung	18.1500	2.1800	15.9700	0.2400	3.8328	42.2200	674.2534 (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)			178.1900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	45.2813		(33)
Party Wall 1			42.3300	0.0000	0.0000	110.0000	4656.3000 (32)
Ground Floor Stud			69.2600			9.0000	623.3400 (32c)
First Floor Stud			90.7800			9.0000	817.0200 (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)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss
(28)...(30) + (32) + (32a)...(32e) = 14873.0534 (34)
175.9292 (35)
8.2833 (36)
(33) + (36) = 53.5646 (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	94.7294	94.4850	94.2456	93.1207	92.9102	91.9305	91.9305	91.7490	92.3079	92.9102	93.3360	93.7811 (39)
Average = Sum(39)m / 12 =												93.1197 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1205	1.1176	1.1148	1.1015	1.0990	1.0874	1.0874	1.0853	1.0919	1.0990	1.1040	1.1093 (40)
HLP (average)												1.1015 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy
Average daily hot water use (litres/day)
2.5434 (42)
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)
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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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)
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	53.7000	47.6959	38.7889	29.3657	21.9512	18.5321	20.0246	26.0288	34.9357	44.3589	51.7734	55.1925	(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	579.1431	574.4946	552.1113	517.5027	482.0877	450.4739	432.1055	440.7245	460.7462	495.5709	534.1979	563.3962	(73)

6. Solar gains

[Jan]												Gains
			Area			Solar flux			g	FF	Access	Gains
			m2			Table 6a			Specific data	Specific data	factor	W
						W/m2			or Table 6b	or Table 6c	Table 6d	
East			3.6200			19.6403			0.6300	0.7000	0.7700	21.7284 (76)
South			1.4400			46.7521			0.6300	0.7000	0.7700	20.5748 (78)
West			7.8200			19.6403			0.6300	0.7000	0.7700	46.9381 (80)
Solar gains	89.2413	168.0225	264.1393	371.1431	445.9489	453.4085	432.8806	377.1692	302.1218	195.7340	110.0072	74.2465 (83)
Total gains	668.3844	742.5171	816.2506	888.6458	928.0367	903.8824	864.9861	817.8937	762.8681	691.3049	644.2051	637.6428 (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	43.6127	43.7255	43.8366	44.3661	44.4666	44.9405	44.9405	45.0294	44.7568	44.4666	44.2638	44.0537
alpha	3.9075	3.9150	3.9224	3.9577	3.9644	3.9960	3.9960	4.0020	3.9838	3.9644	3.9509	3.9369
util living area	0.9798	0.9682	0.9421	0.8806	0.7691	0.6046	0.4554	0.4977	0.7217	0.9069	0.9673	0.9829 (86)
MIT	19.6455	19.8271	20.1258	20.4948	20.7793	20.9384	20.9844	20.9779	20.8729	20.5017	20.0111	19.6102 (87)
Th 2	19.9841	19.9865	19.9888	19.9996	20.0016	20.0111	20.0111	20.0129	20.0075	20.0016	19.9975	19.9932 (88)
util rest of house	0.9752	0.9611	0.9290	0.8537	0.7189	0.5264	0.3585	0.3987	0.6489	0.8799	0.9588	0.9790 (89)
MIT 2	18.7658	18.9459	19.2384	19.5961	19.8487	19.9792	20.0060	20.0050	19.9335	19.6121	19.1378	18.7381 (90)
Living area fraction	18.9551	19.1355	19.4293	19.7895	20.0489	20.1856	20.2165	20.2143	20.1357	19.8035	19.3257	18.9257 (91)
MIT	18.9551	19.1355	19.4293	19.7895	20.0489	20.1856	20.2165	20.2143	20.1357	19.8035	19.3257	18.9257 (92)
Temperature adjustment												0.0000
adjusted MIT	18.9551	19.1355	19.4293	19.7895	20.0489	20.1856	20.2165	20.2143	20.1357	19.8035	19.3257	18.9257 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	647.8928	708.1749	751.2337	752.9393	669.5801	488.8767	327.9454	343.1617	502.8382	603.8911	613.0627	620.8945	(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	1388.2696	1345.0391	1218.5287	1014.0357	775.7023	513.4868	332.4677	349.9589	557.1391	855.1029	1141.1014	1380.9951	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	550.8403	427.9727	347.6675	187.9894	78.9549	0.0000	0.0000	0.0000	0.0000	186.9016	380.1878	565.5149	(98)
Space heating	550.8403	427.9727	347.6675	187.9894	78.9549	0.0000	0.0000	0.0000	0.0000	186.9016	380.1878	565.5149	(98)
Space heating per m2	550.8403	427.9727	347.6675	187.9894	78.9549	0.0000	0.0000	0.0000	0.0000	186.9016	380.1878	565.5149	(98)
													(98) / (4) = 32.2454 (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													3005.5447 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	550.8403	427.9727	347.6675	187.9894	78.9549	0.0000	0.0000	0.0000	0.0000	186.9016	380.1878	565.5149	(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)	607.3212	471.8553	383.3159	207.2650	87.0506	0.0000	0.0000	0.0000	0.0000	206.0657	419.1707	623.5004	(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 (217)m	89.8135	89.7296	89.5453	89.1370	88.4209	87.2000	87.2000	87.2000	87.2000	89.1000	89.6246	89.8486	(216)
Fuel for water heating, kWh/month	200.0204	175.9086	183.7716	163.6175	160.2655	143.2162	135.6606	151.4705	152.0293	169.8381	180.8781	194.5082	(219)
Water heating fuel used												2011.1846	(219)
Annual totals kWh/year													
Space heating fuel - main system												3005.5447	(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)												379.3436	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.60 * 1068 * 1.00) =										-512.6738		-512.6738	(233)
Total delivered energy for all uses												4958.3991	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3005.5447	3.4800	104.5930 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2011.1846	3.4800	69.9892 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	379.3436	13.1900	50.0354 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-512.6738	13.1900	-67.6217 (252)
Total energy cost			286.8884 (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] =	0.9302 (257)
SAP value		87.0242
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	3005.5447	0.2160	649.1977 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2011.1846	0.2160	434.4159 (264)
Space and water heating			1083.6135 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	379.3436	0.5190	196.8793 (268)
Energy saving/generation technologies			
PV Unit	-512.6738	0.5190	-266.0777 (269)
Total kg/year			1053.3402 (272)
CO2 emissions per m2			12.4600 (273)
EI value			89.1039
EI rating			89 (274)
EI band			B

Calculation of stars for heating and DHW

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9070 = 3.837$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9070 = 0.2381$, stars = 4
Water heating energy efficiency	$3.48 / 0.8867 = 3.925$, stars = 4
Water heating environmental impact	$0.216 / 0.8867 = 0.2436$, 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	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1419 (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	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	0.4248	0.3915	0.3831	0.3581	0.3581	0.3332	0.3332	0.3248	0.3332	0.3748	0.3665	0.3915 (22b)
Effective ac	0.5902	0.5766	0.5734	0.5641	0.5641	0.5555	0.5555	0.5528	0.5555	0.5702	0.5671	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)			12.8800	1.1450	14.7481		(27)
Ground Floor			42.2700	0.1200	5.0724	84.0000	3550.6800 (28a)
Brick and Block	75.5000	12.8500	62.6500	0.2400	15.0360	42.2200	2645.0830 (29a)
Tile Hung	18.1500	2.1800	15.9700	0.2400	3.8328	42.2200	674.2534 (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)			178.1900				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		45.2813		(33)
Party Wall 1			42.3300	0.0000	0.0000	110.0000	4656.3000 (32)
Ground Floor Stud			69.2600			9.0000	623.3400 (32c)
First Floor Stud			90.7800			9.0000	817.0200 (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)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss
(28)...(30) + (32) + (32a)...(32e) = 14873.0534 (34)
175.9292 (35)
8.2833 (36)
(33) + (36) = 53.5646 (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	40.2165	39.9916	39.3457	39.3457	38.7433	38.7433	38.5522	38.7433	39.7714	39.5561	40.2165 (38)
Heat transfer coeff	94.7294	93.7811	93.5561	92.9102	92.9102	92.3079	92.3079	92.1168	92.3079	93.3360	93.1207	93.7811 (39)
Average = Sum(39)m / 12 =												93.0971 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1205	1.1093	1.1066	1.0990	1.0990	1.0919	1.0919	1.0896	1.0919	1.1040	1.1015	1.1093 (40)
HLP (average)												1.1012 (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)
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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Energy content (annual)												Total = Sum(45)m = 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)
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	53.7000	47.6959	38.7889	29.3657	21.9512	18.5321	20.0246	26.0288	34.9357	44.3589	51.7734	55.1925	(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	579.1431	574.4946	552.1113	517.5027	482.0877	450.4739	432.1055	440.7245	460.7462	495.5709	534.1979	563.3962	(73)

6. Solar gains

[Jan]													
					Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	FF Specific data or Table 6c		Access factor Table 6d		Gains W
East					3.6200	25.9136		0.6300	0.7000		0.7700		28.6688 (76)
South					1.4400	58.2505		0.6300	0.7000		0.7700		25.6350 (78)
West					7.8200	25.9136		0.6300	0.7000		0.7700		61.9309 (80)
Solar gains	116.2347	187.0789	292.1841	417.1395	478.1558	525.9631	490.1865	436.5571	354.0448	230.4322	141.9964	92.3190	(83)
Total gains	695.3777	761.5735	844.2954	934.6421	960.2436	976.4370	922.2920	877.2816	814.7910	726.0031	676.1943	655.7152	(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	43.6127	44.0537	44.1596	44.4666	44.4666	44.7568	44.7568	44.8496	44.7568	44.2638	44.3661	44.0537
alpha	3.9075	3.9369	3.9440	3.9644	3.9644	3.9838	3.9838	3.9900	3.9838	3.9509	3.9577	3.9369
util living area	0.9715	0.9595	0.9247	0.8452	0.7087	0.5088	0.3658	0.3830	0.6250	0.8589	0.9488	0.9756 (86)
MIT	19.8280	19.9685	20.2656	20.6047	20.8532	20.9704	20.9939	20.9929	20.9344	20.6552	20.2196	19.8078 (87)
Th 2	19.9841	19.9932	19.9954	20.0016	20.0016	20.0075	20.0075	20.0093	20.0075	19.9975	19.9996	19.9932 (88)
util rest of house	0.9648	0.9503	0.9077	0.8117	0.6493	0.4265	0.2699	0.2831	0.5400	0.8184	0.9350	0.9698 (89)
MIT 2	18.9459	19.0899	19.3777	19.6965	19.9074	19.9944	20.0060	20.0076	19.9748	19.7468	19.3423	18.9337 (90)
Living area fraction	19.1357	19.2789	19.5688	19.8919	20.1109	20.2044	20.2186	20.2196	20.1812	19.9422	19.5310	19.1218 (92)
MIT	19.1357	19.2789	19.5688	19.8919	20.1109	20.2044	20.2186	20.2196	20.1812	19.9422	19.5310	19.1218 (93)
Temperature adjustment												0.0000
adjusted MIT	19.1357	19.2789	19.5688	19.8919	20.1109	20.2044	20.2186	20.2196	20.1812	19.9422	19.5310	19.1218 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9578	0.9423	0.8992	0.8076	0.6563	0.4433	0.2906	0.3047	0.5558	0.8158	0.9271	0.9634	(94)
Useful gains	666.0378	717.6543	759.1506	754.7967	630.1654	432.8401	267.9860	267.2703	452.8277	592.2995	626.9153	631.7179	(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	1301.1752	1273.4453	1147.8171	956.2243	697.8378	443.4813	269.4055	268.9417	478.2695	759.9631	1036.5309	1277.4679	(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	472.5423	373.4915	289.1679	145.0279	50.3483	0.0000	0.0000	0.0000	0.0000	124.7417	294.9232	480.4380	(98)
Space heating												2230.6808	(98)
Space heating per m2												26.3861	(99)
												(98) / (4) =	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.7000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													2459.4055 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	472.5423	373.4915	289.1679	145.0279	50.3483	0.0000	0.0000	0.0000	0.0000	124.7417	294.9232	480.4380	(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)	520.9948	411.7878	318.8179	159.8984	55.5108	0.0000	0.0000	0.0000	0.0000	137.5322	325.1634	529.7001	(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 (217)m	89.7082	89.6313	89.3986	88.9107	88.0911	87.2000	87.2000	87.2000	87.2000	88.7474	89.4268	87.2000	(216)
Fuel for water heating, kWh/month	200.2551	176.1016	184.0732	164.0340	160.8654	143.2162	135.6606	151.4705	152.0293	170.5127	181.2782	194.7452	(219)
Water heating fuel used													(219)
Annual totals kWh/year													
Space heating fuel - main system													2459.4055 (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)													379.3436 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.60 * 1212 * 1.00) =										-581.6683			-581.6683 (233)
Total delivered energy for all uses													4346.3228 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2459.4055	10.2300	251.5972 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2014.2420	10.2300	206.0570 (247)
Pumps and fans for heating	75.0000	36.7200	27.5400 (249)
Energy for lighting	379.3436	36.7200	139.2950 (250)
Additional standing charges			103.0000 (251)
Energy saving/generation technologies			
PV Unit	-581.6683	36.7200	-213.5886 (252)
Total energy cost			513.9005 (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	2459.4055	0.2160	531.2316 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2014.2420	0.2160	435.0763 (264)
Space and water heating			966.3079 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	379.3436	0.5190	196.8793 (268)
Energy saving/generation technologies			
PV Unit	-581.6683	0.5190	-301.8859 (269)
Total kg/year			900.2263 (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	2459.4055	1.2200	3000.4747 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2014.2420	1.2200	2457.3752 (264)
Space and water heating			5457.8499 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	379.3436	3.0700	1164.5850 (268)
Energy saving/generation technologies			
PV Unit	-581.6683	3.0700	-1785.7218 (269)
Primary energy kWh/year			5066.9631 (272)
Primary energy kWh/m2/year			59.9357 (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 (21.4%)

		Typical annual savings	Energy efficiency	Environmental impact
Recommended measures				
Solar water heating	£85	2.28 kg/m²	B 88	B 91
Total Savings	£85	2.28 kg/m²		
Potential energy efficiency rating:			B 88	
Potential environmental impact rating:				B 91

Fuel prices for cost data on this page from database revision number 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	£561	£457	£104
Space heating	£382	£382	£0
Water heating	£206	£121	£85
Lighting	£139	£139	£0
Generated (PV)	-£214	-£214	£0
Total cost of fuels	£514	£428	£86
Total cost of uses	£513	£428	£85
Delivered energy	51 kWh/m²	40 kWh/m²	11 kWh/m²
Carbon dioxide emissions	0.9 tonnes	0.7 tonnes	0.2 tonnes
CO2 emissions per m²	11 kg/m²	8 kg/m²	2 kg/m²
Primary energy	60 kWh/m²	47 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					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)			12.8800	1.1450	14.7481		(27)
Ground Floor			42.2700	0.1200	5.0724	84.0000	3550.6800 (28a)
Brick and Block	75.5000	12.8500	62.6500	0.2400	15.0360	42.2200	2645.0830 (29a)
Tile Hung	18.1500	2.1800	15.9700	0.2400	3.8328	42.2200	674.2534 (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)			178.1900				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		45.2813		(33)
Party Wall 1			42.3300	0.0000	0.0000	110.0000	4656.3000 (32)
Ground Floor Stud			69.2600			9.0000	623.3400 (32c)
First Floor Stud			90.7800			9.0000	817.0200 (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)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss
(28)...(30) + (32) + (32a)...(32e) = 14873.0534 (34)
175.9292 (35)
8.2833 (36)
(33) + (36) = 53.5646 (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	94.7294	94.4850	94.2456	93.1207	92.9102	91.9305	91.9305	91.7490	92.3079	92.9102	93.3360	93.7811 (39)
Average = Sum(39)m / 12 =												93.1197 (39)
HLP	1.1205	1.1176	1.1148	1.1015	1.0990	1.0874	1.0874	1.0853	1.0919	1.0990	1.1040	1.1093 (40)
HLP (average)												1.1015 (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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Energy content (annual)												Total = Sum(45)m = 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)
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)
												-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)
												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)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	53.7000	47.6959	38.7889	29.3657	21.9512	18.5321	20.0246	26.0288	34.9357	44.3589	51.7734	55.1925	(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	579.1431	574.4946	552.1113	517.5027	482.0877	450.4739	432.1055	440.7245	460.7462	495.5709	534.1979	563.3962	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W				
East				3.6200	19.6403	0.6300	0.7000	0.7700	21.7284	(76)			
South				1.4400	46.7521	0.6300	0.7000	0.7700	20.5748	(78)			
West				7.8200	19.6403	0.6300	0.7000	0.7700	46.9381	(80)			
Solar gains	89.2413	168.0225	264.1393	371.1431	445.9489	453.4085	432.8806	377.1692	302.1218	195.7340	110.0072	74.2465	(83)
Total gains	668.3844	742.5171	816.2506	888.6458	928.0367	903.8824	864.9861	817.8937	762.8681	691.3049	644.2051	637.6428	(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	43.6127	43.7255	43.8366	44.3661	44.4666	44.9405	44.9405	45.0294	44.7568	44.4666	44.2638	44.0537
alpha	3.9075	3.9150	3.9224	3.9577	3.9644	3.9960	3.9960	4.0020	3.9838	3.9644	3.9509	3.9369
util living area	0.9798	0.9682	0.9421	0.8806	0.7691	0.6046	0.4554	0.4977	0.7217	0.9069	0.9673	0.9829 (86)
MIT	19.6455	19.8271	20.1258	20.4948	20.7793	20.9384	20.9844	20.9779	20.8729	20.5017	20.0111	19.6102 (87)
Th 2	19.9841	19.9865	19.9888	19.9996	20.0016	20.0111	20.0111	20.0129	20.0075	20.0016	19.9975	19.9932 (88)
util rest of house	0.9752	0.9611	0.9290	0.8537	0.7189	0.5264	0.3585	0.3987	0.6489	0.8799	0.9588	0.9790 (89)
MIT 2	18.7658	18.9459	19.2384	19.5961	19.8487	19.9792	20.0060	20.0050	19.9335	19.6121	19.1378	18.7381 (90)
Living area fraction	fLA = Living area / (4) =											0.2152 (91)
MIT	18.9551	19.1355	19.4293	19.7895	20.0489	20.1856	20.2165	20.2143	20.1357	19.8035	19.3257	18.9257 (92)
Temperature adjustment												0.0000
adjusted MIT	18.9551	19.1355	19.4293	19.7895	20.0489	20.1856	20.2165	20.2143	20.1357	19.8035	19.3257	18.9257 (93)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9693	0.9537	0.9203	0.8473	0.7215	0.5409	0.3791	0.4196	0.6591	0.8736	0.9517	0.9737	(94)
Useful gains	647.8928	708.1749	751.2337	752.9393	669.5801	488.8767	327.9454	343.1617	502.8382	603.8911	613.0627	620.8945	(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	1388.2696	1345.0391	1218.5287	1014.0357	775.7023	513.4868	332.4677	349.9589	557.1391	855.1029	1141.1014	1380.9951	(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	550.8403	427.9727	347.6675	187.9894	78.9549	0.0000	0.0000	0.0000	0.0000	186.9016	380.1878	565.5149	(98)
Space heating												2726.0291	(98)
Space heating per m2											(98) / (4) =	32.2454	(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													3005.5447	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	550.8403	427.9727	347.6675	187.9894	78.9549	0.0000	0.0000	0.0000	0.0000	186.9016	380.1878	565.5149	(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)	607.3212	471.8553	383.3159	207.2650	87.0506	0.0000	0.0000	0.0000	0.0000	206.0657	419.1707	623.5004	(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	89.9077	89.9269	89.9293	89.9202	89.8190	87.2000	87.2000	87.2000	87.2000	89.4594	89.7671	89.9271	(217)	
Fuel for water heating, kWh/month	172.3506	129.7095	104.9641	57.6156	28.4295	12.2338	6.4092	38.5429	63.5844	110.2836	147.9685	171.3641	(219)	
Water heating fuel used												1043.4556	(219)	
Annual totals kWh/year														
Space heating fuel - main system													3005.5447	(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)													379.3436	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 0.60 * 1068 * 1.00) =										-512.6738			-512.6738	(233)
Total delivered energy for all uses													4040.6701	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3005.5447	3.4800	104.5930	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1043.4556	3.4800	36.3123	(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	379.3436	13.1900	50.0354	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-512.6738	13.1900	-67.6217	(252)
Total energy cost			259.8065	(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] =	0.8424	(257)
SAP value		88.2491	
SAP rating (Section 12)		88	(258)
SAP band		B	

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3005.5447	0.2160	649.1977	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1043.4556	0.2160	225.3864	(264)
Space and water heating			874.5841	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	379.3436	0.5190	196.8793	(268)
Energy saving/generation technologies				
PV Unit	-512.6738	0.5190	-266.0777	(269)
Total kg/year			870.2607	(272)
CO2 emissions per m2			10.2900	(273)
EI value			90.9978	
EI rating			91	(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	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				30.0000 / (5) = 0.1419 (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	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	0.4248	0.3915	0.3831	0.3581	0.3581	0.3332	0.3332	0.3248	0.3332	0.3748	0.3665	0.3915 (22b)
Effective ac	0.5902	0.5766	0.5734	0.5641	0.5641	0.5555	0.5555	0.5528	0.5555	0.5702	0.5671	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)			12.8800	1.1450	14.7481		(27)
Ground Floor			42.2700	0.1200	5.0724	84.0000	3550.6800 (28a)
Brick and Block	75.5000	12.8500	62.6500	0.2400	15.0360	42.2200	2645.0830 (29a)
Tile Hung	18.1500	2.1800	15.9700	0.2400	3.8328	42.2200	674.2534 (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)			178.1900				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		45.2813		(33)
Party Wall 1			42.3300	0.0000	0.0000	110.0000	4656.3000 (32)
Ground Floor Stud			69.2600			9.0000	623.3400 (32c)
First Floor Stud			90.7800			9.0000	817.0200 (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)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss
(28)...(30) + (32) + (32a)...(32e) = 14873.0534 (34)
175.9292 (35)
8.2833 (36)
(33) + (36) = 53.5646 (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	40.2165	39.9916	39.3457	39.3457	38.7433	38.7433	38.5522	38.7433	39.7714	39.5561	40.2165 (38)
Heat transfer coeff	94.7294	93.7811	93.5561	92.9102	92.9102	92.3079	92.3079	92.1168	92.3079	93.3360	93.1207	93.7811 (39)
Average = Sum(39)m / 12 =												93.0971 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1205	1.1093	1.1066	1.0990	1.0990	1.0919	1.0919	1.0896	1.0919	1.1040	1.1015	1.1093 (40)
HLP (average)												1.1012 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy
Average daily hot water use (litres/day)
2.5434 (42)
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)
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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Energy content (annual)												Total = Sum(45)m =	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)		
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)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	53.7000	47.6959	38.7889	29.3657	21.9512	18.5321	20.0246	26.0288	34.9357	44.3589	51.7734	55.1925	(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	579.1431	574.4946	552.1113	517.5027	482.0877	450.4739	432.1055	440.7245	460.7462	495.5709	534.1979	563.3962	(73)

6. Solar gains

[Jan]												Gains
			Area	Solar flux		g		FF		Access	Gains	
			m2	Table 6a		Specific data		Specific data		factor	W	
				W/m2		or Table 6b		or Table 6c		Table 6d		
East			3.6200	25.9136		0.6300		0.7000		0.7700	28.6688 (76)	
South			1.4400	58.2505		0.6300		0.7000		0.7700	25.6350 (78)	
West			7.8200	25.9136		0.6300		0.7000		0.7700	61.9309 (80)	
Solar gains	116.2347	187.0789	292.1841	417.1395	478.1558	525.9631	490.1865	436.5571	354.0448	230.4322	141.9964	92.3190 (83)
Total gains	695.3777	761.5735	844.2954	934.6421	960.2436	976.4370	922.2920	877.2816	814.7910	726.0031	676.1943	655.7152 (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	43.6127	44.0537	44.1596	44.4666	44.4666	44.7568	44.7568	44.8496	44.7568	44.2638	44.3661	44.0537
alpha	3.9075	3.9369	3.9440	3.9644	3.9644	3.9838	3.9838	3.9900	3.9838	3.9509	3.9577	3.9369
util living area	0.9715	0.9595	0.9247	0.8452	0.7087	0.5088	0.3658	0.3830	0.6250	0.8589	0.9488	0.9756 (86)
MIT	19.8280	19.9685	20.2656	20.6047	20.8532	20.9704	20.9939	20.9929	20.9344	20.6552	20.2196	19.8078 (87)
Th 2	19.9841	19.9932	19.9954	20.0016	20.0016	20.0075	20.0075	20.0093	20.0075	19.9975	19.9996	19.9932 (88)
util rest of house	0.9648	0.9503	0.9077	0.8117	0.6493	0.4265	0.2699	0.2831	0.5400	0.8184	0.9350	0.9698 (89)
MIT 2	18.9459	19.0899	19.3777	19.6965	19.9074	19.9944	20.0060	20.0076	19.9748	19.7468	19.3423	18.9337 (90)
Living area fraction	fLA = Living area / (4) =											0.2152 (91)
MIT	19.1357	19.2789	19.5688	19.8919	20.1109	20.2044	20.2186	20.2196	20.1812	19.9422	19.5310	19.1218 (92)
Temperature adjustment												0.0000
adjusted MIT	19.1357	19.2789	19.5688	19.8919	20.1109	20.2044	20.2186	20.2196	20.1812	19.9422	19.5310	19.1218 (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	0.9578	0.9423	0.8992	0.8076	0.6563	0.4433	0.2906	0.3047	0.5558	0.8158	0.9271	0.9634	(94)
Useful gains	666.0378	717.6543	759.1506	754.7967	630.1654	432.8401	267.9860	267.2703	452.8277	592.2995	626.9153	631.7179	(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	1301.1752	1273.4453	1147.8171	956.2243	697.8378	443.4813	269.4055	268.9417	478.2695	759.9631	1036.5309	1277.4679	(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	472.5423	373.4915	289.1679	145.0279	50.3483	0.0000	0.0000	0.0000	0.0000	124.7417	294.9232	480.4380	(98)
Space heating												2230.6808	(98)
Space heating per m2											(98) / (4) =	26.3861	(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													2459.4055	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	472.5423	373.4915	289.1679	145.0279	50.3483	0.0000	0.0000	0.0000	0.0000	124.7417	294.9232	480.4380	(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)	520.9948	411.7878	318.8179	159.8984	55.5108	0.0000	0.0000	0.0000	0.0000	137.5322	325.1634	529.7001	(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	89.8294	89.8447	89.8167	89.7849	89.4222	87.2000	87.2000	87.2000	87.2000	89.1538	89.6129	89.8359	(217)	
Fuel for water heating, kWh/month	167.4509	129.2480	104.4920	54.9744	31.1274	4.2452	1.8203	32.0673	57.5287	106.4491	142.5594	168.5503	(219)	
Water heating fuel used												1000.5131	(219)	
Annual totals kWh/year														
Space heating fuel - main system													2459.4055	(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)													379.3436	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 0.60 * 1212 * 1.00) =										-581.6683			-581.6683	(233)
Total delivered energy for all uses													3382.5939	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2459.4055	10.2300	251.5972	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1000.5131	10.2300	102.3525	(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	379.3436	36.7200	139.2950	(250)
Additional standing charges			103.0000	(251)
Energy saving/generation technologies				
PV Unit	-581.6683	36.7200	-213.5886	(252)
Total energy cost			428.5560	(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	2459.4055	0.2160	531.2316	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1000.5131	0.2160	216.1108	(264)
Space and water heating			747.3424	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	379.3436	0.5190	196.8793	(268)
Energy saving/generation technologies				
PV Unit	-581.6683	0.5190	-301.8859	(269)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Total kg/year

707.2109 (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	2459.4055	1.2200	3000.4747 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1000.5131	1.2200	1220.6260 (264)
Space and water heating			4221.1007 (265)
Pumps and fans	125.0000	3.0700	383.7500 (267)
Energy for lighting	379.3436	3.0700	1164.5850 (268)
Energy saving/generation technologies			
PV Unit	-581.6683	3.0700	-1785.7218 (269)
Primary energy kWh/year			3983.7138 (272)
Primary energy kWh/m2/year			47.1222 (273)

U-VALUE CALCULATOR REPORT

Property Reference	SAP 0906 Plot 48	Issued on Date	29/11/2023
Assessment Reference	Rev B	Prop Type Ref	Block C
Project			
Calculation Type	New Build (As Designed)		

SAP Rating	87 B	DER	14.31	TER	18.04
Environmental	89 B	% DER<TER	20.67		
CO ₂ Emissions (t/year)	0.90	DFEE	43.35	TFEE	51.26
General Requirements Compliance	Pass	% DFEE<TFEE	15.43		

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

SAP Rating	87 B	DER	14.31	TER	18.04
Environmental	89 B	% DER<TER	20.67		
CO ₂ Emissions (t/year)	0.90	DFEE	43.35	TFEE	51.26
General Requirements Compliance	Pass	% DFEE<TFEE	15.43		

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

SAP Rating	87 B	DER	14.31	TER	18.04
Environmental	89 B	% DER<TER	20.67		
CO ₂ Emissions (t/year)	0.90	DFEE	43.35	TFEE	51.26
General Requirements Compliance	Pass	% DFEE<TFEE	15.43		

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 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 m ² K/W	Lower limit = 4.137 m ² K/W	Average = 4.243 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: 383 mm

U-value: 0.24 W/m² K

Kappa: 42.22 kJ/m² K

U-VALUE CALCULATOR REPORT

Property Reference	SAP 0906 Plot 48	Issued on Date	29/11/2023
Assessment Reference	Rev B	Prop Type Ref	Block C
Project			
Calculation Type	New Build (As Designed)		

SAP Rating	87 B	DER	14.31	TER	18.04
Environmental	89 B	% DER<TER	20.67		
CO ₂ Emissions (t/year)	0.90	DFEE	43.35	TFEE	51.26
General Requirements Compliance	Pass	% DFEE<TFEE	15.43		

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 48	Issued on Date	29/11/2023
Assessment Reference	Rev B	Prop Type Ref	Block C
Property			

SAP Rating	87 B	DER	14.31	TER	18.04
Environmental	89 B	% DER<TER	20.67		
CO ₂ Emissions (t/year)	0.90	DFEE	43.35	TFEE	51.26
General Requirements Compliance	Pass	% DFEE<TFEE	15.43		

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	East
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:	18.73 m	42.27 m ²	2.39 m
	1st Storey:	18.73 m	42.27 m ²	2.61 m

7.0 Living Area	18.19	m ²
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8.0 Thermal Mass Parameter	Precise calculation	
Thermal Mass	175.93	kJ/m ² K

9.0 External Walls			U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area (m ²)	Nett Area (m ²)
Description	Type	Construction				
Brick and Block	Cavity Wall	Other	0.24	42.22	75.50	62.65
Tile Hung	Cavity Wall	Other	0.24	42.22	18.15	15.97

9.1 Party Walls			U-Value (W/m ² K)	Kappa (kJ/m ² K)	Area (m ²)
Description	Type	Construction			
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	42.33

9.2 Internal Walls			Kappa (kJ/m ² K)	Area (m ²)
Description	Construction			
Ground Floor Stud	Plasterboard on timber frame		9.00	69.26
First Floor Stud	Plasterboard on timber frame		9.00	90.78

10.0 External Roofs			U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area (m ²)	Nett Area (m ²)
Description	Type	Construction				
Pitched Roof	External Plane Roof	Other	0.10	9.10	42.27	42.27

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

10.2 Internal Ceilings

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

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	East							2.15	
Front Elevation	Window	[1] Brick and Block	East	None	0.00					1.44	
Side Elevation	Window	[1] Brick and Block	South	None	0.00					1.44	
Rear Elevation	Window	[1] Brick and Block	West	None	0.00					7.82	
Front Tiled	Window	[2] Tile Hung	East	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)	1.37	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)	3.74	0.064	No	Birtley Supatherm
Independently assessed	E2 Other lintels (including other steel lintels)	1.59	0.067	No	Birtley Supatherm
Independently assessed	E3 Sill	8.30	0.021	No	Knauf P5
Independently assessed	E4 Jamb	28.80	0.016	No	Knauf P6
Table K1 - Approved	E5 Ground floor (normal)	18.73	0.160	No	
Independently assessed	E6 Intermediate floor within a dwelling	18.73	0.000	No	CD0029
Independently assessed	E10 Eaves (insulation at ceiling level)	13.91	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)	14.99	0.039	No	Knauf P23
Independently assessed	E18 Party wall between dwellings	5.00	0.036	No	Knauf P25 Halved
Independently assessed	E25 Staggered party wall between dwellings	5.00	0.055	No	Knauf P27 Halved
Table K1 - Default	P1 Party wall - Ground floor	8.47	0.160	No	
Table K1 - Default	P2 Party wall - Intermediate floor within a dwelling	8.47	0.000	No	
Independently assessed	P4 Party wall - Roof (insulation at ceiling level)	8.47	0.035	No	Knauf P29 Halved

Y-value 0.046 W/m²K

18.0 Pressure Testing

Yes

Designed AP₅₀ 5.00

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

Property Tested ? m³/(h.m²) @ 50 Pa

As Built AP₅₀ m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather

Cross ventilation possible

Night Ventilation

Air change rate

Mechanical Ventilation

Mechanical Ventilation System Present

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				3
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System

22.0 Lighting

Internal

Total number of light fittings

Total number of L.E.L. fittings

Percentage of L.E.L. fittings %

External

External lights fitted

Light and motion sensor

23.0 Electricity Tariff

24.0 Main Heating 1

Description	Database	
Percentage of Heat	Mains Gas Combi	%
Database Ref. No.	100	
Fuel Type	17513	
Main Heating	Mains gas	
SAP Code	BGW	
In Winter	104	
In Summer	90.7	
Controls	87.2	
PCDF Controls	CBE Programmer, room thermostat and TRVs	
Delayed Start Stat	0	
Sap Code	No	
Flue Type	2106	
Fan Assisted Flue	Balanced	
Is MHS Pumped	Yes	
Heat Emitter	Pump in heated space	
Flow Temperature	Radiators	
Combi boiler type	Normal (> 45°C)	
	Standard Combi	

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

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			
32.0 Photovoltaic Unit	One Dwelling			
PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
0.60	South	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	