



elmhurst
energy



SAP Report Submission for Building Regulations Compliance

Client: Foreman Homes

Project: Plot 116

Contact: Tobias Whiting
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Report Issue Date: 28/03/2023

EXCELLENCE
IN ENERGY
ASSESSMENT

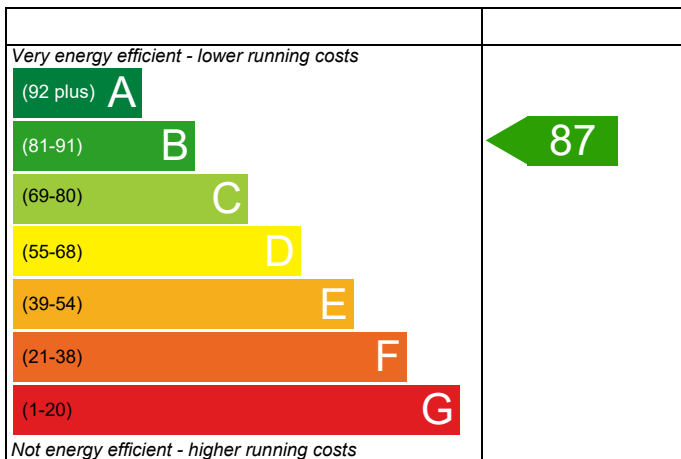
Plot 116

Dwelling type: House, Semi-Detached
 Date of assessment: 28/03/2023
 Produced by: Abacus Energy (UK) Ltd
 Total floor area: 84.52 m²
 DRRN: 5598-2807-2074

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.

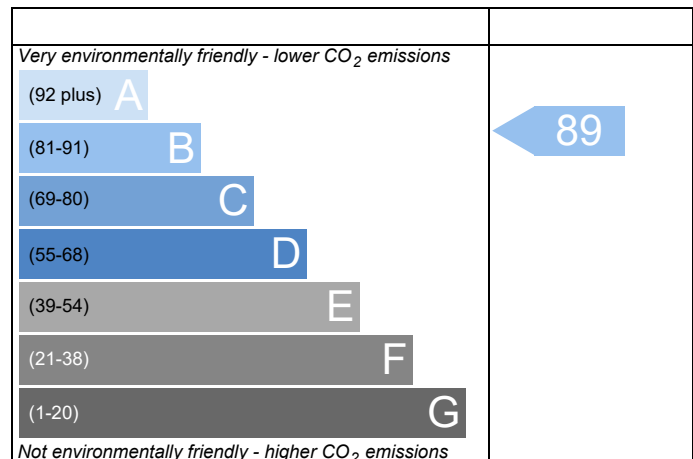
Energy Efficiency Rating



England EU Directive 2002/91/EC

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



England EU Directive 2002/91/EC

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 0879 Plot 116	Issued on Date	28/03/2023
Assessment Reference	Rev A	Prop Type Ref	3B AFF (HA/SO)
Property	Plot 116		

SAP Rating	87 B	DER	13.92	TER	17.88
Environmental	89 B	% DER<TER	22.16		
CO ₂ Emissions (t/year)	0.87	DFEE	42.06	TFEE	49.95
General Requirements Compliance	Pass	% DFEE<TFEE	15.79		

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)	17.88	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	13.92	kgCO ₂ /m ²	Pass
	-3.96 (-22.1%)	kgCO ₂ /m ²	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	49.95	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DFEE)	42.06	kWh/m ² /yr	
	-7.8 (-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)	0.26 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.12 (max. 0.25)	0.12 (max. 0.70)	Pass
Roof	0.10 (max. 0.20)	0.10 (max. 0.35)	Pass
Openings	1.18 (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

4.15 m², No overhang

Windows facing West

7.08 m², No overhang

Air change rate

4.00 ach

Blinds/curtains

None

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type

U-value

Filled Cavity with Edge Sealing

0.00

W/m²K

Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals

5.00 (design value) m³/(h.m²) @ 50 Pa

Maximum

10.0 m³/(h.m²) @ 50 Pa

Pass

10 Key features

Party wall U-value

0.00

W/m²K

Roof U-value

0.10

W/m²K

Floor U-value

0.12

W/m²K

Door U-value

1.10

W/m²K

Photovoltaic array

0.75

kW

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RECOMMENDATIONS

	Typical cost	Typical savings per year	Energy efficiency	Environmental impact	Result
Low energy lights			0	0	Already installed
Solar water heating	£4,000 - £6,000	£80	B 88	B 91	Recommended
Photovoltaic			0	0	Already installed
Wind turbine			0	0	Not applicable
Totals	£4,000 - £6,000	£80	B 88	B 91	

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THERMAL BRIDGING

Calculation Type: New Build (As Designed)

Property Reference	SAP 0879 Plot 116		Issued on Date	28/03/2023
Assessment Reference	Rev A	Prop Type Ref	3B AFF (HA/SO)	
Property	Plot 116			

SAP Rating	87 B	DER	13.92	TER	17.88
Environmental	89 B	% DER<TER	22.16		
CO ₂ Emissions (t/year)	0.87	DFEE	42.06	TFEE	49.95
General Requirements Compliance	Pass	% DFEE<TFEE	15.79		

Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 07798936079, toby@abacusenergyuk.com	Assessor ID	E477-0001
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Client	Foreman Homes, FORE
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	Junction detail	Source Type	Psi (W/mK)	Length (m)	Result	Reference
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.077	1.37	0.11	Birtley Supatherm
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.070	0.91	0.06	Birtley Supatherm
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.071	1.02	0.07	Birtley Supatherm
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.064	4.99	0.32	Birtley Supatherm
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.064	1.81	0.12	Birtley Supatherm
External wall	E3 Sill	Independently assessed	0.021	8.17	0.17	Knauf P5
External wall	E4 Jamb	Independently assessed	0.016	24.15	0.39	Knauf P6
External wall	E5 Ground floor (normal)	Table K1 - Approved	0.160	27.22	4.36	
External wall	E6 Intermediate floor within a dwelling	Independently assessed	0.000	18.36	0.00	CD0029
External wall	E10 Eaves (insulation at ceiling level)	Table K1 - Approved	0.060	9.77	0.59	
External wall	E12 Gable (insulation at ceiling level)	Independently assessed	0.044	8.72	0.38	Knauf P21
External wall	E16 Corner (normal)	Independently assessed	0.039	10.60	0.41	Knauf P23
External wall	E18 Party wall between dwellings	Table K1 - Approved	0.060	8.80	0.53	
Party wall	P2 Party wall - Intermediate floor within a dwelling	Table K1 - Default	0.000	8.72	0.00	
Party wall	P4 Party wall - Roof (insulation at ceiling level)	Independently assessed	0.090	8.72	0.78	Knauf P29 Halved

Total: **8.29** W/mK:
 Y-Value: **0.047** W/m²K:

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Property Reference	SAP 0879 Plot 116		Issued on Date	28/03/2023	
Assessment Reference	Rev A	Prop Type Ref	3B AFF (HA/SO)		
Property	Plot 116				
SAP Rating	87 B	DER	13.92	TER	17.88
Environmental	89 B	% DER<TER	22.16		
CO ₂ Emissions (t/year)	0.87	DFEE	42.06	TFEE	49.95
General Requirements Compliance	Pass	% DFEE<TFEE	15.79		
Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 07798936079, toby@abacusenergyuk.com			Assessor ID	E477-0001
Client	Foreman Homes, FORE				

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

DWELLING AS DESIGNED

Semi-Detached 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) 17.88 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 13.92 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)49.9 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)42.1 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.24 (max. 0.30)	0.26 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.12 (max. 0.25)	0.12 (max. 0.70)	OK
Roof	0.10 (max. 0.20)	0.10 (max. 0.35)	OK
Openings	1.18 (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:

4.15 m², No overhang

Windows facing West:

7.08 m², No overhang

Air change rate:

4.00 ach

Blinds/curtains:

None

10 Key features

Party wall U-value 0.00 W/m²K

Roof U-value 0.10 W/m²K

Floor U-value 0.12 W/m²K

Door U-value 1.10 W/m²K

Photovoltaic array 0.75 kW

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	42.2600 (1b)	2.3900 (2b)	101.0014 (1b) - (3b)
First floor	42.2600 (1c)	2.4200 (2c)	102.2692 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	84.5200		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 203.2706 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour							
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)							
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)							
Number of intermittent fans				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) =	0.1476 (8)							
Pressure test					Yes							
Measured/design AP50					5.0000							
Infiltration rate					0.3976 (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) =	0.3379 (21)							
Wind speed	Jan 5.1000	Feb 5.0000	Mar 4.9000	Apr 4.4000	May 4.3000	Jun 3.8000	Jul 3.8000	Aug 3.7000	Sep 4.0000	Oct 4.3000	Nov 4.5000	Dec 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	0.4309	0.4224	0.4140	0.3717	0.3633	0.3211	0.3211	0.3126	0.3379	0.3633	0.3802	0.3971 (22b)
Effective ac	0.5928	0.5892	0.5857	0.5691	0.5660	0.5515	0.5515	0.5489	0.5571	0.5660	0.5723	0.5788 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Front Door			2.1500	1.1000	2.3650		(26)
Windows & Fully Glazed Do (Uw = 1.20)			11.2300	1.1450	12.8588		(27)
Ground Floor			42.2600	0.1200	5.0712	90.0000	3803.4000 (28a)
Brick and Block	88.3100	13.3800	74.9300	0.2400	17.9832	42.2200	3163.5446 (29a)
Step Party Wall	2.6200		2.6200	0.2600	0.6812	110.0000	288.2000 (29a)
External Roof 1	42.2600		42.2600	0.1000	4.2260	9.1000	384.5660 (30)
Total net area of external elements Aum(A, m2)			175.4500				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	43.1854		(33)
Party Wall 1			40.9700	0.0000	0.0000	45.0000	1843.6500 (32)
GF Timber Stud			76.4600			9.0000	688.1400 (32c)
FF Timber Stud			83.4400			9.0000	750.9600 (32c)
Internal Floor 1			46.2600			18.0000	832.6800 (32d)
Internal Ceiling 1			46.2600			18.0000	832.6800 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	12587.8206 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							148.9330 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.2861 (36)
Total fabric heat loss						(33) + (36) =	51.4714 (37)

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

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	39.7667	39.5249	39.2878	38.1746	37.9663	36.9967	36.9967	36.8172	37.3702	37.9663	38.3877	38.8282 (38)
Average = Sum(39)m / 12 =	91.2381	90.9963	90.7593	89.6460	89.4378	88.4681	88.4681	88.2886	88.8416	89.4378	89.8591	90.2996 (39)
HLP	1.0795	1.0766	1.0738	1.0606	1.0582	1.0467	1.0467	1.0446	1.0511	1.0582	1.0632	1.0684 (40)
HLP (average)												1.0606 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Assumed occupancy												2.5431 (42)
Average daily hot water use (litres/day)												94.5975 (43)
Daily hot water use	104.0573	100.2734	96.4895	92.7056	88.9217	85.1378	85.1378	88.9217	92.7056	96.4895	100.2734	104.0573 (44)
Energy conte	154.3139	134.9639	139.2707	121.4196	116.5050	100.5349	93.1604	106.9029	108.1797	126.0730	137.6185	149.4448 (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 =	1488.3871 (45)
Distribution loss (46)m = 0.15 x (45)m													
	23.1471	20.2446	20.8906	18.2129	17.4757	15.0802	13.9741	16.0354	16.2269	18.9109	20.6428	22.4167	(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	25.2766	24.4140	25.1935	24.3412	25.1279	25.1704	24.3809	25.2422	24.4815	25.3057	(61)
Total heat required for water heating calculated for each month	179.6324	157.8309	164.5473	145.8336	141.6984	124.8761	118.2883	132.0733	132.5605	151.3152	162.1000	174.7505	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Solar input (sum of months) = Sum(63)m =												0.0000 (63)	
Output from w/h	179.6324	157.8309	164.5473	145.8336	141.6984	124.8761	118.2883	132.0733	132.5605	151.3152	162.1000	174.7505	(64)
Total per year (kWh/year) = Sum(64)m =												1785.5066 (64)	
Heat gains from water heating, kWh/month	57.6390	50.5922	52.6267	46.4755	45.0363	39.5132	37.2578	41.8378	42.0650	48.2298	51.8785	56.0168	(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	127.1526	127.1526	127.1526	127.1526	127.1526	127.1526	127.1526	127.1526	127.1526	127.1526	127.1526	127.1526	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	22.1187	19.6456	15.9769	12.0955	9.0416	7.6333	8.2480	10.7211	14.3898	18.2712	21.3251	22.7334	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	228.6276	231.0001	225.0216	212.2941	196.2280	181.1281	171.0405	168.6680	174.6465	187.3739	203.4401	218.5400	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.7153	35.7153	35.7153	35.7153	35.7153	35.7153	35.7153	35.7153	35.7153	35.7153	35.7153	35.7153	(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)	-101.7221	-101.7221	-101.7221	-101.7221	-101.7221	-101.7221	-101.7221	-101.7221	-101.7221	-101.7221	-101.7221	-101.7221	(71)
Water heating gains (Table 5)	77.4718	75.2861	70.7347	64.5493	60.5326	54.8794	50.0777	56.2336	58.4236	64.8250	72.0535	75.2914	(72)
Total internal gains	392.3639	390.0776	375.8790	353.0848	329.9480	307.7866	293.5120	299.7685	311.6056	334.6159	360.9645	380.7106	(73)

6. Solar gains

[Jan]		Area m ²	Solar flux Table 6a W/m ²	Specific data g or Table 6b	Specific data FF or Table 6c	Access factor Table 6d	Gains W						
East		4.1500	19.6403	0.6300	0.7000	0.7700	24.9096 (76)						
West		7.0800	19.6403	0.6300	0.7000	0.7700	42.4964 (80)						
Solar gains	67.4061	131.8605	217.1555	316.7084	388.1380	397.3283	378.2728	324.9307	252.5609	156.4636	84.0474	55.4315	(83)
Total gains	459.7699	521.9381	593.0346	669.7932	718.0860	705.1149	671.7847	624.6992	564.1665	491.0796	445.0119	436.1421	(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	38.3241	38.4259	38.5263	39.0047	39.0955	39.5240	39.5240	39.6044	39.3579	39.0955	38.9122	38.7224	
alpha	3.5549	3.5617	3.5684	3.6003	3.6064	3.6349	3.6349	3.6403	3.6239	3.6064	3.5941	3.5815	
util living area	0.9901	0.9835	0.9672	0.9243	0.8364	0.6914	0.5430	0.5952	0.8150	0.9502	0.9841	0.9918	(86)
MIT	19.2215	19.4147	19.7623	20.2210	20.6130	20.8678	20.9589	20.9424	20.7430	20.2240	19.6439	19.1894	(87)
Th 2	20.0176	20.0200	20.0223	20.0331	20.0351	20.0446	20.0446	20.0463	20.0409	20.0351	20.0310	20.0267	(88)
util rest of house	0.9880	0.9801	0.9600	0.9069	0.7973	0.6178	0.4392	0.4919	0.7569	0.9353	0.9802	0.9901	(89)
MIT 2	18.3868	18.5802	18.9254	19.3796	19.7456	19.9672	20.0284	20.0217	19.8719	19.3913	18.8175	18.3616	(90)
Living area fraction												fLA = Living area / (4) = 0.1745 (91)	
MIT	18.5324	18.7258	19.0714	19.5264	19.8970	20.1244	20.1908	20.1824	20.0239	19.5366	18.9618	18.5061	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5324	18.7258	19.0714	19.5264	19.8970	20.1244	20.1908	20.1824	20.0239	19.5366	18.9618	18.5061	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9837	0.9740	0.9511	0.8959	0.7909	0.6244	0.4560	0.5076	0.7557	0.9255	0.9743	0.9863	(94)
Useful gains	452.2950	508.3901	564.0060	600.0508	567.9671	440.3021	306.3096	317.1240	426.3464	454.5142	433.5782	430.1883	(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	1298.5416	1258.0992	1140.9754	952.6156	733.1193	488.7309	317.6680	333.9429	526.2889	799.2718	1065.8865	1291.8326	(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	629.6074	503.8045	429.2652	253.8467	122.8732	0.0000	0.0000	0.0000	0.0000	256.4997	455.2620	641.0634	(98)
Space heating												3292.2221 (98)	
Space heating per m ²												(98) / (4) = 38.9520 (99)	

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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													3629.7928 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	629.6074	503.8045	429.2652	253.8467	122.8732	0.0000	0.0000	0.0000	0.0000	256.4997	455.2620	641.0634	(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)	694.1647	555.4625	473.2803	279.8751	135.4721	0.0000	0.0000	0.0000	0.0000	282.8001	501.9427	706.7953	(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	179.6324	157.8309	164.5473	145.8336	141.6984	124.8761	118.2883	132.0733	132.5605	151.3152	162.1000	174.7505	(64)
Efficiency of water heater (217)m	89.8990	89.8398	89.7023	89.3908	88.7913	87.2000	87.2000	87.2000	87.2000	89.3691	89.7541	87.2000	(216)
Fuel for water heating, kWh/month	199.8157	175.6803	183.4371	163.1415	159.5860	143.2066	135.6517	151.4602	152.0190	169.3150	180.6045	194.3252	(219)
Water heating fuel used													2008.2429 (219)
Annual totals kWh/year													
Space heating fuel - main system													3629.7928 (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)													390.6229 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.75 * 908 * 1.00) =										-544.7125			-544.7125 (233)
Total delivered energy for all uses													5558.9460 (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	3629.7928	0.2160	784.0352 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2008.2429	0.2160	433.7805 (264)
Space and water heating			1217.8157 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	390.6229	0.5190	202.7333 (268)
Energy saving/generation technologies			
PV Unit	-544.7125	0.5190	-282.7058 (269)
Total CO2, kg/year			1176.7682 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.9200 (273)

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

	TFA	N	EF	
DER				13.9200 ZC1
Total Floor Area				84.5200
Assumed number of occupants				2.5431
CO2 emission factor in Table 12 for electricity displaced from grid				0.5190
CO2 emissions from appliances, equation (L14)				16.0293 ZC2
CO2 emissions from cooking, equation (L16)				2.1301 ZC3
Total CO2 emissions				32.0794 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				32.0794 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 (m2)	Storey height (m)	Volume (m3)
Ground floor	42.2600 (1b)	2.3900 (2b)	101.0014 (1b) - (3b)
First floor	42.2600 (1c)	2.4200 (2c)	102.2692 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	84.5200		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 203.2706 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour							
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)							
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)							
Number of intermittent fans				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) =	0.1476 (8)							
Pressure test					Yes							
Measured/design AP50					5.0000							
Infiltration rate					0.3976 (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) =	0.3379 (21)							
Wind speed	Jan 5.1000	Feb 5.0000	Mar 4.9000	Apr 4.4000	May 4.3000	Jun 3.8000	Jul 3.8000	Aug 3.7000	Sep 4.0000	Oct 4.3000	Nov 4.5000	Dec 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	0.4309	0.4224	0.4140	0.3717	0.3633	0.3211	0.3211	0.3126	0.3379	0.3633	0.3802	0.3971 (22b)
Effective ac	0.5928	0.5892	0.5857	0.5691	0.5660	0.5515	0.5515	0.5489	0.5571	0.5660	0.5723	0.5788 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opaque door			2.1500	1.0000	2.1500		(26)					
TER Opening Type (Uw = 1.40)			11.2300	1.3258	14.8883		(27)					
Ground Floor			42.2600	0.1300	5.4938		(28a)					
Brick and Block	88.3100	13.3800	74.9300	0.1800	13.4874		(29a)					
Step Party Wall	2.6200		2.6200	0.1800	0.4716		(29a)					
External Roof 1	42.2600		42.2600	0.1300	5.4938		(30)					
Total net area of external elements Aum(A, m2)			175.4500				(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =		41.9849 (33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.1140 (36)					
Total fabric heat loss							(33) + (36) = 52.0989 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 39.7667	Feb 39.5249	Mar 39.2878	Apr 38.1746	May 37.9663	Jun 36.9967	Jul 36.9967	Aug 36.8172	Sep 37.3702	Oct 37.9663	Nov 38.3877	Dec 38.8282 (38)
Heat transfer coeff	91.8655	91.6237	91.3867	90.2735	90.0652	89.0956	89.0956	88.9160	89.4690	90.0652	90.4865	90.9270 (39)
Average = Sum(39)m / 12 =												90.2725 (39)
HLP	Jan 1.0869	Feb 1.0840	Mar 1.0812	Apr 1.0681	May 1.0656	Jun 1.0541	Jul 1.0541	Aug 1.0520	Sep 1.0586	Oct 1.0656	Nov 1.0706	Dec 1.0758 (40)
HLP (average)												1.0681 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Assumed occupancy												2.5431 (42)
Average daily hot water use (litres/day)												94.5975 (43)
Daily hot water use	104.0573	100.2734	96.4895	92.7056	88.9217	85.1378	85.1378	88.9217	92.7056	96.4895	100.2734	104.0573 (44)
Energy conte	154.3139	134.9639	139.2707	121.4196	116.5050	100.5349	93.1604	106.9029	108.1797	126.0730	137.6185	149.4448 (45)
Energy content (annual)												Total = Sum(45)m = 1488.3871 (45)
Distribution loss (46)m = 0.15 x (45)m	23.1471	20.2446	20.8906	18.2129	17.4757	15.0802	13.9741	16.0354	16.2269	18.9109	20.6428	22.4167 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	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	49.1700	45.7178	45.3135	41.9857	43.3853	45.3135	45.7178	49.1700	49.3151	50.9589	(61)										
Total heat required for water heating calculated for each month	205.2728	180.9913	188.4407	167.1374	161.8185	142.5207	136.5457	152.2164	153.8975	175.2429	186.9336	200.4037	(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	205.2728	180.9913	188.4407	167.1374	161.8185	142.5207	136.5457	152.2164	153.8975	175.2429	186.9336	200.4037	(64)										
Heat gains from water heating, kWh/month	64.0491	56.3824	58.6000	51.8015	50.0663	43.9243	41.8221	46.8736	47.3992	54.2118	58.0869	62.4301	(65)										

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(66)
(66)m	127.1526	127.1526	127.1526	127.1526	127.1526	127.1526	127.1526	127.1526	127.1526	127.1526	127.1526	127.1526	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	22.1187	19.6456	15.9769	12.0955	9.0416	7.6333	8.2480	10.7211	14.3898	18.2712	21.3251	22.7334	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	228.6276	231.0001	225.0216	212.2941	196.2280	181.1281	171.0405	168.6680	174.6465	187.3739	203.4401	218.5400	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.7153	35.7153	35.7153	35.7153	35.7153	35.7153	35.7153	35.7153	35.7153	35.7153	35.7153	35.7153	(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)	-101.7221	-101.7221	-101.7221	-101.7221	-101.7221	-101.7221	-101.7221	-101.7221	-101.7221	-101.7221	-101.7221	-101.7221	(71)
Water heating gains (Table 5)	86.0875	83.9023	78.7634	71.9465	67.2934	61.0060	56.2126	63.0021	65.8322	72.8653	80.6763	83.9114	(72)
Total internal gains	400.9796	398.6938	383.9077	360.4819	336.7087	313.9131	299.6468	306.5370	319.0143	342.6562	369.5873	389.3306	(73)

6. Solar gains

[Jan]	Area	Solar flux	g	FF	Access	Gains							
	m2	Table 6a	Specific data	Specific data	factor	W							
		W/m2	or Table 6b	or Table 6c	Table 6d								
East	4.1500	19.6403	0.6300	0.7000	0.7700	24.9096							
West	7.0800	19.6403	0.6300	0.7000	0.7700	42.4964							
Solar gains	67.4061	131.8605	217.1555	316.7084	388.1380	397.3283	378.2728	324.9307	252.5609	156.4636	84.0474	55.4315	(83)
Total gains	468.3857	530.5543	601.0632	677.1903	724.8468	711.2415	677.9196	631.4677	571.5752	499.1198	453.6347	444.7621	(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	(86)	
tau	63.8917	64.0603	64.2265	65.0185	65.1689	65.8781	65.8781	66.0111	65.6031	65.1689	64.8654	64.5511	(86)	
alpha	5.2594	5.2707	5.2818	5.3346	5.3446	5.3919	5.3919	5.4007	5.3735	5.3446	5.3244	5.3034	(86)	
util living area	0.9986	0.9971	0.9915	0.9688	0.8965	0.7379	0.5652	0.6244	0.8737	0.9835	0.9972	0.9990	(86)	
MIT	19.8013	19.9359	20.1795	20.5079	20.7881	20.9487	20.9899	20.9834	20.8667	20.4969	20.0919	19.7798	(87)	
Th 2	20.0115	20.0139	20.0162	20.0270	20.0290	20.0385	20.0385	20.0402	20.0348	20.0290	20.0249	20.0206	(88)	
util rest of house	0.9982	0.9961	0.9884	0.9567	0.8565	0.6513	0.4485	0.5057	0.8105	0.9751	0.9960	0.9986	(89)	
MIT 2	18.4050	18.6033	18.9596	19.4378	19.8152	20.0031	20.0346	20.0330	19.9227	19.4298	18.8398	18.3802	(90)	
Living area fraction	fLA = Living area / (4) =												0.1745	(91)
MIT	18.6486	18.8359	19.1725	19.6246	19.9850	20.1681	20.2013	20.1989	20.0874	19.6160	19.0583	18.6244	(92)	
Temperature adjustment													0.0000	(92)
adjusted MIT	18.6486	18.8359	19.1725	19.6246	19.9850	20.1681	20.2013	20.1989	20.0874	19.6160	19.0583	18.6244	(93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(94)		
Useful gains	467.0758	527.5137	591.8632	643.4485	619.2710	472.1922	317.8423	332.3278	465.5670	484.1694	451.0507	443.8117	(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	1318.1457	1276.8547	1158.0981	968.1424	746.1905	496.0963	320.8618	337.7815	535.6912	812.0282	1082.0630	1311.5703	(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	633.1960	503.5572	421.2788	233.7797	94.4281	0.0000	0.0000	0.0000	0.0000	243.9270	454.3289	645.6124	(98)		
Space heating													3230.1080	(98)	
Space heating per m2													(98) / (4) =	38.2171	(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													3458.3598 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	633.1960	503.5572	421.2788	233.7797	94.4281	0.0000	0.0000	0.0000	0.0000	243.9270	454.3289	645.6124	(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)	677.9401	539.1405	451.0480	250.2994	101.1008	0.0000	0.0000	0.0000	0.0000	261.1638	486.4335	691.2338	(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	205.2728	180.9913	188.4407	167.1374	161.8185	142.5207	136.5457	152.2164	153.8975	175.2429	186.9336	200.4037	(64)
Efficiency of water heater (217)m	87.6995	87.4905	87.0174	85.8960	83.7480	80.3000	80.3000	80.3000	80.3000	85.8839	87.2027	80.3000	(216)
Fuel for water heating, kWh/month	234.0639	206.8697	216.5553	194.5811	193.2206	177.4853	170.0444	189.5597	191.6531	204.0464	214.3668	228.2905	(219)
Water heating fuel used													2420.7367 (219)
Annual totals kWh/year													
Space heating fuel - main system													3458.3598 (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)													390.6229 (232)
Total delivered energy for all uses													6344.7193 (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	3458.3598	0.2160	747.0057 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2420.7367	0.2160	522.8791 (264)
Space and water heating			1269.8848 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	390.6229	0.5190	202.7333 (268)
Total CO2, kg/m2/year			1511.5431 (272)
Emissions per m2 for space and water heating			15.0247 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.3986 (272b)
Emissions per m2 for pumps and fans			0.4605 (272c)
Target Carbon Dioxide Emission Rate (TER) = (15.0247 * 1.00) + 2.3986 + 0.4605, rounded to 2 d.p.			17.8800 (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 (m2)	Storey height (m)	Volume (m3)
Ground floor	42.2600 (1b)	2.3900 (2b)	101.0014 (1b) - (3b)
First floor	42.2600 (1c)	2.4200 (2c)	102.2692 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	84.5200		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 203.2706 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour							
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)							
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)							
Number of intermittent fans				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) =	0.1476 (8)							
Pressure test					Yes							
Measured/design AP50					5.0000							
Infiltration rate					0.3976 (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) =	0.3379 (21)							
Wind speed	Jan 5.1000	Feb 5.0000	Mar 4.9000	Apr 4.4000	May 4.3000	Jun 3.8000	Jul 3.8000	Aug 3.7000	Sep 4.0000	Oct 4.3000	Nov 4.5000	Dec 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	0.4309	0.4224	0.4140	0.3717	0.3633	0.3211	0.3211	0.3126	0.3379	0.3633	0.3802	0.3971 (22b)
Effective ac	0.5928	0.5892	0.5857	0.5691	0.5660	0.5515	0.5515	0.5489	0.5571	0.5660	0.5723	0.5788 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Front Door			2.1500	1.1000	2.3650		(26)
Windows & Fully Glazed Do (Uw = 1.20)			11.2300	1.1450	12.8588		(27)
Ground Floor			42.2600	0.1200	5.0712	90.0000	3803.4000 (28a)
Brick and Block	88.3100	13.3800	74.9300	0.2400	17.9832	42.2200	3163.5446 (29a)
Step Party Wall	2.6200		2.6200	0.2600	0.6812	110.0000	288.2000 (29a)
External Roof 1	42.2600		42.2600	0.1000	4.2260	9.1000	384.5660 (30)
Total net area of external elements Aum(A, m2)			175.4500				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	43.1854		(33)
Party Wall 1			40.9700	0.0000	0.0000	45.0000	1843.6500 (32)
GF Timber Stud			76.4600			9.0000	688.1400 (32c)
FF Timber Stud			83.4400			9.0000	750.9600 (32c)
Internal Floor 1			46.2600			18.0000	832.6800 (32d)
Internal Ceiling 1			46.2600			9.0000	416.3400 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	12171.4806 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							144.0071 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.2861 (36)
Total fabric heat loss						(33) + (36) =	51.4714 (37)

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

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	39.7667	39.5249	39.2878	38.1746	37.9663	36.9967	36.9967	36.8172	37.3702	37.9663	38.3877	38.8282 (38)
Average = Sum(39)m / 12 =	91.2381	90.9963	90.7593	89.6460	89.4378	88.4681	88.4681	88.2886	88.8416	89.4378	89.8591	90.2996 (39)
HLP	1.0795	1.0766	1.0738	1.0606	1.0582	1.0467	1.0467	1.0446	1.0511	1.0582	1.0632	1.0684 (40)
HLP (average)												1.0606 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Assumed occupancy												2.5431 (42)
Average daily hot water use (litres/day)												94.5975 (43)
Daily hot water use	104.0573	100.2734	96.4895	92.7056	88.9217	85.1378	85.1378	88.9217	92.7056	96.4895	100.2734	104.0573 (44)
Energy conte	154.3139	134.9639	139.2707	121.4196	116.5050	100.5349	93.1604	106.9029	108.1797	126.0730	137.6185	149.4448 (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 =	1488.3871	(45)	
Distribution loss (46)m = 0.15 x (45)m																
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	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	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage																
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	0.0000	0.0000	0.0000	(57)
Heat gains from water heating, kWh/month	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
	32.7917	28.6798	29.5950	25.8017	24.7573	21.3637	19.7966	22.7169	22.9882	26.7905	29.2439	31.7570	65)			

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

Metabolic gains (Table 5), Watts													
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	127.1526	127.1526	127.1526	127.1526	127.1526	127.1526	127.1526	127.1526	127.1526	127.1526	127.1526	127.1526	(66)
	22.1187	19.6456	15.9769	12.0955	9.0416	7.6333	8.2480	10.7211	14.3898	18.2712	21.3251	22.7334	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	228.6276	231.0001	225.0216	212.2941	196.2280	181.1281	171.0405	168.6680	174.6465	187.3739	203.4401	218.5400	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.7153	35.7153	35.7153	35.7153	35.7153	35.7153	35.7153	35.7153	35.7153	35.7153	35.7153	35.7153	(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)	-101.7221	-101.7221	-101.7221	-101.7221	-101.7221	-101.7221	-101.7221	-101.7221	-101.7221	-101.7221	-101.7221	-101.7221	(71)
Water heating gains (Table 5)	44.0749	42.6783	39.7783	35.8356	33.2759	29.6718	26.6083	30.5334	31.9280	36.0087	40.6166	42.6842	(72)
Total internal gains	355.9670	354.4698	341.9225	321.3711	299.6913	279.5789	267.0426	271.0683	282.1101	302.7996	326.5276	345.1034	(73)

6. Solar gains

[Jan]	Area	Solar flux	g	FF	Access	Gains							
	m ²	Table 6a	Specific data	Specific data	factor	W							
		W/m ²	or Table 6b	or Table 6c	Table 6d								
East	4.1500	19.6403	0.6300	0.7000	0.7700	24.9096 (76)							
West	7.0800	19.6403	0.6300	0.7000	0.7700	42.4964 (80)							
Solar gains	67.4061	131.8605	217.1555	316.7084	388.1380	397.3283	378.2728	324.9307	252.5609	156.4636	84.0474	55.4315	(83)
Total gains	423.3730	486.3303	559.0781	638.0795	687.8293	676.9073	645.3153	595.9990	534.6710	459.2633	410.5750	400.5348	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)													21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)														
tau	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
alpha	37.0565	37.1550	37.2520	37.7146	37.8025	38.2168	38.2168	38.2945	38.0561	37.8025	37.6252	37.4416		
util living area	3.4704	3.4770	3.4835	3.5143	3.5202	3.5478	3.5478	3.5530	3.5371	3.5202	3.5083	3.4961		
	0.9915	0.9855	0.9702	0.9298	0.8462	0.7059	0.5589	0.6141	0.8295	0.9560	0.9864	0.9930	(86)	
MIT	19.1186	19.3186	19.6795	20.1580	20.5718	20.8480	20.9509	20.9310	20.7089	20.1580	19.5549	19.0865	(87)	
Th 2	20.0176	20.0200	20.0223	20.0331	20.0351	20.0446	20.0446	20.0463	20.0409	20.0351	20.0310	20.0267	(88)	
util rest of house	0.9897	0.9824	0.9637	0.9137	0.8090	0.6336	0.4542	0.5105	0.7745	0.9428	0.9830	0.9915	(89)	
MIT 2	18.2878	18.4882	18.8471	19.3220	19.7110	19.9538	20.0246	20.0159	19.8456	19.3307	18.7327	18.2625	(90)	
Living area fraction	18.4328	18.6331	18.9923	19.4679	19.8613	20.1099	20.1863	20.1756	19.9963	19.4751	18.8761	18.4063	(92)	
Temperature adjustment												0.0000		
adjusted MIT	18.4328	18.6331	18.9923	19.4679	19.8613	20.1099	20.1863	20.1756	19.9963	19.4751	18.8761	18.4063	(93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9858	0.9767	0.9549	0.9022	0.8013	0.6390	0.4707	0.5256	0.7715	0.9329	0.9776	0.9882	(94)
Ext temp.	417.3711	475.0021	533.8789	575.6555	551.1571	432.5580	303.7427	313.2813	412.5228	428.4657	401.3761	395.8029	(95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Month fracti	1289.4462	1249.6625	1133.7965	947.3703	729.9254	487.4479	317.2697	333.3446	523.8358	793.7681	1058.1940	1282.8196	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(98)
Space heating per m2	648.8239	520.5718	446.3387	267.6346	133.0036	0.0000	0.0000	0.0000	0.0000	271.7850	472.9089	659.9404	(98)
												3421.0070	(98)
												40.4757	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b													
Ext. temp.	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	831.6006	654.6643	670.9933	0.0000	0.0000	0.0000	0.0000	(100)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.8046	0.8685	0.8403	0.0000	0.0000	0.0000	0.0000	(101)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	669.1221	568.5730	563.8062	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	887.1676	848.3120	792.5310	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	156.9927	208.1258	170.1713	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												535.2898 (104)
Cooled fraction									FC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)												
Intermittency factor	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	39.2482	52.0315	42.5428	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												133.8224 (107)
Space cooling per m2												1.5833 (108)
Energy for space heating												40.4757 (99)
Energy for space cooling												1.5833 (108)
Total												42.0590 (109)
Dwelling Fabric Energy Efficiency (DFEE)												42.1 (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 (m2)	Storey height (m)	Volume (m3)
Ground floor	42.2600 (1b)	2.3900 (2b)	101.0014 (1b) - (3b)
First floor	42.2600 (1c)	2.4200 (2c)	102.2692 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	84.5200		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 203.2706 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour							
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)							
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)							
Number of intermittent fans				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) =	0.1476 (8)							
Pressure test					Yes							
Measured/design AP50					5.0000							
Infiltration rate					0.3976 (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) =	0.3379 (21)							
Wind speed	Jan 5.1000	Feb 5.0000	Mar 4.9000	Apr 4.4000	May 4.3000	Jun 3.8000	Jul 3.8000	Aug 3.7000	Sep 4.0000	Oct 4.3000	Nov 4.5000	Dec 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	0.4309	0.4224	0.4140	0.3717	0.3633	0.3211	0.3211	0.3126	0.3379	0.3633	0.3802	0.3971 (22b)
Effective ac	0.5928	0.5892	0.5857	0.5691	0.5660	0.5515	0.5515	0.5489	0.5571	0.5660	0.5723	0.5788 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opaque door			2.1500	1.0000	2.1500		(26)					
TER Opening Type (Uw = 1.40)			11.2300	1.3258	14.8883		(27)					
Ground Floor			42.2600	0.1300	5.4938		(28a)					
Brick and Block	88.3100	13.3800	74.9300	0.1800	13.4874		(29a)					
Step Party Wall	2.6200		2.6200	0.1800	0.4716		(29a)					
External Roof 1	42.2600		42.2600	0.1300	5.4938		(30)					
Total net area of external elements Aum(A, m2)			175.4500				(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =		41.9849 (33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.1140 (36)					
Total fabric heat loss							(33) + (36) = 52.0989 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 39.7667	Feb 39.5249	Mar 39.2878	Apr 38.1746	May 37.9663	Jun 36.9967	Jul 36.9967	Aug 36.8172	Sep 37.3702	Oct 37.9663	Nov 38.3877	Dec 38.8282 (38)
Heat transfer coeff	91.8655	91.6237	91.3867	90.2735	90.0652	89.0956	89.0956	88.9160	89.4690	90.0652	90.4865	90.9270 (39)
Average = Sum(39)m / 12 =												90.2725 (39)
HLP	Jan 1.0869	Feb 1.0840	Mar 1.0812	Apr 1.0681	May 1.0656	Jun 1.0541	Jul 1.0541	Aug 1.0520	Sep 1.0586	Oct 1.0656	Nov 1.0706	Dec 1.0758 (40)
HLP (average)												1.0681 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Assumed occupancy												2.5431 (42)
Average daily hot water use (litres/day)												94.5975 (43)
Daily hot water use	104.0573	100.2734	96.4895	92.7056	88.9217	85.1378	85.1378	88.9217	92.7056	96.4895	100.2734	104.0573 (44)
Energy conte	154.3139	134.9639	139.2707	121.4196	116.5050	100.5349	93.1604	106.9029	108.1797	126.0730	137.6185	149.4448 (45)
Energy content (annual)												Total = Sum(45)m = 1488.3871 (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	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	0.0000	(59)
Heat gains from water heating, kWh/month	32.7917	28.6798	29.5950	25.8017	24.7573	21.3637	19.7966	22.7169	22.9882	26.7905	29.2439	31.7570		(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	127.1526	127.1526	127.1526	127.1526	127.1526	127.1526	127.1526	127.1526	127.1526	127.1526	127.1526	127.1526	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	22.1187	19.6456	15.9769	12.0955	9.0416	7.6333	8.2480	10.7211	14.3898	18.2712	21.3251	22.7334	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	228.6276	231.0001	225.0216	212.2941	196.2280	181.1281	171.0405	168.6680	174.6465	187.3739	203.4401	218.5400	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.7153	35.7153	35.7153	35.7153	35.7153	35.7153	35.7153	35.7153	35.7153	35.7153	35.7153	35.7153	(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)	-101.7221	-101.7221	-101.7221	-101.7221	-101.7221	-101.7221	-101.7221	-101.7221	-101.7221	-101.7221	-101.7221	-101.7221	(71)
Water heating gains (Table 5)	44.0749	42.6783	39.7783	35.8356	33.2759	29.6718	26.6083	30.5334	31.9280	36.0087	40.6166	42.6842	(72)
Total internal gains	355.9670	354.4698	341.9225	321.3711	299.6913	279.5789	267.0426	271.0683	282.1101	302.7996	326.5276	345.1034	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W							
East	4.1500	19.6403	0.6300	0.7000	0.7700	24.9096 (76)							
West	7.0800	19.6403	0.6300	0.7000	0.7700	42.4964 (80)							
Solar gains	67.4061	131.8605	217.1555	316.7084	388.1380	397.3283	378.2728	324.9307	252.5609	156.4636	84.0474	55.4315	(83)
Total gains	423.3730	486.3303	559.0781	638.0795	687.8293	676.9073	645.3153	595.9990	534.6710	459.2633	410.5750	400.5348	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains for living area, nil,m (see Table 9a)	63.8917	64.0603	64.2265	65.0185	65.1689	65.8781	65.8781	66.0111	65.6031	65.1689	64.8654	64.5511	21.0000 (85)
tau	5.2594	5.2707	5.2818	5.3346	5.3446	5.3919	5.3919	5.4007	5.3735	5.3446	5.3244	5.3034	
alpha	0.9992	0.9981	0.9939	0.9756	0.9126	0.7633	0.5906	0.6553	0.8969	0.9886	0.9983	0.9994	(86)
util living area	19.7510	19.8868	20.1342	20.4700	20.7631	20.9395	20.9876	20.9791	20.8443	20.4553	20.0440	19.7302	(87)
MIT	20.0115	20.0139	20.0162	20.0270	20.0290	20.0385	20.0385	20.0402	20.0348	20.0290	20.0249	20.0206	(88)
util rest of house	0.9989	0.9974	0.9916	0.9656	0.8765	0.6778	0.4702	0.5337	0.8402	0.9825	0.9975	0.9992	(89)
MIT 2	18.8645	19.0020	19.2501	19.5890	19.8628	20.0094	20.0352	20.0339	19.9424	19.5798	19.1681	18.8511	(90)
Living area fraction	19.0192	19.1564	19.4044	19.7427	20.0199	20.1717	20.2014	20.1989	20.0998	19.7326	19.3209	19.0045	(91)
MIT	19.0192	19.1564	19.4044	19.7427	20.0199	20.1717	20.2014	20.1989	20.0998	19.7326	19.3209	19.0045	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0192	19.1564	19.4044	19.7427	20.0199	20.1717	20.2014	20.1989	20.0998	19.7326	19.3209	19.0045	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9985	0.9966	0.9897	0.9620	0.8761	0.6908	0.4914	0.5550	0.8448	0.9799	0.9968	0.9989	(94)
Useful gains	422.7251	484.6555	553.3193	613.8029	602.6215	467.5758	317.0952	330.7790	451.6741	450.0297	409.2518	400.0804	(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	1352.1850	1306.2241	1179.2893	978.8109	749.3371	496.4115	320.8672	337.7791	536.7980	822.5318	1105.8303	1346.1307	(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	691.5181	552.0941	465.7217	262.8058	109.1564	0.0000	0.0000	0.0000	0.0000	277.1416	501.5365	703.8614	(98)
Space heating												3563.8356	(98)
Space heating per m2												42.1656	(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	837.4983	659.3072	675.7617	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8668	0.9285	0.9026	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	725.9385	612.1557	609.9320	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	887.1676	848.3120	792.5310	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	116.0849	175.7003	135.8537	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												427.6389	(104)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Cooled fraction											FC = cooled area / (4) =	1.0000 (105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	29.0212	43.9251	33.9634	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling											106.9097 (107)	
Space cooling per m2											1.2649 (108)	
Energy for space heating											42.1656 (99)	
Energy for space cooling											1.2649 (108)	
Total											43.4305 (109)	
Target Fabric Energy Efficiency (TFEE)											49.9 (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 (m2)	Storey height (m)	Volume (m3)
Ground floor	42.2600 (1b)	2.3900 (2b)	101.0014 (1b) - (3b)
First floor	42.2600 (1c)	2.4200 (2c)	102.2692 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	84.5200		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 203.2706 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour							
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)							
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)							
Number of intermittent fans				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) =	0.1476 (8)							
Pressure test					Yes							
Measured/design AP50					5.0000							
Infiltration rate					0.3976 (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) =		0.3379 (21)							
Wind speed	Jan 5.1000	Feb 4.7000	Mar 4.6000	Apr 4.3000	May 4.3000	Jun 4.0000	Jul 4.0000	Aug 3.9000	Sep 4.0000	Oct 4.5000	Nov 4.4000	Dec 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	0.4309	0.3971	0.3886	0.3633	0.3633	0.3379	0.3379	0.3295	0.3379	0.3802	0.3717	0.3971 (22b)
Effective ac	0.5928	0.5788	0.5755	0.5660	0.5660	0.5571	0.5571	0.5543	0.5571	0.5723	0.5691	0.5788 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Front Door			2.1500	1.1000	2.3650		(26)
Windows & Fully Glazed Do (Uw = 1.20)			11.2300	1.1450	12.8588		(27)
Ground Floor			42.2600	0.1200	5.0712	90.0000	3803.4000 (28a)
Brick and Block	88.3100	13.3800	74.9300	0.2400	17.9832	42.2200	3163.5446 (29a)
Step Party Wall	2.6200		2.6200	0.2600	0.6812	110.0000	288.2000 (29a)
External Roof 1	42.2600		42.2600	0.1000	4.2260	9.1000	384.5660 (30)
Total net area of external elements Aum(A, m2)			175.4500				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	43.1854		(33)
Party Wall 1			40.9700	0.0000	0.0000	45.0000	1843.6500 (32)
GF Timber Stud			76.4600			9.0000	688.1400 (32c)
FF Timber Stud			83.4400			9.0000	750.9600 (32c)
Internal Floor 1			46.2600			18.0000	832.6800 (32d)
Internal Ceiling 1			46.2600			18.0000	832.6800 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	12587.8206 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							148.9330 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.2861 (36)
Total fabric heat loss						(33) + (36) =	51.4714 (37)

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

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	39.7667	38.8282	38.6055	37.9663	37.9663	37.3702	37.3702	37.1811	37.3702	38.3877	38.1746	38.8282 (38)
Average = Sum(39)m / 12 =	91.2381	90.2996	90.0770	89.4378	89.4378	88.8416	88.8416	88.6525	88.8416	89.8591	89.6460	90.2996 (39)
HLP	1.0795	1.0684	1.0657	1.0582	1.0582	1.0511	1.0511	1.0489	1.0511	1.0632	1.0606	1.0684 (40)
HLP (average)												1.0604 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Assumed occupancy												2.5431 (42)
Average daily hot water use (litres/day)												94.5975 (43)
Daily hot water use	104.0573	100.2734	96.4895	92.7056	88.9217	85.1378	85.1378	88.9217	92.7056	96.4895	100.2734	104.0573 (44)
Energy conte	154.3139	134.9639	139.2707	121.4196	116.5050	100.5349	93.1604	106.9029	108.1797	126.0730	137.6185	149.4448 (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 =	1488.3871 (45)
Distribution loss (46)m = 0.15 x (45)m														
	23.1471	20.2446	20.8906	18.2129	17.4757	15.0802	13.9741	16.0354	16.2269	18.9109	20.6428	22.4167	(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	25.2766	24.4140	25.1935	24.3412	25.1279	25.1704	24.3809	25.2422	24.4815	25.3057	(61)	
Total heat required for water heating calculated for each month	179.6324	157.8309	164.5473	145.8336	141.6984	124.8761	118.2883	132.0733	132.5605	151.3152	162.1000	174.7505	(62)	
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)	
Solar input (sum of months) = Sum(63)m =													0.0000 (63)	
Output from w/h	179.6324	157.8309	164.5473	145.8336	141.6984	124.8761	118.2883	132.0733	132.5605	151.3152	162.1000	174.7505	(64)	
Total per year (kWh/year) = Sum(64)m =													1785.5066 (64)	
RHI water heating demand													1786 (64)	
Heat gains from water heating, kWh/month	57.6390	50.5922	52.6267	46.4755	45.0363	39.5132	37.2578	41.8378	42.0650	48.2298	51.8785	56.0168	(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	152.5832	152.5832	152.5832	152.5832	152.5832	152.5832	152.5832	152.5832	152.5832	152.5832	152.5832	152.5832	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	55.2967	49.1141	39.9422	30.2388	22.6039	19.0832	20.6200	26.8027	35.9745	45.6779	53.3128	56.8336	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	341.2353	344.7762	335.8531	316.8569	292.8776	270.3405	255.2843	251.7433	260.6664	279.6626	303.6419	326.1791	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.8014	52.8014	52.8014	52.8014	52.8014	52.8014	52.8014	52.8014	52.8014	52.8014	52.8014	52.8014	(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)	-101.7221	-101.7221	-101.7221	-101.7221	-101.7221	-101.7221	-101.7221	-101.7221	-101.7221	-101.7221	-101.7221	-101.7221	(71)
Water heating gains (Table 5)	77.4718	75.2861	70.7347	64.5493	60.5326	54.8794	50.0777	56.2336	58.4236	64.8250	72.0535	75.2914	(72)
Total internal gains	580.6662	575.8388	553.1925	518.3075	482.6766	450.9655	432.6444	441.4421	461.7269	496.8280	535.6707	564.9665	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data FF or Table 6c	Access factor Table 6d	Gains W							
East	4.1500	25.9136	0.6300	0.7000	0.7700	32.8661 (76)							
West	7.0800	25.9136	0.6300	0.7000	0.7700	56.0704 (80)							
Solar gains	88.9365	148.5607	242.5022	358.2858	417.9663	462.4715	429.9713	378.1770	298.4359	186.2454	109.8694	69.8357	(83)
Total gains	669.6027	724.3995	795.6947	876.5933	900.6429	913.4369	862.6158	819.6190	760.1628	683.0734	645.5401	634.8022	(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	38.3241	38.7224	38.8181	39.0955	39.0955	39.3579	39.3579	39.4418	39.3579	38.9122	39.0047	38.7224	
alpha	3.5549	3.5815	3.5879	3.6064	3.6064	3.6239	3.6239	3.6295	3.6239	3.5941	3.6003	3.5815	
util living area	0.9625	0.9503	0.9151	0.8378	0.7071	0.5155	0.3738	0.3914	0.6294	0.8501	0.9381	0.9669	(86)
MIT	19.7037	19.8427	20.1547	20.5226	20.8084	20.9553	20.9895	20.9879	20.9084	20.5887	20.1234	19.6880	(87)
Th 2	20.0176	20.0267	20.0289	20.0351	20.0351	20.0409	20.0409	20.0428	20.0409	20.0310	20.0331	20.0267	(88)
util rest of house	0.9551	0.9407	0.8985	0.8067	0.6524	0.4372	0.2802	0.2941	0.5502	0.8123	0.9239	0.9602	(89)
MIT 2	18.8622	19.0045	19.3077	19.6566	19.9055	20.0191	20.0379	20.0393	19.9913	19.7221	19.2861	18.8544	(90)
Living area fraction	19.0090	19.1508	19.4555	19.8077	20.0631	20.1825	20.2040	20.2048	20.1513	19.8734	19.4322	18.9998	(92)
Temperature adjustment													0.0000
adjusted MIT	19.0090	19.1508	19.4555	19.8077	20.0631	20.1825	20.2040	20.2048	20.1513	19.8734	19.4322	18.9998	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	633.0634	673.7294	705.7203	699.9865	589.1121	410.2743	255.7095	254.8656	425.6282	550.0423	589.3935	603.8480	(94)
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	1241.6609	1214.6026	1094.9332	912.9544	667.4831	424.8863	257.9965	257.5213	457.6523	725.4645	988.9949	1219.0302	(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	452.7965	363.4668	289.5745	153.3369	58.3080	0.0000	0.0000	0.0000	0.0000	130.5141	287.7130	457.6955	(98)
Space heating													2193.4052 (98)
RHI space heating demand													2193 (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 (m2)	Storey height (m)	Volume (m3)
Ground floor	42.2600 (1b)	2.3900 (2b)	101.0014 (1b) - (3b)
First floor	42.2600 (1c)	2.4200 (2c)	102.2692 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	84.5200		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 203.2706 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour							
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)							
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)							
Number of intermittent fans				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) =	0.1476 (8)							
Pressure test					Yes							
Measured/design AP50					5.0000							
Infiltration rate					0.3976 (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) =	0.3379 (21)							
Wind speed	Jan 5.1000	Feb 5.0000	Mar 4.9000	Apr 4.4000	May 4.3000	Jun 3.8000	Jul 3.8000	Aug 3.7000	Sep 4.0000	Oct 4.3000	Nov 4.5000	Dec 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	0.4309	0.4224	0.4140	0.3717	0.3633	0.3211	0.3211	0.3126	0.3379	0.3633	0.3802	0.3971 (22b)
Effective ac	0.5928	0.5892	0.5857	0.5691	0.5660	0.5515	0.5515	0.5489	0.5571	0.5660	0.5723	0.5788 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Front Door			2.1500	1.1000	2.3650		(26)
Windows & Fully Glazed Do (Uw = 1.20)			11.2300	1.1450	12.8588		(27)
Ground Floor			42.2600	0.1200	5.0712	90.0000	3803.4000 (28a)
Brick and Block	88.3100	13.3800	74.9300	0.2400	17.9832	42.2200	3163.5446 (29a)
Step Party Wall	2.6200		2.6200	0.2600	0.6812	110.0000	288.2000 (29a)
External Roof 1	42.2600		42.2600	0.1000	4.2260	9.1000	384.5660 (30)
Total net area of external elements Aum(A, m2)			175.4500				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	43.1854		(33)
Party Wall 1			40.9700	0.0000	0.0000	45.0000	1843.6500 (32)
GF Timber Stud			76.4600			9.0000	688.1400 (32c)
FF Timber Stud			83.4400			9.0000	750.9600 (32c)
Internal Floor 1			46.2600			18.0000	832.6800 (32d)
Internal Ceiling 1			46.2600			18.0000	832.6800 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	12587.8206 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							148.9330 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.2861 (36)
Total fabric heat loss						(33) + (36) =	51.4714 (37)

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

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	39.7667	39.5249	39.2878	38.1746	37.9663	36.9967	36.9967	36.8172	37.3702	37.9663	38.3877	38.8282 (38)
Average = Sum(39)m / 12 =	91.2381	90.9963	90.7593	89.6460	89.4378	88.4681	88.4681	88.2886	88.8416	89.4378	89.8591	90.2996 (39)
HLP	1.0795	1.0766	1.0738	1.0606	1.0582	1.0467	1.0467	1.0446	1.0511	1.0582	1.0632	1.0684 (40)
HLP (average)												1.0606 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Assumed occupancy												2.5431 (42)
Average daily hot water use (litres/day)												94.5975 (43)
Daily hot water use	104.0573	100.2734	96.4895	92.7056	88.9217	85.1378	85.1378	88.9217	92.7056	96.4895	100.2734	104.0573 (44)
Energy conte	154.3139	134.9639	139.2707	121.4196	116.5050	100.5349	93.1604	106.9029	108.1797	126.0730	137.6185	149.4448 (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 =	1488.3871 (45)
Distribution loss (46)m = 0.15 x (45)m														
	23.1471	20.2446	20.8906	18.2129	17.4757	15.0802	13.9741	16.0354	16.2269	18.9109	20.6428	22.4167	(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	25.2766	24.4140	25.1935	24.3412	25.1279	25.1704	24.3809	25.2422	24.4815	25.3057	(61)	
Total heat required for water heating calculated for each month	179.6324	157.8309	164.5473	145.8336	141.6984	124.8761	118.2883	132.0733	132.5605	151.3152	162.1000	174.7505	(62)	
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)	
Solar input (sum of months) = Sum(63)m =	0.0000 (63)													
Output from w/h	179.6324	157.8309	164.5473	145.8336	141.6984	124.8761	118.2883	132.0733	132.5605	151.3152	162.1000	174.7505	(64)	
Total per year (kWh/year) = Sum(64)m =	1785.5066 (64)													
Heat gains from water heating, kWh/month	57.6390	50.5922	52.6267	46.4755	45.0363	39.5132	37.2578	41.8378	42.0650	48.2298	51.8785	56.0168	(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	152.5832	152.5832	152.5832	152.5832	152.5832	152.5832	152.5832	152.5832	152.5832	152.5832	152.5832	152.5832	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	55.2967	49.1141	39.9422	30.2388	22.6039	19.0832	20.6200	26.8027	35.9745	45.6779	53.3128	56.8336	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	341.2353	344.7762	335.8531	316.8569	292.8776	270.3405	255.2843	251.7433	260.6664	279.6626	303.6419	326.1791	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.8014	52.8014	52.8014	52.8014	52.8014	52.8014	52.8014	52.8014	52.8014	52.8014	52.8014	52.8014	(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)	-101.7221	-101.7221	-101.7221	-101.7221	-101.7221	-101.7221	-101.7221	-101.7221	-101.7221	-101.7221	-101.7221	-101.7221	(71)
Water heating gains (Table 5)	77.4718	75.2861	70.7347	64.5493	60.5326	54.8794	50.0777	56.2336	58.4236	64.8250	72.0535	75.2914	(72)
Total internal gains	580.6662	575.8388	553.1925	518.3075	482.6766	450.9655	432.6444	441.4421	461.7269	496.8280	535.6707	564.9665	(73)

6. Solar gains

[Jan]		Area m ²	Solar flux Table 6a W/m ²	Specific data g or Table 6b	Specific data FF or Table 6c	Access factor Table 6d	Gains W						
East		4.1500	19.6403	0.6300	0.7000	0.7700	24.9096 (76)						
West		7.0800	19.6403	0.6300	0.7000	0.7700	42.4964 (80)						
Solar gains	67.4061	131.8605	217.1555	316.7084	388.1380	397.3283	378.2728	324.9307	252.5609	156.4636	84.0474	55.4315	(83)
Total gains	648.0722	707.6993	770.3481	835.0159	870.8146	848.2938	810.9172	766.3728	714.2878	653.2916	619.7181	620.3980	(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	38.3241	38.4259	38.5263	39.0047	39.0955	39.5240	39.5240	39.6044	39.3579	39.0955	38.9122	38.7224	
alpha	3.5549	3.5617	3.5684	3.6003	3.6064	3.6349	3.6349	3.6403	3.6239	3.6064	3.5941	3.5815	
util living area	0.9719	0.9598	0.9328	0.8718	0.7646	0.6071	0.4621	0.5039	0.7203	0.8964	0.9577	0.9756	(86)
MIT	19.5123	19.6911	20.0041	20.4031	20.7222	20.9141	20.9756	20.9664	20.8347	20.4232	19.9040	19.4777	(87)
Th 2	20.0176	20.0200	20.0223	20.0331	20.0351	20.0446	20.0446	20.0463	20.0409	20.0351	20.0310	20.0267	(88)
util rest of house	0.9665	0.9522	0.9198	0.8465	0.7185	0.5340	0.3690	0.4095	0.6534	0.8704	0.9484	0.9709	(89)
MIT 2	18.6733	18.8506	19.1575	19.5458	19.8345	19.9964	20.0354	20.0328	19.9384	19.5744	19.0709	18.6463	(90)
Living area fraction	fLA = Living area / (4) =												0.1745 (91)
MIT	18.8197	18.9973	19.3053	19.6954	19.9894	20.1566	20.1995	20.1957	20.0948	19.7225	19.2163	18.7914	(92)
Temperature adjustment													0.0000
adjusted MIT	18.8197	18.9973	19.3053	19.6954	19.9894	20.1566	20.1995	20.1957	20.0948	19.7225	19.2163	18.7914	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9582	0.9423	0.9083	0.8363	0.7161	0.5430	0.3846	0.4249	0.6575	0.8605	0.9385	0.9632	(94)
Useful gains	620.9651	666.8479	699.6764	698.3534	623.5581	460.6641	311.8828	325.6283	469.6220	562.1365	581.6332	597.5581	(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	1324.7492	1282.7992	1162.1965	967.7673	741.3864	491.5778	318.4378	335.1167	532.5909	815.8948	1088.7618	1317.5972	(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	523.6154	413.9193	344.1149	193.9780	87.6643	0.0000	0.0000	0.0000	0.0000	188.7961	365.1326	535.7091	(98)
Space heating													2652.9298 (98)
Space heating per m ²													(98) / (4) = 31.3882 (99)

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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													2924.9501 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	523.6154	413.9193	344.1149	193.9780	87.6643	0.0000	0.0000	0.0000	0.0000	188.7961	365.1326	535.7091	(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)	577.3047	456.3608	379.3991	213.8678	96.6530	0.0000	0.0000	0.0000	0.0000	208.1545	402.5717	590.6385	(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	179.6324	157.8309	164.5473	145.8336	141.6984	124.8761	118.2883	132.0733	132.5605	151.3152	162.1000	174.7505	(64)
Efficiency of water heater (217)m	89.7795	89.7061	89.5374	89.1641	88.5054	87.2000	87.2000	87.2000	87.2000	89.1088	89.5944	87.2000	(216)
Fuel for water heating, kWh/month	200.0817	175.9423	183.7749	163.5564	160.1015	143.2066	135.6517	151.4602	152.0190	169.8095	180.9265	194.5708	(219)
Water heating fuel used													2011.1011 (219)
Annual totals kWh/year													
Space heating fuel - main system													2924.9501 (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)													390.6229 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.75 * 908 * 1.00) =													-544.7125 (233)
Total delivered energy for all uses													4856.9616 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2924.9501	3.4800	101.7883 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2011.1011	3.4800	69.9863 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	390.6229	13.1900	51.5232 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-544.7125	13.1900	-71.8476 (252)
Total energy cost			281.3427 (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] =	0.9123 (257)
SAP value		87.2731
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	2924.9501	0.2160	631.7892 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2011.1011	0.2160	434.3978 (264)
Space and water heating			1066.1871 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	390.6229	0.5190	202.7333 (268)
Energy saving/generation technologies			
PV Unit	-544.7125	0.5190	-282.7058 (269)
Total kg/year			1025.1396 (272)
CO2 emissions per m2			12.1300 (273)
EI value			89.3940
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 (m2)	Storey height (m)	Volume (m3)
Ground floor	42.2600 (1b)	2.3900 (2b)	101.0014 (1b) - (3b)
First floor	42.2600 (1c)	2.4200 (2c)	102.2692 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	84.5200		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 203.2706 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour							
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)							
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)							
Number of intermittent fans				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) =	0.1476 (8)							
Pressure test					Yes							
Measured/design AP50					5.0000							
Infiltration rate					0.3976 (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) =		0.3379 (21)							
Wind speed	Jan 5.1000	Feb 4.7000	Mar 4.6000	Apr 4.3000	May 4.3000	Jun 4.0000	Jul 4.0000	Aug 3.9000	Sep 4.0000	Oct 4.5000	Nov 4.4000	Dec 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	0.4309	0.3971	0.3886	0.3633	0.3633	0.3379	0.3379	0.3295	0.3379	0.3802	0.3717	0.3971 (22b)
Effective ac	0.5928	0.5788	0.5755	0.5660	0.5660	0.5571	0.5571	0.5543	0.5571	0.5723	0.5691	0.5788 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Front Door			2.1500	1.1000	2.3650		(26)
Windows & Fully Glazed Do (Uw = 1.20)			11.2300	1.1450	12.8588		(27)
Ground Floor			42.2600	0.1200	5.0712	90.0000	3803.4000 (28a)
Brick and Block	88.3100	13.3800	74.9300	0.2400	17.9832	42.2200	3163.5446 (29a)
Step Party Wall	2.6200		2.6200	0.2600	0.6812	110.0000	288.2000 (29a)
External Roof 1	42.2600		42.2600	0.1000	4.2260	9.1000	384.5660 (30)
Total net area of external elements Aum(A, m2)			175.4500				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	43.1854		(33)
Party Wall 1			40.9700	0.0000	0.0000	45.0000	1843.6500 (32)
GF Timber Stud			76.4600			9.0000	688.1400 (32c)
FF Timber Stud			83.4400			9.0000	750.9600 (32c)
Internal Floor 1			46.2600			18.0000	832.6800 (32d)
Internal Ceiling 1			46.2600			18.0000	832.6800 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	12587.8206 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							148.9330 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.2861 (36)
Total fabric heat loss						(33) + (36) =	51.4714 (37)

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

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	39.7667	38.8282	38.6055	37.9663	37.9663	37.3702	37.3702	37.1811	37.3702	38.3877	38.1746	38.8282 (38)
Average = Sum(39)m / 12 =	91.2381	90.2996	90.0770	89.4378	89.4378	88.8416	88.8416	88.6525	88.8416	89.8591	89.6460	90.2996 (39)
HLP	1.0795	1.0684	1.0657	1.0582	1.0582	1.0511	1.0511	1.0489	1.0511	1.0632	1.0606	1.0684 (40)
HLP (average)												1.0604 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Assumed occupancy												2.5431 (42)
Average daily hot water use (litres/day)												94.5975 (43)
Daily hot water use	104.0573	100.2734	96.4895	92.7056	88.9217	85.1378	85.1378	88.9217	92.7056	96.4895	100.2734	104.0573 (44)
Energy conte	154.3139	134.9639	139.2707	121.4196	116.5050	100.5349	93.1604	106.9029	108.1797	126.0730	137.6185	149.4448 (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 =	1488.3871 (45)
Distribution loss (46)m = 0.15 x (45)m													
	23.1471	20.2446	20.8906	18.2129	17.4757	15.0802	13.9741	16.0354	16.2269	18.9109	20.6428	22.4167	(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	25.2766	24.4140	25.1935	24.3412	25.1279	25.1704	24.3809	25.2422	24.4815	25.3057	(61)
Total heat required for water heating calculated for each month	179.6324	157.8309	164.5473	145.8336	141.6984	124.8761	118.2883	132.0733	132.5605	151.3152	162.1000	174.7505	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Solar input (sum of months) = Sum(63)m =												0.0000 (63)	
Output from w/h	179.6324	157.8309	164.5473	145.8336	141.6984	124.8761	118.2883	132.0733	132.5605	151.3152	162.1000	174.7505	(64)
Total per year (kWh/year) = Sum(64)m =												1785.5066 (64)	
Heat gains from water heating, kWh/month	57.6390	50.5922	52.6267	46.4755	45.0363	39.5132	37.2578	41.8378	42.0650	48.2298	51.8785	56.0168	(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	152.5832	152.5832	152.5832	152.5832	152.5832	152.5832	152.5832	152.5832	152.5832	152.5832	152.5832	152.5832	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	55.2967	49.1141	39.9422	30.2388	22.6039	19.0832	20.6200	26.8027	35.9745	45.6779	53.3128	56.8336	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	341.2353	344.7762	335.8531	316.8569	292.8776	270.3405	255.2843	251.7433	260.6664	279.6626	303.6419	326.1791	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.8014	52.8014	52.8014	52.8014	52.8014	52.8014	52.8014	52.8014	52.8014	52.8014	52.8014	52.8014	(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)	-101.7221	-101.7221	-101.7221	-101.7221	-101.7221	-101.7221	-101.7221	-101.7221	-101.7221	-101.7221	-101.7221	-101.7221	(71)
Water heating gains (Table 5)	77.4718	75.2861	70.7347	64.5493	60.5326	54.8794	50.0777	56.2336	58.4236	64.8250	72.0535	75.2914	(72)
Total internal gains	580.6662	575.8388	553.1925	518.3075	482.6766	450.9655	432.6444	441.4421	461.7269	496.8280	535.6707	564.9665	(73)

6. Solar gains

[Jan]		Area m ²	Solar flux Table 6a W/m ²	Specific data g or Table 6b	Specific data FF or Table 6c	Access factor Table 6d	Gains W						
East		4.1500	25.9136	0.6300	0.7000	0.7700	32.8661	(76)					
West		7.0800	25.9136	0.6300	0.7000	0.7700	56.0704	(80)					
Solar gains	88.9365	148.5607	242.5022	358.2858	417.9663	462.4715	429.9713	378.1770	298.4359	186.2454	109.8694	69.8357	(83)
Total gains	669.6027	724.3995	795.6947	876.5933	900.6429	913.4369	862.6158	819.6190	760.1628	683.0734	645.5401	634.8022	(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	38.3241	38.7224	38.8181	39.0955	39.0955	39.3579	39.3579	39.4418	39.3579	38.9122	39.0047	38.7224	
alpha	3.5549	3.5815	3.5879	3.6064	3.6064	3.6239	3.6239	3.6295	3.6239	3.5941	3.6003	3.5815	
util living area	0.9625	0.9503	0.9151	0.8378	0.7071	0.5155	0.3738	0.3914	0.6294	0.8501	0.9381	0.9669	(86)
MIT	19.7037	19.8427	20.1547	20.5226	20.8084	20.9553	20.9895	20.9879	20.9084	20.5887	20.1234	19.6880	(87)
Th 2	20.0176	20.0267	20.0289	20.0351	20.0351	20.0409	20.0409	20.0428	20.0409	20.0310	20.0331	20.0267	(88)
util rest of house	0.9551	0.9407	0.8985	0.8067	0.6524	0.4372	0.2802	0.2941	0.5502	0.8123	0.9239	0.9602	(89)
MIT 2	18.8622	19.0045	19.3077	19.6566	19.9055	20.0191	20.0379	20.0393	19.9913	19.7221	19.2861	18.8544	(90)
Living area fraction												fLA = Living area / (4) = 0.1745 (91)	
MIT	19.0090	19.1508	19.4555	19.8077	20.0631	20.1825	20.2040	20.2048	20.1513	19.8734	19.4322	18.9998	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0090	19.1508	19.4555	19.8077	20.0631	20.1825	20.2040	20.2048	20.1513	19.8734	19.4322	18.9998	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9454	0.9301	0.8869	0.7985	0.6541	0.4492	0.2964	0.3110	0.5599	0.8052	0.9130	0.9512	(94)
Useful gains	633.0634	673.7294	705.7203	699.9865	589.1121	410.2743	255.7095	254.8656	425.6282	550.0423	589.3935	603.8480	(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	1241.6609	1214.6026	1094.9332	912.9544	667.4831	424.8863	257.9965	257.5213	457.6523	725.4645	988.9949	1219.0302	(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	452.7965	363.4668	289.5745	153.3369	58.3080	0.0000	0.0000	0.0000	0.0000	130.5141	287.7130	457.6955	(98)
Space heating												2193.4052 (98)	
Space heating per m ²												(98) / (4) = 25.9513 (99)	

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Not applicable

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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													2418.3079 (211)
Space heating requirement	452.7965	363.4668	289.5745	153.3369	58.3080	0.0000	0.0000	0.0000	0.0000	130.5141	287.7130	457.6955	(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)	499.2244	400.7351	319.2662	169.0594	64.2867	0.0000	0.0000	0.0000	0.0000	143.8964	317.2139	504.6257	(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	179.6324	157.8309	164.5473	145.8336	141.6984	124.8761	118.2883	132.0733	132.5605	151.3152	162.1000	174.7505	(64)
Efficiency of water heater (217)m	89.6776	89.6110	89.3998	88.9595	88.1921	87.2000	87.2000	87.2000	87.2000	88.7866	89.4068	87.2000	(216)
Fuel for water heating, kWh/month	200.3091	176.1289	184.0578	163.9326	160.6701	143.2066	135.6517	151.4602	152.0190	170.4256	181.3061	194.8055	(219)
Water heating fuel used													2013.9732 (219)
Annual totals kWh/year													
Space heating fuel - main system													2418.3079 (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)													390.6229 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.75 * 1054 * 1.00) =													-632.6656 (233)
Total delivered energy for all uses													4265.2383 (238)

10a. Fuel costs - using BEDF prices (513)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2418.3079	9.7400	235.5432 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2013.9732	9.7400	196.1610 (247)
Pumps and fans for heating	75.0000	36.8500	27.6375 (249)
Energy for lighting	390.6229	36.8500	143.9445 (250)
Additional standing charges			104.0000 (251)
Energy saving/generation technologies			
PV Unit	-632.6656	36.8500	-233.1373 (252)
Total energy cost			474.1489 (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	2418.3079	0.2160	522.3545 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2013.9732	0.2160	435.0182 (264)
Space and water heating			957.3727 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	390.6229	0.5190	202.7333 (268)
Energy saving/generation technologies			
PV Unit	-632.6656	0.5190	-328.3535 (269)
Total kg/year			870.6775 (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	2418.3079	1.2200	2950.3356 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2013.9732	1.2200	2457.0473 (264)
Space and water heating			5407.3829 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	390.6229	3.0700	1199.2123 (268)
Energy saving/generation technologies			
PV Unit	-632.6656	3.0700	-1942.2834 (269)
Primary energy kWh/year			4894.5618 (272)
Primary energy kWh/m2/year			57.9101 (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
F	Already installed
G	Not considered
H	Not considered
I	Not considered
J	Not considered
K	Not considered
M	Not considered
N	Solar water heating
O	Recommended
P	Not considered
R	Not considered
S	Not considered
T	Not considered
U	Solar photovoltaic panels
A2	Already installed
A3	Not considered
T2	Not considered
W	Not considered
X	Not considered
Y	Not considered
J2	Not considered
Q2	Not considered
Z1	Not considered
Z2	Not considered
Z3	Not considered
Z4	Not considered
Z5	Not considered
V2	Wind turbine
L2	Not applicable
Q3	Not considered
O3	Not considered

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.2	-£ 80	-193 kg (22.2%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£80	2.28 kg/m ²	B 88 B 91
Total Savings	£80	2.28 kg/m ²	

Potential energy efficiency rating: B 88
 Potential environmental impact rating: B 91

Fuel prices for cost data on this page from database revision number 513 TEST (28 Feb 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	£172	£190	-£18
Mains gas	£536	£437	£99
Space heating	£367	£367	£0
Water heating	£196	£116	£80
Lighting	£144	£144	£0
Generated (PV)	-£233	-£233	£0
Total cost of fuels	£475	£394	£81
Total cost of uses	£474	£394	£80
Delivered energy	50 kWh/m ²	39 kWh/m ²	11 kWh/m ²
Carbon dioxide emissions	0.9 tonnes	0.7 tonnes	0.2 tonnes
CO2 emissions per m ²	10 kg/m ²	8 kg/m ²	2 kg/m ²
Primary energy	58 kWh/m ²	45 kWh/m ²	13 kWh/m ²

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 (m2)	Storey height (m)	Volume (m3)
Ground floor	42.2600 (1b)	2.3900 (2b)	101.0014 (1b) - (3b)
First floor	42.2600 (1c)	2.4200 (2c)	102.2692 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	84.5200		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 203.2706 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour							
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)							
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)							
Number of intermittent fans				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) =	0.1476 (8)							
Pressure test					Yes							
Measured/design AP50					5.0000							
Infiltration rate					0.3976 (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) =	0.3379 (21)							
Wind speed	Jan 5.1000	Feb 5.0000	Mar 4.9000	Apr 4.4000	May 4.3000	Jun 3.8000	Jul 3.8000	Aug 3.7000	Sep 4.0000	Oct 4.3000	Nov 4.5000	Dec 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	0.4309	0.4224	0.4140	0.3717	0.3633	0.3211	0.3211	0.3126	0.3379	0.3633	0.3802	0.3971 (22b)
Effective ac	0.5928	0.5892	0.5857	0.5691	0.5660	0.5515	0.5515	0.5489	0.5571	0.5660	0.5723	0.5788 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Front Door			2.1500	1.1000	2.3650		(26)
Windows & Fully Glazed Do (Uw = 1.20)			11.2300	1.1450	12.8588		(27)
Ground Floor			42.2600	0.1200	5.0712	90.0000	3803.4000 (28a)
Brick and Block	88.3100	13.3800	74.9300	0.2400	17.9832	42.2200	3163.5446 (29a)
Step Party Wall	2.6200		2.6200	0.2600	0.6812	110.0000	288.2000 (29a)
External Roof 1	42.2600		42.2600	0.1000	4.2260	9.1000	384.5660 (30)
Total net area of external elements Aum(A, m2)			175.4500				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	43.1854		(33)
Party Wall 1			40.9700	0.0000	0.0000	45.0000	1843.6500 (32)
GF Timber Stud			76.4600			9.0000	688.1400 (32c)
FF Timber Stud			83.4400			9.0000	750.9600 (32c)
Internal Floor 1			46.2600			18.0000	832.6800 (32d)
Internal Ceiling 1			46.2600			18.0000	832.6800 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	12587.8206 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							148.9330 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.2861 (36)
Total fabric heat loss						(33) + (36) =	51.4714 (37)

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

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	39.7667	39.5249	39.2878	38.1746	37.9663	36.9967	36.9967	36.8172	37.3702	37.9663	38.3877	38.8282 (38)
Average = Sum(39)m / 12 =	91.2381	90.9963	90.7593	89.6460	89.4378	88.4681	88.4681	88.2886	88.8416	89.4378	89.8591	90.2996 (39)
HLP	1.0795	1.0766	1.0738	1.0606	1.0582	1.0467	1.0467	1.0446	1.0511	1.0582	1.0632	1.0684 (40)
HLP (average)												1.0606 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Assumed occupancy												2.5431 (42)
Average daily hot water use (litres/day)												94.5975 (43)
Daily hot water use	104.0573	100.2734	96.4895	92.7056	88.9217	85.1378	85.1378	88.9217	92.7056	96.4895	100.2734	104.0573 (44)
Energy conte	154.3139	134.9639	139.2707	121.4196	116.5050	100.5349	93.1604	106.9029	108.1797	126.0730	137.6185	149.4448 (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 =	1488.3871 (45)
Distribution loss (46)m = 0.15 x (45)m													
	23.1471	20.2446	20.8906	18.2129	17.4757	15.0802	13.9741	16.0354	16.2269	18.9109	20.6428	22.4167	(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	25.2766	24.4140	25.1935	24.3412	25.1279	25.1704	24.3809	25.2422	24.4815	25.3057	(61)
Total heat required for water heating calculated for each month	179.6324	157.8309	164.5473	145.8336	141.6984	124.8761	118.2883	132.0733	132.5605	151.3152	162.1000	174.7505	(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												1.2185 (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												94.5975 (H14)	
Volume ratio Veff/V												0.7928 (H15)	
Solar storage volume factor												0.9536 (H16)	
Solar input	-24.6878	-41.1969	-70.1630	-94.0322	-116.1689	-114.2125	-112.7031	-98.4693	-77.1212	-52.6647	-29.2833	-851.3624	(H17)
Solar input (sum of months) = Sum(63)m =												-851.3624 (63)	
Output from w/h	154.9446	116.6340	94.3843	51.8014	25.5296	10.6636	5.5852	33.6040	55.4393	98.6505	132.8167	154.0910	(64)
Total per year (kWh/year) = Sum(64)m =												934.1442 (64)	
Heat gains from water heating, kWh/month	57.6390	50.5922	52.6267	46.4755	45.0363	39.5132	37.2578	41.8378	42.0650	48.2298	51.8785	56.0168	(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	152.5832	152.5832	152.5832	152.5832	152.5832	152.5832	152.5832	152.5832	152.5832	152.5832	152.5832	152.5832	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	55.2967	49.1141	39.9422	30.2388	22.6039	19.0832	20.6200	26.8027	35.9745	45.6779	53.3128	56.8336	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	341.2353	344.7762	335.8531	316.8569	292.8776	270.3405	255.2843	251.7433	260.6664	279.6626	303.6419	326.1791	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.8014	52.8014	52.8014	52.8014	52.8014	52.8014	52.8014	52.8014	52.8014	52.8014	52.8014	52.8014	(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)	-101.7221	-101.7221	-101.7221	-101.7221	-101.7221	-101.7221	-101.7221	-101.7221	-101.7221	-101.7221	-101.7221	-101.7221	(71)
Water heating gains (Table 5)	77.4718	75.2861	70.7347	64.5493	60.5326	54.8794	50.0777	56.2336	58.4236	64.8250	72.0535	75.2914	(72)
Total internal gains	580.6662	575.8388	553.1925	518.3075	482.6766	450.9655	432.6444	441.4421	461.7269	496.8280	535.6707	564.9665	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b g	Specific data or Table 6c FF	Access factor Table 6d	Gains W							
East	4.1500	19.6403	0.6300	0.7000	0.7700	24.9096 (76)							
West	7.0800	19.6403	0.6300	0.7000	0.7700	42.4964 (80)							
Solar gains	67.4061	131.8605	217.1555	316.7084	398.1380	397.3283	378.2728	324.9307	252.5609	156.4636	84.0474	55.4315	(83)
Total gains	648.0722	707.6993	770.3481	835.0159	870.8146	848.2938	810.9172	766.3728	714.2878	653.2916	619.7181	620.3980	(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	38.3241	38.4259	38.5263	39.0047	39.0955	39.5240	39.5240	39.6044	39.3579	39.0955	38.9122	38.7224	(86)
alpha	3.5549	3.5617	3.5684	3.6003	3.6064	3.6349	3.6349	3.6403	3.6239	3.6064	3.5941	3.5815	(87)
util living area	0.9719	0.9598	0.9328	0.8718	0.7646	0.6071	0.4621	0.5039	0.7203	0.8964	0.9577	0.9756	(88)
MIT	19.5123	19.6911	20.0041	20.4031	20.7222	20.9141	20.9756	20.9664	20.8347	20.4232	19.9040	19.4777	(89)
Th 2	20.0176	20.0200	20.0223	20.0331	20.0351	20.0446	20.0446	20.0463	20.0409	20.0351	20.0310	20.0267	(90)
util rest of house	0.9665	0.9522	0.9198	0.8465	0.7185	0.5340	0.3690	0.4095	0.6534	0.8704	0.9484	0.9709	(91)
MIT 2	18.6733	18.8506	19.1575	19.5458	19.8345	19.9964	20.0354	20.0328	19.9384	19.5744	19.0709	18.6463	(92)
Living area fraction												fLA = Living area / (4) =	
MIT	18.8197	18.9973	19.3053	19.6954	19.9894	20.1566	20.1995	20.1957	20.0948	19.7225	19.2163	18.7914	(93)
Temperature adjustment												0.0000	
adjusted MIT	18.8197	18.9973	19.3053	19.6954	19.9894	20.1566	20.1995	20.1957	20.0948	19.7225	19.2163	18.7914	(94)

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	0.9582	0.9423	0.9083	0.8363	0.7161	0.5430	0.3846	0.4249	0.6575	0.8605	0.9385	0.9632	(94)
Useful gains	620.9651	666.8479	699.6764	698.3534	623.5581	460.6641	311.8828	325.6283	469.6220	562.1365	581.6332	597.5581	(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													
	1324.7492	1282.7992	1162.1965	967.7673	741.3864	491.5778	318.4378	335.1167	532.5909	815.8948	1088.7618	1317.5972	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	523.6154	413.9193	344.1149	193.9780	87.6643	0.0000	0.0000	0.0000	0.0000	188.7961	365.1326	535.7091	(98)
Space heating												2652.9298	(98)
Space heating per m2												(98) / (4) =	31.3882 (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													2924.9501 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	523.6154	413.9193	344.1149	193.9780	87.6643	0.0000	0.0000	0.0000	0.0000	188.7961	365.1326	535.7091	(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)	577.3047	456.3608	379.3991	213.8678	96.6530	0.0000	0.0000	0.0000	0.0000	208.1545	402.5717	590.6385	(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	154.9446	116.6340	94.3843	51.8014	25.5296	10.6636	5.5852	33.6040	55.4393	98.6505	132.8167	154.0910	(64)
Efficiency of water heater	89.8763	89.9067	89.9231	89.9392	89.8863	87.2000	87.2000	87.2000	87.2000	89.4676	89.7393	89.8940	(216)
(217)m	89.8763	89.9067	89.9231	89.9392	89.8863	87.2000	87.2000	87.2000	87.2000	89.4676	89.7393	89.8940	(217)
Fuel for water heating, kWh/month	172.3977	129.7279	104.9611	57.5960	28.4021	12.2289	6.4050	38.5367	63.5772	110.2639	148.0028	171.4142	(219)
Water heating fuel used												1043.5135	(219)
Annual totals kWh/year													
Space heating fuel - main system													2924.9501 (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)													390.6229 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.75 * 908 * 1.00) =										-544.7125			-544.7125 (233)
Total delivered energy for all uses													3939.3740 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2924.9501	3.4800	101.7883	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1043.5135	3.4800	36.3143	(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	390.6229	13.1900	51.5232	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-544.7125	13.1900	-71.8476	(252)
Total energy cost			254.2656	(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] =	0.8245 (257)
SAP value		88.4980
SAP rating (Section 12)		88 (258)
SAP band		B

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

Energy Emission factor Emissions

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CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

	kWh/year	kg CO2/kWh	kg CO2/year
Space heating - main system 1	2924.9501	0.2160	631.7892 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1043.5135	0.2160	225.3989 (264)
Space and water heating			857.1881 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	390.6229	0.5190	202.7333 (268)
Energy saving/generation technologies			
PV Unit	-544.7125	0.5190	-282.7058 (269)
Total kg/year			842.0906 (272)
CO2 emissions per m2			9.9600 (273)
EI value			91.2878
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 (m2)	Storey height (m)	Volume (m3)
Ground floor	42.2600 (1b)	2.3900 (2b)	101.0014 (1b) - (3b)
First floor	42.2600 (1c)	2.4200 (2c)	102.2692 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	84.5200		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 203.2706 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour							
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)							
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)							
Number of intermittent fans				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) =	0.1476 (8)							
Pressure test					Yes							
Measured/design AP50					5.0000							
Infiltration rate					0.3976 (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) =		0.3379 (21)							
Wind speed	Jan 5.1000	Feb 4.7000	Mar 4.6000	Apr 4.3000	May 4.3000	Jun 4.0000	Jul 4.0000	Aug 3.9000	Sep 4.0000	Oct 4.5000	Nov 4.4000	Dec 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	0.4309	0.3971	0.3886	0.3633	0.3633	0.3379	0.3379	0.3295	0.3379	0.3802	0.3717	0.3971 (22b)
Effective ac	0.5928	0.5788	0.5755	0.5660	0.5660	0.5571	0.5571	0.5543	0.5571	0.5723	0.5691	0.5788 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Front Door			2.1500	1.1000	2.3650		(26)
Windows & Fully Glazed Do (Uw = 1.20)			11.2300	1.1450	12.8588		(27)
Ground Floor			42.2600	0.1200	5.0712	90.0000	3803.4000 (28a)
Brick and Block	88.3100	13.3800	74.9300	0.2400	17.9832	42.2200	3163.5446 (29a)
Step Party Wall	2.6200		2.6200	0.2600	0.6812	110.0000	288.2000 (29a)
External Roof 1	42.2600		42.2600	0.1000	4.2260	9.1000	384.5660 (30)
Total net area of external elements Aum(A, m2)			175.4500				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	43.1854		(33)
Party Wall 1			40.9700	0.0000	0.0000	45.0000	1843.6500 (32)
GF Timber Stud			76.4600			9.0000	688.1400 (32c)
FF Timber Stud			83.4400			9.0000	750.9600 (32c)
Internal Floor 1			46.2600			18.0000	832.6800 (32d)
Internal Ceiling 1			46.2600			18.0000	832.6800 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	12587.8206 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							148.9330 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.2861 (36)
Total fabric heat loss						(33) + (36) =	51.4714 (37)

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

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	39.7667	38.8282	38.6055	37.9663	37.9663	37.3702	37.3702	37.1811	37.3702	38.3877	38.1746	38.8282 (38)
Average = Sum(39)m / 12 =	91.2381	90.2996	90.0770	89.4378	89.4378	88.8416	88.8416	88.6525	88.8416	89.8591	89.6460	90.2996 (39)
HLP	1.0795	1.0684	1.0657	1.0582	1.0582	1.0511	1.0511	1.0489	1.0511	1.0632	1.0606	1.0684 (40)
HLP (average)												1.0604 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Assumed occupancy												2.5431 (42)
Average daily hot water use (litres/day)												94.5975 (43)
Daily hot water use	104.0573	100.2734	96.4895	92.7056	88.9217	85.1378	85.1378	88.9217	92.7056	96.4895	100.2734	104.0573 (44)
Energy conte	154.3139	134.9639	139.2707	121.4196	116.5050	100.5349	93.1604	106.9029	108.1797	126.0730	137.6185	149.4448 (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 =	1488.3871 (45)
Distribution loss (46)m = 0.15 x (45)m													
	23.1471	20.2446	20.8906	18.2129	17.4757	15.0802	13.9741	16.0354	16.2269	18.9109	20.6428	22.4167	(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	25.2766	24.4140	25.1935	24.3412	25.1279	25.1704	24.3809	25.2422	24.4815	25.3057	(61)
Total heat required for water heating calculated for each month	179.6324	157.8309	164.5473	145.8336	141.6984	124.8761	118.2883	132.0733	132.5605	151.3152	162.1000	174.7505	(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												1.3934 (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												94.5975 (H14)	
Volume ratio Veff/V												0.7928 (H15)	
Solar storage volume factor												0.9536 (H16)	
Solar input	-29.2239	-41.7180	-70.7049	-96.4811	-113.8688	-121.1780	-116.7042	-104.1155	-82.4013	-56.4200	-34.3585	-23.3433	(63)
Solar input (sum of months) = Sum(63)m =												-890.5173 (H17)	
Output from w/h	150.4085	116.1129	93.8424	49.3524	27.8296	3.6982	1.5841	27.9579	50.1592	94.8952	127.7415	151.4072	(64)
Total per year (kWh/year) = Sum(64)m =												894.9892 (64)	
Heat gains from water heating, kWh/month	57.6390	50.5922	52.6267	46.4755	45.0363	39.5132	37.2578	41.8378	42.0650	48.2298	51.8785	56.0168	(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	152.5832	152.5832	152.5832	152.5832	152.5832	152.5832	152.5832	152.5832	152.5832	152.5832	152.5832	152.5832	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	55.2967	49.1141	39.9422	30.2388	22.6039	19.0832	20.6200	26.8027	35.9745	45.6779	53.3128	56.8336	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	341.2353	344.7762	335.8531	316.8569	292.8776	270.3405	255.2843	251.7433	260.6664	279.6626	303.6419	326.1791	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.8014	52.8014	52.8014	52.8014	52.8014	52.8014	52.8014	52.8014	52.8014	52.8014	52.8014	52.8014	(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)	-101.7221	-101.7221	-101.7221	-101.7221	-101.7221	-101.7221	-101.7221	-101.7221	-101.7221	-101.7221	-101.7221	-101.7221	(71)
Water heating gains (Table 5)	77.4718	75.2861	70.7347	64.5493	60.5326	54.8794	50.0777	56.2336	58.4236	64.8250	72.0535	75.2914	(72)
Total internal gains	580.6662	575.8388	553.1925	518.3075	482.6766	450.9655	432.6444	441.4421	461.7269	496.8280	535.6707	564.9665	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data g or Table 6b	Specific data FF or Table 6c	Access factor Table 6d	Gains W							
East	4.1500	25.9136	0.6300	0.7000	0.7700	32.8661 (76)							
West	7.0800	25.9136	0.6300	0.7000	0.7700	56.0704 (80)							
Solar gains	88.9365	148.5607	242.5022	358.2858	417.9663	462.4715	429.9713	378.1770	298.4359	186.2454	109.8694	69.8357	(83)
Total gains	669.6027	724.3995	795.6947	876.5933	900.6429	913.4369	862.6158	819.6190	760.1628	683.0734	645.5401	634.8022	(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	38.3241	38.7224	38.8181	39.0955	39.0955	39.3579	39.3579	39.4418	39.3579	38.9122	39.0047	38.7224	
alpha	3.5549	3.5815	3.5879	3.6064	3.6064	3.6239	3.6239	3.6295	3.6239	3.5941	3.6003	3.5815	
util living area	0.9625	0.9503	0.9151	0.8378	0.7071	0.5155	0.3738	0.3914	0.6294	0.8501	0.9381	0.9669	(86)
MIT	19.7037	19.8427	20.1547	20.5226	20.8084	20.9553	20.9895	20.9879	20.9084	20.5887	20.1234	19.6880	(87)
Th 2	20.0176	20.0267	20.0289	20.0351	20.0351	20.0409	20.0409	20.0428	20.0409	20.0310	20.0331	20.0267	(88)
util rest of house	0.9551	0.9407	0.8985	0.8067	0.6524	0.4372	0.2802	0.2941	0.5502	0.8123	0.9239	0.9602	(89)
MIT 2	18.8622	19.0045	19.3077	19.6566	19.9055	20.0191	20.0379	20.0393	19.9913	19.7221	19.2861	18.8544	(90)
Living area fraction												fLA = Living area / (4) =	
MIT	19.0090	19.1508	19.4555	19.8077	20.0631	20.1825	20.2040	20.2048	20.1513	19.8734	19.4322	18.9998	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0090	19.1508	19.4555	19.8077	20.0631	20.1825	20.2040	20.2048	20.1513	19.8734	19.4322	18.9998	(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	0.9454	0.9301	0.8869	0.7985	0.6541	0.4492	0.2964	0.3110	0.5599	0.8052	0.9130	0.9512	(94)	
Useful gains	633.0634	673.7294	705.7203	699.9865	589.1121	410.2743	255.7095	254.8656	425.6282	550.0423	589.3935	603.8480	(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														
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														
Space heating	452.7965	363.4668	289.5745	153.3369	58.3080	0.0000	0.0000	0.0000	0.0000	130.5141	287.7130	457.6955	(98)	
Space heating per m2												2193.4052	(98)	
												(98) / (4) =	25.9513	(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														2418.3079	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec			
Space heating requirement	452.7965	363.4668	289.5745	153.3369	58.3080	0.0000	0.0000	0.0000	0.0000	130.5141	287.7130	457.6955	(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)	499.2244	400.7351	319.2662	169.0594	64.2867	0.0000	0.0000	0.0000	0.0000	143.8964	317.2139	504.6257	(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	150.4085	116.1129	93.8424	49.3524	27.8296	3.6982	1.5841	27.9579	50.1592	94.8952	127.7415	151.4072	(64)		
Efficiency of water heater	89.8012	89.8271	89.8176	89.8222	89.5389	87.2000	87.2000	87.2000	87.2000	89.1929	89.5943	89.8040	(217)		
Fuel for water heating, kWh/month	167.4905	129.2627	104.4811	54.9446	31.0810	4.2410	1.8167	32.0618	57.5221	106.3933	142.5777	168.5973	(219)		
Water heating fuel used												1000.4698	(219)		
Annual totals kWh/year															
Space heating fuel - main system														2418.3079	(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)														390.6229	(232)
Energy saving/generation technologies (Appendices M ,N and Q)															
PV Unit 0 (0.80 * 0.75 * 1054 * 1.00) =										-632.6656				-632.6656	(233)
Total delivered energy for all uses														3301.7350	(238)

10a. Fuel costs - using BEDF prices (513)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2418.3079	9.7400	235.5432	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1000.4698	9.7400	97.4458	(247)
Pumps and fans for heating	75.0000	36.8500	27.6375	(249)
Pump for solar water heating	50.0000	36.8500	18.4250	(249)
Energy for lighting	390.6229	36.8500	143.9445	(250)
Additional standing charges			104.0000	(251)
Energy saving/generation technologies				
PV Unit	-632.6656	36.8500	-233.1373	(252)
Total energy cost			393.8587	(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	2418.3079	0.2160	522.3545	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1000.4698	0.2160	216.1015	(264)
Space and water heating			738.4560	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	390.6229	0.5190	202.7333	(268)
Energy saving/generation technologies				
PV Unit	-632.6656	0.5190	-328.3535	(269)
Total kg/year			677.7108	(272)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

 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	2418.3079	1.2200	2950.3356 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1000.4698	1.2200	1220.5731 (264)
Space and water heating			4170.9087 (265)
Pumps and fans	125.0000	3.0700	383.7500 (267)
Energy for lighting	390.6229	3.0700	1199.2123 (268)
Energy saving/generation technologies			
PV Unit	-632.6656	3.0700	-1942.2834 (269)
Primary energy kWh/year			3811.5876 (272)
Primary energy kWh/m2/year			45.0969 (273)

U-VALUE CALCULATOR REPORT

Property Reference	SAP 0879 Plot 116		Issued on Date	28/03/2023
Assessment Reference	Rev A	Prop Type Ref	3B AFF (HA/SO)	
Project	Plot 116			
Calculation Type	New Build (As Designed)			

SAP Rating	87 B	DER	13.92	TER	17.88
Environmental	89 B	% DER<TER	22.16		
CO ₂ Emissions (t/year)	0.87	DFEE	42.06	TTEE	49.95
General Requirements Compliance	Pass	% DFEE<TFEE	15.79		

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	Earthwool Loft Roll 40 Main construction Corrections - Air Gap: Level 1, Fasteners: None or plastic	150	0.0400	3.7500	100.00		
Layer 2	Earthwool Loft Roll 40 Main construction Corrections - Air Gap: Level 1, Fasteners: None or plastic	200	0.0400	5.0000	100.00		
Layer 3	Earthwool Loft Roll 40 Main construction Main construction Corrections - Air Gap: Level 1, Fasteners: None or plastic	100 100	0.0400 0.1300	2.5000 0.7692	87.50 12.50		
Layer 4	Plasterboard, standard Main construction	12.5	0.2100	0.0595	100.00	700	1000
Int surface				0.1000			

Total resistance: Upper limit = 11.200 m² K/W Lower limit = 10.901 m² K/W Average = 11.050 m² K/W
Total correction = 0.0065 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 0879 Plot 116	Issued on Date	28/03/2023
Assessment Reference	Rev A	Prop Type Ref	3B AFF (HA/SO)
Project	Plot 116		
Calculation Type	New Build (As Designed)		

SAP Rating	87 B	DER	13.92	TER	17.88
Environmental	89 B	% DER<TER	22.16		
CO ₂ Emissions (t/year)	0.87	DFEE	42.06	TFEE	49.95
General Requirements Compliance	Pass	% DFEE<TFEE	15.79		

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 m² K/W Lower limit = 4.110 m² K/W Average = 4.215 m² K/W
 Total correction = 0.0002 m² K/W U-value (unrounded) = 0.24 W/m² 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 0879 Plot 116	Issued on Date	28/03/2023
Assessment Reference	Rev A	Prop Type Ref	3B AFF (HA/SO)
Project	Plot 116		
Calculation Type	New Build (As Designed)		

SAP Rating	87 B	DER	13.92	TER	17.88
Environmental	89 B	% DER<TER	22.16		
CO ₂ Emissions (t/year)	0.87	DFEE	42.06	TFEE	49.95
General Requirements Compliance	Pass	% DFEE<TFEE	15.79		

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 Party Step

Wall Type: Standard Wall

Layer	Description	Thickness (mm)	Conductivity (W/m ² K)	Resistance (m ² K/W)	Fraction (%)
Ext surface				0.0400	
Layer 1	Supabloc *7				
	Main construction	100	0.1900	0.5263	94.04
	Main construction	100	0.8803	0.1136	5.96
	Corrections - Air Gap: Level 1, Fasteners: None or plastic				
Layer 2	Supafil Party Wall				
	Main construction	100	0.0400	2.5000	100.00
	Corrections - Air Gap: Level 0, Fasteners: None or plastic				
Layer 3	Supabloc *7				
	Main construction	100	0.1900	0.5263	94.04
	Main construction	100	0.8803	0.1136	5.96
	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
Int surface				0.1300	

Total resistance: Upper limit = 3.898 m² K/W Lower limit = 3.765 m² K/W Average = 3.831 m² K/W
 Total correction = 0.0003 m² K/W U-value (unrounded) = 0.26 W/m² K

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

U-VALUE CALCULATOR REPORT

Property Reference	SAP 0879 Plot 116	Issued on Date	28/03/2023
Assessment Reference	Rev A	Prop Type Ref	3B AFF (HA/SO)
Project	Plot 116		
Calculation Type	New Build (As Designed)		

SAP Rating	87 B	DER	13.92	TER	17.88
Environmental	89 B	% DER<TER	22.16		
CO ₂ Emissions (t/year)	0.87	DFEE	42.06	TFEE	49.95
General Requirements Compliance	Pass	% DFEE<TFEE	15.79		

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

Floor 000003

Floor Type: Suspended Floor

Area = 46.25 m², Perimeter = 19.32 m, Wall thickness = 275.00 mm, Soil: Unknown

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

Floor height above ground: h = 0.200 m

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

Ventilation openings per perimeter length: e = 0.0015 %

Mean wind speed: v = 5.000 m/s

Resistance on solum: R_g = 0.000 m²K/W

Layer	Description	Thickness (mm)	Conductivity (W/m ² K)	Resistance (m ² K/W)	Fraction (%)	Density (kg/m ³)	Heat Cap. (J/kgK)
Ext surface				0.1700			
Layer 1	EPS 200 Lower portion						
	Main construction	55	0.0340	1.6176	80.65		
	Main construction	55	2.0000	0.0275	19.35		
	Corrections - Air Gap: Level 1, Fasteners: None or plastic						
Layer 2	EPS Upper portion						
	Main construction	100	0.0340	2.9412	87.10		
	Main construction	100	2.0000	0.0500	12.90		
	Corrections - Air Gap: Level 1, Fasteners: None or plastic						
Layer 3	Grey EPS 100 Topsheet						
	Main construction	155	0.0300	5.1667	100.00	15	1450
	Corrections - Air Gap: Level 1, Fasteners: None or plastic						
Layer 4	Screed						
	Main construction	75	1.1500	0.0652	100.00	1200	1000
Int surface				0.1700			

Total resistance: Upper limit = 9.271 m² K/W Lower limit = 6.052 m² K/W Average = 7.661 m² K/W
 Total correction = 0.0046 m² K/W U-value (unrounded) = 0.12 W/m² K

Unheated space: None

Total thickness: 385 mm

U-value: 0.12 W/m² K

Kappa: 90.00 kJ/m² K

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

Property Reference	SAP 0879 Plot 116	Issued on Date	28/03/2023
Assessment Reference	Rev A	Prop Type Ref	3B AFF (HA/SO)
Property	Plot 116		

SAP Rating	87 B	DER	13.92	TER	17.88
Environmental	89 B	% DER<TER	22.16		
CO ₂ Emissions (t/year)	0.87	DFEE	42.06	TFEE	49.95
General Requirements Compliance	Pass	% DFEE<TFEE	15.79		

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

Orientation	East
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Suburban
1.0 Property Type	House, Semi-Detached
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:	18.36 m	42.26 m ²	2.39 m
1st Storey:	18.36 m	42.26 m ²	2.42 m

7.0 Living Area	14.75	m ²
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8.0 Thermal Mass Parameter	Precise calculation	
Thermal Mass	148.93	kJ/m ² K

9.0 External Walls

Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area (m ²)	Nett Area (m ²)
Brick and Block	Cavity Wall	Other	0.24	42.22	88.31	74.93
Step Party Wall	Cavity Wall	Cavity wall; plasterboard on dabs or battens, lightweight aggregate block, filled cavity, any outside structure	0.26	110.00	2.62	2.62

9.1 Party Walls

Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Area (m ²)
Party Wall 1	Filled Cavity with Edge Sealing	Plasterboard on dabs mounted on cement render on both sides, AAC blocks, cavity	0.00	45.00	40.97

9.2 Internal Walls

Description	Construction	Kappa (kJ/m ² K)	Area (m ²)
GF Timber Stud	Plasterboard on timber frame	9.00	76.46
FF Timber Stud	Plasterboard on timber frame	9.00	83.44

10.0 External Roofs

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area (m ²)	Nett Area (m ²)
External Roof 1	External Plane Roof	Other	0.10	9.10	42.26	42.26

10.2 Internal Ceilings

Description	Construction	Kappa (kJ/m ² K)	Area (m ²)
Internal Ceiling 1	Plasterboard ceiling, carpeted chipboard floor	9.00	46.26

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Area (m ²)
Ground Floor	Ground Floor - Solid	Other	0.12	90.00	42.26

11.2 Internal Floors

Description	Construction	Kappa (kJ/m ² K)	Area (m ²)
Internal Floor 1	Plasterboard ceiling, carpeted chipboard floor	18.00	46.26

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m ² K)
Front Door	Manufacture	Solid Door							1.10
Windows & Fully Glazed Door	Manufacture	Window	Double Low-E Soft 0.1			0.63		0.70	1.20

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m ²)	Curtain Closed
Front Door	Solid Door	[1] Brick and Block	East							2.15	
Front Elevation	Window	[1] Brick and Block	East	None	0.00					4.15	
Rear Elevation	Window	[1] Brick and Block	West	None	0.00					7.08	

14.0 Conservatory

15.0 Draught Proofing

 %

16.0 Draught Lobby

17.0 Thermal Bridging

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported	Reference:
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)	0.91	0.070	No	Birtley Supatherm
Independently assessed	E2 Other lintels (including other steel lintels)	1.02	0.071	No	Birtley Supatherm
Independently assessed	E2 Other lintels (including other steel lintels)	4.99	0.064	No	Birtley Supatherm
Independently assessed	E2 Other lintels (including other steel lintels)	1.81	0.064	No	Birtley Supatherm
Independently assessed	E3 Sill	8.17	0.021	No	Knauf P5
Independently assessed	E4 Jamb	24.15	0.016	No	Knauf P6
Table K1 - Approved	E5 Ground floor (normal)	27.22	0.160	No	
Independently assessed	E6 Intermediate floor within a dwelling	18.36	0.000	No	CD0029
Table K1 - Approved	E10 Eaves (insulation at ceiling level)	9.77	0.060	No	
Independently assessed	E12 Gable (insulation at ceiling level)	8.72	0.044	No	Knauf P21
Independently assessed	E16 Corner (normal)	10.60	0.039	No	Knauf P23
Table K1 - Approved	E18 Party wall between dwellings	8.80	0.060	No	
Table K1 - Default	P2 Party wall - Intermediate floor within a dwelling	8.72	0.000	No	
Independently assessed	P4 Party wall - Roof (insulation at ceiling level)	8.72	0.090	No	Knauf P29 Halved

Y-value W/m²K

18.0 Pressure Testing

Designed AP₅₀ m³/(h.m²) @ 50 Pa

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

Property Tested ?
 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
 Percentage of Heat %
 Database Ref. No.
 Fuel Type
 Main Heating
 SAP Code
 In Winter
 In Summer
 Controls
 PCDF Controls
 Delayed Start Stat
 Sap Code
 Flue Type
 Fan Assisted Flue
 Is MHS Pumped
 Heat Emitter
 Flow Temperature
 Combi boiler type

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
0.75	West	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£80	B 88	