



elmhurst
energy



SAP Report Submission for Building Regulations Compliance

Client: Foreman Homes

Project: Plot 81

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

EXCELLENCE
IN ENERGY
ASSESSMENT

PREDICTED ENERGY ASSESSMENT

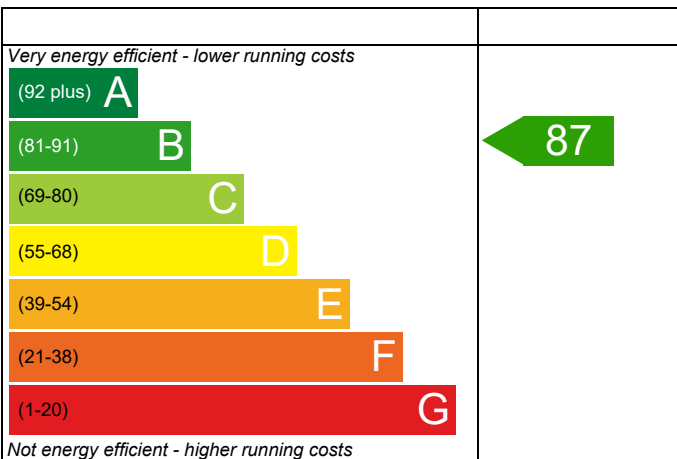
Plot 81

Dwelling type: House, Semi-Detached
 Date of assessment: 28/03/2023
 Produced by: Abacus Energy (UK) Ltd
 Total floor area: 70.34 m²
 DRRN: 8725-8754-2076

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.

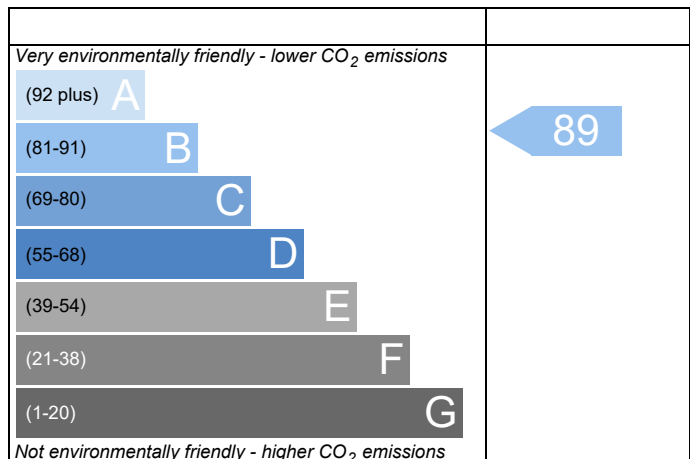
Energy Efficiency Rating



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 81		Issued on Date	28/03/2023	
Assessment Reference	Rev A	Prop Type Ref	Beeley		
Property	Plot 81				
SAP Rating	87 B	DER	15.30	TER	19.10
Environmental	89 B	% DER<TER	19.90		
CO ₂ Emissions (t/year)	0.79	DFEE	49.58	TFEE	51.85
General Requirements Compliance	Pass	% DFEE<TFEE	4.38		
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)	19.10	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	15.30	kgCO ₂ /m ²	Pass
	-3.80 (-19.9%)	kgCO ₂ /m ²	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	51.85	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DFEE)	49.58	kWh/m ² /yr	
	-2.2 (-4.2%)	kWh/m ² /yr	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

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

3.35 m², No overhang

Windows facing South West

6.60 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	£77	B 88	B 91	Recommended
Photovoltaic			0	0	Already installed
Wind turbine			0	0	Not applicable
Totals	£4,000 - £6,000	£77	B 88	B 91	

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THERMAL BRIDGING

Calculation Type: New Build (As Designed)

Property Reference	SAP 0879 Plot 81	Issued on Date	28/03/2023
Assessment Reference	Rev A	Prop Type Ref	Beeley
Property	Plot 81		

SAP Rating	87 B	DER	15.30	TER	19.10
Environmental	89 B	% DER<TER	19.90		
CO ₂ Emissions (t/year)	0.79	DFEE	49.58	TFEE	51.85
General Requirements Compliance	Pass	% DFEE<TFEE	4.38		

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	0.110	0.46	0.05	Birtley Supatherm
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.910	5.46	4.97	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	0.067	1.59	0.11	Birtley Supatherm
External wall	E3 Sill	Independently assessed	0.021	5.92	0.12	Knauf P5
External wall	E4 Jamb	Independently assessed	0.016	24.32	0.39	Knauf P6
External wall	E5 Ground floor (normal)	Table K1 - Default	0.320	16.79	5.37	
External wall	E6 Intermediate floor within a dwelling	Independently assessed	0.000	16.79	0.00	CD0029
External wall	E10 Eaves (insulation at ceiling level)	Table K1 - Approved	0.060	9.10	0.55	
External wall	E12 Gable (insulation at ceiling level)	Independently assessed	0.044	15.64	0.69	Knauf P21
External wall	E16 Corner (normal)	Independently assessed	0.039	10.46	0.41	Knauf P23
External wall	E18 Party wall between dwellings	Table K1 - Approved	0.060	9.55	0.57	
Party wall	P1 Party wall - Ground floor	Table K1 - Default	0.160	7.82	1.25	
Party wall	P2 Party wall - Intermediate floor within a dwelling	Table K1 - Default	0.000	7.82	0.00	
Party wall	P4 Party wall - Roof (insulation at ceiling level)	Independently assessed	0.069	7.82	0.54	Knauf P29

Total: **15.09** W/mK:
 Y-Value: **0.098** W/m²K:

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Property Reference	SAP 0879 Plot 81		Issued on Date	28/03/2023	
Assessment Reference	Rev A	Prop Type Ref	Beeley		
Property	Plot 81				
SAP Rating	87 B	DER	15.30	TER	19.10
Environmental	89 B	% DER<TER	19.90		
CO₂ Emissions (t/year)	0.79	DFEE	49.58	TFEE	51.85
General Requirements Compliance	Pass	% DFEE<TFEE	4.38		
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 70 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) 19.10 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 15.30 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)51.8 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)49.6 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.24 (max. 0.30)	0.24 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.12 (max. 0.25)	0.12 (max. 0.70)	OK
Roof	0.10 (max. 0.20)	0.10 (max. 0.35)	OK
Openings	1.18 (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 North East: 3.35 m², No overhang

Windows facing South West: 6.60 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	35.1700 (1b)	2.3900 (2b)	84.0563 (1b) - (3b)
First floor	35.1700 (1c)	2.6200 (2c)	92.1454 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.3400		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 176.2017 (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) =	0.1703 (8)							
Pressure test					Yes							
Measured/design AP50					5.0000							
Infiltration rate					0.4203 (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) =		0.3572 (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 infiltr rate	0.4555	0.4465	0.4376	0.3929	0.3840	0.3394	0.3394	0.3304	0.3572	0.3840	0.4019	0.4197 (22b)
Effective ac	0.6037	0.5997	0.5957	0.5772	0.5737	0.5576	0.5576	0.5546	0.5638	0.5737	0.5808	0.5881 (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)			9.9500	1.1450	11.3931		(27)
Ground Floor			35.3100	0.1200	4.2372	90.0000	3177.9000 (28a)
Brick and Block	84.0200	12.1000	71.9200	0.2400	17.2608	42.2200	3036.4624 (29a)
External Roof 1	35.1700		35.1700	0.1000	3.5170	9.1000	320.0470 (30)
Total net area of external elements Aum(A, m2)			154.5000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	38.7731		(33)
Party Wall 1			38.9200	0.0000	0.0000	45.0000	1751.4000 (32)
GF Timber Stud			62.5300			9.0000	562.7700 (32c)
FF Timber Stud			67.5400			9.0000	607.8600 (32c)
Internal Floor 1			35.3100			18.0000	635.5800 (32d)
Internal Ceiling 1			35.1700			18.0000	633.0600 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	10725.0794 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							152.4748 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							15.0903 (36)
Total fabric heat loss						(33) + (36) =	53.8634 (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
(38)m	35.1043	34.8701	34.6405	33.5623	33.3606	32.4215	32.4215	32.2476	32.7832	33.3606	33.7687	34.1953 (38)
Heat transfer coeff	88.9677	88.7335	88.5039	87.4257	87.2240	86.2849	86.2849	86.1110	86.6466	87.2240	87.6321	88.0587 (39)
Average = Sum(39)m / 12 =												87.4247 (39)
HLP	1.2648	1.2615	1.2582	1.2429	1.2400	1.2267	1.2267	1.2242	1.2318	1.2400	1.2458	1.2519 (40)
HLP (average)												1.2429 (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												2.2544 (42)
Average daily hot water use (litres/day)												87.7408 (43)
Daily hot water use	96.5149	93.0053	89.4957	85.9860	82.4764	78.9668	78.9668	82.4764	85.9860	89.4957	93.0053	96.5149 (44)
Energy conte	143.1288	125.1814	129.1760	112.6188	108.0604	93.2479	86.4079	99.1543	100.3385	116.9349	127.6436	138.6126 (45)
Energy content (annual)										Total = Sum(45)m =		1380.5050 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	21.4693	18.7772	19.3764	16.8928	16.2091	13.9872	12.9612	14.8731	15.0508	17.5402	19.1465	20.7919 (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	25.2867	22.8171	25.2259	24.3716	25.1544	24.3089	25.0980	25.1346	24.3430	25.1963	24.4306	25.2750 (61)
Total heat required for water heating calculated for each month	168.4156	147.9985	154.4019	136.9903	133.2148	117.5568	111.5059	124.2889	124.6816	142.1312	152.0742	163.8876 (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	168.4156	147.9985	154.4019	136.9903	133.2148	117.5568	111.5059	124.2889	124.6816	142.1312	152.0742	163.8876 (64)
Heat gains from water heating, kWh/month	53.9120	47.3271	49.2575	43.5386	42.2187	37.0822	35.0051	39.2524	39.4483	45.1799	48.5491	52.4074 (65)
												Total per year (kWh/year) = Sum(64)m = 1677.1472 (64)

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	112.7175	112.7175	112.7175	112.7175	112.7175	112.7175	112.7175	112.7175	112.7175	112.7175	112.7175	112.7175 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	18.9032	16.7897	13.6543	10.3372	7.7272	6.5236	7.0490	9.1625	12.2979	15.6150	18.2250	19.4286 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	198.0893	200.1448	194.9649	183.9375	170.0174	156.9344	148.1942	146.1386	151.3186	162.3460	176.2661	189.3491 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.2718	34.2718	34.2718	34.2718	34.2718	34.2718	34.2718	34.2718	34.2718	34.2718	34.2718	34.2718 (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)	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740 (71)
Water heating gains (Table 5)	72.4624	70.4272	66.2063	60.4703	56.7455	51.5030	47.0499	52.7587	54.7893	60.7257	67.4294	70.4401 (72)
Total internal gains	349.2702	347.1770	334.6408	314.5603	294.3053	274.7763	262.1083	267.8751	278.2211	298.5020	321.7358	339.0331 (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							
Northeast	3.3500	11.2829	0.6300	0.7000	0.7700	11.5515 (75)						
Southwest	6.6000	36.7938	0.6300	0.7000	0.7700	74.2148 (79)						
Solar gains	85.7664	149.9288	215.3307	283.8879	333.5704	338.0168	323.0300	284.9161	238.9075	168.4512	103.4271	72.9460 (83)
Total gains	435.0365	497.1058	549.9715	598.4482	627.8758	612.7930	585.1383	552.7912	517.1286	466.9531	425.1628	411.9790 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	33.4862	33.5746	33.6617	34.0768	34.1556	34.5273	34.5273	34.5971	34.3832	34.1556	33.9966	33.8318
alpha	3.2324	3.2383	3.2441	3.2718	3.2770	3.3018	3.3018	3.3065	3.2922	3.2770	3.2664	3.2555
util living area	0.9866	0.9784	0.9624	0.9262	0.8534	0.7261	0.5842	0.6280	0.8193	0.9415	0.9789	0.9887 (86)
MIT	19.0202	19.2329	19.5847	20.0510	20.4807	20.7970	20.9284	20.9073	20.6708	20.1184	19.4900	18.9845 (87)
Th 2	19.8685	19.8711	19.8737	19.8858	19.8881	19.8987	19.8987	19.9007	19.8946	19.8881	19.8835	19.8787 (88)
util rest of house	0.9836	0.9736	0.9537	0.9076	0.8129	0.6456	0.4622	0.5093	0.7556	0.9231	0.9734	0.9862 (89)
MIT 2	18.0749	18.2874	18.6365	19.0994	19.5038	19.7821	19.8719	19.8630	19.6842	19.1732	18.5533	18.0469 (90)
Living area fraction	18.3138	18.5264	18.8762	19.3400	19.7507	20.0387	20.1389	20.1269	19.9336	19.4121	18.7901	18.2839 (92)
Temperature adjustment												0.0000
adjusted MIT	18.3138	18.5264	18.8762	19.3400	19.7507	20.0387	20.1389	20.1269	19.9336	19.4121	18.7901	18.2839 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	425.5050	480.2567	519.0119	536.4410	506.7627	402.5704	287.1990	296.2611	392.0828	426.3409	410.7593	404.2981 (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	1246.7766	1209.1178	1095.3391	912.7225	702.2175	469.2753	305.3574	320.9309	505.4598	768.6269	1024.4281	1240.2074 (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	611.0261	489.7946	428.7874	270.9227	145.4184	0.0000	0.0000	0.0000	0.0000	254.6607	441.8415	621.9165 (98)
Space heating												3264.3680 (98)
Space heating per m ²												(98) / (4) = 46.4084 (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

	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													3599.0826 (211)
Space heating requirement	611.0261	489.7946	428.7874	270.9227	145.4184	0.0000	0.0000	0.0000	0.0000	254.6607	441.8415	621.9165	(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)	673.6781	540.0161	472.7535	298.7020	160.3290	0.0000	0.0000	0.0000	0.0000	280.7726	487.1461	685.6853	(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	168.4156	147.9985	154.4019	136.9903	133.2148	117.5568	111.5059	124.2889	124.6816	142.1312	152.0742	163.8876	(64)
Efficiency of water heater (217)m	89.9202	89.8630	89.7463	89.4937	88.9923	87.2000	87.2000	87.2000	87.2000	89.4145	89.7773	89.9470	(216)
Fuel for water heating, kWh/month	187.2946	164.6934	172.0426	153.0726	149.6926	134.8128	127.8737	142.5331	142.9834	158.9577	169.3904	182.2046	(219)
Water heating fuel used													1885.5517 (219)
Annual totals kWh/year													
Space heating fuel - main system													3599.0826 (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)													333.8367 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.75 * 1029 * 1.00) =										-617.5120			-617.5120 (233)
Total delivered energy for all uses													5275.9590 (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	3599.0826	0.2160	777.4019	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1885.5517	0.2160	407.2792	(264)
Space and water heating			1184.6810	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	333.8367	0.5190	173.2613	(268)
Energy saving/generation technologies				
PV Unit	-617.5120	0.5190	-320.4887	(269)
Total CO2, kg/year			1076.3785	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			15.3000	(273)

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

DER		15.3000	ZC1
Total Floor Area		70.3400	TFA
Assumed number of occupants		2.2544	N
CO2 emission factor in Table 12 for electricity displaced from grid		0.5190	EF
CO2 emissions from appliances, equation (L14)		16.6880	ZC2
CO2 emissions from cooking, equation (L16)		2.4610	ZC3
Total CO2 emissions		34.4490	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m ² /year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		34.4490	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	35.1700 (1b)	2.3900 (2b)	84.0563 (1b) - (3b)
First floor	35.1700 (1c)	2.6200 (2c)	92.1454 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.3400		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 176.2017 (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) =	0.1703 (8)							
Pressure test				Yes								
Measured/design AP50				5.0000								
Infiltration rate				0.4203 (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) =		0.3572 (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 inflt rate	0.4555	0.4465	0.4376	0.3929	0.3840	0.3394	0.3394	0.3304	0.3572	0.3840	0.4019	0.4197 (22b)
Effective ac	0.6037	0.5997	0.5957	0.5772	0.5737	0.5576	0.5576	0.5546	0.5638	0.5737	0.5808	0.5881 (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)			9.9500	1.3258	13.1913		(27)					
Ground Floor			35.3100	0.1300	4.5903		(28a)					
Brick and Block	84.0200	12.1000	71.9200	0.1800	12.9456		(29a)					
External Roof 1	35.1700		35.1700	0.1300	4.5721		(30)					
Total net area of external elements Aum(A, m2)			154.5000				(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 37.4493		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.1877 (36)					
Total fabric heat loss							(33) + (36) = 46.6370 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 35.1043	Feb 34.8701	Mar 34.6405	Apr 33.5623	May 33.3606	Jun 32.4215	Jul 32.4215	Aug 32.2476	Sep 32.7832	Oct 33.3606	Nov 33.7687	Dec 34.1953 (38)
Heat transfer coeff	81.7412	81.5070	81.2775	80.1993	79.9976	79.0585	79.0585	78.8846	79.4202	79.9976	80.4057	80.8323 (39)
Average = Sum(39)m / 12 =												80.1983 (39)
HLP	Jan 1.1621	Feb 1.1588	Mar 1.1555	Apr 1.1402	May 1.1373	Jun 1.1239	Jul 1.1239	Aug 1.1215	Sep 1.1291	Oct 1.1373	Nov 1.1431	Dec 1.1492 (40)
HLP (average)												1.1402 (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												2.2544 (42)
Average daily hot water use (litres/day)												87.7408 (43)
Daily hot water use	96.5149	93.0053	89.4957	85.9860	82.4764	78.9668	78.9668	82.4764	85.9860	89.4957	93.0053	96.5149 (44)
Energy conte	143.1288	125.1814	129.1760	112.6188	108.0604	93.2479	86.4079	99.1543	100.3385	116.9349	127.6436	138.6126 (45)
Energy content (annual)												Total = Sum(45)m = 1380.5050 (45)
Distribution loss (46)m = 0.15 x (45)m												
Water storage loss:	21.4693	18.7772	19.3764	16.8928	16.2091	13.9872	12.9612	14.8731	15.0508	17.5402	19.1465	20.7919 (46)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Total heat required for water heating calculated for each month	49.1829	42.8079	45.6060	42.4041	42.0291	38.9425	40.2406	42.0291	42.4041	45.6060	45.8656	49.1829	61										
Solar input	192.3118	167.9893	174.7820	155.0228	150.0894	132.1904	126.6485	141.1834	142.7426	162.5409	173.5092	187.7956	(62)										
Output from w/h	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Heat gains from water heating, kWh/month	192.3118	167.9893	174.7820	155.0228	150.0894	132.1904	126.6485	141.1834	142.7426	162.5409	173.5092	187.7956	(64)										
	59.8861	52.3248	54.3525	48.0468	46.4373	40.7406	38.7908	43.4761	43.9636	50.2823	53.9079	58.3844	(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	112.7175	112.7175	112.7175	112.7175	112.7175	112.7175	112.7175	112.7175	112.7175	112.7175	112.7175	112.7175	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	18.9032	16.7897	13.6543	10.3372	7.7272	6.5236	7.0490	9.1625	12.2979	15.6150	18.2250	19.4286	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	198.0893	200.1448	194.9649	183.9375	170.0174	156.9344	148.1942	146.1386	151.3186	162.3460	176.2661	189.3491	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.2718	34.2718	34.2718	34.2718	34.2718	34.2718	34.2718	34.2718	34.2718	34.2718	34.2718	34.2718	(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)	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	(71)
Water heating gains (Table 5)	80.4920	77.8643	73.0545	66.7316	62.4158	56.5841	52.1381	58.4356	61.0605	67.5838	74.8721	78.4737	(72)
Total internal gains	357.2998	354.6141	341.4889	320.8215	299.9756	279.8574	267.1965	273.5520	284.4922	305.3601	329.1785	347.0666	(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								
Northeast	3.3500	11.2829	0.6300	0.7000	0.7700	11.5515	(75)						
Southwest	6.6000	36.7938	0.6300	0.7000	0.7700	74.2148	(79)						
Solar gains	85.7664	149.9288	215.3307	283.8879	333.5704	338.0168	323.0300	284.9161	238.9075	168.4512	103.4271	72.9460	(83)
Total gains	443.0662	504.5428	556.8197	604.7095	633.5460	617.8741	590.2266	558.4681	523.3998	473.8112	432.6055	420.0126	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, T _{hl} (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	59.7584	59.9301	60.0993	60.9073	61.0609	61.7862	61.7862	61.9224	61.5048	61.0609	60.7510	60.4303			
alpha	4.9839	4.9953	5.0066	5.0605	5.0707	5.1191	5.1191	5.1282	5.1003	5.0707	5.0501	5.0287			
util living area	0.9975	0.9948	0.9875	0.9635	0.8945	0.7433	0.5725	0.6229	0.8547	0.9744	0.9949	0.9981	(86)		
MIT	19.7702	19.9198	20.1615	20.4813	20.7628	20.9373	20.9867	20.9799	20.8651	20.5044	20.0813	19.7464	(87)		
Th 2	19.9504	19.9531	19.9558	19.9682	19.9705	19.9813	19.9813	19.9833	19.9771	19.9705	19.9658	19.9609	(88)		
util rest of house	0.9967	0.9930	0.9830	0.9494	0.8528	0.6532	0.4486	0.4984	0.7848	0.9617	0.9928	0.9975	(89)		
MIT 2	18.3159	18.5358	18.8885	19.3539	19.7327	19.9384	19.9763	19.9748	19.8672	19.3943	18.7812	18.2886	(90)		
Living area fraction													fLA = Living area / (4) =	0.2528	(91)
MIT	18.6835	18.8856	19.2103	19.6389	19.9931	20.1909	20.2317	20.2289	20.1194	19.6749	19.1099	18.6571	(92)		
Temperature adjustment													0.0000		
adjusted MIT	18.6835	18.8856	19.2103	19.6389	19.9931	20.1909	20.2317	20.2289	20.1194	19.6749	19.1099	18.6571	(93)		

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec			
Useful gains	440.9284	499.7111	544.8984	570.6255	540.9876	416.0122	283.3850	295.9687	416.6272	453.3685	428.4339	418.4423	(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	1175.7253	1139.9286	1033.0594	861.2483	663.4266	442.0089	287.1165	302.0405	478.0632	725.9719	965.6600	1168.5970	(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	546.6889	430.2262	363.1918	209.2484	91.0946	0.0000	0.0000	0.0000	0.0000	202.8169	386.8028	558.1151	(98)		
Space heating													2788.1847	(98)	
Space heating per m2													(98) / (4) =	39.6387	(99)

8c. Space cooling requirement

Not applicable

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	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 %)													93.4000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													2985.2085 (211)
Space heating requirement	546.6889	430.2262	363.1918	209.2484	91.0946	0.0000	0.0000	0.0000	0.0000	202.8169	386.8028	558.1151	(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)	585.3201	460.6276	388.8563	224.0347	97.5317	0.0000	0.0000	0.0000	0.0000	217.1487	414.1357	597.5537	(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	192.3118	167.9893	174.7820	155.0228	150.0894	132.1904	126.6485	141.1834	142.7426	162.5409	173.5092	187.7956	(64)
Efficiency of water heater (217)m	87.5348	87.3159	86.8509	85.8070	83.8378	80.3000	80.3000	80.3000	80.3000	85.6096	87.0110	87.6252	(216)
Fuel for water heating, kWh/month	219.6974	192.3925	201.2437	180.6646	179.0235	164.6207	157.7191	175.8199	177.7616	189.8629	199.4106	214.3169	(219)
Water heating fuel used													2252.5335 (219)
Annual totals kWh/year													
Space heating fuel - main system													2985.2085 (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)													333.8367 (232)
Total delivered energy for all uses													5646.5786 (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	2985.2085	0.2160	644.8050 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2252.5335	0.2160	486.5472 (264)
Space and water heating			1131.3523 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	333.8367	0.5190	173.2613 (268)
Total CO2, kg/m2/year			1343.5385 (272)
Emissions per m2 for space and water heating			16.0841 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.4632 (272b)
Emissions per m2 for pumps and fans			0.5534 (272c)
Target Carbon Dioxide Emission Rate (TER) = (16.0841 * 1.00) + 2.4632 + 0.5534, rounded to 2 d.p.			19.1000 (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	35.1700 (1b)	x 2.3900 (2b)	= 84.0563 (1b) - (3b)
First floor	35.1700 (1c)	x 2.6200 (2c)	= 92.1454 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.3400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 176.2017 (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) =	0.1703 (8)							
Pressure test					Yes							
Measured/design AP50					5.0000							
Infiltration rate					0.4203 (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) =		0.3572 (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	0.4555	0.4465	0.4376	0.3929	0.3840	0.3394	0.3394	0.3304	0.3572	0.3840	0.4019	0.4197 (22b)
Effective ac	0.6037	0.5997	0.5957	0.5772	0.5737	0.5576	0.5576	0.5546	0.5638	0.5737	0.5808	0.5881 (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)			9.9500	1.1450	11.3931		(27)
Ground Floor			35.3100	0.1200	4.2372	90.0000	3177.9000 (28a)
Brick and Block	84.0200	12.1000	71.9200	0.2400	17.2608	42.2200	3036.4624 (29a)
External Roof 1	35.1700		35.1700	0.1000	3.5170	9.1000	320.0470 (30)
Total net area of external elements Aum(A, m2)			154.5000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	38.7731		(33)
Party Wall 1			38.9200	0.0000	0.0000	45.0000	1751.4000 (32)
GF Timber Stud			62.5300			9.0000	562.7700 (32c)
FF Timber Stud			67.5400			9.0000	607.8600 (32c)
Internal Floor 1			35.3100			18.0000	635.5800 (32d)
Internal Ceiling 1			35.1700			9.0000	316.5300 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 10408.5494 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							147.9748 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							15.0903 (36)
Total fabric heat loss						(33) + (36) =	53.8634 (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
(38)m	35.1043	34.8701	34.6405	33.5623	33.3606	32.4215	32.4215	32.2476	32.7832	33.3606	33.7687	34.1953 (38)
Heat transfer coeff	88.9677	88.7335	88.5039	87.4257	87.2240	86.2849	86.2849	86.1110	86.6466	87.2240	87.6321	88.0587 (39)
Average = Sum(39)m / 12 =												87.4247 (39)
HLP	1.2648	1.2615	1.2582	1.2429	1.2400	1.2267	1.2267	1.2242	1.2318	1.2400	1.2458	1.2519 (40)
HLP (average)												1.2429 (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												2.2544 (42)
Average daily hot water use (litres/day)												87.7408 (43)
Daily hot water use	96.5149	93.0053	89.4957	85.9860	82.4764	78.9668	78.9668	82.4764	85.9860	89.4957	93.0053	96.5149 (44)
Energy conte	143.1288	125.1814	129.1760	112.6188	108.0604	93.2479	86.4079	99.1543	100.3385	116.9349	127.6436	138.6126 (45)
Energy content (annual)										Total = Sum(45)m =		1380.5050 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:														
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	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	(57)
Heat gains from water heating, kWh/month	30.4149	26.6010	27.4499	23.9315	22.9628	19.8152	18.3617	21.0703	21.3219	24.8487	27.1243	29.4552	29.4552	(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	112.7175	112.7175	112.7175	112.7175	112.7175	112.7175	112.7175	112.7175	112.7175	112.7175	112.7175	112.7175	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	18.9032	16.7897	13.6543	10.3372	7.7272	6.5236	7.0490	9.1625	12.2979	15.6150	18.2250	19.4286	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	198.0893	200.1448	194.9649	183.9375	170.0174	156.9344	148.1942	146.1386	151.3186	162.3460	176.2661	189.3491	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.2718	34.2718	34.2718	34.2718	34.2718	34.2718	34.2718	34.2718	34.2718	34.2718	34.2718	34.2718	(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)	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	(71)
Water heating gains (Table 5)	40.8802	39.5849	36.8950	33.2382	30.8640	27.5211	24.6797	28.3203	29.6138	33.3987	37.6726	39.5903	(72)
Total internal gains	314.6880	313.3347	302.3295	284.3281	265.4238	247.7943	236.7381	240.4367	250.0455	268.1750	288.9790	305.1832	(73)

6. Solar gains

[Jan]	Area m ²	Solar flux Table 6a W/m ²	Specific data or Table 6b	g Specific data or Table 6c	FF	Access factor Table 6d	Gains W						
Northeast	3.3500	11.2829	0.6300	0.7000	0.7700	11.5515	(75)						
Southwest	6.6000	36.7938	0.6300	0.7000	0.7700	74.2148	(79)						
Solar gains	85.7664	149.9288	215.3307	283.8879	333.5704	338.0168	323.0300	284.9161	238.9075	168.4512	103.4271	72.9460	(83)
Total gains	400.4544	463.2635	517.6602	568.2160	598.9942	585.8111	559.7681	525.3528	488.9531	436.6262	392.4061	378.1292	(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	32.4979	32.5837	32.6682	33.0711	33.1476	33.5083	33.5083	33.5760	33.3685	33.1476	32.9932	32.8334		
alpha	3.1665	3.1722	3.1779	3.2047	3.2098	3.2339	3.2339	3.2384	3.2246	3.2098	3.1995	3.1889		
util living area	0.9885	0.9808	0.9659	0.9318	0.8629	0.7408	0.6012	0.6475	0.8336	0.9480	0.9818	0.9904	(86)	
MIT	18.9160	19.1356	19.4997	19.9839	20.4336	20.7716	20.9167	20.8919	20.6330	20.0508	19.3997	18.8802	(87)	
Th 2	19.8685	19.8711	19.8737	19.8858	19.8881	19.8987	19.8987	19.9007	19.8946	19.8881	19.8835	19.8787	(88)	
util rest of house	0.9859	0.9767	0.9580	0.9147	0.8247	0.6622	0.4787	0.5291	0.7733	0.9315	0.9771	0.9883	(89)	
MIT 2	17.9751	18.1947	18.5566	19.0383	19.4643	19.7649	19.8666	19.8553	19.6555	19.1117	18.4676	17.9468	(90)	
Living area fraction										fLA = Living area / (4) =		0.2528	(91)	
MIT	18.2129	18.4326	18.7950	19.2773	19.7093	20.0194	20.1320	20.1173	19.9026	19.3491	18.7032	18.1828	(92)	
Temperature adjustment												0.0000		
adjusted MIT	18.2129	18.4326	18.7950	19.2773	19.7093	20.0194	20.1320	20.1173	19.9026	19.3491	18.7032	18.1828	(93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation	0.9808	0.9695	0.9482	0.9030	0.8175	0.6718	0.5069	0.5548	0.7738	0.9212	0.9703	0.9838	(94)	
Useful gains	392.7832	449.1311	490.8550	513.1107	489.6493	393.5717	283.7196	291.4537	378.3601	402.2269	380.7387	372.0143	(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	1237.7983	1200.7923	1088.1521	907.2462	698.6053	467.6095	304.7581	320.1003	502.7762	763.1324	1016.8140	1231.3058	(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	628.6912	505.1163	444.3890	283.7775	155.4633	0.0000	0.0000	0.0000	0.0000	268.5137	457.9742	639.3129	(98)	
Space heating												3383.2381	(98)	
Space heating per m ²												(98) / (4) =	48.0984	(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	811.0781	638.5083	654.4436	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7431	0.8154	0.7882	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	602.6993	520.6147	515.8187	0.0000	0.0000	0.0000	0.0000	(102)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	769.0125	736.9225	698.2302	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	119.7455	160.9330	135.7142	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												416.3927 (104)
Cooled fraction												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	29.9364	40.2333	33.9285	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												104.0982 (107)
Space cooling per m2												1.4799 (108)
Energy for space heating												48.0984 (99)
Energy for space cooling												1.4799 (108)
Total												49.5783 (109)
Dwelling Fabric Energy Efficiency (DFEE)												49.6 (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	35.1700 (1b)	2.3900 (2b)	84.0563 (1b) - (3b)
First floor	35.1700 (1c)	2.6200 (2c)	92.1454 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.3400		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 176.2017 (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) =	0.1703 (8)							
Pressure test				Yes								
Measured/design AP50				5.0000								
Infiltration rate				0.4203 (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) =		0.3572 (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	0.4555	0.4465	0.4376	0.3929	0.3840	0.3394	0.3394	0.3304	0.3572	0.3840	0.4019	0.4197 (22b)
Effective ac	0.6037	0.5997	0.5957	0.5772	0.5737	0.5576	0.5576	0.5546	0.5638	0.5737	0.5808	0.5881 (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)			9.9500	1.3258	13.1913		(27)					
Ground Floor			35.3100	0.1300	4.5903		(28a)					
Brick and Block	84.0200	12.1000	71.9200	0.1800	12.9456		(29a)					
External Roof 1	35.1700		35.1700	0.1300	4.5721		(30)					
Total net area of external elements Aum(A, m2)			154.5000				(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 37.4493		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.1877 (36)					
Total fabric heat loss							(33) + (36) = 46.6370 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 35.1043	Feb 34.8701	Mar 34.6405	Apr 33.5623	May 33.3606	Jun 32.4215	Jul 32.4215	Aug 32.2476	Sep 32.7832	Oct 33.3606	Nov 33.7687	Dec 34.1953 (38)
Heat transfer coeff	81.7412	81.5070	81.2775	80.1993	79.9976	79.0585	79.0585	78.8846	79.4202	79.9976	80.4057	80.8323 (39)
Average = Sum(39)m / 12 =												80.1983 (39)
HLP	Jan 1.1621	Feb 1.1588	Mar 1.1555	Apr 1.1402	May 1.1373	Jun 1.1239	Jul 1.1239	Aug 1.1215	Sep 1.1291	Oct 1.1373	Nov 1.1431	Dec 1.1492 (40)
HLP (average)												1.1402 (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												2.2544 (42)
Average daily hot water use (litres/day)												87.7408 (43)
Daily hot water use	96.5149	93.0053	89.4957	85.9860	82.4764	78.9668	78.9668	82.4764	85.9860	89.4957	93.0053	96.5149 (44)
Energy conte	143.1288	125.1814	129.1760	112.6188	108.0604	93.2479	86.4079	99.1543	100.3385	116.9349	127.6436	138.6126 (45)
Energy content (annual)												Total = Sum(45)m = 1380.5050 (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 (46)
If cylinder contains dedicated solar storage												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	24.6477	37.3482	30.2449	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												92.2407 (107)
Space cooling per m2												1.3114 (108)
Energy for space heating												43.7733 (99)
Energy for space cooling												1.3114 (108)
Total												45.0847 (109)
Target Fabric Energy Efficiency (TFEE)												51.8 (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	35.1700 (1b)	2.3900 (2b)	84.0563 (1b) - (3b)
First floor	35.1700 (1c)	2.6200 (2c)	92.1454 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.3400		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 176.2017 (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) =	0.1703 (8)							
Pressure test				Yes								
Measured/design AP50					5.0000							
Infiltration rate					0.4203 (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) =	0.3572 (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	0.4555	0.4197	0.4108	0.3840	0.3840	0.3572	0.3572	0.3483	0.3572	0.4019	0.3929	0.4197 (22b)
Effective ac	0.6037	0.5881	0.5844	0.5737	0.5737	0.5638	0.5638	0.5607	0.5638	0.5808	0.5772	0.5881 (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)			9.9500	1.1450	11.3931		(27)
Ground Floor			35.3100	0.1200	4.2372	90.0000	3177.9000 (28a)
Brick and Block	84.0200	12.1000	71.9200	0.2400	17.2608	42.2200	3036.4624 (29a)
External Roof 1	35.1700		35.1700	0.1000	3.5170	9.1000	320.0470 (30)
Total net area of external elements Aum(A, m2)			154.5000				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	38.7731	(33)
Party Wall 1			38.9200	0.0000	0.0000	45.0000	1751.4000 (32)
GF Timber Stud			62.5300			9.0000	562.7700 (32c)
FF Timber Stud			67.5400			9.0000	607.8600 (32c)
Internal Floor 1			35.3100			18.0000	635.5800 (32d)
Internal Ceiling 1			35.1700			18.0000	633.0600 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 10725.0794 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							152.4748 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							15.0903 (36)
Total fabric heat loss							(33) + (36) = 53.8634 (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
(38)m	35.1043	34.1953	33.9797	33.3606	33.3606	32.7832	32.7832	32.6000	32.7832	33.7687	33.5623	34.1953 (38)
Heat transfer coeff	88.9677	88.0587	87.8431	87.2240	87.2240	86.6466	86.6466	86.4634	86.6466	87.6321	87.4257	88.0587 (39)
Average = Sum(39)m / 12 =												87.4031 (39)
HLP	1.2648	1.2519	1.2488	1.2400	1.2400	1.2318	1.2318	1.2292	1.2318	1.2458	1.2429	1.2519 (40)
HLP (average)												1.2426 (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												2.2544 (42)
Average daily hot water use (litres/day)												87.7408 (43)
Daily hot water use	96.5149	93.0053	89.4957	85.9860	82.4764	78.9668	78.9668	82.4764	85.9860	89.4957	93.0053	96.5149 (44)
Energy conte	143.1288	125.1814	129.1760	112.6188	108.0604	93.2479	86.4079	99.1543	100.3385	116.9349	127.6436	138.6126 (45)
Energy content (annual)												Total = Sum(45)m = 1380.5050 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	21.4693	18.7772	19.3764	16.8928	16.2091	13.9872	12.9612	14.8731	15.0508	17.5402	19.1465	20.7919 (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	25.2867	22.8171	25.2259	24.3716	25.1544	24.3089	25.0980	25.1346	24.3430	25.1963	24.4306	25.2750 (61)
Total heat required for water heating calculated for each month	168.4156	147.9985	154.4019	136.9903	133.2148	117.5568	111.5059	124.2889	124.6816	142.1312	152.0742	163.8876 (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	168.4156	147.9985	154.4019	136.9903	133.2148	117.5568	111.5059	124.2889	124.6816	142.1312	152.0742	163.8876 (64)
RHI water heating demand												
Heat gains from water heating, kWh/month	53.9120	47.3271	49.2575	43.5386	42.2187	37.0822	35.0051	39.2524	39.4483	45.1799	48.5491	52.4074 (65)
												1677 (64)
												1677 (64)
												1677 (64)

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	135.2611	135.2611	135.2611	135.2611	135.2611	135.2611	135.2611	135.2611	135.2611	135.2611	135.2611	135.2611 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	47.2580	41.9742	34.1357	25.8429	19.3179	16.3090	17.6224	22.9063	30.7448	39.0375	45.5626	48.5715 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	295.6557	298.7237	290.9924	274.5336	253.7573	234.2305	221.1854	218.1174	225.8486	242.3074	263.0837	282.6106 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.7805	50.7805	50.7805	50.7805	50.7805	50.7805	50.7805	50.7805	50.7805	50.7805	50.7805	50.7805 (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)	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740 (71)
Water heating gains (Table 5)	72.4624	70.4272	66.2063	60.4703	56.7455	51.5030	47.0499	52.7587	54.7893	60.7257	67.4294	70.4401 (72)
Total internal gains	514.2436	509.9925	490.2019	459.7143	428.6882	400.9099	384.7251	392.6498	410.2502	440.9381	474.9432	500.4896 (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						
Northeast	3.3500	15.0428	0.6300	0.7000	0.7700	15.4009 (75)						
Southwest	6.6000	46.3896	0.6300	0.7000	0.7700	93.5699 (79)						
Solar gains	108.9708	163.1027	234.0429	316.2670	356.7664	392.0139	365.3684	327.8407	276.0202	194.0828	130.2646	88.4697 (83)
Total gains	623.2144	673.0952	724.2448	775.9813	785.4546	792.9238	750.0936	720.4905	686.2704	635.0209	605.2078	588.9593 (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	33.4862	33.8318	33.9149	34.1556	34.1556	34.3832	34.3832	34.4561	34.3832	33.9966	34.0768	33.8318
alpha	3.2324	3.2555	3.2610	3.2770	3.2770	3.2922	3.2922	3.2971	3.2922	3.2664	3.2718	3.2555
util living area	0.9571	0.9449	0.9141	0.8509	0.7389	0.5583	0.4121	0.4265	0.6518	0.8476	0.9312	0.9621 (86)
MIT	19.5170	19.6627	19.9813	20.3701	20.7127	20.9196	20.9783	20.9761	20.8629	20.4954	19.9862	19.4992 (87)
Th 2	19.8685	19.8787	19.8811	19.8881	19.8881	19.8946	19.8946	19.8967	19.8946	19.8835	19.8858	19.8787 (88)
util rest of house	0.9481	0.9335	0.8959	0.8185	0.6798	0.4659	0.2957	0.3070	0.5626	0.8056	0.9144	0.9540 (89)
MIT 2	18.5637	18.7127	19.0226	19.3936	19.6962	19.8568	19.8890	19.8904	19.8227	19.5129	19.0364	18.5545 (90)
Living area fraction	fLA = Living area / (4) = 0.2528 (91)											
MIT	18.8046	18.9528	19.2649	19.6404	19.9531	20.1254	20.1643	20.1648	20.0857	19.7613	19.2764	18.7933 (92)
Temperature adjustment	0.0000											
adjusted MIT	18.8046	18.9528	19.2649	19.6404	19.9531	20.1254	20.1643	20.1648	20.0857	19.7613	19.2764	18.7933 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9374	0.9219	0.8839	0.8102	0.6836	0.4863	0.3250	0.3371	0.5793	0.8003	0.9030	0.9439 (94)
Useful gains	584.1957	620.5545	640.1959	628.7310	536.9006	385.5679	243.7912	242.8447	397.5331	508.1850	546.5193	555.9100 (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	1192.5794	1167.0259	1051.0373	875.7665	641.3691	409.4430	248.1833	247.7041	440.6547	697.6626	950.8811	1170.5911 (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	452.6374	367.2288	305.6660	177.8655	77.7245	0.0000	0.0000	0.0000	0.0000	140.9713	291.1405	457.3227 (98)
Space heating												2270.5569 (98)
RHI space heating demand												2271 (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	35.1700 (1b)	x 2.3900 (2b)	= 84.0563 (1b) - (3b)
First floor	35.1700 (1c)	x 2.6200 (2c)	= 92.1454 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.3400		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 176.2017 (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) =	0.1703 (8)							
Pressure test					Yes							
Measured/design AP50					5.0000							
Infiltration rate					0.4203 (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) =		0.3572 (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	0.4555	0.4465	0.4376	0.3929	0.3840	0.3394	0.3394	0.3304	0.3572	0.3840	0.4019	0.4197 (22b)
Effective ac	0.6037	0.5997	0.5957	0.5772	0.5737	0.5576	0.5576	0.5546	0.5638	0.5737	0.5808	0.5881 (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)			9.9500	1.1450	11.3931		(27)
Ground Floor			35.3100	0.1200	4.2372	90.0000	3177.9000 (28a)
Brick and Block	84.0200	12.1000	71.9200	0.2400	17.2608	42.2200	3036.4624 (29a)
External Roof 1	35.1700		35.1700	0.1000	3.5170	9.1000	320.0470 (30)
Total net area of external elements Aum(A, m2)			154.5000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	38.7731		(33)
Party Wall 1			38.9200	0.0000	0.0000	45.0000	1751.4000 (32)
GF Timber Stud			62.5300			9.0000	562.7700 (32c)
FF Timber Stud			67.5400			9.0000	607.8600 (32c)
Internal Floor 1			35.3100			18.0000	635.5800 (32d)
Internal Ceiling 1			35.1700			18.0000	633.0600 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	10725.0794 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							152.4748 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							15.0903 (36)
Total fabric heat loss						(33) + (36) =	53.8634 (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
(38)m	35.1043	34.8701	34.6405	33.5623	33.3606	32.4215	32.4215	32.2476	32.7832	33.3606	33.7687	34.1953 (38)
Heat transfer coeff	88.9677	88.7335	88.5039	87.4257	87.2240	86.2849	86.2849	86.1110	86.6466	87.2240	87.6321	88.0587 (39)
Average = Sum(39)m / 12 =												87.4247 (39)
HLP	Jan 1.2648	Feb 1.2615	Mar 1.2582	Apr 1.2429	May 1.2400	Jun 1.2267	Jul 1.2267	Aug 1.2242	Sep 1.2318	Oct 1.2400	Nov 1.2458	Dec 1.2519 (40)
HLP (average)												1.2429 (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												2.2544 (42)
Average daily hot water use (litres/day)												87.7408 (43)
Daily hot water use	96.5149	93.0053	89.4957	85.9860	82.4764	78.9668	78.9668	82.4764	85.9860	89.4957	93.0053	96.5149 (44)
Energy conte	143.1288	125.1814	129.1760	112.6188	108.0604	93.2479	86.4079	99.1543	100.3385	116.9349	127.6436	138.6126 (45)
Energy content (annual)										Total = Sum(45)m =		1380.5050 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	21.4693	18.7772	19.3764	16.8928	16.2091	13.9872	12.9612	14.8731	15.0508	17.5402	19.1465	20.7919 (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	25.2867	22.8171	25.2259	24.3716	25.1544	24.3089	25.0980	25.1346	24.3430	25.1963	24.4306	25.2750 (61)
Total heat required for water heating calculated for each month	168.4156	147.9985	154.4019	136.9903	133.2148	117.5568	111.5059	124.2889	124.6816	142.1312	152.0742	163.8876 (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	168.4156	147.9985	154.4019	136.9903	133.2148	117.5568	111.5059	124.2889	124.6816	142.1312	152.0742	163.8876 (64)
Heat gains from water heating, kWh/month	53.9120	47.3271	49.2575	43.5386	42.2187	37.0822	35.0051	39.2524	39.4483	45.1799	48.5491	52.4074 (65)
										Solar input (sum of months) = Sum(63)m =		0.0000 (63)
										Total per year (kWh/year) = Sum(64)m =		1677.1472 (64)

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	135.2611	135.2611	135.2611	135.2611	135.2611	135.2611	135.2611	135.2611	135.2611	135.2611	135.2611	135.2611 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	47.2580	41.9742	34.1357	25.8429	19.3179	16.3090	17.6224	22.9063	30.7448	39.0375	45.5626	48.5715 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	295.6557	298.7237	290.9924	274.5336	253.7573	234.2305	221.1854	218.1174	225.8486	242.3074	263.0837	282.6106 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.7805	50.7805	50.7805	50.7805	50.7805	50.7805	50.7805	50.7805	50.7805	50.7805	50.7805	50.7805 (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)	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740 (71)
Water heating gains (Table 5)	72.4624	70.4272	66.2063	60.4703	56.7455	51.5030	47.0499	52.7587	54.7893	60.7257	67.4294	70.4401 (72)
Total internal gains	514.2436	509.9925	490.2019	459.7143	428.6882	400.9099	384.7251	392.6498	410.2502	440.9381	474.9432	500.4896 (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						
Northeast	3.3500	11.2829	0.6300	0.7000	0.7700	11.5515 (75)						
Southwest	6.6000	36.7938	0.6300	0.7000	0.7700	74.2148 (79)						
Solar gains	85.7664	149.9288	215.3307	283.8879	333.5704	338.0168	323.0300	284.9161	238.9075	168.4512	103.4271	72.9460 (83)
Total gains	600.0100	659.9213	705.5326	743.6022	762.2586	738.9267	707.7552	677.5659	649.1577	609.3893	578.3702	573.4356 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (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)												21.0000 (85)
tau	33.4862	33.5746	33.6617	34.0768	34.1556	34.5273	34.5273	34.5971	34.3832	34.1556	33.9966	33.8318
alpha	3.2324	3.2383	3.2441	3.2718	3.2770	3.3018	3.3018	3.3065	3.2922	3.2770	3.2664	3.2555
util living area	0.9675	0.9541	0.9298	0.8795	0.7894	0.6463	0.5023	0.5389	0.7345	0.8910	0.9519	0.9715 (86)
MIT	19.3037	19.5016	19.8225	20.2390	20.6051	20.8587	20.9543	20.9414	20.7713	20.3133	19.7430	19.2660 (87)
Th 2	19.8685	19.8711	19.8737	19.8858	19.8881	19.8987	19.8987	19.9007	19.8946	19.8881	19.8835	19.8787 (88)
util rest of house	0.9609	0.9449	0.9152	0.8530	0.7407	0.5634	0.3900	0.4274	0.6609	0.8616	0.9406	0.9657 (89)
MIT 2	18.3534	18.5492	18.8640	19.2712	19.6059	19.8213	19.8825	19.8782	19.7565	19.3505	18.7985	18.3241 (90)
Living area fraction										fLA = Living area / (4) =		0.2528 (91)
MIT	18.5936	18.7899	19.1063	19.5158	19.8585	20.0835	20.1534	20.1470	20.0130	19.5938	19.0373	18.5622 (92)
Temperature adjustment												0.0000
adjusted MIT	18.5936	18.7899	19.1063	19.5158	19.8585	20.0835	20.1534	20.1470	20.0130	19.5938	19.0373	18.5622 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9514	0.9339	0.9030	0.8427	0.7392	0.5784	0.4173	0.4538	0.6696	0.8523	0.9299	0.9569 (94)
Useful gains	570.8403	616.2794	637.1000	626.6361	563.4653	427.3650	295.3201	307.4953	434.6867	519.3836	537.8118	548.7110 (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	1271.6705	1232.5027	1115.7036	928.0967	711.6159	473.1458	306.6046	322.6547	512.3418	784.4771	1046.0869	1264.7180 (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	521.4177	414.1021	356.0811	217.0517	110.2241	0.0000	0.0000	0.0000	0.0000	197.2295	365.9580	532.7092 (98)
Space heating												2714.7734 (98)
Space heating per m2												38.5950 (99)
										(98) / (4) =		38.5950 (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

	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													2993.1349 (211)
Space heating requirement	521.4177	414.1021	356.0811	217.0517	110.2241	0.0000	0.0000	0.0000	0.0000	197.2295	365.9580	532.7092	(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)	574.8817	456.5624	392.5921	239.3072	121.5260	0.0000	0.0000	0.0000	0.0000	217.4526	403.4818	587.3309	(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	168.4156	147.9985	154.4019	136.9903	133.2148	117.5568	111.5059	124.2889	124.6816	142.1312	152.0742	163.8876	(64)
Efficiency of water heater (217)m	89.8198	89.7515	89.6121	89.3129	88.7507	87.2000	87.2000	87.2000	87.2000	89.2005	89.6437	89.8515	(216)
Fuel for water heating, kWh/month	187.5038	164.8981	172.3003	153.3824	150.1000	134.8128	127.8737	142.5331	142.9834	159.3390	169.6428	182.3983	(219)
Water heating fuel used													1887.7678 (219)
Annual totals kWh/year													
Space heating fuel - main system													2993.1349 (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)													333.8367 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.75 * 1029 * 1.00) =										-617.5120			-617.5120 (233)
Total delivered energy for all uses													4672.2274 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2993.1349	3.4800	104.1611	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1887.7678	3.4800	65.6943	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	333.8367	13.1900	44.0331	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-617.5120	13.1900	-81.4498	(252)
Total energy cost			262.3311	(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] =	0.9553 (257)
SAP value		86.6742
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	2993.1349	0.2160	646.5171	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1887.7678	0.2160	407.7578	(264)
Space and water heating			1054.2750	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	333.8367	0.5190	173.2613	(268)
Energy saving/generation technologies				
PV Unit	-617.5120	0.5190	-320.4887	(269)
Total kg/year			945.9725	(272)
CO2 emissions per m2			13.4500	(273)
EI value			89.0099	
EI rating			89	(274)
EI band			B	

Calculation of stars for heating and DHW

Main heating energy efficiency $3.48 \times (1 + 0.29 \times 0.00) / 0.9070 = 3.837$, stars = 4

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Main heating environmental impact $0.216 \times (1 + 0.29 \times 0.00) / 0.9070 = 0.2381$, stars = 4
Water heating energy efficiency $3.48 / 0.8873 = 3.922$, stars = 4
Water heating environmental impact $0.216 / 0.8873 = 0.2434$, stars = 4

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

1. Overall dwelling dimensions

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	35.1700 (1b)	2.3900 (2b)	84.0563 (1b) - (3b)
First floor	35.1700 (1c)	2.6200 (2c)	92.1454 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.3400		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 176.2017 (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) =	0.1703 (8)							
Pressure test					Yes							
Measured/design AP50					5.0000							
Infiltration rate					0.4203 (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) =		0.3572 (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	0.4555	0.4197	0.4108	0.3840	0.3840	0.3572	0.3572	0.3483	0.3572	0.4019	0.3929	0.4197 (22b)
Effective ac	0.6037	0.5881	0.5844	0.5737	0.5737	0.5638	0.5638	0.5607	0.5638	0.5808	0.5772	0.5881 (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)			9.9500	1.1450	11.3931		(27)
Ground Floor			35.3100	0.1200	4.2372	90.0000	3177.9000 (28a)
Brick and Block	84.0200	12.1000	71.9200	0.2400	17.2608	42.2200	3036.4624 (29a)
External Roof 1	35.1700		35.1700	0.1000	3.5170	9.1000	320.0470 (30)
Total net area of external elements Aum(A, m2)			154.5000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	38.7731		(33)
Party Wall 1			38.9200	0.0000	0.0000	45.0000	1751.4000 (32)
GF Timber Stud			62.5300			9.0000	562.7700 (32c)
FF Timber Stud			67.5400			9.0000	607.8600 (32c)
Internal Floor 1			35.3100			18.0000	635.5800 (32d)
Internal Ceiling 1			35.1700			18.0000	633.0600 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	10725.0794 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							152.4748 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							15.0903 (36)
Total fabric heat loss						(33) + (36) =	53.8634 (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
(38)m	35.1043	34.1953	33.9797	33.3606	33.3606	32.7832	32.7832	32.6000	32.7832	33.7687	33.5623	34.1953 (38)
Heat transfer coeff	88.9677	88.0587	87.8431	87.2240	87.2240	86.6466	86.6466	86.4634	86.6466	87.6321	87.4257	88.0587 (39)
Average = Sum(39)m / 12 =												87.4031 (39)
HLP	1.2648	1.2519	1.2488	1.2400	1.2400	1.2318	1.2318	1.2292	1.2318	1.2458	1.2429	1.2519 (40)
HLP (average)												1.2426 (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												2.2544 (42)
Average daily hot water use (litres/day)												87.7408 (43)
Daily hot water use	96.5149	93.0053	89.4957	85.9860	82.4764	78.9668	78.9668	82.4764	85.9860	89.4957	93.0053	96.5149 (44)
Energy conte	143.1288	125.1814	129.1760	112.6188	108.0604	93.2479	86.4079	99.1543	100.3385	116.9349	127.6436	138.6126 (45)
Energy content (annual)										Total = Sum(45)m =		1380.5050 (45)

FULL SAP CALCULATION PRINTOUT

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

Distribution loss (46)m = 0.15 x (45)m	21.4693	18.7772	19.3764	16.8928	16.2091	13.9872	12.9612	14.8731	15.0508	17.5402	19.1465	20.7919 (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	25.2867	22.8171	25.2259	24.3716	25.1544	24.3089	25.0980	25.1346	24.3430	25.1963	24.4306	25.2750 (61)
Total heat required for water heating calculated for each month	168.4156	147.9985	154.4019	136.9903	133.2148	117.5568	111.5059	124.2889	124.6816	142.1312	152.0742	163.8876 (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	168.4156	147.9985	154.4019	136.9903	133.2148	117.5568	111.5059	124.2889	124.6816	142.1312	152.0742	163.8876 (64)
Heat gains from water heating, kWh/month	53.9120	47.3271	49.2575	43.5386	42.2187	37.0822	35.0051	39.2524	39.4483	45.1799	48.5491	52.4074 (65)
												Total per year (kWh/year) = Sum(64)m = 1677.1472 (64)

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	135.2611	135.2611	135.2611	135.2611	135.2611	135.2611	135.2611	135.2611	135.2611	135.2611	135.2611	135.2611 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	47.2580	41.9742	34.1357	25.8429	19.3179	16.3090	17.6224	22.9063	30.7448	39.0375	45.5626	48.5715 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	295.6557	298.7237	290.9924	274.5336	253.7573	234.2305	221.1854	218.1174	225.8486	242.3074	263.0837	282.6106 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.7805	50.7805	50.7805	50.7805	50.7805	50.7805	50.7805	50.7805	50.7805	50.7805	50.7805	50.7805 (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)	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740 (71)
Water heating gains (Table 5)	72.4624	70.4272	66.2063	60.4703	56.7455	51.5030	47.0499	52.7587	54.7893	60.7257	67.4294	70.4401 (72)
Total internal gains	514.2436	509.9925	490.2019	459.7143	428.6882	400.9099	384.7251	392.6498	410.2502	440.9381	474.9432	500.4896 (73)

6. Solar gains

[Jan]		Area m ²	Solar flux Table 6a W/m ²	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
Northeast		3.3500	15.0428	0.6300	0.7000	0.7700	15.4009 (75)
Southwest		6.6000	46.3896	0.6300	0.7000	0.7700	93.5699 (79)
Solar gains	108.9708	163.1027	234.0429	316.2670	356.7664	392.0139	365.3684
Total gains	623.2144	673.0952	724.2448	775.9813	785.4546	792.9238	750.0936
							327.8407
							276.0202
							686.2704
							194.0828
							130.2646
							88.4697 (83)
							588.9593 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	33.4862	33.8318	33.9149	34.1556	34.1556	34.3832	34.3832	34.4561	34.3832	33.9966	34.0768	33.8318
alpha	3.2324	3.2555	3.2610	3.2770	3.2770	3.2922	3.2922	3.2971	3.2922	3.2664	3.2718	3.2555
util living area	0.9571	0.9449	0.9141	0.8509	0.7389	0.5583	0.4121	0.4265	0.6518	0.8476	0.9312	0.9621 (86)
MIT	19.5170	19.6627	19.9813	20.3701	20.7127	20.9196	20.9783	20.9761	20.8629	20.4954	19.9862	19.4992 (87)
Th 2	19.8685	19.8787	19.8811	19.8881	19.8881	19.8946	19.8946	19.8967	19.8946	19.8835	19.8858	19.8787 (88)
util rest of house	0.9481	0.9335	0.8959	0.8185	0.6798	0.4659	0.2957	0.3070	0.5626	0.8056	0.9144	0.9540 (89)
MIT 2	18.5637	18.7127	19.0226	19.3936	19.6962	19.8568	19.8890	19.8904	19.8227	19.5129	19.0364	18.5545 (90)
Living area fraction	18.8046	18.9528	19.2649	19.6404	19.9531	20.1254	20.1643	20.1648	20.0857	19.7613	19.2764	18.7933 (91)
Temperature adjustment												0.0000
adjusted MIT	18.8046	18.9528	19.2649	19.6404	19.9531	20.1254	20.1643	20.1648	20.0857	19.7613	19.2764	18.7933 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9374	0.9219	0.8839	0.8102	0.6836	0.4863	0.3250	0.3371	0.5793	0.8003	0.9030	0.9439 (94)
Ext temp.	584.1957	620.5545	640.1959	628.7310	536.9006	385.5679	243.7912	242.8447	397.5331	508.1850	546.5193	555.9100 (95)
Heat loss rate W	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)
Month fracti	1192.5794	1167.0259	1051.0373	875.7665	641.3691	409.4430	248.1833	247.7041	440.6547	697.6626	950.8811	1170.5911 (97)
Space heating kWh	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 per m ²	452.6374	367.2288	305.6660	177.8655	77.7245	0.0000	0.0000	0.0000	0.0000	140.9713	291.1405	457.3227 (98)
												2270.5569 (98)
												(98) / (4) = 32.2797 (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													2503.3703 (211)
Space heating requirement	452.6374	367.2288	305.6660	177.8655	77.7245	0.0000	0.0000	0.0000	0.0000	140.9713	291.1405	457.3227	(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)	499.0490	404.8829	337.0077	196.1031	85.6941	0.0000	0.0000	0.0000	0.0000	155.4260	320.9928	504.2147	(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	168.4156	147.9985	154.4019	136.9903	133.2148	117.5568	111.5059	124.2889	124.6816	142.1312	152.0742	163.8876	(64)
Efficiency of water heater (217)m	89.7234	89.6662	89.4945	89.1433	88.4578	87.2000	87.2000	87.2000	87.2000	88.9084	89.4679	89.7496	(216)
Fuel for water heating, kWh/month	187.7053	165.0550	172.5267	153.6743	150.5971	134.8128	127.8737	142.5331	142.9834	159.8625	169.9763	182.6053	(219)
Water heating fuel used													1890.2057 (219)
Annual totals kWh/year													
Space heating fuel - main system													2503.3703 (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)													333.8367 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.75 * 1182 * 1.00) =										-709.0239			-709.0239 (233)
Total delivered energy for all uses													4093.3888 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2503.3703	9.7400	243.8283 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1890.2057	9.7400	184.1060 (247)
Pumps and fans for heating	75.0000	36.8500	27.6375 (249)
Energy for lighting	333.8367	36.8500	123.0188 (250)
Additional standing charges			104.0000 (251)
Energy saving/generation technologies			
PV Unit	-709.0239	36.8500	-261.2753 (252)
Total energy cost			421.3153 (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	2503.3703	0.2160	540.7280 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1890.2057	0.2160	408.2844 (264)
Space and water heating			949.0124 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	333.8367	0.5190	173.2613 (268)
Energy saving/generation technologies			
PV Unit	-709.0239	0.5190	-367.9834 (269)
Total kg/year			793.2153 (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	2503.3703	1.2200	3054.1118 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1890.2057	1.2200	2306.0509 (264)
Space and water heating			5360.1627 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	333.8367	3.0700	1024.8788 (268)
Energy saving/generation technologies			
PV Unit	-709.0239	3.0700	-2176.7035 (269)
Primary energy kWh/year			4438.5880 (272)
Primary energy kWh/m2/year			63.1019 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 87
 Current environmental impact rating: B 89

(For testing purposes):

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

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.3	-£ 77	-185 kg (23.3%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£77	2.62 kg/m ²	B 88 B 91
Total Savings	£77	2.62 kg/m²	

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

Fuel prices for cost data on this page from database revision number 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	£151	£169	-£18
Mains gas	£532	£437	£95
Space heating	£375	£375	£0
Water heating	£184	£108	£77
Lighting	£123	£123	£0
Generated (PV)	-£261	-£261	£0
Total cost of fuels	£422	£345	£77
Total cost of uses	£421	£345	£77
Delivered energy	58 kWh/m ²	45 kWh/m ²	13 kWh/m ²
Carbon dioxide emissions	0.8 tonnes	0.6 tonnes	0.2 tonnes
CO2 emissions per m ²	11 kg/m ²	9 kg/m ²	3 kg/m ²
Primary energy	63 kWh/m ²	48 kWh/m ²	15 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	35.1700 (1b)	x 2.3900 (2b)	= 84.0563 (1b) - (3b)
First floor	35.1700 (1c)	x 2.6200 (2c)	= 92.1454 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.3400		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 176.2017 (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) =	0.1703 (8)							
Pressure test					Yes							
Measured/design AP50					5.0000							
Infiltration rate					0.4203 (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) =		0.3572 (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	0.4555	0.4465	0.4376	0.3929	0.3840	0.3394	0.3394	0.3304	0.3572	0.3840	0.4019	0.4197 (22b)
Effective ac	0.6037	0.5997	0.5957	0.5772	0.5737	0.5576	0.5576	0.5546	0.5638	0.5737	0.5808	0.5881 (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)			9.9500	1.1450	11.3931		(27)
Ground Floor			35.3100	0.1200	4.2372	90.0000	3177.9000 (28a)
Brick and Block	84.0200	12.1000	71.9200	0.2400	17.2608	42.2200	3036.4624 (29a)
External Roof 1	35.1700		35.1700	0.1000	3.5170	9.1000	320.0470 (30)
Total net area of external elements Aum(A, m2)			154.5000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	38.7731		(33)
Party Wall 1			38.9200	0.0000	0.0000	45.0000	1751.4000 (32)
GF Timber Stud			62.5300			9.0000	562.7700 (32c)
FF Timber Stud			67.5400			9.0000	607.8600 (32c)
Internal Floor 1			35.3100			18.0000	635.5800 (32d)
Internal Ceiling 1			35.1700			18.0000	633.0600 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	10725.0794 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							152.4748 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							15.0903 (36)
Total fabric heat loss						(33) + (36) =	53.8634 (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
(38)m	35.1043	34.8701	34.6405	33.5623	33.3606	32.4215	32.4215	32.2476	32.7832	33.3606	33.7687	34.1953 (38)
Heat transfer coeff	88.9677	88.7335	88.5039	87.4257	87.2240	86.2849	86.2849	86.1110	86.6466	87.2240	87.6321	88.0587 (39)
Average = Sum(39)m / 12 =												87.4247 (39)
HLP	Jan 1.2648	Feb 1.2615	Mar 1.2582	Apr 1.2429	May 1.2400	Jun 1.2267	Jul 1.2267	Aug 1.2242	Sep 1.2318	Oct 1.2400	Nov 1.2458	Dec 1.2519 (40)
HLP (average)												1.2429 (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												2.2544 (42)
Average daily hot water use (litres/day)												87.7408 (43)
Daily hot water use	96.5149	93.0053	89.4957	85.9860	82.4764	78.9668	78.9668	82.4764	85.9860	89.4957	93.0053	96.5149 (44)
Energy conte	143.1288	125.1814	129.1760	112.6188	108.0604	93.2479	86.4079	99.1543	100.3385	116.9349	127.6436	138.6126 (45)
Energy content (annual)										Total = Sum(45)m =		1380.5050 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	21.4693	18.7772	19.3764	16.8928	16.2091	13.9872	12.9612	14.8731	15.0508	17.5402	19.1465	20.7919 (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	25.2867	22.8171	25.2259	24.3716	25.1544	24.3089	25.0980	25.1346	24.3430	25.1963	24.4306	25.2750 (61)
Total heat required for water heating calculated for each month	168.4156	147.9985	154.4019	136.9903	133.2148	117.5568	111.5059	124.2889	124.6816	142.1312	152.0742	163.8876 (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												1.3137 (H8)
Utilisation factor												0.5329 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												87.7408 (H14)
Volume ratio Veff/V												0.8548 (H15)
Solar storage volume factor												0.9686 (H16)
Solar input												-823.1303 (H17)
Solar input	-23.8691	-39.8307	-67.8363	-90.9140	-112.3166	-110.4251	-108.9658	-95.2040	-74.5638	-50.9183	-28.3122	-19.9744 (63)
Solar input (sum of months) = Sum(63)m =												-823.1303 (63)
Output from w/h	144.5464	108.1678	86.5656	46.0763	20.8982	7.1317	2.5401	29.0849	50.1178	91.2129	123.7619	143.9132 (64)
Total per year (kWh/year) = Sum(64)m =												854.0169 (64)
Heat gains from water heating, kWh/month	53.9120	47.3271	49.2575	43.5386	42.2187	37.0822	35.0051	39.2524	39.4483	45.1799	48.5491	52.4074 (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	135.2611	135.2611	135.2611	135.2611	135.2611	135.2611	135.2611	135.2611	135.2611	135.2611	135.2611	135.2611 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	47.2580	41.9742	34.1357	25.8429	19.3179	16.3090	17.6224	22.9063	30.7448	39.0375	45.5626	48.5715 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	295.6557	298.7237	290.9924	274.5336	253.7573	234.2305	221.1854	218.1174	225.8486	242.3074	263.0837	282.6106 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.7805	50.7805	50.7805	50.7805	50.7805	50.7805	50.7805	50.7805	50.7805	50.7805	50.7805	50.7805 (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)	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740 (71)
Water heating gains (Table 5)	72.4624	70.4272	66.2063	60.4703	56.7455	51.5030	47.0499	52.7587	54.7893	60.7257	67.4294	70.4401 (72)
Total internal gains	514.2436	509.9925	490.2019	459.7143	428.6882	400.9099	384.7251	392.6498	410.2502	440.9381	474.9432	500.4896 (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							
Northeast	3.3500	11.2829	0.6300	0.7000	0.7700	11.5515 (75)						
Southwest	6.6000	36.7938	0.6300	0.7000	0.7700	74.2148 (79)						
Solar gains	85.7664	149.9288	215.3307	283.8879	333.5704	338.0168	323.0300	284.9161	238.9075	168.4512	103.4271	72.9460 (83)
Total gains	600.0100	659.9213	705.5326	743.6022	762.2586	738.9267	707.7552	677.5659	649.1577	609.3893	578.3702	573.4356 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	33.4862	33.5746	33.6617	34.0768	34.1556	34.5273	34.5273	34.5971	34.3832	34.1556	33.9966	33.8318
alpha	3.2324	3.2383	3.2441	3.2718	3.2770	3.3018	3.3018	3.3065	3.2922	3.2770	3.2664	3.2555
util living area	0.9675	0.9541	0.9298	0.8795	0.7894	0.6463	0.5023	0.5389	0.7345	0.8910	0.9519	0.9715 (86)
MIT	19.3037	19.5016	19.8225	20.2390	20.6051	20.8587	20.9543	20.9414	20.7713	20.3133	19.7430	19.2660 (87)
Th 2	19.8685	19.8711	19.8737	19.8858	19.8881	19.8987	19.8987	19.9007	19.8946	19.8881	19.8835	19.8787 (88)
util rest of house	0.9609	0.9449	0.9152	0.8530	0.7407	0.5634	0.3900	0.4274	0.6609	0.8616	0.9406	0.9657 (89)
MIT 2	18.3534	18.5492	18.8640	19.2712	19.6059	19.8213	19.8825	19.8782	19.7565	19.3505	18.7985	18.3241 (90)
Living area fraction												0.2528 (91)
MIT	18.5936	18.7899	19.1063	19.5158	19.8585	20.0835	20.1534	20.1470	20.0130	19.5938	19.0373	18.5622 (92)
Temperature adjustment												0.0000
adjusted MIT	18.5936	18.7899	19.1063	19.5158	19.8585	20.0835	20.1534	20.1470	20.0130	19.5938	19.0373	18.5622 (93)

8. Space heating requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9514	0.9339	0.9030	0.8427	0.7392	0.5784	0.4173	0.4538	0.6696	0.8523	0.9299	0.9569	(94)
Useful gains	570.8403	616.2794	637.1000	626.6361	563.4653	427.3650	295.3201	307.4953	434.6867	519.3836	537.8118	548.7110	(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	1271.6705	1232.5027	1115.7036	928.0967	711.6159	473.1458	306.6046	322.6547	512.3418	784.4771	1046.0869	1264.7180	(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	521.4177	414.1021	356.0811	217.0517	110.2241	0.0000	0.0000	0.0000	0.0000	197.2295	365.9580	532.7092	(98)
Space heating												2714.7734	(98)
Space heating per m2											(98) / (4) =	38.5950	(99)

8c. Space cooling requirement

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													2993.1349	(211)	
Space heating requirement	521.4177	414.1021	356.0811	217.0517	110.2241	0.0000	0.0000	0.0000	0.0000	197.2295	365.9580	532.7092	(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)	574.8817	456.5624	392.5921	239.3072	121.5260	0.0000	0.0000	0.0000	0.0000	217.4526	403.4818	587.3309	(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	144.5464	108.1678	86.5656	46.0763	20.8982	7.1317	2.5401	29.0849	50.1178	91.2129	123.7619	143.9132	(64)		
Efficiency of water heater (217)m	89.9167	89.9522	89.9936	90.0670	90.1235	87.2000	87.2000	87.2000	87.2000	89.5632	89.7892	89.9322	(216)		
Fuel for water heating, kWh/month	160.7560	120.2502	96.1908	51.1578	23.1884	8.1786	2.9129	33.3543	57.4745	101.8419	137.8361	160.0240	(219)		
Water heating fuel used												953.1657	(219)		
Annual totals kWh/year															
Space heating fuel - main system													2993.1349	(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)														333.8367	(232)
Energy saving/generation technologies (Appendices M ,N and Q)															
PV Unit 0 (0.80 * 0.75 * 1029 * 1.00) =														-617.5120	(233)
Total delivered energy for all uses														3787.6253	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2993.1349	3.4800	104.1611	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	953.1657	3.4800	33.1702	(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	333.8367	13.1900	44.0331	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-617.5120	13.1900	-81.4498	(252)
Total energy cost			236.4020	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)		0.8608	(257)
SAP value	$[(255) \times (256)] / [(4) + 45.0] =$	87.9913	
SAP rating (Section 12)		88	(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
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FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Space heating - main system 1	2993.1349	0.2160	646.5171 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	953.1657	0.2160	205.8838 (264)
Space and water heating			852.4009 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	333.8367	0.5190	173.2613 (268)
Energy saving/generation technologies			
PV Unit			
Total kg/year	-617.5120	0.5190	-320.4887 (269)
CO2 emissions per m2			770.0484 (272)
EI value			10.9500 (273)
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	35.1700 (1b)	x 2.3900 (2b)	= 84.0563 (1b) - (3b)
First floor	35.1700 (1c)	x 2.6200 (2c)	= 92.1454 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.3400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 176.2017 (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) =	0.1703 (8)							
Pressure test					Yes							
Measured/design AP50					5.0000							
Infiltration rate					0.4203 (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) =		0.3572 (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	0.4555	0.4197	0.4108	0.3840	0.3840	0.3572	0.3572	0.3483	0.3572	0.4019	0.3929	0.4197 (22b)
Effective ac	0.6037	0.5881	0.5844	0.5737	0.5737	0.5638	0.5638	0.5607	0.5638	0.5808	0.5772	0.5881 (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)			9.9500	1.1450	11.3931		(27)
Ground Floor			35.3100	0.1200	4.2372	90.0000	3177.9000 (28a)
Brick and Block	84.0200	12.1000	71.9200	0.2400	17.2608	42.2200	3036.4624 (29a)
External Roof 1	35.1700		35.1700	0.1000	3.5170	9.1000	320.0470 (30)
Total net area of external elements Aum(A, m2)			154.5000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	38.7731		(33)
Party Wall 1			38.9200	0.0000	0.0000	45.0000	1751.4000 (32)
GF Timber Stud			62.5300			9.0000	562.7700 (32c)
FF Timber Stud			67.5400			9.0000	607.8600 (32c)
Internal Floor 1			35.3100			18.0000	635.5800 (32d)
Internal Ceiling 1			35.1700			18.0000	633.0600 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	10725.0794 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							152.4748 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							15.0903 (36)
Total fabric heat loss						(33) + (36) =	53.8634 (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
(38)m	35.1043	34.1953	33.9797	33.3606	33.3606	32.7832	32.7832	32.6000	32.7832	33.7687	33.5623	34.1953 (38)
Heat transfer coeff	88.9677	88.0587	87.8431	87.2240	87.2240	86.6466	86.6466	86.4634	86.6466	87.6321	87.4257	88.0587 (39)
Average = Sum(39)m / 12 =												87.4031 (39)
HLP	Jan 1.2648	Feb 1.2519	Mar 1.2488	Apr 1.2400	May 1.2400	Jun 1.2318	Jul 1.2318	Aug 1.2292	Sep 1.2318	Oct 1.2458	Nov 1.2429	Dec 1.2519 (40)
HLP (average)												1.2426 (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												2.2544 (42)
Average daily hot water use (litres/day)												87.7408 (43)
Daily hot water use	96.5149	93.0053	89.4957	85.9860	82.4764	78.9668	78.9668	82.4764	85.9860	89.4957	93.0053	96.5149 (44)
Energy conte	143.1288	125.1814	129.1760	112.6188	108.0604	93.2479	86.4079	99.1543	100.3385	116.9349	127.6436	138.6126 (45)
Energy content (annual)										Total = Sum(45)m =		1380.5050 (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

Distribution loss (46)m = 0.15 x (45)m	21.4693	18.7772	19.3764	16.8928	16.2091	13.9872	12.9612	14.8731	15.0508	17.5402	19.1465	20.7919 (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	25.2867	22.8171	25.2259	24.3716	25.1544	24.3089	25.0980	25.1346	24.3430	25.1963	24.4306	25.2750 (61)
Total heat required for water heating calculated for each month	168.4156	147.9985	154.4019	136.9903	133.2148	117.5568	111.5059	124.2889	124.6816	142.1312	152.0742	163.8876 (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												1.5023 (H8)
Utilisation factor												0.4861 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												87.7408 (H14)
Volume ratio Veff/V												0.8548 (H15)
Solar storage volume factor												0.9686 (H16)
Solar input												-858.5560 (H17)
Solar input	-28.1750	-40.2207	-68.1672	-93.0184	-109.7820	-116.8288	-112.5156	-100.3787	-79.4438	-54.3950	-33.1253	-22.5055 (63)
Solar input (sum of months) = Sum(63)m =												-858.5560 (63)
Output from w/h	140.2406	107.7778	86.2347	43.9719	23.4328	0.7280	0.0000	23.9102	45.2377	87.7362	118.9488	141.3821 (64)
Total per year (kWh/year) = Sum(64)m =												819.6009 (64)
Heat gains from water heating, kWh/month	53.9120	47.3271	49.2575	43.5386	42.2187	37.0822	35.0051	39.2524	39.4483	45.1799	48.5491	52.4074 (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	135.2611	135.2611	135.2611	135.2611	135.2611	135.2611	135.2611	135.2611	135.2611	135.2611	135.2611	135.2611 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	47.2580	41.9742	34.1357	25.8429	19.3179	16.3090	17.6224	22.9063	30.7448	39.0375	45.5626	48.5715 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	295.6557	298.7237	290.9924	274.5336	253.7573	234.2305	221.1854	218.1174	225.8486	242.3074	263.0837	282.6106 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.7805	50.7805	50.7805	50.7805	50.7805	50.7805	50.7805	50.7805	50.7805	50.7805	50.7805	50.7805 (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)	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740	-90.1740 (71)
Water heating gains (Table 5)	72.4624	70.4272	66.2063	60.4703	56.7455	51.5030	47.0499	52.7587	54.7893	60.7257	67.4294	70.4401 (72)
Total internal gains	514.2436	509.9925	490.2019	459.7143	428.6882	400.9099	384.7251	392.6498	410.2502	440.9381	474.9432	500.4896 (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							
Northeast	3.3500	15.0428	0.6300	0.7000	0.7700	15.4009 (75)						
Southwest	6.6000	46.3896	0.6300	0.7000	0.7700	93.5699 (79)						
Solar gains	108.9708	163.1027	234.0429	316.2670	356.7664	392.0139	365.3684	327.8407	276.0202	194.0828	130.2646	88.4697 (83)
Total gains	623.2144	673.0952	724.2448	775.9813	785.4546	792.9238	750.0936	720.4905	686.2704	635.0209	605.2078	588.9593 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, T _{hl} (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	33.4862	33.8318	33.9149	34.1556	34.1556	34.3832	34.3832	34.4561	34.3832	33.9966	34.0768	33.8318
alpha	3.2324	3.2555	3.2610	3.2770	3.2770	3.2922	3.2922	3.2971	3.2922	3.2664	3.2718	3.2555
util living area	0.9571	0.9449	0.9141	0.8509	0.7389	0.5583	0.4121	0.4265	0.6518	0.8476	0.9312	0.9621 (86)
MIT	19.5170	19.6627	19.9813	20.3701	20.7127	20.9196	20.9783	20.9761	20.8629	20.4954	19.9862	19.4992 (87)
Th 2	19.8685	19.8787	19.8811	19.8881	19.8881	19.8946	19.8946	19.8967	19.8946	19.8835	19.8858	19.8787 (88)
util rest of house	0.9481	0.9335	0.8959	0.8185	0.6798	0.4659	0.2957	0.3070	0.5626	0.8056	0.9144	0.9540 (89)
MIT 2	18.5637	18.7127	19.0226	19.3936	19.6962	19.8568	19.8890	19.8904	19.8227	19.5129	19.0364	18.5545 (90)
Living area fraction									fLA = Living area / (4) =			0.2528 (91)
MIT	18.8046	18.9528	19.2649	19.6404	19.9531	20.1254	20.1643	20.1648	20.0857	19.7613	19.2764	18.7933 (92)
Temperature adjustment												0.0000
adjusted MIT	18.8046	18.9528	19.2649	19.6404	19.9531	20.1254	20.1643	20.1648	20.0857	19.7613	19.2764	18.7933 (93)

8. Space heating requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9374	0.9219	0.8839	0.8102	0.6836	0.4863	0.3250	0.3371	0.5793	0.8003	0.9030	0.9439	(94)
Useful gains	584.1957	620.5545	640.1959	628.7310	536.9006	385.5679	243.7912	242.8447	397.5331	508.1850	546.5193	555.9100	(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	1192.5794	1167.0259	1051.0373	875.7665	641.3691	409.4430	248.1833	247.7041	440.6547	697.6626	950.8811	1170.5911	(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	452.6374	367.2288	305.6660	177.8655	77.7245	0.0000	0.0000	0.0000	0.0000	140.9713	291.1405	457.3227	(98)
Space heating												2270.5569	(98)
Space heating per m2											(98) / (4) =	32.2797	(99)

8c. Space cooling requirement

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													2503.3703	(211)	
Space heating requirement	452.6374	367.2288	305.6660	177.8655	77.7245	0.0000	0.0000	0.0000	0.0000	140.9713	291.1405	457.3227	(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)	499.0490	404.8829	337.0077	196.1031	85.6941	0.0000	0.0000	0.0000	0.0000	155.4260	320.9928	504.2147	(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	140.2406	107.7778	86.2347	43.9719	23.4328	0.7280	0.0000	23.9102	45.2377	87.7362	118.9488	141.3821	(64)		
Efficiency of water heater (217)m	89.8470	89.8814	89.9060	89.9841	89.8645	87.2000	87.2000	87.2000	87.2000	89.3246	89.6562	89.8484	(216)		
Fuel for water heating, kWh/month	156.0883	119.9111	95.9166	48.8664	26.0757	0.8349	0.0000	27.4199	51.8781	98.2217	132.6722	157.3563	(219)		
Water heating fuel used												915.2411	(219)		
Annual totals kWh/year															
Space heating fuel - main system													2503.3703	(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)														333.8367	(232)
Energy saving/generation technologies (Appendices M ,N and Q)															
PV Unit 0 (0.80 * 0.75 * 1182 * 1.00) =														-709.0239	(233)
Total delivered energy for all uses														3168.4242	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost f/year	
Space heating - main system 1	2503.3703	9.7400	243.8283	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	915.2411	9.7400	89.1445	(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	333.8367	36.8500	123.0188	(250)
Additional standing charges			104.0000	(251)
Energy saving/generation technologies				
PV Unit	-709.0239	36.8500	-261.2753	(252)
Total energy cost			344.7788	(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	2503.3703	0.2160	540.7280	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	915.2411	0.2160	197.6921	(264)
Space and water heating			738.4201	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	333.8367	0.5190	173.2613	(268)
Energy saving/generation technologies				
PV Unit	-709.0239	0.5190	-367.9834	(269)
Total kg/year			608.5729	(272)

FULL SAP CALCULATION PRINTOUT

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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	2503.3703	1.2200	3054.1118 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	915.2411	1.2200	1116.5942 (264)
Space and water heating			4170.7059 (265)
Pumps and fans	125.0000	3.0700	383.7500 (267)
Energy for lighting	333.8367	3.0700	1024.8788 (268)
Energy saving/generation technologies			
PV Unit	-709.0239	3.0700	-2176.7035 (269)
Primary energy kWh/year			3402.6312 (272)
Primary energy kWh/m2/year			48.3741 (273)

U-VALUE CALCULATOR REPORT

Property Reference	SAP 0879 Plot 81	Issued on Date	28/03/2023
Assessment Reference	Rev A	Prop Type Ref	Beeley
Project	Plot 81		
Calculation Type	New Build (As Designed)		

SAP Rating	87 B	DER	15.30	TER	19.10
Environmental	89 B	% DER<TER	19.90		
CO ₂ Emissions (t/year)	0.79	DFEE	49.58	TTEE	51.85
General Requirements Compliance	Pass	% DFEE<TFEE	4.38		

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	100	0.0400	2.5000	87.50		
	Main construction	100	0.1300	0.7692	12.50		
	Corrections - Air Gap: Level 1, Fasteners: None or plastic						
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 81	Issued on Date	28/03/2023
Assessment Reference	Rev A	Prop Type Ref	Beeley
Project	Plot 81		
Calculation Type	New Build (As Designed)		

SAP Rating	87 B	DER	15.30	TER	19.10
Environmental	89 B	% DER<TER	19.90		
CO ₂ Emissions (t/year)	0.79	DFEE	49.58	TFEE	51.85
General Requirements Compliance	Pass	% DFEE<TFEE	4.38		

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

Wall 000001

Wall Type: Standard Wall

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

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

Unheated space:	None	
Total thickness: 330 mm	U-value: 0.24 W/m² K	Kappa: 42.22 kJ/m² K

U-VALUE CALCULATOR REPORT

Property Reference	SAP 0879 Plot 81	Issued on Date	28/03/2023
Assessment Reference	Rev A	Prop Type Ref	Beeley
Project	Plot 81		
Calculation Type	New Build (As Designed)		

SAP Rating	87 B	DER	15.30	TER	19.10
Environmental	89 B	% DER<TER	19.90		
CO ₂ Emissions (t/year)	0.79	DFEE	49.58	TFEE	51.85
General Requirements Compliance	Pass	% DFEE<TFEE	4.38		

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 000008

Floor Type: Suspended Floor

Area = 42.22 m², Perimeter = 18.37 m, Wall thickness = 300.00 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 81	Issued on Date	28/03/2023
Assessment Reference	Rev A	Prop Type Ref	Beeley
Property	Plot 81		

SAP Rating	87 B	DER	15.30	TER	19.10
Environmental	89 B	% DER<TER	19.90		
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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	North 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	2020
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:	16.77 m	35.17 m ²	2.39 m
1st Storey:	16.77 m	35.17 m ²	2.62 m

7.0 Living Area	17.78	m ²
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8.0 Thermal Mass Parameter	Precise calculation	
Thermal Mass	152.47	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	84.02	71.92

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	38.92

9.2 Internal Walls	Description	Construction	Kappa (kJ/m ² K)	Area (m ²)
	GF Timber Stud	Plasterboard on timber frame	9.00	62.53
	FF Timber Stud	Plasterboard on timber frame	9.00	67.54

10.0 External Roofs	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	35.17	35.17

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

10.2 Internal Ceilings

Description	Construction	Kappa (kJ/m ² K)	Area (m ²)
Internal Ceiling 1	Plasterboard ceiling, carpeted chipboard floor	9.00	35.17

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	35.31

11.2 Internal Floors

Description	Construction	Kappa (kJ/m ² K)	Area (m ²)
Internal Floor 1	Plasterboard ceiling, carpeted chipboard floor	18.00	35.31

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	Manufacturer	Solid Door							1.10
Windows & Fully Glazed Do	Manufacturer	Window	Double Low-E Soft 0.1			0.63		0.70	1.20

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m ²)	Curtain Closed
Front Door	Solid Door	[1] Brick and Block	North East							2.15	
Front Elevation	Window	[1] Brick and Block	North East	None	0.00					3.35	
Rear Elevation	Window	[1] Brick and Block	South West	None	0.00					6.60	

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)	0.46	0.110	No	Birtley Supatherm
Independently assessed	E2 Other lintels (including other steel lintels)	5.46	0.910	No	Birtley Supatherm
Independently assessed	E2 Other lintels (including other steel lintels)	1.02	0.071	No	Birtley Supatherm
Independently assessed	E2 Other lintels (including other steel lintels)	1.59	0.067	No	Birtley Supatherm
Independently assessed	E3 Sill	5.92	0.021	No	Knauf P5
Independently assessed	E4 Jamb	24.32	0.016	No	Knauf P6
Table K1 - Default	E5 Ground floor (normal)	16.79	0.320	No	
Independently assessed	E6 Intermediate floor within a dwelling	16.79	0.000	No	CD0029
Table K1 - Approved	E10 Eaves (insulation at ceiling level)	9.10	0.060	No	
Independently assessed	E12 Gable (insulation at ceiling level)	15.64	0.044	No	Knauf P21
Independently assessed	E16 Corner (normal)	10.46	0.039	No	Knauf P23
Table K1 - Approved	E18 Party wall between dwellings	9.55	0.060	No	
Table K1 - Default	P1 Party wall - Ground floor	7.82	0.160	No	
Table K1 - Default	P2 Party wall - Intermediate floor within a dwelling	7.82	0.000	No	
Independently assessed	P4 Party wall - Roof (insulation at ceiling level)	7.82	0.069	No	Knauf P29

Y-value	<input type="text" value="0.098"/>	W/m ² K
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18.0 Pressure Testing

Designed AP ₅₀	<input type="text" value="Yes"/>	
Property Tested ?	<input type="text" value="5.00"/>	m ³ /(h.m ²) @ 50 Pa
As Built AP ₅₀	<input type="text"/>	m ³ /(h.m ²) @ 50 Pa

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

19.0 Mechanical Ventilation

Summer Overheating

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

Mechanical Ventilation

Mechanical Ventilation System Present	No
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20.0 Fans, Open Fireplaces, Flues

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

21.0 Fixed Cooling System

No

22.0 Lighting

Internal

Total number of light fittings	16	
Total number of L.E.L. fittings	16	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	Yes
Light and motion sensor	Yes

23.0 Electricity Tariff

Standard

24.0 Main Heating 1

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

25.0 Main Heating 2

None

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

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	South 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	£77	B 88	