



elmhurst
energy



SAP Report Submission for Building Regulations Compliance

Client: Foreman Homes

Project: Plot 29

Contact: Tobias Whiting
Abacus Energy (UK) Ltd
toby@abacusenergyuk.com

Report Issue Date: 08/02/2024

EXCELLENCE
IN ENERGY
ASSESSMENT

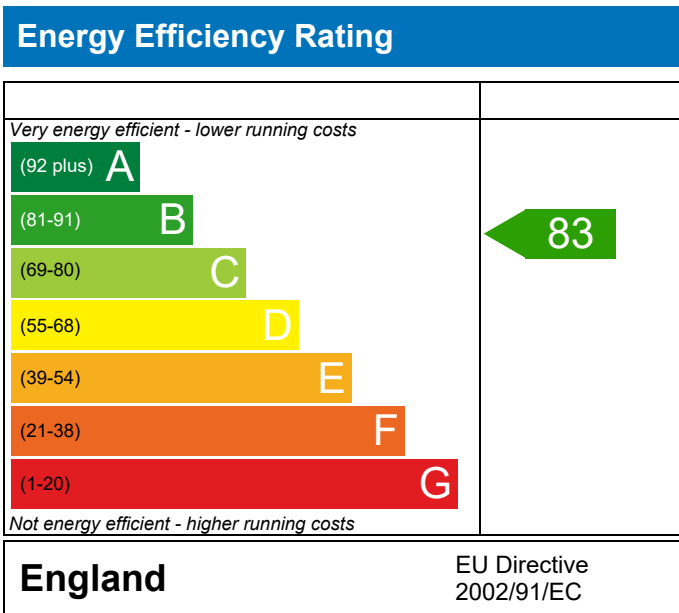
PREDICTED ENERGY ASSESSMENT

Plot 29

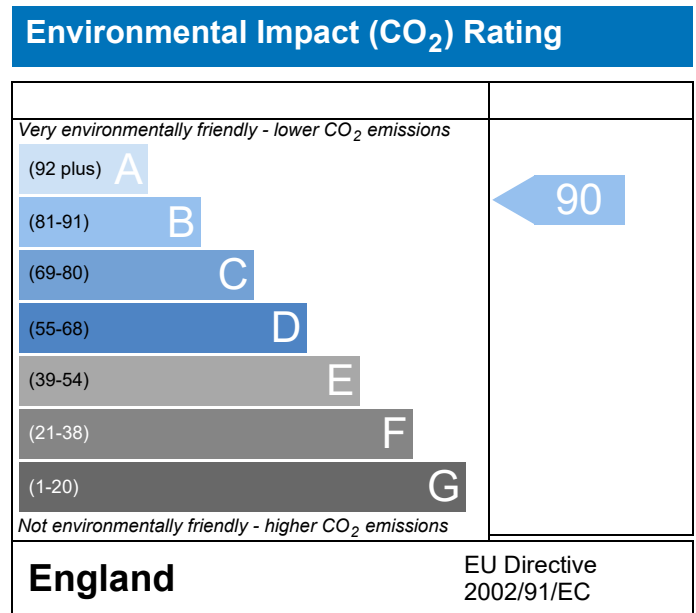
Dwelling type: Flat, Detached
 Date of assessment: 08/02/2024
 Produced by: Abacus Energy (UK) Ltd
 Total floor area: 60.9 m²
 DRRN: 0204-0522-8061

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.



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.



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 0931 Plot 29	Issued on Date	08/02/2024
Assessment Reference	Rev B	Prop Type Ref	Block Ev
Property	Plot 29		

SAP Rating	83 B	DER	14.99	TER	20.24
Environmental	90 B	% DER<TER	25.93		
CO ₂ Emissions (t/year)	0.73	DFEE	45.83	TFEE	54.30
General Requirements Compliance	Pass	% DFEE<TFEE	15.60		

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)	20.24	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	14.99	kgCO ₂ /m ²	Pass
	-5.25 (-25.9%)	kgCO ₂ /m ²	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	54.30	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DFEE)	45.83	kWh/m ² /yr	
	-8.5 (-15.7%)	kWh/m ² /yr	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.22 (max. 0.30)	0.23 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Roof	0.12 (max. 0.20)	0.17 (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
Vaillant ecoFIT sustain 830 VUW 306/6-3 (H-GB)
Combi boiler
Efficiency: 89.3% 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

Continuous supply and extract system

Specific fan power

0.58

Maximum

1.5

Pass

MVHR efficiency

93 %

Minimum

70 %

Pass

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)

Medium

Pass

Based on:

Overshading

Average

Windows facing North East

3.00 m², No overhang

Windows facing South East

4.89 m², No overhang

Windows facing North West

1.68 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

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

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BUILDING REGULATION COMPLIANCE

Calculation Type: New Build (As Designed)

10 Key features

Party wall U-value	0.00	W/m ² K
Roof U-value	0.10	W/m ² K
Door U-value	1.10	W/m ² K
Photovoltaic array	420.00	kWh/Year

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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			0	0	Not applicable
Photovoltaic			0	0	Not applicable
Wind turbine			0	0	Not applicable
Totals	£0	£0	B 83	B 90	

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THERMAL BRIDGING

Calculation Type: New Build (As Designed)

Property Reference	SAP 0931 Plot 29	Issued on Date	08/02/2024
Assessment Reference	Rev B	Prop Type Ref	Block Ev
Property	Plot 29		

SAP Rating	83 B	DER	14.99	TER	20.24
Environmental	90 B	% DER<TER	25.93		
CO ₂ Emissions (t/year)	0.73	DFEE	45.83	TFEE	54.30
General Requirements Compliance	Pass	% DFEE<TFEE	15.60		

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	0.043	3.51	0.15	Catnic Thermally Broken
External wall	E3 Sill	Independently assessed	0.021	7.36	0.15	Knauf P5
External wall	E4 Jamb	Independently assessed	0.016	13.62	0.22	Knauf P6
External wall	E7 Party floor between dwellings (in blocks of flats)	Table K1 - Approved	0.070	33.54	2.35	
External wall	E10 Eaves (insulation at ceiling level)	Table K1 - Approved	0.060	3.96	0.24	
External wall	E12 Gable (insulation at ceiling level)	Independently assessed	0.087	18.45	1.61	Knauf P21
External wall	E13 Gable (insulation at rafter level)	Independently assessed	0.008	5.04	0.04	Knauf P20
External wall	E16 Corner (normal)	Independently assessed	0.061	11.94	0.73	Knauf P23
External wall	E17 Corner (inverted – internal area greater than external area)	Independently assessed	-0.113	4.70	-0.53	Knauf P24
External roof	R1 Head of roof window	Table K1 - Default	0.080	4.39	0.35	
External roof	R3 Jamb of roof window	Table K1 - Default	0.080	3.48	0.28	
External roof	R6 Flat ceiling	Table K1 - Default	0.060	16.07	0.96	
External roof	R8 Roof to wall (rafter)	Table K1 - Default	0.060	5.04	0.30	
External roof	R9 Roof to wall (flat ceiling)	Table K1 - Default	0.040	4.87	0.19	

Total: **7.04** W/mK:
 Y-Value: **0.047** W/m²K:

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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CO₂ Emissions (t/year)	0.73	DFEE	45.83	TFEE	54.30
General Requirements Compliance	Pass	% DFEE<TFEE	15.60		
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Client	Foreman Homes, FORE				

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

DWELLING AS DESIGNED

Top-floor flat, total floor area 61 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) 20.24 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 14.99 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 54.3 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE) 45.8 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.22 (max. 0.30)	0.23 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	(no floor)		
Roof	0.12 (max. 0.20)	0.17 (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

Vaillant ecoFIT sustain 830 VUW 306/6-3 (H-GB)

Combi boiler

Efficiency: 89.3% 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

Continuous supply and extract system

Specific fan power:

0.58

Maximum

1.5

OK

MVHR efficiency:

93%

Minimum:

70%

OK

9 Summertime temperature

Overheating risk (Southern England): Medium OK

Based on:

Overshading:

Average

Windows facing North East: 3.00 m², No overhang

Windows facing South East: 4.89 m², No overhang

Windows facing North West: 1.68 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

Door U-value 1.10 W/m²K

Photovoltaic array 420.00 kWh/Year

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	60.9000 (1b)	x 2.3000 (2b)	= 140.0700 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	60.9000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 140.0700 (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				0 * 10 =	0.0000 (7a)							
Number of passive vents				0 * 10 =	0.0000 (7b)							
Number of flueless gas fires				0 * 40 =	0.0000 (7c)							
Air changes per hour												
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				0.0000 / (5) =	0.0000 (8)							
Pressure test				Yes								
Measured/design AP50				5.0000								
Infiltration rate				0.2500	(18)							
Number of sides sheltered				1	(19)							
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.9250 (20)							
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.2313 (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	0.2948	0.2891	0.2833	0.2544	0.2486	0.2197	0.2197	0.2139	0.2313	0.2486	0.2602	0.2717 (22b)
Balanced mechanical ventilation with heat recovery												0.5000 (23a)
If mechanical ventilation:												65.1000 (23c)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												
Effective ac	0.4693	0.4636	0.4578	0.4289	0.4231	0.3942	0.3942	0.3884	0.4058	0.4231	0.4347	0.4462 (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			2.1200	1.1000	2.3320		(26)					
Windows (Uw = 1.20)			9.5700	1.1450	10.9580		(27)					
Brick and Block	50.9900	3.0000	47.9900	0.2200	10.5578	42.2200	2026.1378 (29a)					
Wall to Corridor	18.1200	2.1200	16.0000	0.2300	3.6796	113.5000	1816.0000 (29a)					
Dormers	8.0300	6.5700	1.4600	0.2300	0.3358	9.1000	13.2860 (29a)					
Pitched Roof	54.3200		54.3200	0.1000	5.4320	9.1000	494.3120 (30)					
Sloping Roof	18.1900		18.1900	0.1700	3.0923	9.1000	165.5290 (30)					
Total net area of external elements Aum(A, m2)			149.6500				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	36.3875		(33)					
Party Floor 1			60.9000			70.0000	4263.0000 (32d)					
Ground Floor Stud			94.4900			9.0000	850.4100 (32c)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	9628.6748 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							158.1063 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.0425 (36)					
Total fabric heat loss						(33) + (36) =	43.4301 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 21.6945	Feb 21.4273	Mar 21.1601	Apr 19.8239	May 19.5567	Jun 18.2206	Jul 18.2206	Aug 17.9533	Sep 18.7550	Oct 19.5567	Nov 20.0912	Dec 20.6256 (38)
Heat transfer coeff	65.1246	64.8574	64.5901	63.2540	62.9868	61.6506	61.6506	61.3834	62.1851	62.9868	63.5212	64.0557 (39)
Average = Sum(39)m / 12 =												63.1872 (39)
HLP	Jan 1.0694	Feb 1.0650	Mar 1.0606	Apr 1.0387	May 1.0343	Jun 1.0123	Jul 1.0123	Aug 1.0079	Sep 1.0211	Oct 1.0343	Nov 1.0430	Dec 1.0518 (40)
HLP (average)												1.0376 (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												2.0070 (42)
Average daily hot water use (litres/day)												81.8654 (43)
Daily hot water use	90.0519	86.7773	83.5027	80.2281	76.9535	73.6788	73.6788	76.9535	80.2281	83.5027	86.7773	90.0519 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Energy conte	133.5444	116.7988	120.5259	105.0774	100.8243	87.0037	80.6217	92.5146	93.6195	109.1045	119.0961	129.3306 (45)
Energy content (annual)	Total = Sum(45)m = 1288.0612 (45)											
Distribution loss (46)m = 0.15 x (45)m	20.0317	17.5198	18.0789	15.7616	15.1236	13.0505	12.0933	13.8772	14.0429	16.3657	17.8644	19.3996 (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	1.3830	1.1656	1.1574	0.9695	0.8923	0.7372	0.6831	0.8187	0.8638	1.0477	1.1885	1.3393 (61)
Total heat required for water heating calculated for each month	134.9274	117.9644	121.6833	106.0469	101.7165	87.7409	81.3048	93.3333	94.4832	110.1522	120.2846	130.6700 (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	134.9274	117.9644	121.6833	106.0469	101.7165	87.7409	81.3048	93.3333	94.4832	110.1522	120.2846	130.6700 (64)
Heat gains from water heating, kWh/month	44.7493	39.1270	40.3642	35.1806	33.7471	29.1130	26.9775	30.9658	31.3444	36.5392	39.8966	43.3373 (65)
Total per year (kWh/year) = Sum(64)m = 1300.3072 (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	100.3482	100.3482	100.3482	100.3482	100.3482	100.3482	100.3482	100.3482	100.3482	100.3482	100.3482	100.3482 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	16.3548	14.5262	11.8135	8.9436	6.6854	5.6441	6.0987	7.9273	10.6400	13.5099	15.7681	16.8094 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	175.2109	177.0291	172.4474	162.6936	150.3812	138.8092	131.0785	129.2603	133.8420	143.5958	155.9082	167.4801 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.0348	33.0348	33.0348	33.0348	33.0348	33.0348	33.0348	33.0348	33.0348	33.0348	33.0348	33.0348 (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)	-80.2785	-80.2785	-80.2785	-80.2785	-80.2785	-80.2785	-80.2785	-80.2785	-80.2785	-80.2785	-80.2785	-80.2785 (71)
Water heating gains (Table 5)	60.1469	58.2247	54.2530	48.8619	45.3590	40.4347	36.2601	41.6207	43.5339	49.1118	55.4119	58.2490 (72)
Total internal gains	307.8171	305.8844	294.6183	276.6036	258.5301	240.9926	229.5417	234.9127	244.1203	262.3219	283.1926	298.6430 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	g Specific data or Table 6c	FF Access factor Table 6d	Gains W						
Northeast	3.0000	11.2829	0.6300	0.7000	0.7700	10.3446 (75)						
Southeast	4.8900	36.7938	0.6300	0.7000	0.7700	54.9865 (77)						
Northwest	1.6800	11.2829	0.6300	0.7000	0.7700	5.7930 (81)						
Solar gains	71.1241	126.5109	187.3356	255.9827	308.5046	315.8551	300.5307	259.8821	210.8775	143.6604	86.1664	60.2358 (83)
Total gains	378.9412	432.3953	481.9539	532.5863	567.0347	556.8477	530.0724	494.7949	454.9979	405.9823	369.3591	358.8788 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	41.0695	41.2387	41.4093	42.2840	42.4634	43.3837	43.3837	43.5726	43.0108	42.4634	42.1061	41.7548
alpha	3.7380	3.7492	3.7606	3.8189	3.8309	3.8922	3.8922	3.9048	3.8674	3.8309	3.8071	3.7837
util living area	0.9873	0.9782	0.9583	0.9078	0.8057	0.6423	0.4926	0.5414	0.7706	0.9325	0.9786	0.9895 (86)
MIT	19.4163	19.6194	19.9439	20.3692	20.7112	20.9168	20.9771	20.9673	20.8236	20.3806	19.8344	19.3921 (87)
Th 2	20.0259	20.0295	20.0331	20.0512	20.0549	20.0731	20.0731	20.0767	20.0658	20.0549	20.0476	20.0404 (88)
util rest of house	0.9845	0.9736	0.9492	0.8871	0.7624	0.5688	0.3968	0.4443	0.7068	0.9130	0.9733	0.9872 (89)
MIT 2	18.5807	18.7844	19.1062	19.5300	19.8444	20.0264	20.0645	20.0635	19.9547	19.5511	19.0128	18.5678 (90)
Living area fraction	fLA = Living area / (4) =											0.4841 (91)
MIT	18.9852	19.1886	19.5117	19.9362	20.2640	20.4574	20.5063	20.5010	20.3754	19.9526	19.4105	18.9668 (92)
Temperature adjustment												0.0000
adjusted MIT	18.9852	19.1886	19.5117	19.9362	20.2640	20.4574	20.5063	20.5010	20.3754	19.9526	19.4105	18.9668 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9808	0.9686	0.9433	0.8842	0.7728	0.6005	0.4426	0.4902	0.7296	0.9105	0.9688	0.9840 (94)
Useful gains	371.6630	418.7973	454.6197	470.9239	438.1773	334.3791	234.5987	242.5661	331.9632	369.6510	357.8344	353.1315 (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	6.4000 (96)
Heat loss rate W	956.3669	926.7200	840.4267	698.0858	539.4183	361.1137	240.8257	251.7349	390.2332	589.0900	781.9787	945.8969 (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	435.0198	341.3241	287.0404	163.5565	75.3233	0.0000	0.0000	0.0000	0.0000	163.2626	305.3839	441.0174 (98)
Space heating												2211.9280 (98)
Space heating per m2												(98) / (4) = 36.3207 (99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)
 Fraction of space heat from main system(s) 1.0000 (202)
 Efficiency of main space heating system 1 (in %) 90.2000 (206)
 Efficiency of secondary/supplementary heating system, % 0.0000 (208)
 Space heating requirement 2452.2484 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	435.0198	341.3241	287.0404	163.5565	75.3233	0.0000	0.0000	0.0000	0.0000	163.2626	305.3839	441.0174	(98)
Space heating efficiency (main heating system 1)	90.2000	90.2000	90.2000	90.2000	90.2000	0.0000	0.0000	0.0000	0.0000	90.2000	90.2000	90.2000	(210)
Space heating fuel (main heating system)	482.2836	378.4081	318.2266	181.3265	83.5070	0.0000	0.0000	0.0000	0.0000	181.0007	338.5630	488.9328	(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	134.9274	117.9644	121.6833	106.0469	101.7165	87.7409	81.3048	93.3333	94.4832	110.1522	120.2846	130.6700	(64)
Efficiency of water heater (217)m	86.4403	86.1354	85.5221	84.1208	81.5877	76.2000	76.2000	76.2000	76.2000	83.9836	85.7482	76.2000	(216)
Fuel for water heating, kWh/month	156.0932	136.9523	142.2829	126.0650	124.6714	115.1455	106.6992	122.4846	123.9937	131.1592	140.2765	150.9505	(219)
Water heating fuel used												1576.7739	(219)
Annual totals kWh/year													
Space heating fuel - main system													2452.2484 (211)
Space heating fuel - secondary													0.0000 (215)

Electricity for pumps and fans:

(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.8120)
 mechanical ventilation fans (SFP = 0.8120) 138.7589 (230a)
 central heating pump 30.0000 (230c)
 main heating flue fan 45.0000 (230e)
 Total electricity for the above, kWh/year 213.7589 (231)
 Electricity for lighting (calculated in Appendix L) 288.8317 (232)

Energy saving/generation technologies (Appendices M ,N and Q)
 Total delivered energy for all uses 4531.6130 (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	2452.2484	0.2160	529.6857	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1576.7739	0.2160	340.5832	(264)
Space and water heating			870.2688	(265)
Pumps and fans	213.7589	0.5190	110.9409	(267)
Energy for lighting	288.8317	0.5190	149.9037	(268)
Energy saving/generation technologies				
PV Unit	-420.0000	0.5190	-217.9800	(269)
Total CO2, kg/year			913.1334	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			14.9900	(273)

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

DER			14.9900	ZC1
Total Floor Area		TFA	60.9000	ZC3
Assumed number of occupants		N	2.0070	
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190	
CO2 emissions from appliances, equation (L14)			17.0487	ZC2
CO2 emissions from cooking, equation (L16)			2.7449	ZC3
Total CO2 emissions			34.7836	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			34.7836	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	60.9000 (1b)	2.3000 (2b)	140.0700 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	60.9000		140.0700 (4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	140.0700 (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				2 * 10 =	20.0000 (7a)
Number of passive vents				0 * 10 =	0.0000 (7b)
Number of flueless gas fires				0 * 40 =	0.0000 (7c)
Air changes per hour					
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				20.0000 / (5) =	0.1428 (8)
Pressure test				Yes	
Measured/design AP50					5.0000
Infiltration rate					0.3928 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3633 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4632	0.4542	0.4451	0.3997	0.3906	0.3452	0.3452	0.3361	0.3633	0.3906	0.4087	0.4269 (22b)
Effective ac	0.6073	0.6031	0.5990	0.5799	0.5763	0.5596	0.5596	0.5565	0.5660	0.5763	0.5835	0.5911 (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			2.1200	1.0000	2.1200		(26)					
TER Opening Type (Uw = 1.40)			9.5700	1.3258	12.6875		(27)					
Brick and Block	50.9900	3.0000	47.9900	0.1800	8.6382		(29a)					
Wall to Corridor	18.1200	2.1200	16.0000	0.1800	2.8800		(29a)					
Dormers	8.0300	6.5700	1.4600	0.1800	0.2628		(29a)					
Pitched Roof	54.3200		54.3200	0.1300	7.0616		(30)					
Sloping Roof	18.1900		18.1900	0.1300	2.3647		(30)					
Total net area of external elements Aum(A, m2)			149.6500				(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	36.0148	(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.0627 (36)					
Total fabric heat loss							(33) + (36) =					
							44.0775 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	28.0711	27.8785	27.6898	26.8031	26.6372	25.8650	25.8650	25.7220	26.1624	26.6372	26.9728	27.3237 (38)
Average = Sum(39)m / 12 =	72.1486	71.9560	71.7673	70.8806	70.7147	69.9425	69.9425	69.7995	70.2399	70.7147	71.0503	71.4012 (39)
												70.8798 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1847	1.1815	1.1784	1.1639	1.1612	1.1485	1.1485	1.1461	1.1534	1.1612	1.1667	1.1724 (40)
Days in month												1.1639 (40)
	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												2.0070 (42)
Average daily hot water use (litres/day)												81.8654 (43)
Daily hot water use	90.0519	86.7773	83.5027	80.2281	76.9535	73.6788	73.6788	76.9535	80.2281	83.5027	86.7773	90.0519 (44)
Energy conte	133.5444	116.7988	120.5259	105.0774	100.8243	87.0037	80.6217	92.5146	93.6195	109.1045	119.0961	129.3306 (45)
Energy content (annual)												Total = Sum(45)m =
Distribution loss (46)m = 0.15 x (45)m	20.0317	17.5198	18.0789	15.7616	15.1236	13.0505	12.0933	13.8772	14.0429	16.3657	17.8644	19.3996 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)	
Combi loss	45.8895	39.9413	42.5521	39.5645	39.2146	36.3348	37.5459	39.2146	39.5645	42.5521	42.7943	45.8895	45.8895	45.8895	45.8895	45.8895	45.8895	45.8895	45.8895	45.8895	45.8895	45.8895	45.8895	(61)
Total heat required for water heating calculated for each month	179.4339	156.7401	163.0779	144.6419	140.0389	123.3384	118.1676	131.7292	133.1840	151.6565	161.8904	175.2201	175.2201	175.2201	175.2201	175.2201	175.2201	175.2201	175.2201	175.2201	175.2201	175.2201	175.2201	(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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Output from w/h	179.4339	156.7401	163.0779	144.6419	140.0389	123.3384	118.1676	131.7292	133.1840	151.6565	161.8904	175.2201	175.2201	175.2201	175.2201	175.2201	175.2201	175.2201	175.2201	175.2201	175.2201	175.2201	175.2201	(64)
Heat gains from water heating, kWh/month	55.8759	48.8209	50.7129	44.8294	43.3277	38.0124	36.1932	40.5648	41.0196	46.9153	50.2980	54.4748	54.4748	54.4748	54.4748	54.4748	54.4748	54.4748	54.4748	54.4748	54.4748	54.4748	54.4748	(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	100.3482	100.3482	100.3482	100.3482	100.3482	100.3482	100.3482	100.3482	100.3482	100.3482	100.3482	100.3482	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	16.3548	14.5262	11.8135	8.9436	6.6854	5.6441	6.0987	7.9273	10.6400	13.5099	15.7681	16.8094	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	175.2109	177.0291	172.4474	162.6936	150.3812	138.8092	131.0785	129.2603	133.8420	143.5958	155.9082	167.4801	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.0348	33.0348	33.0348	33.0348	33.0348	33.0348	33.0348	33.0348	33.0348	33.0348	33.0348	33.0348	(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)	-80.2785	-80.2785	-80.2785	-80.2785	-80.2785	-80.2785	-80.2785	-80.2785	-80.2785	-80.2785	-80.2785	-80.2785	(71)
Water heating gains (Table 5)	75.1020	72.6502	68.1625	62.2630	58.2362	52.7950	48.6468	54.5225	56.9717	63.0581	69.8584	73.2188	(72)
Total internal gains	322.7722	320.3099	308.5278	290.0047	271.4073	253.3528	241.9284	247.8146	257.5581	276.2683	297.6391	313.6128	(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	3.0000	11.2829	0.6300	0.7000	0.7700	10.3446 (75)						
Southeast	4.8900	36.7938	0.6300	0.7000	0.7700	54.9865 (77)						
Northwest	1.6800	11.2829	0.6300	0.7000	0.7700	5.7930 (81)						
Solar gains	71.1241	126.5109	187.3356	255.9827	308.5046	315.8551	300.5307	259.8821	210.8775	143.6604	86.1664	60.2358 (83)
Total gains	393.8963	446.8208	495.8634	545.9873	579.9119	569.2080	542.4591	507.6967	468.4357	419.9287	383.8055	373.8486 (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	58.6174	58.7743	58.9289	59.6661	59.8060	60.4664	60.4664	60.5903	60.2103	59.8060	59.5235	59.2311	
alpha	4.9078	4.9183	4.9286	4.9777	4.9871	5.0311	5.0311	5.0394	5.0140	4.9871	4.9682	4.9487	
util living area	0.9972	0.9943	0.9863	0.9589	0.8807	0.7209	0.5527	0.6078	0.8476	0.9728	0.9944	0.9978 (86)	
MIT	19.7555	19.9049	20.1538	20.4860	20.7739	20.9425	20.9877	20.9807	20.8650	20.4969	20.0684	19.7306 (87)	
Th 2	19.9323	19.9348	19.9373	19.9490	19.9512	19.9614	19.9614	19.9633	19.9575	19.9512	19.9468	19.9421 (88)	
util rest of house	0.9963	0.9924	0.9813	0.9431	0.8355	0.6288	0.4297	0.4829	0.7754	0.9594	0.9921	0.9971 (89)	
MIT 2	18.2816	18.5010	18.8638	19.3447	19.7281	19.9229	19.9569	19.9554	19.8487	19.3688	18.7488	18.2522 (90)	
Living area fraction	fLA = Living area / (4) = 0.4841 (91)												
MIT	18.9951	19.1806	19.4882	19.8972	20.2344	20.4165	20.4559	20.4517	20.3406	19.9149	19.3876	18.9679 (92)	
Temperature adjustment	0.0000												
adjusted MIT	18.9951	19.1806	19.4882	19.8972	20.2344	20.4165	20.4559	20.4517	20.3406	19.9149	19.3876	18.9679 (93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9951	0.9905	0.9786	0.9422	0.8491	0.6714	0.4896	0.5437	0.8049	0.9588	0.9905	0.9962 (94)
Ext temp.	391.9711	442.5881	485.2694	514.4364	492.4215	382.1438	265.6010	276.0430	377.0285	402.6382	380.1533	372.4199 (95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Month fracti	1060.2305	1027.5747	932.1293	779.4875	603.5050	406.8169	269.6920	282.8061	438.3407	658.6973	873.0363	1054.4434 (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 m2	497.1850	393.1110	332.4637	190.8368	82.6461	0.0000	0.0000	0.0000	0.0000	190.5080	354.8757	507.4255 (98)
												2549.0517 (98)
												41.8564 (99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

	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													2729.1775 (211)
Space heating requirement	497.1850	393.1110	332.4637	190.8368	82.6461	0.0000	0.0000	0.0000	0.0000	190.5080	354.8757	507.4255	(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)	532.3180	420.8897	355.9569	204.3221	88.4862	0.0000	0.0000	0.0000	0.0000	203.9700	379.9526	543.2821	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	179.4339	156.7401	163.0779	144.6419	140.0389	123.3384	118.1676	131.7292	133.1840	151.6565	161.8904	175.2201	(64)
Efficiency of water heater (217)m	87.4820	87.2710	86.8069	85.7498	83.7737	80.3000	80.3000	80.3000	80.3000	85.6265	86.9730	87.5728	(216)
Fuel for water heating, kWh/month	205.1095	179.6017	187.8630	168.6789	167.1633	153.5971	147.1577	164.0463	165.8580	177.1141	186.1387	200.0852	(219)
Water heating fuel used													2102.4134 (219)
Annual totals kWh/year													
Space heating fuel - main system													2729.1775 (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)													288.8317 (232)
Total delivered energy for all uses													5195.4226 (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	2729.1775	0.2160	589.5023 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2102.4134	0.2160	454.1213 (264)
Space and water heating			1043.6236 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	288.8317	0.5190	149.9037 (268)
Total CO2, kg/m2/year			1232.4523 (272)
Emissions per m2 for space and water heating			17.1367 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.4615 (272b)
Emissions per m2 for pumps and fans			0.6392 (272c)
Target Carbon Dioxide Emission Rate (TER) = (17.1367 * 1.00) + 2.4615 + 0.6392, rounded to 2 d.p.			20.2400 (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	60.9000 (1b)	x 2.3000 (2b)	= 140.0700 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	60.9000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 140.0700 (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				2 * 10 =	20.0000 (7a)
Number of passive vents				0 * 10 =	0.0000 (7b)
Number of flueless gas fires				0 * 40 =	0.0000 (7c)
Air changes per hour					
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				20.0000 / (5) =	0.1428 (8)
Pressure test				Yes	
Measured/design AP50				5.0000	
Infiltration rate				0.3928	(18)
Number of sides sheltered				1	(19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.9250 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3633 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4632	0.4542	0.4451	0.3997	0.3906	0.3452	0.3452	0.3361	0.3633	0.3906	0.4087	0.4269 (22b)
Effective ac	0.6073	0.6031	0.5990	0.5799	0.5763	0.5596	0.5596	0.5565	0.5660	0.5763	0.5835	0.5911 (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			2.1200	1.1000	2.3320		(26)
Windows (Uw = 1.20)			9.5700	1.1450	10.9580		(27)
Brick and Block	50.9900	3.0000	47.9900	0.2200	10.5578	42.2200	2026.1378 (29a)
Wall to Corridor	18.1200	2.1200	16.0000	0.2300	3.6796	113.5000	1816.0000 (29a)
Dormers	8.0300	6.5700	1.4600	0.2300	0.3358	9.1000	13.2860 (29a)
Pitched Roof	54.3200		54.3200	0.1000	5.4320	9.1000	494.3120 (30)
Sloping Roof	18.1900		18.1900	0.1700	3.0923	9.1000	165.5290 (30)
Total net area of external elements Aum(A, m2)			149.6500				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	36.3875		(33)
Party Floor 1			60.9000			70.0000	4263.0000 (32d)
Ground Floor Stud			94.4900			9.0000	850.4100 (32c)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	9628.6748 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							158.1063 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.0425 (36)
Total fabric heat loss						(33) + (36) =	43.4301 (37)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	28.0711	27.8785	27.6898	26.8031	26.6372	25.8650	25.8650	25.7220	26.1624	26.6372	26.9728	27.3237 (38)
Heat transfer coeff	71.5012	71.3086	71.1198	70.2332	70.0673	69.2950	69.2950	69.1520	69.5925	70.0673	70.4029	70.7537 (39)
Average = Sum(39)m / 12 =												70.2324 (39)
HLP	1.1741	1.1709	1.1678	1.1533	1.1505	1.1378	1.1378	1.1355	1.1427	1.1505	1.1560	1.1618 (40)
HLP (average)												1.1532 (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												2.0070 (42)
Average daily hot water use (litres/day)												81.8654 (43)
Daily hot water use	90.0519	86.7773	83.5027	80.2281	76.9535	73.6788	73.6788	76.9535	80.2281	83.5027	86.7773	90.0519 (44)
Energy conte	133.5444	116.7988	120.5259	105.0774	100.8243	87.0037	80.6217	92.5146	93.6195	109.1045	119.0961	129.3306 (45)
Energy content (annual)										Total = Sum(45)m =		1288.0612 (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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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												
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Heat gains from water heating, kWh/month												
	28.3782	24.8197	25.6117	22.3289	21.4252	18.4883	17.1321	19.6593	19.8941	23.1847	25.3079	27.4828 (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	100.3482	100.3482	100.3482	100.3482	100.3482	100.3482	100.3482	100.3482	100.3482	100.3482	100.3482	100.3482 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	16.3548	14.5262	11.8135	8.9436	6.6854	5.6441	6.0987	7.9273	10.6400	13.5099	15.7681	16.8094 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	175.2109	177.0291	172.4474	162.6936	150.3812	138.8092	131.0785	129.2603	133.8420	143.5958	155.9082	167.4801 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	33.0348	33.0348	33.0348	33.0348	33.0348	33.0348	33.0348	33.0348	33.0348	33.0348	33.0348	33.0348 (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)												
	-80.2785	-80.2785	-80.2785	-80.2785	-80.2785	-80.2785	-80.2785	-80.2785	-80.2785	-80.2785	-80.2785	-80.2785 (71)
Water heating gains (Table 5)												
	38.1427	36.9341	34.4244	31.0124	28.7972	25.6782	23.0270	26.4238	27.6307	31.1622	35.1499	36.9392 (72)
Total internal gains	282.8129	281.5939	271.7898	255.7541	238.9683	223.2360	213.3086	216.7159	225.2172	241.3724	259.9306	274.3332 (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	3.0000	11.2829	0.6300	0.7000	0.7700	10.3446 (75)		
Southeast	4.8900	36.7938	0.6300	0.7000	0.7700	54.9865 (77)		
Northwest	1.6800	11.2829	0.6300	0.7000	0.7700	5.7930 (81)		

Solar gains	71.1241	126.5109	187.3356	255.9827	308.5046	315.8551	300.5307	259.8821	210.8775	143.6604	86.1664	60.2358 (83)
Total gains	353.9370	408.1048	459.1254	511.7367	547.4729	539.0911	513.8393	476.5981	436.0947	385.0328	346.0971	334.5689 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)												
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	37.4068	37.5078	37.6074	38.0822	38.1723	38.5978	38.5978	38.6776	38.4328	38.1723	37.9904	37.8020
alpha	3.4938	3.5005	3.5072	3.5388	3.5448	3.5732	3.5732	3.5785	3.5622	3.5448	3.5327	3.5201
util living area	0.9899	0.9826	0.9667	0.9266	0.8423	0.6997	0.5522	0.6055	0.8168	0.9480	0.9834	0.9917 (86)
MIT	19.1772	19.3847	19.7289	20.1841	20.5860	20.8554	20.9539	20.9356	20.7299	20.2095	19.6147	19.1429 (87)
Th 2	19.9408	19.9433	19.9458	19.9576	19.9598	19.9700	19.9700	19.9719	19.9661	19.9598	19.9553	19.9507 (88)
util rest of house	0.9877	0.9787	0.9588	0.9082	0.8011	0.6206	0.4393	0.4933	0.7543	0.9314	0.9790	0.9898 (89)
MIT 2	18.2799	18.4875	18.8292	19.2803	19.6551	19.8882	19.9530	19.9460	19.7934	19.3138	18.7264	18.2532 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	18.7143	18.9218	19.2647	19.7178	20.1058	20.3564	20.4375	20.4250	20.2468	19.7474	19.1564	18.6839 (92)
Temperature adjustment	0.0000											
adjusted MIT	18.7143	18.9218	19.2647	19.7178	20.1058	20.3564	20.4375	20.4250	20.2468	19.7474	19.1564	18.6839 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9842	0.9738	0.9526	0.9033	0.8075	0.6522	0.4926	0.5453	0.7732	0.9272	0.9747	0.9868 (94)
Useful gains	348.3388	397.4282	437.3429	462.2487	442.1043	351.5997	253.0980	259.8666	337.1975	357.0206	337.3303	330.1604 (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	1030.6374	999.8756	907.8225	759.7669	588.9686	398.8890	265.9191	278.3365	427.7695	640.9331	848.8065	1024.7894 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	507.6302	404.8446	350.0368	214.2131	109.2670	0.0000	0.0000	0.0000	0.0000	211.2309	368.2629	516.8040 (98)
Space heating	2682.2894 (98)											
Space heating per m ²	(98) / (4) = 44.0442 (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	651.3732	512.7831	525.5553	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8113	0.8739	0.8474	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	528.4664	448.1441	445.3503	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	705.3358	674.3709	632.1143	0.0000	0.0000	0.0000	0.0000 (103)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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	127.3459	168.3127	138.9524	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling Cooled fraction												434.6111 (104)
Intermittency factor (Table 10b)												fC = cooled area / (4) = 1.0000 (105)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling												108.6528 (107)
Space cooling per m2												1.7841 (108)
Energy for space heating												44.0442 (99)
Energy for space cooling												1.7841 (108)
Total												45.8283 (109)
Dwelling Fabric Energy Efficiency (DFEE)												45.8 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	60.9000 (1b)	2.3000 (2b)	140.0700 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	60.9000		140.0700 (4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	140.0700 (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				2 * 10 =	20.0000 (7a)
Number of passive vents				0 * 10 =	0.0000 (7b)
Number of flueless gas fires				0 * 40 =	0.0000 (7c)
Air changes per hour					
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				20.0000 / (5) =	0.1428 (8)
Pressure test				Yes	
Measured/design AP50					5.0000
Infiltration rate					0.3928 (18)
Number of sides sheltered					1 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.9250 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3633 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4632	0.4542	0.4451	0.3997	0.3906	0.3452	0.3452	0.3361	0.3633	0.3906	0.4087	0.4269 (22b)
Effective ac	0.6073	0.6031	0.5990	0.5799	0.5763	0.5596	0.5596	0.5565	0.5660	0.5763	0.5835	0.5911 (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			2.1200	1.0000	2.1200		(26)					
TER Opening Type (Uw = 1.40)			9.5700	1.3258	12.6875		(27)					
Brick and Block	50.9900	3.0000	47.9900	0.1800	8.6382		(29a)					
Wall to Corridor	18.1200	2.1200	16.0000	0.1800	2.8800		(29a)					
Dormers	8.0300	6.5700	1.4600	0.1800	0.2628		(29a)					
Pitched Roof	54.3200		54.3200	0.1300	7.0616		(30)					
Sloping Roof	18.1900		18.1900	0.1300	2.3647		(30)					
Total net area of external elements Aum(A, m2)			149.6500				(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	36.0148	(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.0627 (36)					
Total fabric heat loss						(33) + (36) =	44.0775 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	28.0711	27.8785	27.6898	26.8031	26.6372	25.8650	25.8650	25.7220	26.1624	26.6372	26.9728	27.3237 (38)
Average = Sum(39)m / 12 =	72.1486	71.9560	71.7673	70.8806	70.7147	69.9425	69.9425	69.7995	70.2399	70.7147	71.0503	71.4012 (39)
	70.8798 (39)											
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1847	1.1815	1.1784	1.1639	1.1612	1.1485	1.1485	1.1461	1.1534	1.1612	1.1667	1.1724 (40)
Days in month												1.1639 (40)
	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												2.0070 (42)
Average daily hot water use (litres/day)												81.8654 (43)
Daily hot water use	90.0519	86.7773	83.5027	80.2281	76.9535	73.6788	73.6788	76.9535	80.2281	83.5027	86.7773	90.0519 (44)
Energy conte	133.5444	116.7988	120.5259	105.0774	100.8243	87.0037	80.6217	92.5146	93.6195	109.1045	119.0961	129.3306 (45)
Energy content (annual)												Total = Sum(45)m = 1288.0612 (45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling												361.8661 (104)
Cooled fraction												1.0000 (105)
Intermittency factor (Table 10b)												
	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	24.9406	36.5790	28.9469	0.0000	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												90.4665 (107)
Space cooling per m2												1.4855 (108)
Energy for space heating												45.7294 (99)
Energy for space cooling												1.4855 (108)
Total												47.2149 (109)
Target Fabric Energy Efficiency (TFEE)												54.3 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	60.9000 (1b)	x 2.3000 (2b)	= 140.0700 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	60.9000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 140.0700 (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				0 * 10 =	0.0000 (7a)
Number of passive vents				0 * 10 =	0.0000 (7b)
Number of flueless gas fires				0 * 40 =	0.0000 (7c)
Air changes per hour					
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				0.0000 / (5) =	0.0000 (8)
Pressure test				Yes	
Measured/design AP50				5.0000	
Infiltration rate				0.2500	(18)
Number of sides sheltered				1	(19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.9250 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.2313 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	4.7000	4.6000	4.3000	4.3000	4.0000	4.0000	3.9000	4.0000	4.5000	4.4000	4.7000 (22)
Wind factor	1.2750	1.1750	1.1500	1.0750	1.0750	1.0000	1.0000	0.9750	1.0000	1.1250	1.1000	1.1750 (22a)
Adj infilt rate	0.2948	0.2717	0.2659	0.2486	0.2486	0.2313	0.2313	0.2255	0.2313	0.2602	0.2544	0.2717 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation:												0.5000 (23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												65.1000 (23c)
Effective ac	0.4693	0.4462	0.4404	0.4231	0.4231	0.4058	0.4058	0.4000	0.4058	0.4347	0.4289	0.4462 (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			2.1200	1.1000	2.3320		(26)
Windows (Uw = 1.20)			9.5700	1.1450	10.9580		(27)
Brick and Block	50.9900	3.0000	47.9900	0.2200	10.5578	42.2200	2026.1378 (29a)
Wall to Corridor	18.1200	2.1200	16.0000	0.2300	3.6796	113.5000	1816.0000 (29a)
Dormers	8.0300	6.5700	1.4600	0.2300	0.3358	9.1000	13.2860 (29a)
Pitched Roof	54.3200		54.3200	0.1000	5.4320	9.1000	494.3120 (30)
Sloping Roof	18.1900		18.1900	0.1700	3.0923	9.1000	165.5290 (30)
Total net area of external elements Aum(A, m2)			149.6500				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	36.3875		(33)
Party Floor 1			60.9000			70.0000	4263.0000 (32d)
Ground Floor Stud			94.4900			9.0000	850.4100 (32c)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	9628.6748 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							158.1063 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.0425 (36)
Total fabric heat loss						(33) + (36) =	43.4301 (37)

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

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	21.6945	20.6256	20.3584	19.5567	19.5567	18.7550	18.7550	18.4878	18.7550	20.0912	19.8239	20.6256 (38)
Average = Sum(39)m / 12 =	65.1246	64.0557	63.7884	62.9868	62.9868	62.1851	62.1851	61.9179	62.1851	63.5212	63.2540	64.0557 (39)
HLP	1.0694	1.0518	1.0474	1.0343	1.0343	1.0211	1.0211	1.0167	1.0211	1.0430	1.0387	1.0518 (40)
HLP (average)												1.0376 (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												2.0070 (42)
Average daily hot water use (litres/day)												81.8654 (43)
Daily hot water use	90.0519	86.7773	83.5027	80.2281	76.9535	73.6788	73.6788	76.9535	80.2281	83.5027	86.7773	90.0519 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Energy content (annual)	133.5444	116.7988	120.5259	105.0774	100.8243	87.0037	80.6217	92.5146	93.6195	109.1045	119.0961	129.3306 (45)
Distribution loss (46)m = 0.15 x (45)m	20.0317	17.5198	18.0789	15.7616	15.1236	13.0505	12.0933	13.8772	14.0429	16.3657	17.8644	19.3996 (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	1.3830	1.1656	1.1574	0.9695	0.8923	0.7372	0.6831	0.8187	0.8638	1.0477	1.1885	1.3393 (61)
Total heat required for water heating calculated for each month	134.9274	117.9644	121.6833	106.0469	101.7165	87.7409	81.3048	93.3333	94.4832	110.1522	120.2846	130.6700 (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	134.9274	117.9644	121.6833	106.0469	101.7165	87.7409	81.3048	93.3333	94.4832	110.1522	120.2846	130.6700 (64)
RHI water heating demand												1300 (64)
Heat gains from water heating, kWh/month	44.7493	39.1270	40.3642	35.1806	33.7471	29.1130	26.9775	30.9658	31.3444	36.5392	39.8966	43.3373 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	120.4178	120.4178	120.4178	120.4178	120.4178	120.4178	120.4178	120.4178	120.4178	120.4178	120.4178	120.4178 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	40.8871	36.3156	29.5338	22.3590	16.7136	14.1103	15.2467	19.8183	26.6000	33.7748	39.4202	42.0235 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	261.5088	264.2225	257.3842	242.8263	224.4495	207.1779	195.6395	192.9258	199.7641	214.3221	232.6988	249.9704 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	49.0487	49.0487	49.0487	49.0487	49.0487	49.0487	49.0487	49.0487	49.0487	49.0487	49.0487	49.0487 (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)	-80.2785	-80.2785	-80.2785	-80.2785	-80.2785	-80.2785	-80.2785	-80.2785	-80.2785	-80.2785	-80.2785	-80.2785 (71)
Water heating gains (Table 5)	60.1469	58.2247	54.2530	48.8619	45.3590	40.4347	36.2601	41.6207	43.5339	49.1118	55.4119	58.2490 (72)
Total internal gains	454.7308	450.9508	433.3590	406.2352	378.7102	353.9110	339.3343	346.5528	362.0861	389.3967	419.7190	442.4309 (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		3.0000	15.0428	0.6300	0.7000	0.7700	13.7919 (75)
Southeast		4.8900	46.3896	0.6300	0.7000	0.7700	69.3268 (77)
Northwest		1.6800	15.0428	0.6300	0.7000	0.7700	7.7234 (81)
Solar gains	90.8421	138.5422	205.2417	287.3951	332.0749	368.3469	341.9412
Total gains	545.5729	589.4930	638.6006	693.6303	710.7850	722.2579	681.2755

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	41.0695	41.7548	41.9297	42.4634	42.4634	43.0108	43.0108	43.1965	43.0108	42.1061	42.2840	41.7548
alpha	3.7380	3.7837	3.7953	3.8309	3.8309	3.8674	3.8674	3.8798	3.8674	3.8071	3.8189	3.7837
util living area	0.9522	0.9362	0.8947	0.8065	0.6635	0.4668	0.3343	0.3496	0.5744	0.8111	0.9184	0.9578 (86)
MIT	19.8980	20.0451	20.3246	20.6446	20.8713	20.9752	20.9948	20.9941	20.9459	20.7020	20.3034	19.8877 (87)
Th 2	20.0259	20.0404	20.0440	20.0549	20.0549	20.0658	20.0658	20.0694	20.0658	20.0476	20.0512	20.0404 (88)
util rest of house	0.9427	0.9240	0.8749	0.7719	0.6077	0.3946	0.2515	0.2636	0.4979	0.7677	0.9003	0.9493 (89)
MIT 2	19.0532	19.2066	19.4764	19.7791	19.9706	20.0542	20.0644	20.0678	20.0378	19.8309	19.4676	19.0554 (90)
Living area fraction									fLA = Living area / (4) =			0.4841 (91)
MIT	19.4621	19.6125	19.8870	20.1981	20.4066	20.5000	20.5148	20.5162	20.4774	20.2526	19.8722	19.4583 (92)
Temperature adjustment												0.0000
adjusted MIT	19.4621	19.6125	19.8870	20.1981	20.4066	20.5000	20.5148	20.5162	20.4774	20.2526	19.8722	19.4583 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	510.7624	540.9981	556.3633	539.3168	447.2772	309.6313	198.6761	197.7142	323.6439	432.5706	474.0851	486.4931 (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	915.7915	891.1754	802.9050	667.5370	491.7110	317.1437	199.9114	199.1383	340.6100	536.9189	725.6615	894.1068 (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	301.3416	235.3192	183.4270	92.3185	33.0588	0.0000	0.0000	0.0000	0.0000	77.6352	181.1350	303.2646 (98)
Space heating												1407.4999 (98)
RHI space heating demand												1407 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	60.9000 (1b)	x 2.3000 (2b)	= 140.0700 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	60.9000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 140.0700 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ 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				0 * 10 =	0.0000 (7a)							
Number of passive vents				0 * 10 =	0.0000 (7b)							
Number of flueless gas fires				0 * 40 =	0.0000 (7c)							
Air changes per hour												
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				0.0000 / (5) =	0.0000 (8)							
Pressure test				Yes								
Measured/design AP50				5.0000								
Infiltration rate				0.2500	(18)							
Number of sides sheltered				1	(19)							
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.9250 (20)							
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.2313 (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	0.2948	0.2891	0.2833	0.2544	0.2486	0.2197	0.2197	0.2139	0.2313	0.2486	0.2602	0.2717 (22b)
Balanced mechanical ventilation with heat recovery												0.5000 (23a)
If mechanical ventilation:												65.1000 (23c)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												
Effective ac	0.4693	0.4636	0.4578	0.4289	0.4231	0.3942	0.3942	0.3884	0.4058	0.4231	0.4347	0.4462 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			2.1200	1.1000	2.3320		(26)
Windows (Uw = 1.20)			9.5700	1.1450	10.9580		(27)
Brick and Block	50.9900	3.0000	47.9900	0.2200	10.5578	42.2200	2026.1378 (29a)
Wall to Corridor	18.1200	2.1200	16.0000	0.2300	3.6796	113.5000	1816.0000 (29a)
Dormers	8.0300	6.5700	1.4600	0.2300	0.3358	9.1000	13.2860 (29a)
Pitched Roof	54.3200		54.3200	0.1000	5.4320	9.1000	494.3120 (30)
Sloping Roof	18.1900		18.1900	0.1700	3.0923	9.1000	165.5290 (30)
Total net area of external elements Aum(A, m ²)			149.6500				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	36.3875		(33)
Party Floor 1			60.9000			70.0000	4263.0000 (32d)
Ground Floor Stud			94.4900			9.0000	850.4100 (32c)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	9628.6748 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							158.1063 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.0425 (36)
Total fabric heat loss						(33) + (36) =	43.4301 (37)

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

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	21.6945	21.4273	21.1601	19.8239	19.5567	18.2206	18.2206	17.9533	18.7550	19.5567	20.0912	20.6256 (38)
Average = Sum(39)m / 12 =	65.1246	64.8574	64.5901	63.2540	62.9868	61.6506	61.6506	61.3834	62.1851	62.9868	63.5212	64.0557 (39)
HLP	1.0694	1.0650	1.0606	1.0387	1.0343	1.0123	1.0123	1.0079	1.0211	1.0343	1.0430	1.0518 (40)
HLP (average)												1.0376 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.0070 (42)											
Average daily hot water use (litres/day)	81.8654 (43)											
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	90.0519	86.7773	83.5027	80.2281	76.9535	73.6788	73.6788	76.9535	80.2281	83.5027	86.7773	90.0519 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Energy conte	133.5444	116.7988	120.5259	105.0774	100.8243	87.0037	80.6217	92.5146	93.6195	109.1045	119.0961	129.3306 (45)
Energy content (annual)												Total = Sum(45)m = 1288.0612 (45)
Distribution loss (46)m = 0.15 x (45)m	20.0317	17.5198	18.0789	15.7616	15.1236	13.0505	12.0933	13.8772	14.0429	16.3657	17.8644	19.3996 (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	1.3830	1.1656	1.1574	0.9695	0.8923	0.7372	0.6831	0.8187	0.8638	1.0477	1.1885	1.3393 (61)
Total heat required for water heating calculated for each month	134.9274	117.9644	121.6833	106.0469	101.7165	87.7409	81.3048	93.3333	94.4832	110.1522	120.2846	130.6700 (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	134.9274	117.9644	121.6833	106.0469	101.7165	87.7409	81.3048	93.3333	94.4832	110.1522	120.2846	130.6700 (64)
Heat gains from water heating, kWh/month	44.7493	39.1270	40.3642	35.1806	33.7471	29.1130	26.9775	30.9658	31.3444	36.5392	39.8966	43.3373 (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	120.4178	120.4178	120.4178	120.4178	120.4178	120.4178	120.4178	120.4178	120.4178	120.4178	120.4178	120.4178 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	40.8871	36.3156	29.5338	22.3590	16.7136	14.1103	15.2467	19.8183	26.6000	33.7748	39.4202	42.0235 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	261.5088	264.2225	257.3842	242.8263	224.4495	207.1779	195.6395	192.9258	199.7641	214.3221	232.6988	249.9704 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	49.0487	49.0487	49.0487	49.0487	49.0487	49.0487	49.0487	49.0487	49.0487	49.0487	49.0487	49.0487 (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)	-80.2785	-80.2785	-80.2785	-80.2785	-80.2785	-80.2785	-80.2785	-80.2785	-80.2785	-80.2785	-80.2785	-80.2785 (71)
Water heating gains (Table 5)	60.1469	58.2247	54.2530	48.8619	45.3590	40.4347	36.2601	41.6207	43.5339	49.1118	55.4119	58.2490 (72)
Total internal gains	454.7308	450.9508	433.3590	406.2352	378.7102	353.9110	339.3343	346.5528	362.0861	389.3967	419.7190	442.4309 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	FF	Access factor Table 6d	Gains W					
Northeast	3.0000	11.2829	0.6300	0.7000	0.7700	10.3446 (75)						
Southeast	4.8900	36.7938	0.6300	0.7000	0.7700	54.9865 (77)						
Northwest	1.6800	11.2829	0.6300	0.7000	0.7700	5.7930 (81)						
Solar gains	71.1241	126.5109	187.3356	255.9827	308.5046	315.8551	300.5307	259.8821	210.8775	143.6604	86.1664	60.2358 (83)
Total gains	525.8549	577.4617	620.6946	662.2179	687.2148	669.7662	639.8650	606.4349	572.9636	533.0571	505.8854	502.6667 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	41.0695	41.2387	41.4093	42.2840	42.4634	43.3837	43.3837	43.5726	43.0108	42.4634	42.1061	41.7548
alpha	3.7380	3.7492	3.7606	3.8189	3.8309	3.8922	3.8922	3.9048	3.8674	3.8309	3.8071	3.7837
util living area	0.9647	0.9484	0.9164	0.8456	0.7255	0.5557	0.4152	0.4527	0.6675	0.8659	0.9450	0.9693 (86)
MIT	19.7119	19.8965	20.1818	20.5404	20.8046	20.9496	20.9873	20.9824	20.8952	20.5665	20.0950	19.6867 (87)
Th 2	20.0259	20.0295	20.0331	20.0512	20.0549	20.0731	20.0731	20.0767	20.0658	20.0549	20.0476	20.0404 (88)
util rest of house	0.9579	0.9387	0.9005	0.8167	0.6767	0.4858	0.3315	0.3672	0.5992	0.8345	0.9330	0.9633 (89)
MIT 2	18.8708	19.0535	19.3319	19.6831	19.9178	20.0460	20.0685	20.0699	20.0035	19.7172	19.2643	18.8575 (90)
Living area fraction												fLA = Living area / (4) = 0.4841 (91)
MIT	19.2779	19.4616	19.7433	20.0981	20.3471	20.4834	20.5133	20.5116	20.4352	20.1283	19.6664	19.2589 (92)
Temperature adjustment												0.0000
adjusted MIT	19.2779	19.4616	19.7433	20.0981	20.3471	20.4834	20.5133	20.5116	20.4352	20.1283	19.6664	19.2589 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9516	0.9320	0.8951	0.8183	0.6926	0.5175	0.3717	0.4081	0.6274	0.8372	0.9274	0.9575 (94)
Useful gains	500.4243	538.1852	555.5645	541.8766	475.9334	346.6352	237.8542	247.5142	359.4752	446.2714	469.1456	481.2808 (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	975.4322	944.4255	855.3884	708.3237	544.6501	362.7155	241.2570	252.3854	393.9523	600.1594	798.2335	964.6089 (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	353.4059	272.9935	223.0689	119.8419	51.1252	0.0000	0.0000	0.0000	0.0000	114.4927	236.9433	359.5961 (98)
Space heating												1731.4675 (98)
Space heating per m2												(98) / (4) = 28.4313 (99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

8c. Space cooling requirement

Not applicable

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

	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 %)													90.2000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													1919.5871 (211)
Space heating requirement	353.4059	272.9935	223.0689	119.8419	51.1252	0.0000	0.0000	0.0000	0.0000	114.4927	236.9433	359.5961	(98)
Space heating efficiency (main heating system 1)	90.2000	90.2000	90.2000	90.2000	90.2000	0.0000	0.0000	0.0000	0.0000	90.2000	90.2000	90.2000	(210)
Space heating fuel (main heating system)	391.8025	302.6535	247.3048	132.8624	56.6798	0.0000	0.0000	0.0000	0.0000	126.9320	262.6866	398.6653	(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	134.9274	117.9644	121.6833	106.0469	101.7165	87.7409	81.3048	93.3333	94.4832	110.1522	120.2846	130.6700	(64)
Efficiency of water heater (217)m	85.8423	85.4623	84.7069	83.0377	80.3728	76.2000	76.2000	76.2000	76.2000	82.7456	84.9450	76.2000	(216)
Fuel for water heating, kWh/month	157.1805	138.0309	143.6521	127.7093	126.5559	115.1455	106.6992	122.4846	123.9937	133.1216	141.6029	151.9608	(219)
Water heating fuel used													1588.1371 (219)
Annual totals kWh/year													
Space heating fuel - main system													1919.5871 (211)
Space heating fuel - secondary													0.0000 (215)
Electricity for pumps and fans: (BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.8120)													
mechanical ventilation fans (SFP = 0.8120)													138.7589 (230a)
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													213.7589 (231)
Electricity for lighting (calculated in Appendix L)													288.8317 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
Total delivered energy for all uses													4010.3149 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1919.5871	3.4800	66.8016	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1588.1371	3.4800	55.2672	(247)
Mechanical ventilation fans	138.7589	13.1900	18.3023	(249)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	288.8317	13.1900	38.0969	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	0.0000	13.1900	0.0000	(252)
Total energy cost			308.3605	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	1.2230	(257)
SAP value		82.9397	
SAP rating (Section 12)		83	(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	1919.5871	0.2160	414.6308	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1588.1371	0.2160	343.0376	(264)
Space and water heating			757.6684	(265)
Pumps and fans	213.7589	0.5190	110.9409	(267)
Energy for lighting	288.8317	0.5190	149.9037	(268)
Energy saving/generation technologies				
PV Unit	-420.0000	0.5190	-217.9800	(269)
Total kg/year			800.5330	(272)
CO2 emissions per m2			13.1500	(273)
EI value			89.8705	
EI rating			90	(274)
EI band			B	

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Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Calculation of stars for heating and DHW

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9020 = 3.858$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9020 = 0.2395$, stars = 4
Water heating energy efficiency	$3.48 / 0.8149 = 4.270$, stars = 4
Water heating environmental impact	$0.216 / 0.8149 = 0.2651$, 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	60.9000 (1b)	x 2.3000 (2b)	= 140.0700 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	60.9000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 140.0700 (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				0 * 10 =	0.0000 (7a)
Number of passive vents				0 * 10 =	0.0000 (7b)
Number of flueless gas fires				0 * 40 =	0.0000 (7c)
Air changes per hour					
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				0.0000 / (5) =	0.0000 (8)
Pressure test				Yes	
Measured/design AP50					5.0000
Infiltration rate					0.2500 (18)
Number of sides sheltered					1 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.9250 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.2313 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	4.7000	4.6000	4.3000	4.3000	4.0000	4.0000	3.9000	4.0000	4.5000	4.4000	4.7000 (22)
Wind factor	1.2750	1.1750	1.1500	1.0750	1.0750	1.0000	1.0000	0.9750	1.0000	1.1250	1.1000	1.1750 (22a)
Adj infilt rate	0.2948	0.2717	0.2659	0.2486	0.2486	0.2313	0.2313	0.2255	0.2313	0.2602	0.2544	0.2717 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation:												0.5000 (23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												65.1000 (23c)
Effective ac	0.4693	0.4462	0.4404	0.4231	0.4231	0.4058	0.4058	0.4000	0.4058	0.4347	0.4289	0.4462 (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			2.1200	1.1000	2.3320		(26)
Windows (Uw = 1.20)			9.5700	1.1450	10.9580		(27)
Brick and Block	50.9900	3.0000	47.9900	0.2200	10.5578	42.2200	2026.1378 (29a)
Wall to Corridor	18.1200	2.1200	16.0000	0.2300	3.6796	113.5000	1816.0000 (29a)
Dormers	8.0300	6.5700	1.4600	0.2300	0.3358	9.1000	13.2860 (29a)
Pitched Roof	54.3200		54.3200	0.1000	5.4320	9.1000	494.3120 (30)
Sloping Roof	18.1900		18.1900	0.1700	3.0923	9.1000	165.5290 (30)
Total net area of external elements Aum(A, m2)			149.6500				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	36.3875		(33)
Party Floor 1			60.9000			70.0000	4263.0000 (32d)
Ground Floor Stud			94.4900			9.0000	850.4100 (32c)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	9628.6748 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							158.1063 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.0425 (36)
Total fabric heat loss						(33) + (36) =	43.4301 (37)

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

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	21.6945	20.6256	20.3584	19.5567	19.5567	18.7550	18.7550	18.4878	18.7550	20.0912	19.8239	20.6256 (38)
Average = Sum(39)m / 12 =	65.1246	64.0557	63.7884	62.9868	62.9868	62.1851	62.1851	61.9179	62.1851	63.5212	63.2540	64.0557 (39)
HLP	1.0694	1.0518	1.0474	1.0343	1.0343	1.0211	1.0211	1.0167	1.0211	1.0430	1.0387	1.0518 (40)
HLP (average)												1.0376 (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												2.0070 (42)
Average daily hot water use (litres/day)												81.8654 (43)
Daily hot water use	90.0519	86.7773	83.5027	80.2281	76.9535	73.6788	73.6788	76.9535	80.2281	83.5027	86.7773	90.0519 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Energy conte	133.5444	116.7988	120.5259	105.0774	100.8243	87.0037	80.6217	92.5146	93.6195	109.1045	119.0961	129.3306 (45)
Energy content (annual)	Total = Sum(45)m = 1288.0612 (45)											
Distribution loss (46)m = 0.15 x (45)m	20.0317	17.5198	18.0789	15.7616	15.1236	13.0505	12.0933	13.8772	14.0429	16.3657	17.8644	19.3996 (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	1.3830	1.1656	1.1574	0.9695	0.8923	0.7372	0.6831	0.8187	0.8638	1.0477	1.1885	1.3393 (61)
Total heat required for water heating calculated for each month	134.9274	117.9644	121.6833	106.0469	101.7165	87.7409	81.3048	93.3333	94.4832	110.1522	120.2846	130.6700 (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	134.9274	117.9644	121.6833	106.0469	101.7165	87.7409	81.3048	93.3333	94.4832	110.1522	120.2846	130.6700 (64)
Heat gains from water heating, kWh/month	44.7493	39.1270	40.3642	35.1806	33.7471	29.1130	26.9775	30.9658	31.3444	36.5392	39.8966	43.3373 (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	120.4178	120.4178	120.4178	120.4178	120.4178	120.4178	120.4178	120.4178	120.4178	120.4178	120.4178	120.4178 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	40.8871	36.3156	29.5338	22.3590	16.7136	14.1103	15.2467	19.8183	26.6000	33.7748	39.4202	42.0235 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	261.5088	264.2225	257.3842	242.8263	224.4495	207.1779	195.6395	192.9258	199.7641	214.3221	232.6988	249.9704 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	49.0487	49.0487	49.0487	49.0487	49.0487	49.0487	49.0487	49.0487	49.0487	49.0487	49.0487	49.0487 (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)	-80.2785	-80.2785	-80.2785	-80.2785	-80.2785	-80.2785	-80.2785	-80.2785	-80.2785	-80.2785	-80.2785	-80.2785 (71)
Water heating gains (Table 5)	60.1469	58.2247	54.2530	48.8619	45.3590	40.4347	36.2601	41.6207	43.5339	49.1118	55.4119	58.2490 (72)
Total internal gains	454.7308	450.9508	433.3590	406.2352	378.7102	353.9110	339.3343	346.5528	362.0861	389.3967	419.7190	442.4309 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data FF or Table 6c	Access factor Table 6d	Gains W						
Northeast	3.0000	15.0428	0.6300	0.7000	0.7700	13.7919 (75)						
Southeast	4.8900	46.3896	0.6300	0.7000	0.7700	69.3268 (77)						
Northwest	1.6800	15.0428	0.6300	0.7000	0.7700	7.7234 (81)						
Solar gains	90.8421	138.5422	205.2417	287.3951	332.0749	368.3469	341.9412	301.2136	245.6177	166.7240	109.1407	73.4086 (83)
Total gains	545.5729	589.4930	638.6006	693.6303	710.7850	722.2579	681.2755	647.7664	607.7038	556.1207	528.8597	515.8395 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	41.0695	41.7548	41.9297	42.4634	42.4634	43.0108	43.0108	43.1965	43.0108	42.1061	42.2840	41.7548
alpha	3.7380	3.7837	3.7953	3.8309	3.8309	3.8674	3.8674	3.8798	3.8674	3.8071	3.8189	3.7837
util living area	0.9522	0.9362	0.8947	0.8065	0.6635	0.4668	0.3343	0.3496	0.5744	0.8111	0.9184	0.9578 (86)
MIT	19.8980	20.0451	20.3246	20.6446	20.8713	20.9752	20.9948	20.9941	20.9459	20.7020	20.3034	19.8877 (87)
Th 2	20.0259	20.0404	20.0440	20.0549	20.0549	20.0658	20.0658	20.0694	20.0658	20.0476	20.0512	20.0404 (88)
util rest of house	0.9427	0.9240	0.8749	0.7719	0.6077	0.3946	0.2515	0.2636	0.4979	0.7677	0.9003	0.9493 (89)
MIT 2	19.0532	19.2066	19.4764	19.7791	19.9706	20.0542	20.0644	20.0678	20.0378	19.8309	19.4676	19.0554 (90)
Living area fraction	fLA = Living area / (4) = 0.4841 (91)											
MIT	19.4621	19.6125	19.8870	20.1981	20.4066	20.5000	20.5148	20.5162	20.4774	20.2526	19.8722	19.4583 (92)
Temperature adjustment	0.0000											
adjusted MIT	19.4621	19.6125	19.8870	20.1981	20.4066	20.5000	20.5148	20.5162	20.4774	20.2526	19.8722	19.4583 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9362	0.9177	0.8712	0.7775	0.6293	0.4287	0.2916	0.3052	0.5326	0.7778	0.8964	0.9431 (94)
Useful gains	510.7624	540.9981	556.3633	539.3168	447.2772	309.6313	198.6761	197.7142	323.6439	432.5706	474.0851	486.4931 (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	915.7915	891.1754	802.9050	667.5370	491.7110	317.1437	199.9114	199.1383	340.6100	536.9189	725.6615	894.1068 (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	301.3416	235.3192	183.4270	92.3185	33.0588	0.0000	0.0000	0.0000	0.0000	77.6352	181.1350	303.2646 (98)
Space heating	1407.4999 (98)											
Space heating per m2	(98) / (4) = 23.1117 (99)											

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8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)
 Fraction of space heat from main system(s) 1.0000 (202)
 Efficiency of main space heating system 1 (in %) 90.2000 (206)
 Efficiency of secondary/supplementary heating system, % 0.0000 (208)
 Space heating requirement 1560.4212 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	301.3416	235.3192	183.4270	92.3185	33.0588	0.0000	0.0000	0.0000	0.0000	77.6352	181.1350	303.2646	(98)
Space heating efficiency (main heating system 1)	90.2000	90.2000	90.2000	90.2000	90.2000	0.0000	0.0000	0.0000	0.0000	90.2000	90.2000	90.2000	(210)
Space heating fuel (main heating system)	334.0816	260.8860	203.3559	102.3487	36.6505	0.0000	0.0000	0.0000	0.0000	86.0700	200.8149	336.2136	(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	134.9274	117.9644	121.6833	106.0469	101.7165	87.7409	81.3048	93.3333	94.4832	110.1522	120.2846	130.6700	(64)
Efficiency of water heater (217)m	85.3502	84.9863	84.0420	82.1328	79.2159	76.2000	76.2000	76.2000	76.2000	81.4248	84.0385	76.2000	(216)
Fuel for water heating, kWh/month	158.0868	138.8040	144.7887	129.1163	128.4042	115.1455	106.6992	122.4846	123.9937	135.2809	143.1304	152.8817	(219)
Water heating fuel used												1598.8161	(219)
Annual totals kWh/year													
Space heating fuel - main system													1560.4212 (211)
Space heating fuel - secondary													0.0000 (215)

Electricity for pumps and fans:

(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.8120)
 mechanical ventilation fans (SFP = 0.8120) 138.7589 (230a)
 central heating pump 30.0000 (230c)
 main heating flue fan 45.0000 (230e)
 Total electricity for the above, kWh/year 213.7589 (231)
 Electricity for lighting (calculated in Appendix L) 288.8317 (232)

Energy saving/generation technologies (Appendices M ,N and Q)
 Total delivered energy for all uses 3661.8280 (238)

10a. Fuel costs - using BEDF prices (536)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1560.4212	7.6100	118.7481	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1598.8161	7.6100	121.6699	(247)
Mechanical ventilation fans	138.7589	31.0800	43.1263	(249)
Pumps and fans for heating	75.0000	31.0800	23.3100	(249)
Energy for lighting	288.8317	31.0800	89.7689	(250)
Additional standing charges			105.0000	(251)
Energy saving/generation technologies				
PV Unit	0.0000	31.0800	0.0000	(252)
Total energy cost			501.6231	(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	1560.4212	0.2160	337.0510	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1598.8161	0.2160	345.3443	(264)
Space and water heating			682.3953	(265)
Pumps and fans	213.7589	0.5190	110.9409	(267)
Energy for lighting	288.8317	0.5190	149.9037	(268)
Energy saving/generation technologies				
PV Unit	-420.0000	0.5190	-217.9800	(269)
Total kg/year			725.2598	(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	1560.4212	1.2200	1903.7139	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1598.8161	1.2200	1950.5556	(264)
Space and water heating			3854.2695	(265)
Pumps and fans	213.7589	3.0700	656.2400	(267)
Energy for lighting	288.8317	3.0700	886.7135	(268)
Energy saving/generation technologies				
PV Unit	-420.0000	3.0700	-1289.4000	(269)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Primary energy kWh/year
Primary energy kWh/m²/year

4107.8229 (272)
67.4519 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 83
Current environmental impact rating: B 90

(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	Not applicable
O	Not considered
P	Not considered
R	Not considered
S	Not considered
T	Not considered
U Solar photovoltaic panels	Not applicable
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
(none)

Recommended measures (none)	Typical annual savings	Energy efficiency	Environmental impact
	Total Savings £0		0.00 kg/m ²

Potential energy efficiency rating: B 83
Potential environmental impact rating: B 90

Fuel prices for cost data on this page from database revision number 536 TEST (31 Jan 2024)
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	£156	£156	£0
Mains gas	£345	£345	£0
Space heating	£290	£290	£0
Water heating	£122	£122	£0
Lighting	£90	£90	£0
Total cost of fuels	£501	£501	£0
Total cost of uses	£502	£502	£0
Delivered energy	60 kWh/m ²	60 kWh/m ²	0 kWh/m ²
Carbon dioxide emissions	0.7 tonnes	0.7 tonnes	0.0 tonnes
CO2 emissions per m ²	12 kg/m ²	12 kg/m ²	0 kg/m ²
Primary energy	67 kWh/m ²	67 kWh/m ²	0 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

No improvements selected / applicable

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

No improvements selected / applicable

U-VALUE CALCULATOR REPORT

Property Reference	SAP 0931 Plot 29		Issued on Date	08/02/2024
Assessment Reference	Rev B	Prop Type Ref	Block Ev	
Project	Plot 29			
Calculation Type	New Build (As Designed)			

SAP Rating	83 B	DER	14.99	TER	20.24
Environmental	90 B	% DER<TER	25.93		
CO ₂ Emissions (t/year)	0.73	DFEE	45.83	TFEE	54.30
General Requirements Compliance	Pass	% DFEE<TFEE	15.60		

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 000006 - Mineral Wool between and above

Roof Type: Pitched Roof, insulated flat ceiling

Layer	Description	Thickness (mm)	Conductivity (W/m ² K)	Resistance (m ² K/W)	Fraction (%)	Density (kg/m ³)	Heat Cap. (J/kgK)
Ext surface				0.0400			
Layer 1	Mineral wool batt						
	Main construction	350	0.0380	9.2105	100.00		
	Corrections - Air Gap: Level 1, Fasteners: None or plastic						
Layer 2	Mineral wool batt						
	Main construction	100	0.0380	2.6316	87.50		
	Main construction	100	0.1300	0.7692	12.50		
	Corrections - Air Gap: Level 1, Fasteners: None or plastic						
Layer 3	Plasterboard, standard						
	Main construction	12.5	0.2100	0.0595	100.00	700	1000
Int surface				0.1000			

Total resistance: Upper limit = 11.772 m² K/W Lower limit = 11.430 m² K/W Average = 11.601 m² K/W
 Total correction = 0.0096 m² K/W U-value (unrounded) = 0.1 W/m² K

Unheated space: None

Total thickness: 463 mm

U-value: 0.10 W/m² K

Kappa: 9.10 kJ/m² K

U-VALUE CALCULATOR REPORT

Property Reference	SAP 0931 Plot 29	Issued on Date	08/02/2024
Assessment Reference	Rev B	Prop Type Ref	Block Ev
Project	Plot 29		
Calculation Type	New Build (As Designed)		

SAP Rating	83 B	DER	14.99	TER	20.24
Environmental	90 B	% DER<TER	25.93		
CO ₂ Emissions (t/year)	0.73	DFEE	45.83	TFEE	54.30
General Requirements Compliance	Pass	% DFEE<TFEE	15.60		

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

Roof 000007 - Insulation between and below

Roof Type: Pitched Roof, insulated sloping 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	Tiling						
	Main construction	30	1.5000	0.0200	100.00		
Layer 2	airspace/timber battens						
	Main construction	25	0.2500	0.1000	91.59		
	Main construction	25	0.1563	0.1600	8.41		
	Corrections - Cavity Unventilated, Emissivity: Normal						
Layer 3	Breather membrane						
	Main construction	1	0.0000	0.0000	100.00		
Layer 4	Standard cavity						
	Main construction	50	0.2948	0.1696	87.50		
	Main construction	50	0.1300	0.3846	12.50		
	Corrections - Cavity Unventilated, Emissivity: Low Emissivity (BR443)						
Layer 5	Celotex GA4000						
	Main construction	100	0.0220	4.5455	87.50		
	Main construction	100	0.1300	0.7692	12.50		
	Corrections - Air Gap: Level 1, Fasteners: None or plastic						
Layer 6	Celotex GA4000						
	Main construction	50	0.0220	2.2727	100.00		
	Corrections - Air Gap: Level 1, Fasteners: None or plastic						
Layer 7	Plasterboard, standard						
	Main construction	12.5	0.2100	0.0595	100.00	700	1000
Int surface				0.1000			

Total resistance: Upper limit = 6.480 m² K/W Lower limit = 5.595 m² K/W Average = 6.037 m² K/W
 Total correction = 0.0036 m² K/W U-value (unrounded) = 0.17 W/m² K

Unheated space: None

Total thickness: 269 mm

U-value: 0.17 W/m² K

Kappa: 9.10 kJ/m² K

U-VALUE CALCULATOR REPORT

Property Reference	SAP 0931 Plot 29	Issued on Date	08/02/2024
Assessment Reference	Rev B	Prop Type Ref	Block Ev
Project	Plot 29		
Calculation Type	New Build (As Designed)		

SAP Rating	83 B	DER	14.99	TER	20.24
Environmental	90 B	% DER<TER	25.93		
CO ₂ Emissions (t/year)	0.73	DFEE	45.83	TFEE	54.30
General Requirements Compliance	Pass	% DFEE<TFEE	15.60		

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	140	0.1100	1.2727	94.04	460	1000
	Main construction	140	0.8803	0.1590	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 = 4.657 m ² K/W	Lower limit = 4.366 m ² K/W	Average = 4.511 m ² K/W
	Total correction = 0.0004 m ² K/W	U-value (unrounded) = 0.22 W/m ² K	

Unheated space:	None	
Total thickness: 370 mm	U-value: 0.22 W/m² K	Kappa: 42.22 kJ/m² K

U-VALUE CALCULATOR REPORT

Property Reference	SAP 0931 Plot 29	Issued on Date	08/02/2024
Assessment Reference	Rev B	Prop Type Ref	Block Ev
Project	Plot 29		
Calculation Type	New Build (As Designed)		

SAP Rating	83 B	DER	14.99	TER	20.24
Environmental	90 B	% DER<TER	25.93		
CO ₂ Emissions (t/year)	0.73	DFEE	45.83	TFEE	54.30
General Requirements Compliance	Pass	% DFEE<TFEE	15.60		

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 Wall to Corridor

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	Plasterboard, standard						
	Main construction	12.5	0.2100	0.0595	100.00		
Layer 2	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 3	Masterblock Masterlite Pro						
	Main construction	100	0.5700	0.1754	100.00	1450	1000
Layer 4	Supafil 40						
	Main construction	100	0.0400	2.5000	100.00		
	Corrections - Air Gap: Level 1, Fasteners: None or plastic						
Layer 5	Masterblock Masterlite Pro						
	Main construction	100	0.5700	0.1754	100.00	1450	1000
Layer 6	airspace/plaster dabs						
	Main construction	15	0.0882	0.1700	80.00		
	Main construction	15	0.0882	0.1700	20.00		
	Corrections - Cavity Unventilated, Emissivity: Normal						
Layer 7	Plasterboard, standard						
	Main construction	12.5	0.2100	0.0595	100.00	700	1000
Int surface				0.1300			

Total resistance: Upper limit = 3.480 m² K/W Lower limit = 3.480 m² K/W Average = 3.480 m² K/W
 Total correction = 0.0052 m² K/W U-value (unrounded) = 0.29 W/m² K

Unheated space:	None
Total thickness: 355 mm	U-value: 0.29 W/m² K
	Kappa: 113.50 kJ/m² K

U-VALUE CALCULATOR REPORT

Property Reference	SAP 0931 Plot 29	Issued on Date	08/02/2024
Assessment Reference	Rev B	Prop Type Ref	Block Ev
Project	Plot 29		
Calculation Type	New Build (As Designed)		

SAP Rating	83 B	DER	14.99	TER	20.24
Environmental	90 B	% DER<TER	25.93		
CO ₂ Emissions (t/year)	0.73	DFEE	45.83	TFEE	54.30
General Requirements Compliance	Pass	% DFEE<TFEE	15.60		

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 000008

Wall Type: Standard Wall

Layer	Description	Thickness (mm)	Conductivity (W/m ² K)	Resistance (m ² K/W)	Fraction (%)
Ext surface				0.0400	
Layer 1	Code 5 Lead				
	Main construction	2	35.0000	0.0001	100.00
Layer 2	Breather membrane				
	Main construction	0.5	0.0000	0.0000	100.00
Layer 3	Orientated Strand Board				
	Main construction	9	0.1300	0.0692	100.00
Layer 4	Celotex GA4000				
	Main construction	100	0.0220	4.5455	87.50
	Main construction	100	0.1300	0.7692	12.50
	Corrections - Air Gap: Level 1, Fasteners: None or plastic				
Layer 5	Celotex TB4000				
	Main construction	20	0.0220	0.9091	100.00
	Corrections - Air Gap: Level 1, Fasteners: None or plastic				
Layer 6	Plasterboard, standard				
	Main construction	12.5	0.2100	0.0595	100.00
Int surface				0.1300	

Total resistance: Upper limit = 4.645 m² K/W Lower limit = 4.025 m² K/W Average = 4.335 m² K/W
 Total correction = 0.0047 m² K/W U-value (unrounded) = 0.23 W/m² K

Unheated space:	None
Total thickness: 144 mm	U-value: 0.23 W/m² K
	Kappa: n/a

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

Property Reference	SAP 0931 Plot 29	Issued on Date	08/02/2024
Assessment Reference	Rev B	Prop Type Ref	Block Ev
Property	Plot 29		

SAP Rating	83 B	DER	14.99	TER	20.24
Environmental	90 B	% DER<TER	25.93		
CO ₂ Emissions (t/year)	0.73	DFEE	45.83	TFEE	54.30
General Requirements Compliance	Pass	% DFEE<TFEE	15.60		

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 West
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Suburban
1.0 Property Type	Flat, Detached
2.0 Number of Storeys	1
3.0 Date Built	2023
4.0 Sheltered Sides	1
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements		Heat Loss Perimeter	Internal Floor Area	Average Storey Height
	Ground Floor:	33.54 m	60.90 m ²	2.30 m

7.0 Living Area	29.48	m ²
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8.0 Thermal Mass Parameter	Precise calculation	
Thermal Mass	158.11	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	0.22	42.22	50.99	47.99
	Wall to Corridor	Cavity Wall	Other	0.29	113.50	18.12	16.00
	Dormers	Timber Frame	Other	0.23	9.10	8.03	1.46

9.1 Party Walls	Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Area (m ²)
			Single plasterboard on dabs both sides, lightweight aggregate blocks, cavity or cavity fill		110.00	

9.2 Internal Walls	Description	Construction	Kappa (kJ/m ² K)	Area (m ²)
	Ground Floor Stud	Plasterboard on timber frame	9.00	94.49

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)
	Pitched Roof	External Plane Roof	Other	0.10	9.10	54.32	54.32
	Sloping Roof	External Slope Roof	Other	0.17	9.10	18.19	18.19

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

11.1 Party Floors

Description	Construction	Kappa (kJ/m ² K)	Area (m ²)
Party Floor 1	Precast concrete plank floor (screed laid on rubber), carpeted	70.00	60.90

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	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	[2] Wall to Corridor	North West							2.12	
Windows	Window	[3] Dormers	South East	None	0.00					4.89	
Side Elevation	Window	[3] Dormers	North West	None	0.00					1.68	
North Elevation	Window	[1] Brick and Block	North East	None	0.00					3.00	

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)	3.51	0.043	No	Catnic Thermally Broken
Independently assessed	E3 Sill	7.36	0.021	No	Knauf P5
Independently assessed	E4 Jamb	13.62	0.016	No	Knauf P6
Table K1 - Approved	E7 Party floor between dwellings (in blocks of flats)	33.54	0.070	No	
Table K1 - Approved	E10 Eaves (insulation at ceiling level)	3.96	0.060	No	
Independently assessed	E12 Gable (insulation at ceiling level)	18.45	0.087	No	Knauf P21
Independently assessed	E13 Gable (insulation at rafter level)	5.04	0.008	No	Knauf P20
Independently assessed	E16 Corner (normal)	11.94	0.061	No	Knauf P23
Independently assessed	E17 Corner (inverted – internal area greater than external area)	4.70	-0.113	No	Knauf P24
Table K1 - Default	R1 Head of roof window	4.39	0.080	No	
Table K1 - Default	R3 Jamb of roof window	3.48	0.080	No	
Table K1 - Default	R6 Flat ceiling	16.07	0.060	No	
Table K1 - Default	R8 Roof to wall (rafter)	5.04	0.060	No	
Table K1 - Default	R9 Roof to wall (flat ceiling)	4.87	0.040	No	

Y-value W/m²K

18.0 Pressure Testing

Designed AP₅₀ m³/(h.m²) @ 50 Pa

Property Tested ?

As Built AP₅₀ m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather

Cross ventilation possible

Night Ventilation

Air change rate

Mechanical Ventilation

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

Mechanical Ventilation System Present	Yes
Approved Installation	No
Mechanical Ventilation data Type	Database
Type	Balanced mechanical ventilation with heat recovery
MV Reference Number	500352
Configuration	1
MVHR Duct Insulated	No
Manufacturer SFP	0.58
Duct Type	Rigid
MVHR Efficiency	93.00
Wet Rooms	1

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				0
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	15	
Total number of L.E.L. fittings	15	
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

Description	Gas Combi	
Percentage of Heat	100	%
Database Ref. No.	17959	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.2	
In Summer	76.2	
Controls	CBE Programmer, room thermostat and TRVs	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2106	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	
29.0 Hot Water Cylinder	None	
32.0 Photovoltaic Unit	More Dwellings, One Block	
Apportioned	420.00	kWh/Year

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

None

BLOCK COMPLIANCE

Calculation Type: New Build (As Designed)

Block Reference	SAP 0931 Block Ev	Issued on Date	08/02/2024
Block Name	Block EV		
Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 07798936079, toby@abacusenergyuk.com	Assessor ID	E477-0001
Client	Foreman Homes, FORE		

Block Compliance Report - DER

Block Reference: SAP 0931 Block Ev		Block Name: Block EV			
Property-Assessment Reference	Multiplier	Floor Area (m ²)	DER (kgCO ₂ /m ²)	TER (kgCO ₂ /m ²)	% DER/TER
SAP 0931 Plot 27-Rev B	1	60.9	14.29	19.11	25.23 %
SAP 0931 Plot 28-Rev B	1	60.63	13.08	18.14	27.90 %
SAP 0931 Plot 29-Rev B	1	60.9	14.99	20.24	25.93 %
SAP 0931 Plot 30-Rev B	1	60.63	14.65	19.99	26.73 %
SAP 0931 Plot 25-Rev B	1	60.9	18.29	21.22	13.83 %
SAP 0931 Plot 26-Rev B	1	60.63	17.22	20.63	16.52 %
Totals:	6	364.59	92.52	119.34	
Average DER = 15.42 kgCO ₂ /m ²		% DER/TER		PASS	
Average TER = 19.89 kgCO ₂ /m ²		22.47 %			

Block Compliance Report - DFEE

Block Reference: SAP 0931 Block Ev		Block Name: Block EV			
Property-Assessment Reference	Multiplier	Floor Area (m ²)	DFEE (kWh/m ² /yr)	TFEE (kWh/m ² /yr)	% DFEE/TFEE
SAP 0931 Plot 27-Rev B	1	60.9	42.94	48.50	11.46 %
SAP 0931 Plot 28-Rev B	1	60.63	38.24	43.76	12.61 %
SAP 0931 Plot 29-Rev B	1	60.9	45.83	54.30	15.60 %
SAP 0931 Plot 30-Rev B	1	60.63	43.78	52.78	17.06 %
SAP 0931 Plot 25-Rev B	1	60.9	52.47	59.51	11.84 %
SAP 0931 Plot 26-Rev B	1	60.63	48.79	56.59	13.79 %
Totals:	6	364.59	272.04	315.44	
Average DFEE = 45.34 kWh/m ² /yr		% DFEE/TFEE		PASS	
Average TFEE = 52.58 kWh/m ² /yr		13.77 %			