



elmhurst
energy



SAP Report Submission for Building Regulations Compliance

Client: Foreman Homes

Project: Plot 27

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

Report Issue Date: 08/02/2024

EXCELLENCE
IN ENERGY
ASSESSMENT

PREDICTED ENERGY ASSESSMENT

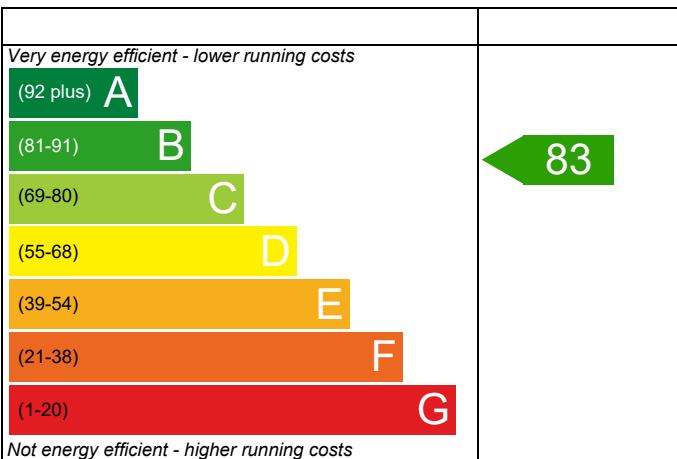
Plot 27

Dwelling type: Flat, Detached
 Date of assessment: 08/02/2024
 Produced by: Abacus Energy (UK) Ltd
 Total floor area: 60.9 m²
 DRRN: 0082-3248-4073

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

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

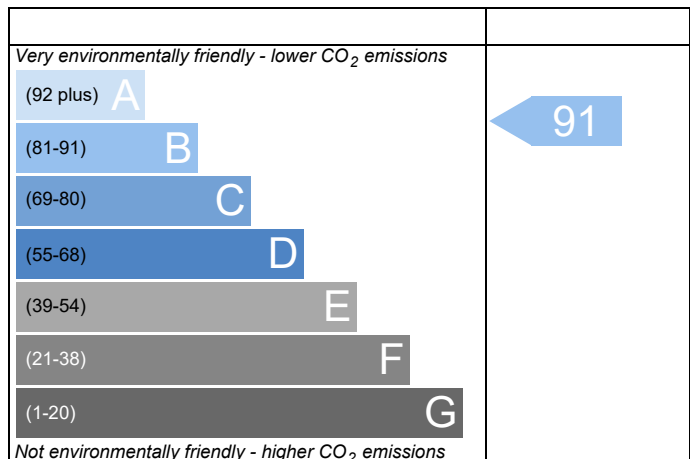
Energy Efficiency Rating



England EU Directive 2002/91/EC

The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

Environmental Impact (CO₂) Rating



England EU Directive 2002/91/EC

The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO₂) emissions. The higher the rating the less impact it has on the environment.

This report has been produced by an accredited Elmhurst member whose work is subject to quality assurance audits. The data used to produce the report has been verified by the Elmhurst members' portal.



BUILDING REGULATION COMPLIANCE

Calculation Type: New Build (As Designed)

Property Reference	SAP 0931 Plot 27	Issued on Date	08/02/2024
Assessment Reference	Rev B	Prop Type Ref	Block Ev
Property	Plot 27		
SAP Rating	83 B	DER	14.29
Environmental	91 B	TER	19.11
CO ₂ Emissions (t/year)	0.67	% DER<TER	25.23
General Requirements Compliance	Pass	DFEE	42.94
		TREE	48.50
		% DFEE<TFEE	11.46
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 TFE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	19.11	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	14.29	kgCO ₂ /m ²	Pass
	-4.82 (-25.2%)	kgCO ₂ /m ²	

1b TFE and DFEE

Target Fabric Energy Efficiency (TFEE)	48.50	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DFEE)	42.94	kWh/m ² /yr	
	-5.6 (-11.5%)	kWh/m ² /yr	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.24 (max. 0.30)	0.27 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	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

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)

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)

Slight

Pass

Based on:

Overshading

Average

Windows facing North East

4.89 m², No overhang

Windows facing South West

1.68 m², No overhang

Windows facing North West

3.00 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

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)

10 Key features

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

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.



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 91	

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.



THERMAL BRIDGING

Calculation Type: New Build (As Designed)

Property Reference	SAP 0931 Plot 27	Issued on Date	08/02/2024
Assessment Reference	Rev B	Prop Type Ref	Block Ev
Property	Plot 27		

SAP Rating	83 B	DER	14.29	TER	19.11
Environmental	91 B	% DER<TER	25.23		
CO ₂ Emissions (t/year)	0.67	DFEE	42.94	TFEE	48.50
General Requirements Compliance	Pass	% DFEE<TFEE	11.46		

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

Client	Foreman Homes, FORE
--------	---------------------

	Junction detail	Source Type	Psi (W/mK)	Length (m)	Result	Reference
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.043	8.37	0.36	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	17.70	0.28	Knauf P6
External wall	E7 Party floor between dwellings (in blocks of flats)	Table K1 - Approved	0.070	67.08	4.70	
External wall	E16 Corner (normal)	Independently assessed	0.061	14.75	0.90	Knauf P23
External wall	E17 Corner (inverted – internal area greater than external area)	Independently assessed	-0.113	4.92	-0.56	Knauf P24

Total: **5.84** W/mK:
 Y-Value: **0.071** W/m²K:

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Property Reference	SAP 0931 Plot 27			Issued on Date	08/02/2024
Assessment Reference	Rev B	Prop Type Ref	Block Ev		
Property	Plot 27				
SAP Rating	83 B	DER	14.29	TER	19.11
Environmental	91 B	% DER<TER	25.23		
CO₂ Emissions (t/year)	0.67	DFEE	42.94	TFEE	48.50
General Requirements Compliance	Pass	% DFEE<TFEE	11.46		
Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 07798936079, toby@abacusenergyuk.com			Assessor ID	E477-0001
Client	Foreman Homes, FORE				

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

DWELLING AS DESIGNED

Mid-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) 19.11 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 14.29 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)48.5 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)42.9 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.24 (max. 0.30)	0.27 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	(no floor)		
Roof	(no roof)		
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): Slight OK

Based on:

Overshading: Average
Windows facing North East: 4.89 m², No overhang
Windows facing South West: 1.68 m², No overhang
Windows facing North West: 3.00 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

10 Key features

Party wall U-value 0.00 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 (m ²)	Storey height (m)	Volume (m ³)
Ground floor	60.9000 (1b)	2.4600 (2b)	149.8140 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	60.9000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	149.8140 (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	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind factor	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)
Adj infilt rate	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)
Balanced mechanical ventilation with heat recovery	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)
If mechanical ventilation:												
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	38.5500	4.6800	33.8700	0.2200	7.4514	42.2200	1429.9914 (29a)					
7.3N Brick and Block	25.8400	4.8900	20.9500	0.2700	5.6565	113.5000	2377.8250 (29a)					
Wall to Corridor	18.1200	2.1200	16.0000	0.2300	3.6796	113.5000	1816.0000 (29a)					
Total net area of external elements Aum(A, m ²)			82.5100				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	30.0775		(33)					
Party Floor 1			60.9000			70.0000	4263.0000 (32d)					
Party Ceilings 1			60.9000			70.0000	4263.0000 (32b)					
Ground Floor Stud			95.5100			9.0000	859.5900 (32c)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	15009.4064 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							246.4599 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.8371 (36)					
Total fabric heat loss						(33) + (36) =	35.9146 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	23.2037	22.9179	22.6321	21.2030	20.9172	19.4881	19.4881	19.2023	20.0597	20.9172	21.4888	22.0604 (38)
Heat transfer coeff	59.1183	58.8325	58.5467	57.1176	56.8318	55.4027	55.4027	55.1169	55.9743	56.8318	57.4034	57.9750 (39)
Average = Sum(39)m / 12 =												
HLP	0.9707	0.9661	0.9614	0.9379	0.9332	0.9097	0.9097	0.9050	0.9191	0.9332	0.9426	0.9520 (40)
HLP (average)												
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												
Average daily hot water use (litres/day)												
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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Energy content (annual)													Total = Sum(45)m =	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	Solar input (sum of months) = Sum(63)m =				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)	
													Total per year (kWh/year) = Sum(64)m =	1300.3072 (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	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 g or Table 6b	Specific data or Table 6c	FF	Access factor Table 6d	Gains W					
Northeast	4.8900	11.2829	0.6300	0.7000	0.7700	16.8618 (75)						
Southwest	1.6800	36.7938	0.6300	0.7000	0.7700	18.8911 (79)						
Northwest	3.0000	11.2829	0.6300	0.7000	0.7700	10.3446 (81)						
Solar gains	46.0975	87.5579	143.8041	218.4138	281.3650	295.4837	278.1555	228.7215	169.2517	103.2421	56.8598	38.3849 (83)
Total gains	353.9145	393.4423	438.4224	495.0174	539.8951	536.4763	507.6972	463.6343	413.3721	365.5640	340.0525	337.0279 (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	70.5243	70.8670	71.2129	72.9947	73.3618	75.2541	75.2541	75.6444	74.4856	73.3618	72.6312	71.9151	
alpha	5.7016	5.7245	5.7475	5.8663	5.8908	6.0169	6.0169	6.0430	5.9657	5.8908	5.8421	5.7943	
util living area	0.9981	0.9962	0.9890	0.9554	0.8456	0.6413	0.4771	0.5403	0.8258	0.9766	0.9961	0.9986	(86)
MIT	19.9774	20.1036	20.3290	20.6459	20.8831	20.9828	20.9975	20.9950	20.9269	20.6198	20.2554	19.9682	(87)
Th 2	20.1078	20.1117	20.1157	20.1354	20.1394	20.1592	20.1592	20.1632	20.1513	20.1394	20.1315	20.1235	(88)
util rest of house	0.9975	0.9949	0.9853	0.9401	0.7998	0.5653	0.3876	0.4455	0.7593	0.9658	0.9945	0.9981	(89)
MIT 2	19.1699	19.2989	19.5256	19.8491	20.0617	20.1515	20.1586	20.1618	20.1108	19.8322	19.4668	19.1738	(90)
Living area fraction	19.5608	19.6885	19.9145	20.2348	20.4593	20.5539	20.5647	20.5651	20.5059	20.2135	19.8486	19.5584	(92)
Temperature adjustment	19.5608	19.6885	19.9145	20.2348	20.4593	20.5539	20.5647	20.5651	20.5059	20.2135	19.8486	0.0000	
adjusted MIT	19.5608	19.6885	19.9145	20.2348	20.4593	20.5539	20.5647	20.5651	20.5059	20.2135	19.8486	19.5584	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Useful gains	0.9971	0.9941	0.9842	0.9421	0.8180	0.6017	0.4311	0.4916	0.7891	0.9669	0.9939	0.9978	(94)	
Ext temp.	352.8763	391.1377	431.4963	466.3432	441.6446	322.8220	218.8450	227.8998	326.1985	353.4635	337.9732	336.2747	(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	902.1939	870.0417	785.3735	647.4178	497.8069	329.8627	219.6530	229.5689	358.5639	546.3508	731.8107	890.4016	(97)	
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)	
Space heating per m2	408.6923	321.8235	263.2847	130.3737	41.7848	0.0000	0.0000	0.0000	0.0000	143.5081	283.5630	412.2704	(98)	
													(98) / (4) =	32.9278 (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

	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													2223.1713 (211)
Space heating requirement	408.6923	321.8235	263.2847	130.3737	41.7848	0.0000	0.0000	0.0000	0.0000	143.5081	283.5630	412.2704	(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)	453.0957	356.7888	291.8899	144.5385	46.3246	0.0000	0.0000	0.0000	0.0000	159.0999	314.3714	457.0626	(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	86.2661	85.9636	85.2493	83.3325	79.8068	76.2000	76.2000	76.2000	76.2000	83.5353	85.5201	86.3805	(216)
Fuel for water heating, kWh/month	156.4083	137.2259	142.7382	127.2575	127.4534	115.1455	106.6992	122.4846	123.9937	131.8631	140.6506	151.2726	(219)
Water heating fuel used													1583.1927 (219)
Annual totals kWh/year													
Space heating fuel - main system													2223.1713 (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)													148.4117 (230a)
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													223.4117 (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													4318.6075 (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	2223.1713	0.2160	480.2050	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1583.1927	0.2160	341.9696	(264)
Space and water heating			822.1746	(265)
Pumps and fans	223.4117	0.5190	115.9507	(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			870.0490	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			14.2900	(273)

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

DER			14.2900	ZC1
Total Floor Area		TFA	60.9000	
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			34.0836	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			34.0836	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)	x 2.4600 (2b)	= 149.8140 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	60.9000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 149.8140 (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) =	0.1335 (8)
Pressure test				Yes	
Measured/design AP50				5.0000	
Infiltration rate				0.3835	(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) =		0.3547 (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 infiltr rate												
Effective ac	0.4523	0.4434	0.4346	0.3902	0.3813	0.3370	0.3370	0.3281	0.3547	0.3813	0.3991	0.4168 (22b)
Effective ac	0.6023	0.5983	0.5944	0.5761	0.5727	0.5568	0.5568	0.5538	0.5629	0.5727	0.5796	0.5869 (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	38.5500	4.6800	33.8700	0.1800	6.0966		(29a)
7.3N Brick and Block	25.8400	4.8900	20.9500	0.1800	3.7710		(29a)
Wall to Corridor	18.1200	2.1200	16.0000	0.1800	2.8800		(29a)
Total net area of external elements Aum(A, m2)			82.5100				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	27.5551	(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.2518 (36)
Total fabric heat loss							(33) + (36) = 34.8069 (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	29.7760	29.5797	29.3872	28.4832	28.3140	27.5267	27.5267	27.3808	27.8299	28.3140	28.6562	29.0139 (38)
Average = Sum(39)m / 12 =	64.5829	64.3866	64.1941	63.2901	63.1209	62.3336	62.3336	62.1877	62.6368	63.1209	63.4631	63.8208 (39)
												63.2893 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.0605	1.0573	1.0541	1.0392	1.0365	1.0235	1.0235	1.0211	1.0285	1.0365	1.0421	1.0480 (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
Energy conte	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 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												Total = Sum(45)m = 1288.0612 (45)
Water storage loss:	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)
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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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 (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 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	179.4339	156.7401	163.0779	144.6419	140.0389	123.3384	118.1676	131.7292	133.1840	151.6565	161.8904	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 (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	Specific data or Table 6b	g Specific data or Table 6c	FF or Table 6c	Access factor Table 6d	Gains W					
Northeast	4.8900	11.2829	0.6300	0.7000	0.7700	16.8618 (75)						
Southwest	1.6800	36.7938	0.6300	0.7000	0.7700	18.8911 (79)						
Northwest	3.0000	11.2829	0.6300	0.7000	0.7700	10.3446 (81)						
Solar gains	46.0975	87.5579	143.8041	218.4138	281.3650	295.4837	278.1555	228.7215	169.2517	103.2421	56.8598	38.3849 (83)
Total gains	368.8697	407.8678	452.3319	508.4185	552.7723	548.8366	520.0839	476.5361	426.8098	379.5104	354.4989	351.9977 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, T _{hl} (C)												21.0000 (85)
Utilisation factor for gains for living area, nil _m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	65.4843	65.6840	65.8809	66.8220	67.0010	67.8474	67.8474	68.0064	67.5188	67.0010	66.6398	66.2663
alpha	5.3656	5.3789	5.3921	5.4548	5.4667	5.5232	5.5232	5.5338	5.5013	5.4667	5.4427	5.4178
util living area	0.9979	0.9960	0.9894	0.9613	0.8696	0.6879	0.5200	0.5855	0.8514	0.9783	0.9958	0.9984 (86)
MIT	19.8863	20.0111	20.2415	20.5639	20.8326	20.9663	20.9939	20.9889	20.8915	20.5509	20.1677	19.8674 (87)
Th 2	20.0332	20.0359	20.0385	20.0508	20.0531	20.0638	20.0638	20.0657	20.0596	20.0531	20.0484	20.0436 (88)
util rest of house	0.9972	0.9946	0.9856	0.9469	0.8247	0.6029	0.4132	0.4741	0.7844	0.9676	0.9941	0.9979 (89)
MIT 2	18.5448	18.7289	19.0655	19.5336	19.8884	20.0413	20.0615	20.0611	19.9707	19.5238	18.9671	18.5248 (90)
Living area fraction												f _{LA} = Living area / (4) = 0.4841 (91)
MIT	19.1941	19.3496	19.6347	20.0324	20.3455	20.4891	20.5129	20.5102	20.4164	20.0210	19.5482	19.1747 (92)
Temperature adjustment												0.0000
adjusted MIT	19.1941	19.3496	19.6347	20.0324	20.3455	20.4891	20.5129	20.5102	20.4164	20.0210	19.5482	19.1747 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9964	0.9933	0.9836	0.9465	0.8399	0.6429	0.4651	0.5283	0.8124	0.9671	0.9929	0.9972 (94)
Ext temp.	367.5383	405.1398	444.8950	481.2355	464.2596	352.8715	241.9110	251.7652	346.7269	367.0394	351.9908	351.0032 (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	961.9076	930.3598	843.1725	704.5678	545.7090	367.0866	243.9023	255.6038	395.6406	594.6619	790.0043	955.7003 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating per m2	442.2107	352.9479	296.3185	160.7993	60.5983	0.0000	0.0000	0.0000	0.0000	169.3512	315.3697	449.8947 (98)
												2247.4903 (98)
												36.9046 (99)

8c. Space cooling requirement

Not applicable

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.4000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													2406.3065 (211)
Space heating requirement	442.2107	352.9479	296.3185	160.7993	60.5983	0.0000	0.0000	0.0000	0.0000	169.3512	315.3697	449.8947	(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)	473.4590	377.8885	317.2574	172.1620	64.8804	0.0000	0.0000	0.0000	0.0000	181.3182	337.6549	481.6860	(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	87.2330	87.0336	86.5362	85.3182	83.1043	80.3000	80.3000	80.3000	80.3000	85.3295	86.7009	87.3214	(216)
Fuel for water heating, kWh/month	205.6950	180.0915	188.4505	169.5322	168.5098	153.5971	147.1577	164.0463	165.8580	177.7305	186.7228	200.6611	(219)
Water heating fuel used													2108.0524 (219)
Annual totals kWh/year													
Space heating fuel - main system													2406.3065 (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													4878.1907 (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	2406.3065	0.2160	519.7622 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2108.0524	0.2160	455.3393 (264)
Space and water heating			975.1015 (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			1163.9302 (272)
Emissions per m2 for space and water heating			16.0115 (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) = (16.0115 * 1.00) + 2.4615 + 0.6392, rounded to 2 d.p.			19.1100 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	60.9000 (1b)	x 2.4600 (2b)	= 149.8140 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	60.9000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 149.8140 (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				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) =	0.1335 (8)
Pressure test				Yes	
Measured/design AP50				5.0000	
Infiltration rate				0.3835	(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) =		0.3547 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
Effective ac	0.4523	0.4434	0.4346	0.3902	0.3813	0.3370	0.3370	0.3281	0.3547	0.3813	0.3991	0.4168 (22b)
Effective ac	0.6023	0.5983	0.5944	0.5761	0.5727	0.5568	0.5568	0.5538	0.5629	0.5727	0.5796	0.5869 (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	38.5500	4.6800	33.8700	0.2200	7.4514	42.2200	1429.9914 (29a)
7.3N Brick and Block	25.8400	4.8900	20.9500	0.2700	5.6565	113.5000	2377.8250 (29a)
Wall to Corridor	18.1200	2.1200	16.0000	0.2300	3.6796	113.5000	1816.0000 (29a)
Total net area of external elements Aum(A, m ²)			82.5100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	30.0775		(33)
Party Floor 1			60.9000			70.0000	4263.0000 (32d)
Party Ceilings 1			60.9000			30.0000	1827.0000 (32b)
Ground Floor Stud			95.5100			9.0000	859.5900 (32c)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	12573.4064 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							206.4599 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.8371 (36)
Total fabric heat loss						(33) + (36) =	35.9146 (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	29.7760	29.5797	29.3872	28.4832	28.3140	27.5267	27.5267	27.3808	27.8299	28.3140	28.6562	29.0139 (38)
Average = Sum(39)m / 12 =	65.6906	65.4943	65.3018	64.3978	64.2286	63.4412	63.4412	63.2954	63.7445	64.2286	64.5708	64.9285 (39)
												64.3970 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.0787	1.0754	1.0723	1.0574	1.0547	1.0417	1.0417	1.0393	1.0467	1.0547	1.0603	1.0661 (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												
Water storage loss:	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month	28.3782	24.8197	25.6117	22.3289	21.4252	18.4883	17.1321	19.6593	19.8941	23.1847	25.3079	27.4828	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	Solar flux	g	FF	Access	Gains
	m2	Table 6a	Specific data	Specific data	factor	W
		W/m2	or Table 6b	or Table 6c	Table 6d	
Northeast	4.8900	11.2829	0.6300	0.7000	0.7700	16.8618 (75)
Southwest	1.6800	36.7938	0.6300	0.7000	0.7700	18.8911 (79)
Northwest	3.0000	11.2829	0.6300	0.7000	0.7700	10.3446 (81)

Solar gains	46.0975	87.5579	143.8041	218.4138	281.3650	295.4837	278.1555	228.7215	169.2517	103.2421	56.8598	38.3849	(83)
Total gains	328.9104	369.1518	415.5938	474.1679	520.3333	518.7197	491.4642	445.4375	394.4689	344.6145	316.7905	312.7181	(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	53.1676	53.3270	53.4842	54.2350	54.3778	55.0527	55.0527	55.1795	54.7908	54.3778	54.0897	53.7917	53.7917	
alpha	4.5445	4.5551	4.5656	4.6157	4.6252	4.6702	4.6702	4.6786	4.6527	4.6252	4.6060	4.5861	4.5861	
util living area	0.9971	0.9945	0.9868	0.9579	0.8739	0.7106	0.5498	0.6196	0.8647	0.9768	0.9946	0.9977	0.9977	(86)
MIT	19.6036	19.7512	20.0240	20.4072	20.7397	20.9315	20.9836	20.9723	20.8195	20.3952	19.9383	19.5821	19.5821	(87)
Th 2	20.0183	20.0209	20.0235	20.0357	20.0380	20.0487	20.0487	20.0507	20.0446	20.0380	20.0334	20.0286	20.0286	(88)
util rest of house	0.9962	0.9930	0.9828	0.9444	0.8339	0.6293	0.4395	0.5069	0.8062	0.9670	0.9928	0.9970	0.9970	(89)
MIT 2	18.7384	18.8876	19.1605	19.5445	19.8525	20.0135	20.0436	20.0410	19.9332	19.5398	19.0844	18.7251	18.7251	(90)
Living area fraction														(91)
MIT	19.1572	19.3056	19.5785	19.9621	20.2820	20.4579	20.4986	20.4918	20.3622	19.9539	19.4977	19.1400	19.1400	(92)
Temperature adjustment														(93)
adjusted MIT	19.1572	19.3056	19.5785	19.9621	20.2820	20.4579	20.4986	20.4918	20.3622	19.9539	19.4977	19.1400	19.1400	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Useful gains	327.3509	366.0065	407.4865	447.2020	439.7195	345.4791	242.2559	250.0039	326.5997	332.8611	314.0988	311.5371	(94)	
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)	
Heat loss rate W	975.9799	943.4839	854.0501	712.3728	551.2086	371.6296	247.3336	258.9922	399.1836	600.7884	800.5314	970.0301	(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	482.5799	388.0648	332.2434	190.9230	82.9479	0.0000	0.0000	0.0000	0.0000	199.3379	350.2315	489.9188	(98)	
Space heating												2516.2472	(98)	
Space heating per m2												(98) / (4) =	41.3177	(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	596.3477	469.4652	481.0453	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8738	0.9272	0.8993	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	521.0971	435.2873	432.6001	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	681.5251	648.2181	595.6928	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	115.5081	158.4205	121.3410	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												395.2696 (104)
Cooled fraction									fC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)												
0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)	
Space cooling kWh												
0.0000	0.0000	0.0000	0.0000	0.0000	28.8770	39.6051	30.3352	0.0000	0.0000	0.0000	0.0000 (107)	
Space cooling												98.8174 (107)
Space cooling per m2												1.6226 (108)
Energy for space heating												41.3177 (99)
Energy for space cooling												1.6226 (108)
Total												42.9403 (109)
Dwelling Fabric Energy Efficiency (DFEE)												42.9 (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)	x 2.4600 (2b)	= 149.8140 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	60.9000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 149.8140 (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) =	0.1335 (8)
Pressure test				Yes	
Measured/design AP50					5.0000
Infiltration rate					0.3835 (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) =		0.3547 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
Effective ac	0.4523	0.4434	0.4346	0.3902	0.3813	0.3370	0.3370	0.3281	0.3547	0.3813	0.3991	0.4168 (22b)
Effective ac	0.6023	0.5983	0.5944	0.5761	0.5727	0.5568	0.5568	0.5538	0.5629	0.5727	0.5796	0.5869 (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	38.5500	4.6800	33.8700	0.1800	6.0966		(29a)
7.3N Brick and Block	25.8400	4.8900	20.9500	0.1800	3.7710		(29a)
Wall to Corridor	18.1200	2.1200	16.0000	0.1800	2.8800		(29a)
Total net area of external elements Aum(A, m2)			82.5100				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	27.5551	(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.2518 (36)
Total fabric heat loss							(33) + (36) = 34.8069 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	29.7760	29.5797	29.3872	28.4832	28.3140	27.5267	27.5267	27.3808	27.8299	28.3140	28.6562	29.0139 (38)
Heat transfer coeff	64.5829	64.3866	64.1941	63.2901	63.1209	62.3336	62.3336	62.1877	62.6368	63.1209	63.4631	63.8208 (39)
Average = Sum(39)m / 12 =												63.2893 (39)
HLP	1.0605	1.0573	1.0541	1.0392	1.0365	1.0235	1.0235	1.0211	1.0285	1.0365	1.0421	1.0480 (40)
HLP (average)												1.0392 (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)
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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	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 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	4.8900	11.2829	0.6300	0.7000	0.7700	16.8618 (75)							
Southwest	1.6800	36.7938	0.6300	0.7000	0.7700	18.8911 (79)							
Northwest	3.0000	11.2829	0.6300	0.7000	0.7700	10.3446 (81)							
Solar gains	46.0975	87.5579	143.8041	218.4138	281.3650	295.4837	278.1555	228.7215	169.2517	103.2421	56.8598	38.3849	(83)
Total gains	328.9104	369.1518	415.5938	474.1679	520.3333	518.7197	491.4642	445.4375	394.4689	344.6145	316.7905	312.7181	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains for living area, nil,m (see Table 9a)	65.4843	65.6840	65.8809	66.8220	67.0010	67.8474	67.8474	68.0064	67.5188	67.0010	66.6398	66.2663	21.0000 (85)
tau	5.3656	5.3789	5.3921	5.4548	5.4667	5.5232	5.5232	5.5338	5.5013	5.4667	5.4427	5.4178	
util living area	0.9988	0.9975	0.9928	0.9708	0.8915	0.7183	0.5480	0.6212	0.8821	0.9858	0.9976	0.9991	(86)
MIT	19.8242	19.9515	20.1866	20.5192	20.8061	20.9584	20.9922	20.9852	20.8671	20.5012	20.1095	19.8062	(87)
Th 2	20.0332	20.0359	20.0385	20.0508	20.0531	20.0638	20.0638	20.0657	20.0596	20.0531	20.0484	20.0436	(88)
util rest of house	0.9984	0.9966	0.9901	0.9594	0.8509	0.6330	0.4367	0.5056	0.8219	0.9784	0.9966	0.9988	(89)
MIT 2	18.9551	19.0843	19.3203	19.6560	19.9200	20.0444	20.0617	20.0614	19.9822	19.6444	19.2524	18.9455	(90)
Living area fraction	19.3758	19.5041	19.7397	20.0739	20.3489	20.4869	20.5121	20.5086	20.4106	20.0591	19.6673	19.3621	(91)
MIT	19.3758	19.5041	19.7397	20.0739	20.3489	20.4869	20.5121	20.5086	20.4106	20.0591	19.6673	19.3621	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.3758	19.5041	19.7397	20.0739	20.3489	20.4869	20.5121	20.5086	20.4106	20.0591	19.6673	19.3621	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9980	0.9960	0.9919	0.9597	0.8649	0.6732	0.4909	0.5620	0.8470	0.9784	0.9960	0.9985	(94)
Ext temp.	328.2654	367.6808	411.0619	455.0683	450.0431	349.2255	241.2697	250.3392	334.1335	337.1803	315.5326	312.2524	(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	973.6404	940.3083	849.9080	707.1938	545.9275	366.9490	243.8574	255.5043	395.2756	597.0703	797.5577	967.6594	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating	480.1590	384.8057	326.5015	181.5303	71.3380	0.0000	0.0000	0.0000	0.0000	193.3581	347.0581	487.6228	(98)
Space heating per m2										(98) / (4) =		2472.3735	(98)
												40.5973	(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	585.9354	461.2683	472.6268	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9029	0.9506	0.9264	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	529.0355	438.4768	437.8227	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	681.5251	648.2181	595.6928	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	109.7925	156.0476	117.4554	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												383.2954	(104)
Cooled fraction												1.0000	(105)
													fc = cooled area / (4) =

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	27.4481	39.0119	29.3638	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												95.8239 (107)
Space cooling per m2												1.5735 (108)
Energy for space heating												40.5973 (99)
Energy for space cooling												1.5735 (108)
Total												42.1707 (109)
Target Fabric Energy Efficiency (TFEE)												48.5 (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)	2.4600 (2b)	149.8140 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	60.9000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	149.8140 (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	0.2500 (18)
Number of sides sheltered				1	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	38.5500	4.6800	33.8700	0.2200	7.4514	42.2200	1429.9914 (29a)
7.3N Brick and Block	25.8400	4.8900	20.9500	0.2700	5.6565	113.5000	2377.8250 (29a)
Wall to Corridor	18.1200	2.1200	16.0000	0.2300	3.6796	113.5000	1816.0000 (29a)
Total net area of external elements Aum(A, m2)			82.5100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	30.0775		(33)
Party Floor 1			60.9000			70.0000	4263.0000 (32d)
Party Ceilings 1			60.9000			70.0000	4263.0000 (32b)
Ground Floor Stud			95.5100			9.0000	859.5900 (32c)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	15009.4064 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							246.4599 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.8371 (36)
Total fabric heat loss						(33) + (36) =	35.9146 (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	23.2037	22.0604	21.7746	20.9172	20.9172	20.0597	20.0597	19.7739	20.0597	21.4888	21.2030	22.0604 (38)
Average = Sum(39)m / 12 =	59.1183	57.9750	57.6892	56.8318	56.8318	55.9743	55.9743	55.6885	55.9743	57.4034	57.1176	57.9750 (39)
HLP	0.9707	0.9520	0.9473	0.9332	0.9332	0.9191	0.9191	0.9144	0.9191	0.9426	0.9379	0.9520 (40)
HLP (average)												0.9367 (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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

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	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	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	1.3830	1.1656	1.1574	0.9695	0.8923	0.7372	0.6831	0.8187	0.8638	1.0477	1.1885	1.3393	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	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	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	130.6700	(64)
RHI water heating demand													Total per year (kWh/year) = Sum(64)m =	1300.3072 (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	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	Solar flux	Specific data	Specific data	Access	Gains							
	m ²	Table 6a	g	FF	factor	W							
		W/m ²	or Table 6b	or Table 6c	Table 6d								
Northeast	4.8900	15.0428	0.6300	0.7000	0.7700	22.4807 (75)							
Southwest	1.6800	46.3896	0.6300	0.7000	0.7700	23.8178 (79)							
Northwest	3.0000	15.0428	0.6300	0.7000	0.7700	13.7919 (81)							
Solar gains	60.0904	98.1812	161.5087	250.4206	307.7097	349.2013	321.0832	270.1546	201.8888	122.8068	73.5848	47.6870	(83)
Total gains	514.8212	549.1320	594.8677	656.6558	686.4199	703.1124	660.4175	616.7074	563.9749	512.2035	493.3038	490.1179	(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	70.5243	71.9151	72.2714	73.3618	73.3618	74.4856	74.4856	74.8679	74.4856	72.6312	72.9947	71.9151	
alpha	5.7016	5.7943	5.8181	5.8908	5.8908	5.9657	5.9657	5.9912	5.9657	5.8421	5.8663	5.7943	
util living area	0.9838	0.9754	0.9447	0.8491	0.6683	0.4438	0.3134	0.3338	0.5843	0.8666	0.9629	0.9862	(86)
MIT	20.3294	20.4312	20.6300	20.8532	20.9697	20.9977	20.9998	20.9997	20.9897	20.8634	20.6029	20.3279	(87)
Th 2	20.1078	20.1235	20.1275	20.1394	20.1394	20.1513	20.1513	20.1553	20.1513	20.1315	20.1354	20.1235	(88)
util rest of house	0.9788	0.9682	0.9289	0.8128	0.6090	0.3775	0.2416	0.2578	0.5067	0.8230	0.9502	0.9819	(89)
MIT 2	19.5182	19.6306	19.8238	20.0334	20.1224	20.1505	20.1512	20.1552	20.1470	20.0395	19.8083	19.5303	(90)
Living area fraction													fLA = Living area / (4) =
MIT	19.9109	20.0181	20.2141	20.4303	20.5326	20.5606	20.5620	20.5640	20.5549	20.4383	20.1929	19.9164	(92)
Temperature adjustment													0.0000
adjusted MIT	19.9109	20.0181	20.2141	20.4303	20.5326	20.5606	20.5620	20.5640	20.5549	20.4383	20.1929	19.9164	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9775	0.9671	0.9306	0.8258	0.6367	0.4096	0.2764	0.2946	0.5441	0.8397	0.9512	0.9807	(94)
Useful gains	503.2438	531.0836	553.6054	542.2788	437.0604	288.0152	182.5260	181.6818	306.8710	430.0742	469.2311	480.6669	(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	857.8574	830.0945	745.0023	615.5035	450.8222	288.8605	182.5876	181.7668	310.9339	495.8694	673.5843	835.7888	(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	263.8325	200.9353	142.3993	52.7218	10.2388	0.0000	0.0000	0.0000	0.0000	48.9516	147.1343	264.2107	(98)
Space heating													1130.4242 (98)
RHI space heating demand													1130 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	60.9000 (1b)	2.4600 (2b)	149.8140 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	60.9000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	149.8140 (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	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					0.2486	0.2197	0.2197	0.2139	0.2313	0.2486	0.2602	0.2717 (22b)
Balanced mechanical ventilation with heat recovery	0.2948	0.2891	0.2833	0.2544								
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	0.4636	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	38.5500	4.6800	33.8700	0.2200	7.4514	42.2200	1429.9914 (29a)
7.3N Brick and Block	25.8400	4.8900	20.9500	0.2700	5.6565	113.5000	2377.8250 (29a)
Wall to Corridor	18.1200	2.1200	16.0000	0.2300	3.6796	113.5000	1816.0000 (29a)
Total net area of external elements Aum(A, m2)			82.5100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	30.0775		(33)
Party Floor 1			60.9000			70.0000	4263.0000 (32d)
Party Ceilings 1			60.9000			70.0000	4263.0000 (32b)
Ground Floor Stud			95.5100			9.0000	859.5900 (32c)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 15009.4064 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							246.4599 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.8371 (36)
Total fabric heat loss							(33) + (36) = 35.9146 (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	23.2037	22.9179	22.6321	21.2030	20.9172	19.4881	19.4881	19.2023	20.0597	20.9172	21.4888	22.0604 (38)
Heat transfer coeff	59.1183	58.8325	58.5467	57.1176	56.8318	55.4027	55.4027	55.1169	55.9743	56.8318	57.4034	57.9750 (39)
Average = Sum(39)m / 12 =												57.0461 (39)
HLP	0.9707	0.9661	0.9614	0.9379	0.9332	0.9097	0.9097	0.9050	0.9191	0.9332	0.9426	0.9520 (40)
HLP (average)												0.9367 (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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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 m ²	Solar flux Table 6a W/m ²	Specific data g or Table 6b	Specific data FF or Table 6c	Access factor Table 6d	Gains W							
Northeast	4.8900	11.2829	0.6300	0.7000	0.7700	16.8618 (75)							
Southwest	1.6800	36.7938	0.6300	0.7000	0.7700	18.8911 (79)							
Northwest	3.0000	11.2829	0.6300	0.7000	0.7700	10.3446 (81)							
Solar gains	46.0975	87.5579	143.8041	218.4138	281.3650	295.4837	278.1555	228.7215	169.2517	103.2421	56.8598	38.3849	(83)
Total gains	500.8283	538.5086	577.1630	624.6490	660.0752	649.3948	617.4898	575.2743	531.3378	492.6388	476.5788	480.8158	(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	70.5243	70.8670	71.2129	72.9947	73.3618	75.2541	75.2541	75.6444	74.4856	73.3618	72.6312	71.9151	
alpha	5.7016	5.7245	5.7475	5.8663	5.8908	6.0169	6.0169	6.0430	5.9657	5.8908	5.8421	5.7943	
util living area	0.9896	0.9826	0.9624	0.8938	0.7457	0.5394	0.3939	0.4390	0.6937	0.9203	0.9796	0.9915	(86)
MIT	20.2070	20.3251	20.5258	20.7845	20.9411	20.9930	20.9991	20.9984	20.9713	20.7764	20.4632	20.1951	(87)
Th 2	20.1078	20.1117	20.1157	20.1354	20.1394	20.1592	20.1592	20.1632	20.1513	20.1394	20.1315	20.1235	(88)
util rest of house	0.9866	0.9775	0.9514	0.8656	0.6926	0.4715	0.3191	0.3601	0.6210	0.8925	0.9727	0.9889	(89)
MIT 2	19.3974	19.5168	19.7149	19.9715	20.1029	20.1563	20.1590	20.1628	20.1370	19.9729	19.6701	19.3989	(90)
Living area fraction	19.7893	19.9081	20.1074	20.3650	20.5086	20.5613	20.5657	20.5673	20.5409	20.3618	20.0540	0.4841	(91)
Temperature adjustment	19.7893	19.9081	20.1074	20.3650	20.5086	20.5613	20.5657	20.5673	20.5409	20.3618	20.0540	19.7843	(92)
adjusted MIT	19.7893	19.9081	20.1074	20.3650	20.5086	20.5613	20.5657	20.5673	20.5409	20.3618	20.0540	19.7843	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	493.4266	525.6568	549.0236	545.7817	472.7436	327.4711	219.4266	229.1476	348.2369	443.6057	463.2185	474.9176	(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	915.7034	882.9622	796.6689	654.8543	500.6088	330.2721	219.7090	229.6858	360.5226	554.7829	743.6049	903.5020	(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	314.1739	240.1093	184.2481	78.5323	20.7317	0.0000	0.0000	0.0000	0.0000	82.7158	201.8782	318.8669	(98)
Space heating												1441.2562 (98)	
Space heating per m ²												(98) / (4) = 23.6659 (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													1597.8450 (211)
Space heating requirement	314.1739	240.1093	184.2481	78.5323	20.7317	0.0000	0.0000	0.0000	0.0000	82.7158	201.8782	318.8669	(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)	348.3081	266.1965	204.2662	87.0646	22.9842	0.0000	0.0000	0.0000	0.0000	91.7027	223.8118	353.5109	(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	85.4815	85.0520	84.0574	81.5878	78.2565	76.2000	76.2000	76.2000	76.2000	81.6340	84.4097	85.6271	(217)
Fuel for water heating, kWh/month	157.8439	138.6967	144.7622	129.9788	129.9784	115.1455	106.6992	122.4846	123.9937	134.9342	142.5009	152.6036	(219)
Water heating fuel used													1599.6216 (219)
Annual totals kWh/year													
Space heating fuel - main system													1597.8450 (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)													148.4117 (230a)
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													223.4117 (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													3709.7101 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1597.8450	3.4800	55.6050	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1599.6216	3.4800	55.6668	(247)
Mechanical ventilation fans	148.4117	13.1900	19.5755	(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			298.8368	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	1.1852	(257)
SAP value		83.4666	
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	1597.8450	0.2160	345.1345	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1599.6216	0.2160	345.5183	(264)
Space and water heating			690.6528	(265)
Pumps and fans	223.4117	0.5190	115.9507	(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			738.5272	(272)
CO2 emissions per m2			12.1300	(273)
EI value			90.6551	
EI rating			91	(274)
EI band			B	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Calculation of stars for heating and DHW

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9020 = 3.858$, 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	$3.48 / 0.8091 = 4.301$, stars = 4
Water heating environmental impact	$0.216 / 0.8091 = 0.2670$, 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)	2.4600 (2b)	149.8140 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	60.9000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	149.8140 (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)							
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	0.2500 (18)							
Number of sides sheltered				1	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 4.7000	Mar 4.6000	Apr 4.3000	May 4.3000	Jun 4.0000	Jul 4.0000	Aug 3.9000	Sep 4.0000	Oct 4.5000	Nov 4.4000	Dec 4.7000 (22)
Wind factor	1.2750	1.1750	1.1500	1.0750	1.0750	1.0000	1.0000	0.9750	1.0000	1.1250	1.1000	1.1750 (22a)
Adj infilt rate	0.2948	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												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	0.4462	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	38.5500	4.6800	33.8700	0.2200	7.4514	42.2200	1429.9914 (29a)
7.3N Brick and Block	25.8400	4.8900	20.9500	0.2700	5.6565	113.5000	2377.8250 (29a)
Wall to Corridor	18.1200	2.1200	16.0000	0.2300	3.6796	113.5000	1816.0000 (29a)
Total net area of external elements Aum(A, m2)			82.5100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	30.0775		(33)
Party Floor 1			60.9000			70.0000	4263.0000 (32d)
Party Ceilings 1			60.9000			70.0000	4263.0000 (32b)
Ground Floor Stud			95.5100			9.0000	859.5900 (32c)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 15009.4064 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							246.4599 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.8371 (36)
Total fabric heat loss							(33) + (36) = 35.9146 (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	23.2037	22.0604	21.7746	20.9172	20.9172	20.0597	20.0597	19.7739	20.0597	21.4888	21.2030	22.0604 (38)
Average = Sum(39)m / 12 =	59.1183	57.9750	57.6892	56.8318	56.8318	55.9743	55.9743	55.6885	55.9743	57.4034	57.1176	57.9750 (39)
HLP	0.9707	0.9520	0.9473	0.9332	0.9332	0.9191	0.9191	0.9144	0.9191	0.9426	0.9379	0.9520 (40)
HLP (average)												0.9367 (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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Energy content (annual)												Total = Sum(45)m =	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	Solar input (sum of months) = Sum(63)m =				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 m ²	Solar flux Table 6a W/m ²	Specific data g or Table 6b	Specific data FF or Table 6c	Access factor Table 6d	Gains W							
Northeast	4.8900	15.0428	0.6300	0.7000	0.7700	22.4807	(75)						
Southwest	1.6800	46.3896	0.6300	0.7000	0.7700	23.8178	(79)						
Northwest	3.0000	15.0428	0.6300	0.7000	0.7700	13.7919	(81)						
Solar gains	60.0904	98.1812	161.5087	250.4206	307.7097	349.2013	321.0832	270.1546	201.8888	122.8068	73.5848	47.6870	(83)
Total gains	514.8212	549.1320	594.8677	656.6558	686.4199	703.1124	660.4175	616.7074	563.9749	512.2035	493.3038	490.1179	(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	70.5243	71.9151	72.2714	73.3618	73.3618	74.4856	74.4856	74.8679	74.4856	72.6312	72.9947	71.9151		
alpha	5.7016	5.7943	5.8181	5.8908	5.8908	5.9657	5.9657	5.9912	5.9657	5.8421	5.8663	5.7943		
util living area	0.9838	0.9754	0.9447	0.8491	0.6683	0.4438	0.3134	0.3338	0.5843	0.8666	0.9629	0.9862	(86)	
MIT	20.3294	20.4312	20.6300	20.8532	20.9697	20.9977	20.9998	20.9997	20.9897	20.8634	20.6029	20.3279	(87)	
Th 2	20.1078	20.1235	20.1275	20.1394	20.1394	20.1513	20.1513	20.1553	20.1513	20.1315	20.1354	20.1235	(88)	
util rest of house	0.9788	0.9682	0.9289	0.8128	0.6090	0.3775	0.2416	0.2578	0.5067	0.8230	0.9502	0.9819	(89)	
MIT 2	19.5182	19.6306	19.8238	20.0334	20.1224	20.1505	20.1512	20.1552	20.1470	20.0395	19.8083	19.5303	(90)	
Living area fraction	19.9109	20.0181	20.2141	20.4303	20.5326	20.5606	20.5620	20.5640	fLA = Living area / (4) =				0.4841	(91)
Temperature adjustment	19.9109	20.0181	20.2141	20.4303	20.5326	20.5606	20.5620	20.5640	20.5549	20.4383	20.1929	19.9164	(92)	
adjusted MIT	19.9109	20.0181	20.2141	20.4303	20.5326	20.5606	20.5620	20.5640	20.5549	20.4383	20.1929	19.9164	(93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Useful gains	503.2438	531.0836	553.6054	542.2788	437.0604	288.0152	182.5260	181.6818	306.8710	430.0742	469.2311	480.6669	(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	857.8574	830.0945	745.0023	615.5035	450.8222	288.8605	182.5876	181.7668	310.9339	495.8694	673.5843	835.7888	(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	263.8325	200.9353	142.3993	52.7218	10.2388	0.0000	0.0000	0.0000	0.0000	48.9516	147.1343	264.2107	(98)	
Space heating												1130.4242	(98)	
Space heating per m ²												(98) / (4) =	18.5620	(99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

8c. Space cooling requirement

Not applicable

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

	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													1253.2419 (211)
Space heating requirement	263.8325	200.9353	142.3993	52.7218	10.2388	0.0000	0.0000	0.0000	0.0000	48.9516	147.1343	264.2107	(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)	292.4972	222.7664	157.8706	58.4499	11.3512	0.0000	0.0000	0.0000	0.0000	54.2701	163.1200	292.9165	(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	84.9207	84.4599	83.1599	80.3408	77.2972	76.2000	76.2000	76.2000	76.2000	80.0213	83.3148	85.0304	(216)
Fuel for water heating, kWh/month	158.8863	139.6691	146.3244	131.9963	131.5914	115.1455	106.6992	122.4846	123.9937	137.6535	144.3735	153.6744	(219)
Water heating fuel used													1612.4921 (219)
Annual totals kWh/year													
Space heating fuel - main system													1253.2419 (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)													148.4117 (230a)
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													223.4117 (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													3377.9775 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1253.2419	7.6100	95.3717	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1612.4921	7.6100	122.7106	(247)
Mechanical ventilation fans	148.4117	31.0800	46.1264	(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			482.2876	(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	1253.2419	0.2160	270.7003	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1612.4921	0.2160	348.2983	(264)
Space and water heating			618.9985	(265)
Pumps and fans	223.4117	0.5190	115.9507	(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			666.8729	(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	1253.2419	1.2200	1528.9552	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1612.4921	1.2200	1967.2403	(264)
Space and water heating			3496.1955	(265)
Pumps and fans	223.4117	3.0700	685.8740	(267)
Energy for lighting	288.8317	3.0700	886.7135	(268)
Energy saving/generation technologies				
PV Unit	-420.0000	3.0700	-1289.4000	(269)
Primary energy kWh/year			3779.3830	(272)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Primary energy kWh/m²/year

62.0588 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 83
Current environmental impact rating: B 91

(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: (none)	SAP change	Cost change	CO2 change
---------------------------------	------------	-------------	------------

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 91

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	£159	£159	£0
Mains gas	£323	£323	£0
Space heating	£270	£270	£0
Water heating	£123	£123	£0
Lighting	£90	£90	£0
Total cost of fuels	£482	£482	£0
Total cost of uses	£483	£483	£0
Delivered energy	55 kWh/m ²	55 kWh/m ²	0 kWh/m ²
Carbon dioxide emissions	0.7 tonnes	0.7 tonnes	0.0 tonnes
CO2 emissions per m ²	11 kg/m ²	11 kg/m ²	0 kg/m ²
Primary energy	62 kWh/m ²	62 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 27		Issued on Date	08/02/2024
Assessment Reference	Rev B	Prop Type Ref	Block Ev	
Project	Plot 27			
Calculation Type	New Build (As Designed)			

SAP Rating	83 B	DER	14.29	TER	19.11
Environmental	91 B	% DER<TER	25.23		
CO ₂ Emissions (t/year)	0.67	DFEE	42.94	TFEE	48.50
General Requirements Compliance	Pass	% DFEE<TFEE	11.46		

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

Building Elements

Wall 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 m² K/W Lower limit = 4.366 m² K/W Average = 4.511 m² K/W
 Total correction = 0.0004 m² K/W U-value (unrounded) = 0.22 W/m² 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 27	Issued on Date	08/02/2024
Assessment Reference	Rev B	Prop Type Ref	Block Ev
Project	Plot 27		
Calculation Type	New Build (As Designed)		

SAP Rating	83 B	DER	14.29	TER	19.11
Environmental	91 B	% DER<TER	25.23		
CO ₂ Emissions (t/year)	0.67	DFEE	42.94	TFEE	48.50
General Requirements Compliance	Pass	% DFEE<TFEE	11.46		

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

Client	Foreman Homes, FORE
--------	---------------------

Building Elements

Wall 000004

Wall Type: Standard Wall

Layer	Description	Thickness (mm)	Conductivity (W/m ² K)	Resistance (m ² K/W)	Fraction (%)	Density (kg/m ³)	Heat Cap. (J/kgK)
Ext surface				0.0400			
Layer 1	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	Hemelite standard solid *7.3N						
	Main construction	140	0.4700	0.2979	93.43	1450	1000
	Main construction	140	0.8803	0.1590	6.57	1450	1000
	Corrections - Air Gap: Level 1, Fasteners: None or plastic						
Layer 4	airspace/plaster dabs						
	Main construction	15	0.0882	0.1700	80.00		
	Main construction	15	0.0882	0.1700	20.00		
	Corrections - Cavity Unventilated, Emissivity: Normal						
Layer 5	Plasterboard, standard						
	Main construction	12.5	0.2100	0.0595	100.00	700	1000
Int surface				0.1300			

Total resistance:	Upper limit = 3.757 m ² K/W	Lower limit = 3.750 m ² K/W	Average = 3.754 m ² K/W
	Total correction = 0.0001 m ² K/W	U-value (unrounded) = 0.27 W/m ² K	

Unheated space:	None	
Total thickness: 370 mm	U-value: 0.27 W/m² K	Kappa: 113.50 kJ/m² K

U-VALUE CALCULATOR REPORT

Property Reference	SAP 0931 Plot 27	Issued on Date	08/02/2024
Assessment Reference	Rev B	Prop Type Ref	Block Ev
Project	Plot 27		
Calculation Type	New Build (As Designed)		

SAP Rating	83 B	DER	14.29	TER	19.11
Environmental	91 B	% DER<TER	25.23		
CO ₂ Emissions (t/year)	0.67	DFEE	42.94	TFEE	48.50
General Requirements Compliance	Pass	% DFEE<TFEE	11.46		

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

Client	Foreman Homes, FORE
--------	---------------------

Building Elements

Wall 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 m ² K/W	Lower limit = 3.480 m ² K/W	Average = 3.480 m ² K/W
	Total correction = 0.0052 m ² K/W	U-value (unrounded) = 0.29 W/m ² K	

Unheated space: None

Total thickness: 355 mm

U-value: 0.29 W/m² K

Kappa: 113.50 kJ/m² K

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

Property Reference	SAP 0931 Plot 27	Issued on Date	08/02/2024
Assessment Reference	Rev B	Prop Type Ref	Block Ev
Property	Plot 27		

SAP Rating	83 B	DER	14.29	TER	19.11
Environmental	91 B	% DER<TER	25.23		
CO ₂ Emissions (t/year)	0.67	DFEE	42.94	TFEE	48.50
General Requirements Compliance	Pass	% DFEE<TFEE	11.46		

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

Client	Foreman Homes, FORE
--------	---------------------

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

Orientation	South 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	2.46 m

7.0 Living Area	29.48	m ²
-----------------	-------	----------------

8.0 Thermal Mass Parameter	Precise calculation	
Thermal Mass	246.46	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	38.55	33.87
	7.3N Brick and Block	Cavity Wall	Other	0.27	113.50	25.84	20.95
	Wall to Corridor	Cavity Wall	Other	0.29	113.50	18.12	16.00

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	95.51

10.1 Party Ceilings	Description	Construction	Kappa (kJ/m ² K)	Area (m ²)
	Party Ceilings 1	Precast concrete plank floor (screed laid on rubber), carpeted	30.00	60.90

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	[3] Wall to Corridor	South West							2.12	
Windows	Window	[2] 7.3N Brick and Block	North East	None	0.00					4.89	
Side Elevation	Window	[1] Brick and Block	South West	None	0.00					1.68	
North Elevation	Window	[1] Brick and Block	North West	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)	8.37	0.043	No	Catnic Thermally Broken
Independently assessed	E3 Sill	7.36	0.021	No	Knauf P5
Independently assessed	E4 Jamb	17.70	0.016	No	Knauf P6
Table K1 - Approved	E7 Party floor between dwellings (in blocks of flats)	67.08	0.070	No	
Independently assessed	E16 Corner (normal)	14.75	0.061	No	Knauf P23
Independently assessed	E17 Corner (inverted – internal area greater than external area)	4.92	-0.113	No	Knauf P24

Y-value	<input type="text" value="0.071"/>	W/m ² K
---------	------------------------------------	--------------------

18.0 Pressure Testing

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

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	<input type="text" value="Windows half open"/>
Cross ventilation possible	<input type="text" value="Yes"/>
Night Ventilation	<input type="text" value="Yes"/>
Air change rate	<input type="text" value="4.00"/>

Mechanical Ventilation

Mechanical Ventilation System Present	<input type="text" value="Yes"/>
Approved Installation	<input type="text" value="No"/>
Mechanical Ventilation data Type	<input type="text" value="Database"/>
Type	<input type="text" value="Balanced mechanical ventilation with heat recovery"/>
MV Reference Number	<input type="text" value="500352"/>

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

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

Database	Database	
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)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	

25.0 Main Heating 2

None

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

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