



SAP Report Submission for Building Regulations Compliance

Client: Foreman Homes

Project:

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

EXCELLENCE
IN ENERGY
ASSESSMENT

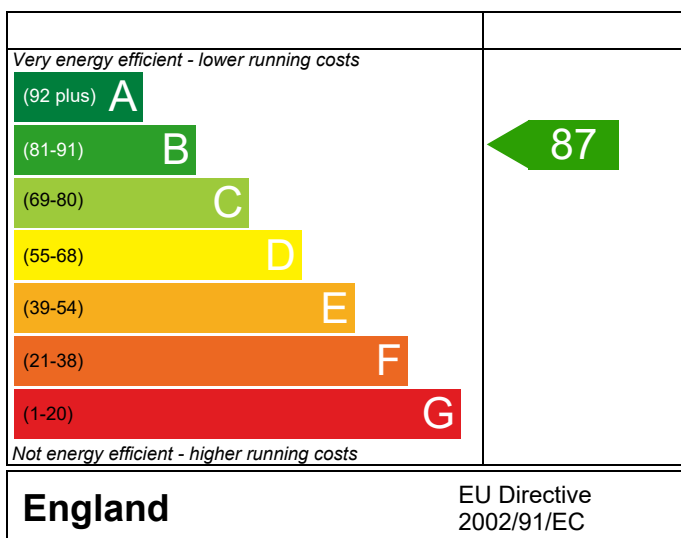
PREDICTED ENERGY ASSESSMENT

Dwelling type: House, Mid-Terrace
Date of assessment: 29/11/2023
Produced by: Abacus Energy (UK) Ltd
Total floor area: 84.14 m²
DRRN: 9424-1910-2976

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

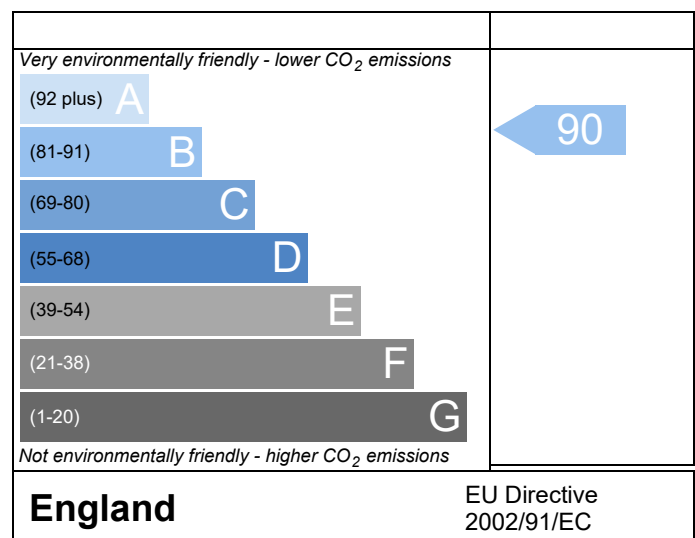
The energy performance has been assessed using the Government approved SAP2012 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO₂) emissions.

Energy Efficiency Rating



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

Environmental Impact (CO₂) Rating



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

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

BUILDING REGULATION COMPLIANCE

Calculation Type: New Build (As Designed)

Property Reference	SAP 0906 Plot 43				Issued on Date	29/11/2023
Assessment Reference	Rev B	Prop Type Ref	Block Cv			
Property						
SAP Rating	87 B	DER	13.63	TER	17.12	
Environmental	90 B	% DER<TER	20.40			
CO ₂ Emissions (t/year)	0.84	DFEE	37.87	TFEE	45.44	
General Requirements Compliance	Pass	% DFEE<TFEE	16.66			
Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 07798936079, toby@abacusenergyuk.com				Assessor ID	E477-0001
Client	Foreman Homes, FORE					

SUMMARY FOR INPUT DATA FOR New Build (As Designed)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	17.12	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	13.63	kgCO ₂ /m ²	Pass
	-3.49 (-20.4%)	kgCO ₂ /m ²	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	45.44	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DFEE)	37.87	kWh/m ² /yr	
	-7.5 (-16.5%)	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)	0.26 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.12 (max. 0.25)	0.12 (max. 0.70)	Pass
Roof	0.10 (max. 0.20)	0.10 (max. 0.35)	Pass
Openings	1.18 (max. 2.00)	1.20 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

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

Limiting System Efficiencies

4 Heating efficiency

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BUILDING REGULATION COMPLIANCE

Calculation Type: New Build (As Designed)

Main heating system

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

Pass

Secondary heating system

None

5 Cylinder insulation

Hot water storage

No cylinder

6 Controls

Space heating controls

Programmer, room thermostat and TRVs

Pass

Hot water controls

No cylinder

Boiler interlock

Yes

Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings

100 %

Minimum

75 %

Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)

Not significant

Pass

Based on:

Overshading

Average

Windows facing North

7.72 m², No overhang

Windows facing South

3.62 m², No overhang

Air change rate

4.00 ach

Blinds/curtains

None

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type

U-value

Filled Cavity with Edge Sealing

0.00

W/m²K

Pass

Filled Cavity with Edge Sealing

0.00

W/m²K

Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals

5.00 (design value)

m³/(h.m²) @ 50 Pa

Maximum

10.0

m³/(h.m²) @ 50 Pa

Pass

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BUILDING REGULATION COMPLIANCE

Calculation Type: New Build (As Designed)

10 Key features

Party wall U-value	0.00	W/m ² K
Party wall U-value	0.00	W/m ² K
Roof U-value	0.10	W/m ² K
Floor U-value	0.12	W/m ² K
Door U-value	1.10	W/m ² K
Photovoltaic array	0.55	kW

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RECOMMENDATIONS

	Typical cost	Typical savings per year	Energy efficiency	Environmental impact	Result
Low energy lights			0	0	Already installed
Solar water heating	£4,000 - £6,000	£85	B 89	A 92	Recommended
Photovoltaic			0	0	Already installed
Wind turbine			0	0	Not applicable
Totals	£4,000 - £6,000	£85	B 89	A 92	

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THERMAL BRIDGING

Calculation Type: New Build (As Designed)

Property Reference	SAP 0906 Plot 43	Issued on Date	29/11/2023
Assessment Reference	Rev B	Prop Type Ref	Block Cv
Property			

SAP Rating	87 B	DER	13.63	TER	17.12
Environmental	90 B	% DER<TER	20.40		
CO ₂ Emissions (t/year)	0.84	DFEE	37.87	TFEE	45.44
General Requirements Compliance	Pass	% DFEE<TFEE	16.66		

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Client	Foreman Homes, FORE
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	Junction detail	Source Type	Psi (W/mK)	Length (m)	Result	Reference
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.093	0.46	0.04	Birtley Supatherm
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.077	0.69	0.05	Birtley Supatherm
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.071	3.75	0.27	Birtley Supatherm
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.067	1.59	0.11	Birtley Supatherm
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.061	1.81	0.11	Birtley Supatherm
External wall	E3 Sill	Independently assessed	0.021	6.93	0.15	Knauf P5
External wall	E4 Jamb	Independently assessed	0.016	24.30	0.39	Knauf P6
External wall	E5 Ground floor (normal)	Table K1 - Approved	0.160	9.92	1.59	
External wall	E6 Intermediate floor within a dwelling	Independently assessed	0.000	9.92	0.00	CD0029
External wall	E10 Eaves (insulation at ceiling level)	Independently assessed	0.071	9.92	0.70	Knauf P16
External wall	E12 Gable (insulation at ceiling level)	Independently assessed	0.044	8.45	0.37	Knauf P23
External wall	E18 Party wall between dwellings	Independently assessed	0.036	9.10	0.33	Knauf P25 Halved
External wall	E25 Staggered party wall between dwellings	Independently assessed	0.055	9.10	0.50	Knauf P27 Halved
Party wall	P1 Party wall - Ground floor	Table K1 - Default	0.160	8.45	1.35	
Party wall	P6 Party wall - Ground floor (inverted)	Table K1 - Default	0.070	8.45	0.59	
Party wall	P2 Party wall - Intermediate floor within a dwelling	Table K1 - Default	0.000	16.90	0.00	
Party wall	P4 Party wall - Roof (insulation at ceiling level)	Independently assessed	0.035	8.45	0.30	Knauf P29 Halved

Total: **6.84** W/mK:
Y-Value: **0.048** W/m²K:

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

DWELLING AS DESIGNED

Mid-Terrace House, total floor area 84 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 17.12 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 13.63 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)45.4 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)37.9 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.24 (max. 0.30)	0.26 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.12 (max. 0.25)	0.12 (max. 0.70)	OK
Roof	0.10 (max. 0.20)	0.10 (max. 0.35)	OK
Openings	1.18 (max. 2.00)	1.20 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

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

4 Heating efficiency

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

Secondary heating system: None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls: Programmer, room thermostat and TRVs OK

Hot water controls: No cylinder

Boiler interlock Yes OK

7 Low energy lights

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

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 7.72 m², No overhang
Windows facing South: 3.62 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

10 Key features

Party wall U-value 0.00 W/m²K
Party wall U-value 0.00 W/m²K
Roof U-value 0.10 W/m²K
Floor U-value 0.12 W/m²K
Door U-value 1.10 W/m²K
Photovoltaic array 0.55 kW

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	42.0700 (1b)	x 2.3900 (2b)	= 100.5473 (1b) - (3b)
First floor	42.0700 (1c)	x 2.6100 (2c)	= 109.8027 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	84.1400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 210.3500 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (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) =				40.0000 / (5) = 0.1902 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4402 (18)
Number of sides sheltered					2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3741 (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	0.4770	0.4677	0.4583	0.4115	0.4022	0.3554	0.3554	0.3461	0.3741	0.4022	0.4209	0.4396 (22b)
Effective ac	0.6138	0.6094	0.6050	0.5847	0.5809	0.5632	0.5632	0.5599	0.5700	0.5809	0.5886	0.5966 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			2.1500	1.1000	2.3650		(26)
Windows (Uw = 1.20)			11.3400	1.1450	12.9847		(27)
Ground Floor			42.0700	0.1200	5.0484	84.0000	3533.8800 (28a)
Brick and Block	35.8000	11.3100	24.4900	0.2400	5.8776	42.2200	1033.9678 (29a)
Tile Hung	13.8000	2.1800	11.6200	0.2400	2.7888	42.2200	490.5964 (29a)
Step Party Wall	7.6000		7.6000	0.2600	1.9760	58.0600	441.2560 (29a)
Pitched Roof	42.0700		42.0700	0.1000	4.2070	9.1000	382.8370 (30)
Total net area of external elements Aum(A, m ²)			141.3400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	35.2475		(33)
Party Wall 1			42.1600	0.0000	0.0000	110.0000	4637.6000 (32)
Party Wall 2			34.5600	0.0000	0.0000	110.0000	3801.6000 (32)
Ground Floor Stud			62.9600			9.0000	566.6400 (32c)
First Floor Stud			93.8500			9.0000	844.6500 (32c)
Internal Floor 1			42.0700			18.0000	757.2600 (32d)
Internal Ceiling 1			42.0700			18.0000	757.2600 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	17247.5472 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							204.9863 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.8441 (36)
Total fabric heat loss						(33) + (36) =	42.0916 (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	42.6055	42.2988	41.9982	40.5863	40.3221	39.0924	39.0924	38.8646	39.5660	40.3221	40.8565	41.4152 (38)
Heat transfer coeff	84.6972	84.3905	84.0899	82.6779	82.4138	81.1840	81.1840	80.9563	81.6577	82.4138	82.9482	83.5069 (39)
Average = Sum(39)m / 12 =												82.6767 (39)
HLP	1.0066	1.0030	0.9994	0.9826	0.9795	0.9649	0.9649	0.9622	0.9705	0.9795	0.9858	0.9925 (40)
HLP (average)												0.9826 (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 2.5367 (42)
Average daily hot water use (litres/day) 94.4475 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Energy conte	103.8923	100.1144	96.3365	92.5586	88.7807	85.0028	85.0028	88.7807	92.5586	96.3365	100.1144	103.8923 (44)
Energy content (annual)	154.0692	134.7499	139.0498	121.2270	116.3202	100.3755	93.0127	106.7334	108.0081	125.8730	137.4003	149.2078 (45)
Distribution loss (46)m = 0.15 x (45)m	23.1104	20.2125	20.8575	18.1841	17.4480	15.0563	13.9519	16.0100	16.2012	18.8810	20.6100	22.3812 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	25.3184	22.8666	25.2755	24.4131	25.1926	24.3405	25.1272	25.1696	24.3800	25.2412	24.4811	25.3056 (61)
Total heat required for water heating calculated for each month	179.3876	157.6165	164.3253	145.6401	141.5128	124.7160	118.1399	131.9030	132.3881	151.1142	161.8814	174.5134 (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	179.3876	157.6165	164.3253	145.6401	141.5128	124.7160	118.1399	131.9030	132.3881	151.1142	161.8814	174.5134 (64)
Heat gains from water heating, kWh/month	57.5576	50.5210	52.5529	46.4112	44.9746	39.4600	37.2085	41.7813	42.0077	48.1631	51.8059	55.9380 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	126.8368	126.8368	126.8368	126.8368	126.8368	126.8368	126.8368	126.8368	126.8368	126.8368	126.8368	126.8368 (66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	21.9767	19.5195	15.8744	12.0179	8.9835	7.5843	8.1951	10.6523	14.2975	18.1539	21.1883	22.5875 (67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	227.8752	230.2398	224.2811	211.5955	195.5822	180.5320	170.4776	168.1129	174.0717	186.7573	202.7706	217.8208 (68)
Pumps, fans	35.6837	35.6837	35.6837	35.6837	35.6837	35.6837	35.6837	35.6837	35.6837	35.6837	35.6837	35.6837 (69)
Losses e.g. evaporation (negative values) (Table 5)	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)
Water heating gains (Table 5)	-101.4695	-101.4695	-101.4695	-101.4695	-101.4695	-101.4695	-101.4695	-101.4695	-101.4695	-101.4695	-101.4695	-101.4695 (71)
Total internal gains	77.3624	75.1800	70.6357	64.4601	60.4498	54.8055	50.0114	56.1576	58.3440	64.7353	71.9526	75.1855 (72)
	391.2654	388.9905	374.8421	352.1245	329.0666	306.9729	292.7352	298.9739	310.7643	333.6976	359.9625	379.6448 (73)

6. Solar gains

[Jan]				Area	Solar flux	g	Specific data	FF			Access	Gains
				m2	Table 6a	W/m2	or Table 6b	or Table 6c			factor	W
											Table 6d	
North				7.7200	10.6334		0.6300		0.7000		0.7700	25.0877
South				3.6200	46.7521		0.6300		0.7000		0.7700	51.7227
Solar gains	76.8104	132.6523	189.3719	252.8136	303.3633	311.0132	295.6825	255.8286	210.6694	148.4370	92.2580	65.6075
Total gains	468.0758	521.6428	564.2141	604.9381	632.4298	617.9861	588.4177	554.8025	521.4337	482.1345	452.2204	445.2524

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
alpha	56.5661	56.7716	56.9746	57.9476	58.1333	59.0139	59.0139	59.1799	58.6716	58.1333	57.7588	57.3724
util living area	4.7711	4.7848	4.7983	4.8632	4.8756	4.9343	4.9343	4.9453	4.9114	4.8756	4.8506	4.8248
MIT	0.9966	0.9937	0.9865	0.9639	0.8988	0.7522	0.5856	0.6373	0.8613	0.9726	0.9935	0.9973 (86)
Th 2	19.7275	19.8711	20.1091	20.4369	20.7326	20.9259	20.9829	20.9745	20.8453	20.4758	20.0511	19.7089 (87)
util rest of house	20.0778	20.0809	20.0838	20.0978	20.1005	20.1127	20.1127	20.1150	20.1080	20.1005	20.0952	20.0896 (88)
MIT 2	0.9956	0.9919	0.9826	0.9523	0.8650	0.6765	0.4775	0.5297	0.8045	0.9616	0.9914	0.9966 (89)
Living area fraction	18.9096	19.0549	19.2934	19.6259	19.9043	20.0728	20.1071	20.1057	20.0118	19.6693	19.2462	18.9004 (90)
MIT	19.0766	19.2216	19.4600	19.7915	20.0735	20.2470	20.2859	20.2831	20.1820	19.8340	19.4105	19.0655 (92)
Temperature adjustment												0.0000
adjusted MIT	19.0766	19.2216	19.4600	19.7915	20.0735	20.2470	20.2859	20.2831	20.1820	19.8340	19.4105	19.0655 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9942	0.9897	0.9791	0.9475	0.8639	0.6890	0.4995	0.5513	0.8100	0.9575	0.9892	0.9954 (94)
Ext temp.	465.3810	516.2802	552.3961	573.1685	546.3338	425.7750	293.9097	305.8631	422.3505	461.6443	447.3314	443.2185 (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	1251.5370	1208.6036	1089.8033	900.4867	690.0880	458.4458	299.2353	314.3613	496.6428	761.0049	1021.1343	1241.3731 (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	584.9000	465.2414	399.8310	235.6691	106.9532	0.0000	0.0000	0.0000	0.0000	222.7242	413.1380	593.8270 (98)
Space heating per m2												3022.2840 (98)
												(98) / (4) = 35.9197 (99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.7000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3332.1764 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	584.9000	465.2414	399.8310	235.6691	106.9532	0.0000	0.0000	0.0000	0.0000	222.7242	413.1380	593.8270	(98)
Space heating efficiency (main heating system 1)	90.7000	90.7000	90.7000	90.7000	90.7000	0.0000	0.0000	0.0000	0.0000	90.7000	90.7000	90.7000	(210)
Space heating fuel (main heating system)	644.8732	512.9453	440.8280	259.8336	117.9197	0.0000	0.0000	0.0000	0.0000	245.5615	455.4995	654.7156	(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	179.3876	157.6165	164.3253	145.6401	141.5128	124.7160	118.1399	131.9030	132.3881	151.1142	161.8814	174.5134	(64)
Efficiency of water heater (217)m	89.8535	89.7880	89.6519	89.3305	88.6729	87.2000	87.2000	87.2000	87.2000	89.2519	89.6866	87.2000	(216)
Fuel for water heating, kWh/month	199.6445	175.5429	183.2927	163.0351	159.5897	143.0229	135.4815	151.2649	151.8213	169.3120	180.4968	194.1614	(219)
Water heating fuel used												2006.6655	(219)
Annual totals kWh/year													
Space heating fuel - main system												3332.1764	(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)												388.1161	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.55 * 1080 * 1.00) =												-474.9908	(233)
Total delivered energy for all uses												5326.9671	(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	3332.1764	0.2160	719.7501 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2006.6655	0.2160	433.4398 (264)
Space and water heating			1153.1899 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	388.1161	0.5190	201.4322 (268)
Energy saving/generation technologies			
PV Unit	-474.9908	0.5190	-246.5202 (269)
Total CO2, kg/year			1147.0268 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.6300 (273)

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

DER			13.6300 ZC1
Total Floor Area		TFA	84.1400
Assumed number of occupants		N	2.5367
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190
CO2 emissions from appliances, equation (L14)			16.0487 ZC2
CO2 emissions from cooking, equation (L16)			2.1379 ZC3
Total CO2 emissions			31.8166 ZC4
Residual CO2 emissions offset from biofuel CHP			0.0000 ZC5
Additional allowable electricity generation, kWh/m²/year			0.0000 ZC6
Resulting CO2 emissions offset from additional allowable electricity generation			0.0000 ZC7
Net CO2 emissions			31.8166 ZC8

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	42.0700 (1b)	x 2.3900 (2b)	= 100.5473 (1b) - (3b)
First floor	42.0700 (1c)	x 2.6100 (2c)	= 109.8027 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	84.1400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 210.3500 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1426 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3926 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3337 (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	0.4255	0.4172	0.4088	0.3671	0.3588	0.3170	0.3170	0.3087	0.3337	0.3588	0.3754	0.3921 (22b)
Effective ac	0.5905	0.5870	0.5836	0.5674	0.5644	0.5503	0.5503	0.5476	0.5557	0.5644	0.5705	0.5769 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			2.1500	1.0000	2.1500		(26)
TER Opening Type (Uw = 1.40)			11.3400	1.3258	15.0341		(27)
Ground Floor			42.0700	0.1300	5.4691		(28a)
Brick and Block	35.8000	11.3100	24.4900	0.1800	4.4082		(29a)
Tile Hung	13.8000	2.1800	11.6200	0.1800	2.0916		(29a)
Step Party Wall	7.6000		7.6000	0.1800	1.3680		(29a)
Pitched Roof	42.0700		42.0700	0.1300	5.4691		(30)
Total net area of external elements Aum(A, m ²)			141.3400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	35.9901		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.0394 (36)
Total fabric heat loss						(33) + (36) =	44.0295 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	40.9916	40.7476	40.5084	39.3850	39.1748	38.1964	38.1964	38.0152	38.5733	39.1748	39.6000	40.0446 (38)
Heat transfer coeff	85.0211	84.7771	84.5379	83.4145	83.2043	82.2259	82.2259	82.0447	82.6028	83.2043	83.6295	84.0741 (39)
Average = Sum(39)m / 12 =												83.4135 (39)
HLP	1.0105	1.0076	1.0047	0.9914	0.9889	0.9773	0.9773	0.9751	0.9817	0.9889	0.9939	0.9992 (40)
HLP (average)												0.9914 (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												2.5367 (42)
Average daily hot water use (litres/day)												94.4475 (43)
Daily hot water use	103.8923	100.1144	96.3365	92.5586	88.7807	85.0028	85.0028	88.7807	92.5586	96.3365	100.1144	103.8923 (44)
Energy conte	154.0692	134.7499	139.0498	121.2270	116.3202	100.3755	93.0127	106.7334	108.0081	125.8730	137.4003	149.2078 (45)
Energy content (annual)										Total = Sum(45)m =		1486.0270 (45)
Distribution loss (46)m = 0.15 x (45)m												
23.1104	20.2125	20.8575	18.1841	17.4480	15.0563	13.9519	16.0100	16.2012	18.8810	20.6100	22.3812 (46)	
Water storage loss:												
Total storage loss												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Total heat required for water heating calculated for each month	50.9589	46.0274	49.0920	45.6453	45.2416	41.9192	43.3165	45.2416	45.6453	49.0920	49.3151	50.9589 (61)
Solar input	205.0281	180.7773	188.1418	166.8723	161.5619	142.2947	136.3291	151.9750	153.6534	174.9651	186.7153	200.1667 (62)
Output from w/h	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Heat gains from water heating, kWh/month	205.0281	180.7773	188.1418	166.8723	161.5619	142.2947	136.3291	151.9750	153.6534	174.9651	186.7153	200.1667 (64)
	63.9677	56.3112	58.5071	51.7193	49.9869	43.8546	41.7558	46.7993	47.3240	54.1258	58.0144	62.3513 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(66)
(66)m	126.8368	126.8368	126.8368	126.8368	126.8368	126.8368	126.8368	126.8368	126.8368	126.8368	126.8368	126.8368	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.9767	19.5195	15.8744	12.0179	8.9835	7.5843	8.1951	10.6523	14.2975	18.1539	21.1883	22.5875	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	227.8752	230.2398	224.2811	211.5955	195.5822	180.5320	170.4776	168.1129	174.0717	186.7573	202.7706	217.8208	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.6837	35.6837	35.6837	35.6837	35.6837	35.6837	35.6837	35.6837	35.6837	35.6837	35.6837	35.6837	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-101.4695	-101.4695	-101.4695	-101.4695	-101.4695	-101.4695	-101.4695	-101.4695	-101.4695	-101.4695	-101.4695	-101.4695	(71)
Water heating gains (Table 5)	85.9781	83.7964	78.6385	71.8324	67.1867	60.9092	56.1234	62.9022	65.7278	72.7497	80.5755	83.8055	(72)
Total internal gains	399.8812	397.6069	382.8450	359.4968	335.8035	313.0766	298.8471	305.7185	318.1481	341.7120	368.5854	388.2649	(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			
North	7.7200				10.6334	0.6300	0.7000	0.7700	25.0877 (74)			
South	3.6200				46.7521	0.6300	0.7000	0.7700	51.7227 (78)			
Solar gains	76.8104	132.6523	189.3719	252.8136	303.3633	311.0132	295.6825	255.8286	210.6694	148.4370	92.2580	65.6075 (83)
Total gains	476.6916	530.2592	572.2169	612.3104	639.1668	624.0898	594.5296	561.5471	528.8175	490.1489	460.8433	453.8724 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	68.7247	68.9226	69.1176	70.0484	70.2254	71.0610	71.0610	71.2180	70.7368	70.2254	69.8683	69.4989	
alpha	5.5816	5.5948	5.6078	5.6699	5.6817	5.7374	5.7374	5.7479	5.7158	5.6817	5.6579	5.6333	
util living area	0.9985	0.9969	0.9925	0.9760	0.9186	0.7705	0.5943	0.6480	0.8810	0.9824	0.9968	0.9989	(86)
MIT	19.9190	20.0417	20.2457	20.5268	20.7853	20.9477	20.9902	20.9844	20.8802	20.5587	20.1923	19.8992	(87)
Th 2	20.0746	20.0770	20.0794	20.0905	20.0926	20.1023	20.1023	20.1041	20.0986	20.0926	20.0884	20.0840	(88)
util rest of house	0.9980	0.9959	0.9898	0.9665	0.8852	0.6894	0.4805	0.5338	0.8220	0.9737	0.9955	0.9985	(89)
MIT 2	18.6229	18.8038	19.1027	19.5153	19.8695	20.0649	20.0984	20.0971	19.9961	19.5662	19.0326	18.6009	(90)
Living area fraction	18.8875	19.0566	19.3361	19.7219	20.0565	20.2451	20.2805	20.2783	20.1766	19.7688	19.2694	18.8660	(92)
Temperature adjustment	18.8875	19.0566	19.3361	19.7219	20.0565	20.2451	20.2805	20.2783	20.1766	19.7688	19.2694	18.8660	(93)
adjusted MIT	18.8875	19.0566	19.3361	19.7219	20.0565	20.2451	20.2805	20.2783	20.1766	19.7688	19.2694	18.8660	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	475.2775	527.1797	564.6321	588.7313	564.8135	438.9854	299.5118	312.8092	437.8733	475.1801	457.9780	452.8418	(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	1240.2478	1200.1537	1085.1393	902.7013	695.2951	464.1749	302.6310	318.1928	501.9432	762.8851	1017.7205	1233.0334	(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	569.1380	452.2385	387.2574	226.0584	97.0783	0.0000	0.0000	0.0000	0.0000	214.0525	403.0146	580.4626	(98)
Space heating												2929.3003	(98)
Space heating per m2												34.8146	(99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.4000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3136.2958 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	569.1380	452.2385	387.2574	226.0584	97.0783	0.0000	0.0000	0.0000	0.0000	214.0525	403.0146	580.4626	(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)	609.3554	484.1954	414.6224	242.0326	103.9383	0.0000	0.0000	0.0000	0.0000	229.1783	431.4931	621.4803	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	205.0281	180.7773	188.1418	166.8723	161.5619	142.2947	136.3291	151.9750	153.6534	174.9651	186.7153	200.1667	(64)
Efficiency of water heater (217)m	87.4858	87.2654	86.8290	85.8160	83.8148	80.3000	80.3000	80.3000	80.3000	85.5599	86.9379	87.5755	(216)
Fuel for water heating, kWh/month	234.3559	207.1580	216.6808	194.4536	192.7606	177.2038	169.7748	189.2591	191.3492	204.4943	214.7687	228.5646	(219)
Water heating fuel used												2420.8234	(219)
Annual totals kWh/year													
Space heating fuel - main system												3136.2958	(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)												388.1161	(232)
Total delivered energy for all uses												6020.2352	(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	3136.2958	0.2160	677.4399 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2420.8234	0.2160	522.8979 (264)
Space and water heating			1200.3377 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	388.1161	0.5190	201.4322 (268)
Total CO2, kg/m2/year			1440.6950 (272)
Emissions per m2 for space and water heating			14.2660 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.3940 (272b)
Emissions per m2 for pumps and fans			0.4626 (272c)
Target Carbon Dioxide Emission Rate (TER) = (14.2660 * 1.00) + 2.3940 + 0.4626, rounded to 2 d.p.			17.1200 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	42.0700 (1b)	x 2.3900 (2b)	= 100.5473 (1b) - (3b)
First floor	42.0700 (1c)	x 2.6100 (2c)	= 109.8027 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	84.1400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 210.3500 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1426 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3926 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3337 (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	0.4255	0.4172	0.4088	0.3671	0.3588	0.3170	0.3170	0.3087	0.3337	0.3588	0.3754	0.3921 (22b)
Effective ac	0.5905	0.5870	0.5836	0.5674	0.5644	0.5503	0.5503	0.5476	0.5557	0.5644	0.5705	0.5769 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			2.1500	1.1000	2.3650		(26)
Windows (Uw = 1.20)			11.3400	1.1450	12.9847		(27)
Ground Floor			42.0700	0.1200	5.0484	84.0000	3533.8800 (28a)
Brick and Block	35.8000	11.3100	24.4900	0.2400	5.8776	42.2200	1033.9678 (29a)
Tile Hung	13.8000	2.1800	11.6200	0.2400	2.7888	42.2200	490.5964 (29a)
Step Party Wall	7.6000		7.6000	0.2600	1.9760	58.0600	441.2560 (29a)
Pitched Roof	42.0700		42.0700	0.1000	4.2070	9.1000	382.8370 (30)
Total net area of external elements Aum(A, m ²)			141.3400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	35.2475		(33)
Party Wall 1			42.1600	0.0000	0.0000	110.0000	4637.6000 (32)
Party Wall 2			34.5600	0.0000	0.0000	110.0000	3801.6000 (32)
Ground Floor Stud			62.9600			9.0000	566.6400 (32c)
First Floor Stud			93.8500			9.0000	844.6500 (32c)
Internal Floor 1			42.0700			18.0000	757.2600 (32d)
Internal Ceiling 1			42.0700			9.0000	378.6300 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	16868.9172 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							200.4863 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.8441 (36)
Total fabric heat loss						(33) + (36) =	42.0916 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 40.9916	Feb 40.7476	Mar 40.5084	Apr 39.3850	May 39.1748	Jun 38.1964	Jul 38.1964	Aug 38.0152	Sep 38.5733	Oct 39.1748	Nov 39.6000	Dec 40.0446 (38)
Heat transfer coeff	83.0833	82.8393	82.6001	81.4767	81.2665	80.2880	80.2880	80.1068	80.6649	81.2665	81.6917	82.1362 (39)
Average = Sum(39)m / 12 =												81.4757 (39)
HLP	Jan 0.9874	Feb 0.9845	Mar 0.9817	Apr 0.9683	May 0.9658	Jun 0.9542	Jul 0.9542	Aug 0.9521	Sep 0.9587	Oct 0.9658	Nov 0.9709	Dec 0.9762 (40)
HLP (average)												0.9683 (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												2.5367 (42)
Average daily hot water use (litres/day)												94.4475 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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Energy conte	103.8923	100.1144	96.3365	92.5586	88.7807	85.0028	85.0028	88.7807	92.5586	96.3365	100.1144	103.8923 (44)
Energy content (annual)	154.0692	134.7499	139.0498	121.2270	116.3202	100.3755	93.0127	106.7334	108.0081	125.8730	137.4003	149.2078 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum (45)m =		1486.0270 (45)
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)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	32.7397	28.6344	29.5481	25.7607	24.7180	21.3298	19.7652	22.6808	22.9517	26.7480	29.1976	31.7067 (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	126.8368	126.8368	126.8368	126.8368	126.8368	126.8368	126.8368	126.8368	126.8368	126.8368	126.8368	126.8368	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.9767	19.5195	15.8744	12.0179	8.9835	7.5843	8.1951	10.6523	14.2975	18.1539	21.1883	22.5875	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	227.8752	230.2398	224.2811	211.5955	195.5822	180.5320	170.4776	168.1129	174.0717	186.7573	202.7706	217.8208	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.6837	35.6837	35.6837	35.6837	35.6837	35.6837	35.6837	35.6837	35.6837	35.6837	35.6837	35.6837	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-101.4695	-101.4695	-101.4695	-101.4695	-101.4695	-101.4695	-101.4695	-101.4695	-101.4695	-101.4695	-101.4695	-101.4695	(71)
Water heating gains (Table 5)	44.0050	42.6107	39.7152	35.7788	33.2232	29.6247	26.5661	30.4850	31.8774	35.9516	40.5522	42.6165	(72)
Total internal gains	354.9080	353.4211	340.9216	320.4433	298.8400	278.7921	266.2898	270.3013	281.2976	301.9139	325.5621	344.0758	(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	
North	7.7200				10.6334		0.6300		0.7000		0.7700		25.0877 (74)	
South	3.6200				46.7521		0.6300		0.7000		0.7700		51.7227 (78)	
Solar gains	76.8104	132.6523	189.3719	252.8136	303.3633	311.0132	295.6825	255.8286	210.6694	148.4370	92.2580	65.6075 (83)		
Total gains	431.7184	486.0734	530.2936	573.2568	602.2033	589.8053	561.9723	526.1299	491.9670	450.3509	417.8200	409.6834 (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	56.3990	56.5651	56.7289	57.5111	57.6598	58.3625	58.3625	58.4945	58.0898	57.6598	57.3597	57.0493	
alpha	4.7599	4.7710	4.7819	4.8341	4.8440	4.8908	4.8908	4.8996	4.8727	4.8440	4.8240	4.8033	
util living area	0.9973	0.9948	0.9886	0.9682	0.9080	0.7684	0.6028	0.6586	0.8766	0.9773	0.9949	0.9979	(86)
MIT	19.6875	19.8332	20.0751	20.4066	20.7120	20.9162	20.9800	20.9696	20.8270	20.4418	20.0091	19.6648	(87)
Th 2	20.0938	20.0962	20.0986	20.1098	20.1119	20.1217	20.1217	20.1235	20.1179	20.1119	20.1077	20.1032	(88)
util rest of house	0.9966	0.9934	0.9852	0.9580	0.8769	0.6949	0.4943	0.5511	0.8241	0.9682	0.9932	0.9974	(89)
MIT 2	18.8842	19.0313	19.2735	19.6082	19.8975	20.0754	20.1148	20.1120	20.0075	19.6475	19.2161	18.8690	(90)
Living area fraction									fLA = Living area / (4) =			0.2042	(91)
MIT	19.0482	19.1950	19.4372	19.7712	20.0638	20.2471	20.2914	20.2871	20.1748	19.8096	19.3780	19.0315	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0482	19.1950	19.4372	19.7712	20.0638	20.2471	20.2914	20.2871	20.1748	19.8096	19.3780	19.0315	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	429.7635	481.9551	520.7613	546.4555	526.8765	416.6145	290.1060	301.1948	407.3845	434.2056	414.2308	408.2314	(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	1225.3307	1184.1888	1068.6151	885.7522	679.6979	453.3926	296.3791	311.3839	490.0233	748.4352	1003.0126	1218.2022	(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	591.9020	471.9011	407.6032	244.2936	113.6991	0.0000	0.0000	0.0000	0.0000	233.7868	423.9229	602.6183	(98)
Space heating												3089.7269	(98)
Space heating per m2												36.7213	(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													

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Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	754.7073	594.1313	608.8118	0.0000	0.0000	0.0000	0.0000 (100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.8462	0.9111	0.8877	0.0000	0.0000	0.0000	0.0000 (101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	638.6181	541.3303	540.4594	0.0000	0.0000	0.0000	0.0000 (102)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	785.0501	750.5928	710.5429	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	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	0.0000	0.0000	0.0000	0.0000	0.0000	105.4310	155.6913	126.5421	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction									FC = cooled area / (4) =			387.6645 (104)
Intermittency factor (Table 10b)												1.0000 (105)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	26.3578	38.9228	31.6355	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling per m2												96.9161 (107)
Energy for space heating												1.1518 (108)
Energy for space cooling												36.7213 (99)
Total												1.1518 (108)
Dwelling Fabric Energy Efficiency (DFEE)												37.8731 (109)
												37.9 (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 (m ²)	Storey height (m)	Volume (m ³)
Ground floor	42.0700 (1b)	x 2.3900 (2b)	= 100.5473 (1b) - (3b)
First floor	42.0700 (1c)	x 2.6100 (2c)	= 109.8027 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	84.1400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 210.3500 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					30.0000 / (5) = 0.1426 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3926 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3337 (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	0.4255	0.4172	0.4088	0.3671	0.3588	0.3170	0.3170	0.3087	0.3337	0.3588	0.3754	0.3921 (22b)
Effective ac	0.5905	0.5870	0.5836	0.5674	0.5644	0.5503	0.5503	0.5476	0.5557	0.5644	0.5705	0.5769 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			2.1500	1.0000	2.1500		(26)
TER Opening Type (Uw = 1.40)			11.3400	1.3258	15.0341		(27)
Ground Floor			42.0700	0.1300	5.4691		(28a)
Brick and Block	35.8000	11.3100	24.4900	0.1800	4.4082		(29a)
Tile Hung	13.8000	2.1800	11.6200	0.1800	2.0916		(29a)
Step Party Wall	7.6000		7.6000	0.1800	1.3680		(29a)
Pitched Roof	42.0700		42.0700	0.1300	5.4691		(30)
Total net area of external elements Aum(A, m ²)			141.3400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	35.9901		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.0394 (36)
Total fabric heat loss						(33) + (36) =	44.0295 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	40.9916	40.7476	40.5084	39.3850	39.1748	38.1964	38.1964	38.0152	38.5733	39.1748	39.6000	40.0446 (38)
Heat transfer coeff	85.0211	84.7771	84.5379	83.4145	83.2043	82.2259	82.2259	82.0447	82.6028	83.2043	83.6295	84.0741 (39)
Average = Sum(39)m / 12 =												83.4135 (39)
HLP	1.0105	1.0076	1.0047	0.9914	0.9889	0.9773	0.9773	0.9751	0.9817	0.9889	0.9939	0.9992 (40)
HLP (average)												0.9914 (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												2.5367 (42)
Average daily hot water use (litres/day)												94.4475 (43)
Daily hot water use	103.8923	100.1144	96.3365	92.5586	88.7807	85.0028	85.0028	88.7807	92.5586	96.3365	100.1144	103.8923 (44)
Energy conte	154.0692	134.7499	139.0498	121.2270	116.3202	100.3755	93.0127	106.7334	108.0081	125.8730	137.4003	149.2078 (45)
Energy content (annual)												1486.0270 (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												

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Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	32.7397	28.6344	29.5481	25.7607	24.7180	21.3298	19.7652	22.6808	22.9517	26.7480	29.1976	31.7067 (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	126.8368	126.8368	126.8368	126.8368	126.8368	126.8368	126.8368	126.8368	126.8368	126.8368	126.8368	126.8368	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.9767	19.5195	15.8744	12.0179	8.9835	7.5843	8.1951	10.6523	14.2975	18.1539	21.1883	22.5875	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	227.8752	230.2398	224.2811	211.5955	195.5822	180.5320	170.4776	168.1129	174.0717	186.7573	202.7706	217.8208	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.6837	35.6837	35.6837	35.6837	35.6837	35.6837	35.6837	35.6837	35.6837	35.6837	35.6837	35.6837	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-101.4695	-101.4695	-101.4695	-101.4695	-101.4695	-101.4695	-101.4695	-101.4695	-101.4695	-101.4695	-101.4695	-101.4695	(71)
Water heating gains (Table 5)	44.0050	42.6107	39.7152	35.7788	33.2232	29.6247	26.5661	30.4850	31.8774	35.9516	40.5522	42.6165	(72)
Total internal gains	354.9080	353.4211	340.9216	320.4433	298.8400	278.7921	266.2898	270.3013	281.2976	301.9139	325.5621	344.0758	(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
North				7.7200	10.6334		0.6300		0.7000		0.7700		25.0877 (74)
South				3.6200	46.7521		0.6300		0.7000		0.7700		51.7227 (78)

Solar gains	76.8104	132.6523	189.3719	252.8136	303.3633	311.0132	295.6825	255.8286	210.6694	148.4370	92.2580	65.6075 (83)	
Total gains	431.7184	486.0734	530.2936	573.2568	602.2033	589.8053	561.9723	526.1299	491.9670	450.3509	417.8200	409.6834 (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	68.7247	68.9226	69.1176	70.0484	70.2254	71.0610	71.0610	71.2180	70.7368	70.2254	69.8683	69.4989	
alpha	5.5816	5.5948	5.6078	5.6699	5.6817	5.7374	5.7374	5.7479	5.7158	5.6817	5.6579	5.6333	
util living area	0.9991	0.9980	0.9948	0.9821	0.9343	0.7990	0.6245	0.6837	0.9060	0.9881	0.9980	0.9993	(86)
MIT	19.8678	19.9918	20.1994	20.4870	20.7572	20.9366	20.9875	20.9796	20.8569	20.5167	20.1436	19.8488	(87)
Th 2	20.0746	20.0770	20.0794	20.0905	20.0926	20.1023	20.1023	20.1041	20.0986	20.0926	20.0884	20.0840	(88)
util rest of house	0.9988	0.9973	0.9929	0.9747	0.9055	0.7202	0.5070	0.5670	0.8541	0.9819	0.9972	0.9991	(89)
MIT 2	19.0324	19.1581	19.3669	19.6599	19.9167	20.0705	20.0988	20.0977	20.0119	19.6929	19.3192	19.0211	(90)
Living area fraction	19.2030	19.3283	19.5369	19.8287	20.0883	20.2473	20.2803	20.2777	fLA = Living area / (4) =	19.8611	19.4875	0.2042	(91)
MIT	19.2030	19.3283	19.5369	19.8287	20.0883	20.2473	20.2803	20.2777	20.1844	19.8611	19.4875	19.1901	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.2030	19.3283	19.5369	19.8287	20.0883	20.2473	20.2803	20.2777	20.1844	19.8611	19.4875	19.1901	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	431.0191	484.3932	525.7084	557.1954	545.2169	433.0624	298.5436	310.9258	423.1084	441.2505	416.3526	409.1904	(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	1267.0700	1223.1937	1102.1103	911.6158	697.9435	464.3562	302.6123	318.1483	502.5907	770.5614	1035.9621	1260.2778	(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	622.0218	496.4739	428.8430	255.1827	113.6286	0.0000	0.0000	0.0000	0.0000	245.0073	446.1188	633.2090	(98)
Space heating												3240.4853	(98)
Space heating per m2											(98) / (4) =	38.5130	(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	772.9232	608.4715	623.5395	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8581	0.9250	0.9013	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	663.2618	562.8244	562.0203	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	785.0501	750.5928	710.5429	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	87.6876	139.6997	110.5008	0.0000	0.0000	0.0000	0.0000	(104)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling												337.8881 (104)
Cooled fraction												1.0000 (105)
Intermittency factor (Table 10b)												
	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)	
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	21.9219	34.9249	27.6252	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												84.4720 (107)
Space cooling per m2												1.0039 (108)
Energy for space heating												38.5130 (99)
Energy for space cooling												1.0039 (108)
Total												39.5170 (109)
Target Fabric Energy Efficiency (TFEE)												45.4 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	42.0700 (1b)	x 2.3900 (2b)	= 100.5473 (1b) - (3b)
First floor	42.0700 (1c)	x 2.6100 (2c)	= 109.8027 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	84.1400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 210.3500 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (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) =					40.0000 / (5) = 0.1902 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4402 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3741 (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	0.4770	0.4396	0.4303	0.4022	0.4022	0.3741	0.3741	0.3648	0.3741	0.4209	0.4115	0.4396 (22b)
Effective ac	0.6138	0.5966	0.5926	0.5809	0.5809	0.5700	0.5700	0.5665	0.5700	0.5886	0.5847	0.5966 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			2.1500	1.1000	2.3650		(26)
Windows (Uw = 1.20)			11.3400	1.1450	12.9847		(27)
Ground Floor			42.0700	0.1200	5.0484	84.0000	3533.8800 (28a)
Brick and Block	35.8000	11.3100	24.4900	0.2400	5.8776	42.2200	1033.9678 (29a)
Tile Hung	13.8000	2.1800	11.6200	0.2400	2.7888	42.2200	490.5964 (29a)
Step Party Wall	7.6000		7.6000	0.2600	1.9760	58.0600	441.2560 (29a)
Pitched Roof	42.0700		42.0700	0.1000	4.2070	9.1000	382.8370 (30)
Total net area of external elements Aum(A, m ²)			141.3400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	35.2475		(33)
Party Wall 1			42.1600	0.0000	0.0000	110.0000	4637.6000 (32)
Party Wall 2			34.5600	0.0000	0.0000	110.0000	3801.6000 (32)
Ground Floor Stud			62.9600			9.0000	566.6400 (32c)
First Floor Stud			93.8500			9.0000	844.6500 (32c)
Internal Floor 1			42.0700			18.0000	757.2600 (32d)
Internal Ceiling 1			42.0700			18.0000	757.2600 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	17247.5472 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							204.9863 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.8441 (36)
Total fabric heat loss						(33) + (36) =	42.0916 (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	42.6055	41.4152	41.1328	40.3221	40.3221	39.5660	39.5660	39.3262	39.5660	40.8565	40.5863	41.4152 (38)
Average = Sum(39)m / 12 =	84.6972	83.5069	83.2245	82.4138	82.4138	81.6577	81.6577	81.4178	81.6577	82.9482	82.6779	83.5069 (39)
	82.6483 (39)											
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.0066	0.9925	0.9891	0.9795	0.9795	0.9705	0.9705	0.9676	0.9705	0.9858	0.9826	0.9925 (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												2.5367 (42)
Average daily hot water use (litres/day)												94.4475 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Energy conte	103.8923	100.1144	96.3365	92.5586	88.7807	85.0028	85.0028	88.7807	92.5586	96.3365	100.1144	103.8923 (44)
Energy content (annual)	154.0692	134.7499	139.0498	121.2270	116.3202	100.3755	93.0127	106.7334	108.0081	125.8730	137.4003	149.2078 (45)
Distribution loss (46)m = 0.15 x (45)m	23.1104	20.2125	20.8575	18.1841	17.4480	15.0563	13.9519	16.0100	16.2012	18.8810	20.6100	22.3812 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	25.3184	22.8666	25.2755	24.4131	25.1926	24.3405	25.1272	25.1696	24.3800	25.2412	24.4811	25.3056 (61)
Total heat required for water heating calculated for each month	179.3876	157.6165	164.3253	145.6401	141.5128	124.7160	118.1399	131.9030	132.3881	151.1142	161.8814	174.5134 (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	179.3876	157.6165	164.3253	145.6401	141.5128	124.7160	118.1399	131.9030	132.3881	151.1142	161.8814	174.5134 (64)
RHI water heating demand	57.5576	50.5210	52.5529	46.4112	44.9746	39.4600	37.2085	41.7813	42.0077	48.1631	51.8059	55.9380 (65)
Heat gains from water heating, kWh/month												
	57.5576	50.5210	52.5529	46.4112	44.9746	39.4600	37.2085	41.7813	42.0077	48.1631	51.8059	55.9380 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	152.2042	152.2042	152.2042	152.2042	152.2042	152.2042	152.2042	152.2042	152.2042	152.2042	152.2042	152.2042 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	54.9418	48.7989	39.6859	30.0448	22.4588	18.9607	20.4877	26.6307	35.7436	45.3848	52.9707	56.4688 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	340.1123	343.6416	334.7478	315.8142	291.9138	269.4508	254.4441	250.9148	259.8086	278.7422	302.6426	325.1056 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.7572	52.7572	52.7572	52.7572	52.7572	52.7572	52.7572	52.7572	52.7572	52.7572	52.7572	52.7572 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-101.4695	-101.4695	-101.4695	-101.4695	-101.4695	-101.4695	-101.4695	-101.4695	-101.4695	-101.4695	-101.4695	-101.4695 (71)
Water heating gains (Table 5)	77.3624	75.1800	70.6357	64.4601	60.4498	54.8055	50.0114	56.1576	58.3440	64.7353	71.9526	75.1855 (72)
Total internal gains	578.9084	574.1124	551.5613	516.8109	481.3143	449.7089	431.4352	440.1950	460.3881	495.3542	534.0578	563.2518 (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	
North					7.7200	13.8645	0.6300	0.7000	0.7700		32.7111 (74)	
South					3.6200	58.2505	0.6300	0.7000	0.7700		64.4437 (78)	
Solar gains	97.1547	143.9057	206.0470	283.1495	326.7410	363.2674	336.8255	296.2284	244.1077	170.7633	115.7218	79.1889 (83)
Total gains	676.0631	718.0181	757.6083	799.9604	808.0552	812.9763	768.2607	736.4234	704.4959	666.1175	649.7797	642.4407 (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	56.5661	57.3724	57.5670	58.1333	58.1333	58.6716	58.6716	58.8444	58.6716	57.7588	57.9476	57.3724
alpha	4.7711	4.8248	4.8378	4.8756	4.8756	4.9114	4.9114	4.9230	4.9114	4.8506	4.8632	4.8248
util living area	0.9796	0.9719	0.9489	0.8890	0.7600	0.5474	0.3908	0.4061	0.6552	0.8802	0.9596	0.9826 (86)
MIT	20.1154	20.2193	20.4323	20.6917	20.8944	20.9834	20.9975	20.9970	20.9616	20.7616	20.4356	20.1071 (87)
Th 2	20.0778	20.0896	20.0924	20.1005	20.1005	20.1080	20.1080	20.1104	20.1080	20.0952	20.0978	20.0896 (88)
util rest of house	0.9743	0.9647	0.9355	0.8607	0.7036	0.4665	0.2979	0.3100	0.5728	0.8422	0.9475	0.9779 (89)
MIT 2	19.2933	19.4043	19.6129	19.8616	20.0334	20.1010	20.1074	20.1097	20.0896	19.9238	19.6235	19.2951 (90)
Living area fraction	19.4611	19.5707	19.7802	20.0311	20.2092	20.2812	20.2891	20.2909	20.2677	20.0949	19.7893	19.4609 (92)
MIT	19.4611	19.5707	19.7802	20.0311	20.2092	20.2812	20.2891	20.2909	20.2677	20.0949	19.7893	19.4609 (93)
Temperature adjustment												0.0000
adjusted MIT	19.4611	19.5707	19.7802	20.0311	20.2092	20.2812	20.2891	20.2909	20.2677	20.0949	19.7893	19.4609 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	655.6714	689.0675	704.6672	686.5453	574.4291	392.3616	243.4895	242.8083	414.4462	561.0170	612.3805	625.6503 (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	1190.9377	1158.2984	1038.6582	859.6680	627.1066	398.5839	244.0869	243.5110	430.1450	688.0461	941.6466	1165.8294 (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	398.2381	315.3232	248.4893	124.6483	39.1920	0.0000	0.0000	0.0000	0.0000	94.5097	237.0716	401.8933 (98)
Space heating												1859.3655 (98)
RHI space heating demand												1859 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	42.0700 (1b)	x 2.3900 (2b)	= 100.5473 (1b) - (3b)
First floor	42.0700 (1c)	x 2.6100 (2c)	= 109.8027 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	84.1400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 210.3500 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (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) =					40.0000 / (5) = 0.1902 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4402 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3741 (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	0.4770	0.4677	0.4583	0.4115	0.4022	0.3554	0.3554	0.3461	0.3741	0.4022	0.4209	0.4396 (22b)
Effective ac	0.6138	0.6094	0.6050	0.5847	0.5809	0.5632	0.5632	0.5599	0.5700	0.5809	0.5886	0.5966 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			2.1500	1.1000	2.3650		(26)
Windows (Uw = 1.20)			11.3400	1.1450	12.9847		(27)
Ground Floor			42.0700	0.1200	5.0484	84.0000	3533.8800 (28a)
Brick and Block	35.8000	11.3100	24.4900	0.2400	5.8776	42.2200	1033.9678 (29a)
Tile Hung	13.8000	2.1800	11.6200	0.2400	2.7888	42.2200	490.5964 (29a)
Step Party Wall	7.6000		7.6000	0.2600	1.9760	58.0600	441.2560 (29a)
Pitched Roof	42.0700		42.0700	0.1000	4.2070	9.1000	382.8370 (30)
Total net area of external elements Aum(A, m ²)			141.3400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	35.2475		(33)
Party Wall 1			42.1600	0.0000	0.0000	110.0000	4637.6000 (32)
Party Wall 2			34.5600	0.0000	0.0000	110.0000	3801.6000 (32)
Ground Floor Stud			62.9600			9.0000	566.6400 (32c)
First Floor Stud			93.8500			9.0000	844.6500 (32c)
Internal Floor 1			42.0700			18.0000	757.2600 (32d)
Internal Ceiling 1			42.0700			18.0000	757.2600 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	17247.5472 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							204.9863 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.8441 (36)
Total fabric heat loss						(33) + (36) =	42.0916 (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	42.6055	42.2988	41.9982	40.5863	40.3221	39.0924	39.0924	38.8646	39.5660	40.3221	40.8565	41.4152 (38)
Average = Sum(39)m / 12 =	84.6972	84.3905	84.0899	82.6779	82.4138	81.1840	81.1840	80.9563	81.6577	82.4138	82.9482	83.5069 (39)
	82.6767 (39)											
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.0066	1.0030	0.9994	0.9826	0.9795	0.9649	0.9649	0.9622	0.9705	0.9795	0.9858	0.9925 (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												2.5367 (42)
Average daily hot water use (litres/day)												94.4475 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Energy conte	103.8923	100.1144	96.3365	92.5586	88.7807	85.0028	85.0028	88.7807	92.5586	96.3365	100.1144	103.8923 (44)
Energy content (annual)	154.0692	134.7499	139.0498	121.2270	116.3202	100.3755	93.0127	106.7334	108.0081	125.8730	137.4003	149.2078 (45)
Distribution loss (46)m = 0.15 x (45)m	23.1104	20.2125	20.8575	18.1841	17.4480	15.0563	13.9519	16.0100	16.2012	18.8810	20.6100	22.3812 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	25.3184	22.8666	25.2755	24.4131	25.1926	24.3405	25.1272	25.1696	24.3800	25.2412	24.4811	25.3056 (61)
Total heat required for water heating calculated for each month	179.3876	157.6165	164.3253	145.6401	141.5128	124.7160	118.1399	131.9030	132.3881	151.1142	161.8814	174.5134 (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	179.3876	157.6165	164.3253	145.6401	141.5128	124.7160	118.1399	131.9030	132.3881	151.1142	161.8814	174.5134 (64)
Heat gains from water heating, kWh/month	57.5576	50.5210	52.5529	46.4112	44.9746	39.4600	37.2085	41.7813	42.0077	48.1631	51.8059	55.9380 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	152.2042	152.2042	152.2042	152.2042	152.2042	152.2042	152.2042	152.2042	152.2042	152.2042	152.2042	152.2042 (66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	54.9418	48.7989	39.6859	30.0448	22.4588	18.9607	20.4877	26.6307	35.7436	45.3848	52.9707	56.4688 (67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	340.1123	343.6416	334.7478	315.8142	291.9138	269.4508	254.4441	250.9148	259.8086	278.7422	302.6426	325.1056 (68)
Pumps, fans	52.7572	52.7572	52.7572	52.7572	52.7572	52.7572	52.7572	52.7572	52.7572	52.7572	52.7572	52.7572 (69)
Losses e.g. evaporation (negative values) (Table 5)	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)
Water heating gains (Table 5)	-101.4695	-101.4695	-101.4695	-101.4695	-101.4695	-101.4695	-101.4695	-101.4695	-101.4695	-101.4695	-101.4695	-101.4695 (71)
Total internal gains	77.3624	75.1800	70.6357	64.4601	60.4498	54.8055	50.0114	56.1576	58.3440	64.7353	71.9526	75.1855 (72)
	578.9084	574.1124	551.5613	516.8109	481.3143	449.7089	431.4352	440.1950	460.3881	495.3542	534.0578	563.2518 (73)

6. Solar gains

[Jan]													Gains
	Area				Solar flux		g		FF		Access		W
	m2				Table 6a		or Table 6b		or Table 6c		factor		
					W/m2						Table 6d		
North	7.7200				10.6334		0.6300		0.7000		0.7700		25.0877 (74)
South	3.6200				46.7521		0.6300		0.7000		0.7700		51.7227 (78)
Solar gains	76.8104	132.6523	189.3719	252.8136	303.3633	311.0132	295.6825	255.8286	210.6694	148.4370	92.2580	65.6075 (83)	
Total gains	655.7188	706.7647	740.9332	769.6245	784.6775	760.7221	727.1177	696.0236	671.0575	643.7912	626.3158	628.8594 (84)	

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
alpha	56.5661	56.7716	56.9746	57.9476	58.1333	59.0139	59.0139	59.1799	58.6716	58.1333	57.7588	57.3724
util living area	4.7711	4.7848	4.7983	4.8632	4.8756	4.9343	4.9343	4.9453	4.9114	4.8756	4.8506	4.8248
MIT	0.9861	0.9785	0.9619	0.9179	0.8199	0.6462	0.4837	0.5235	0.7510	0.9242	0.9756	0.9884 (86)
Th 2	19.9694	20.1038	20.3189	20.6034	20.8338	20.9620	20.9925	20.9891	20.9196	20.6461	20.2693	19.9479 (87)
util rest of house	20.0778	20.0809	20.0838	20.0978	20.1005	20.1127	20.1127	20.1150	20.1080	20.1005	20.0952	20.0896 (88)
MIT 2	0.9827	0.9731	0.9521	0.8962	0.7740	0.5698	0.3898	0.4282	0.6810	0.8998	0.9686	0.9855 (89)
Living area fraction	19.1490	19.2837	19.4965	19.7792	19.9857	20.0937	20.1104	20.1113	20.0625	19.8254	19.4597	19.1374 (90)
MIT	19.3165	19.4512	19.6645	19.9475	20.1589	20.2710	20.2905	20.2905	20.2375	19.9930	19.6250	19.3029 (92)
Temperature adjustment												0.0000
adjusted MIT	19.3165	19.4512	19.6645	19.9475	20.1589	20.2710	20.2905	20.2905	20.2375	19.9930	19.6250	19.3029 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9790	0.9685	0.9466	0.8920	0.7773	0.5841	0.4090	0.4476	0.6920	0.8964	0.9640	0.9822 (94)
Ext temp.	641.9523	684.5159	701.3903	686.4991	609.9205	444.3243	297.3801	311.5154	464.3691	577.0922	603.7877	617.6876 (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	1271.8526	1227.9807	1106.9974	913.3855	697.1299	460.3933	299.6096	314.9633	501.1755	774.1130	1038.9233	1261.1973 (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	468.6458	365.2084	301.7717	163.3582	64.8838	0.0000	0.0000	0.0000	0.0000	146.5834	313.2976	478.7712 (98)
Space heating per m2												2302.5202 (98)
												(98) / (4) = 27.3653 (99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.7000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													2538.6110 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	468.6458	365.2084	301.7717	163.3582	64.8838	0.0000	0.0000	0.0000	0.0000	146.5834	313.2976	478.7712	(98)
Space heating efficiency (main heating system 1)	90.7000	90.7000	90.7000	90.7000	90.7000	0.0000	0.0000	0.0000	0.0000	90.7000	90.7000	90.7000	(210)
Space heating fuel (main heating system)	516.6988	402.6553	332.7141	180.1083	71.5367	0.0000	0.0000	0.0000	0.0000	161.6135	345.4218	527.8624	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	179.3876	157.6165	164.3253	145.6401	141.5128	124.7160	118.1399	131.9030	132.3881	151.1142	161.8814	174.5134	(64)
Efficiency of water heater	89.7033	89.6156	89.4344	89.0160	88.2708	87.2000	87.2000	87.2000	87.2000	88.8890	89.4765	87.2000	(216)
(217)m	89.7033	89.6156	89.4344	89.0160	88.2708	87.2000	87.2000	87.2000	87.2000	88.8890	89.4765	89.7378	(217)
Fuel for water heating, kWh/month	199.9788	175.8806	183.7383	163.6111	160.3167	143.0229	135.4815	151.2649	151.8213	170.0034	180.9205	194.4703	(219)
Water heating fuel used												2010.5102	(219)
Annual totals kWh/year													
Space heating fuel - main system												2538.6110	(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)												388.1161	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.55 * 1080 * 1.00) =										-474.9908		-474.9908	(233)
Total delivered energy for all uses												4537.2464	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2538.6110	3.4800	88.3437 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2010.5102	3.4800	69.9658 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	388.1161	13.1900	51.1925 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-474.9908	13.1900	-62.6513 (252)
Total energy cost			276.7431 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.9000 (257)
SAP value	87.4443	
SAP rating (Section 12)	87	(258)
SAP band	B	

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	2538.6110	0.2160	548.3400 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2010.5102	0.2160	434.2702 (264)
Space and water heating			982.6102 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	388.1161	0.5190	201.4322 (268)
Energy saving/generation technologies			
PV Unit	-474.9908	0.5190	-246.5202 (269)
Total kg/year			976.4472 (272)
CO2 emissions per m2			11.6100 (273)
EI value			89.8681
EI rating			90
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	$3.48 \times (1 + 0.29 \times 0.00) / 0.9070 = 3.837$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9070 = 0.2381$, stars = 4
Water heating energy efficiency	$3.48 / 0.8858 = 3.929$, stars = 4
Water heating environmental impact	$0.216 / 0.8858 = 0.2439$, stars = 4

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	42.0700 (1b)	x 2.3900 (2b)	= 100.5473 (1b) - (3b)
First floor	42.0700 (1c)	x 2.6100 (2c)	= 109.8027 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	84.1400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 210.3500 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (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) =				40.0000 / (5) =	0.1902 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4402 (18)
Number of sides sheltered					2 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.8500 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3741 (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	0.4770	0.4396	0.4303	0.4022	0.4022	0.3741	0.3741	0.3648	0.3741	0.4209	0.4115	0.4396 (22b)
Effective ac	0.6138	0.5966	0.5926	0.5809	0.5809	0.5700	0.5700	0.5665	0.5700	0.5886	0.5847	0.5966 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			2.1500	1.1000	2.3650		(26)
Windows (Uw = 1.20)			11.3400	1.1450	12.9847		(27)
Ground Floor			42.0700	0.1200	5.0484	84.0000	3533.8800 (28a)
Brick and Block	35.8000	11.3100	24.4900	0.2400	5.8776	42.2200	1033.9678 (29a)
Tile Hung	13.8000	2.1800	11.6200	0.2400	2.7888	42.2200	490.5964 (29a)
Step Party Wall	7.6000		7.6000	0.2600	1.9760	58.0600	441.2560 (29a)
Pitched Roof	42.0700		42.0700	0.1000	4.2070	9.1000	382.8370 (30)
Total net area of external elements Aum(A, m ²)			141.3400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	35.2475		(33)
Party Wall 1			42.1600	0.0000	0.0000	110.0000	4637.6000 (32)
Party Wall 2			34.5600	0.0000	0.0000	110.0000	3801.6000 (32)
Ground Floor Stud			62.9600			9.0000	566.6400 (32c)
First Floor Stud			93.8500			9.0000	844.6500 (32c)
Internal Floor 1			42.0700			18.0000	757.2600 (32d)
Internal Ceiling 1			42.0700			18.0000	757.2600 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	17247.5472 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							204.9863 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.8441 (36)
Total fabric heat loss						(33) + (36) =	42.0916 (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	42.6055	41.4152	41.1328	40.3221	40.3221	39.5660	39.5660	39.3262	39.5660	40.8565	40.5863	41.4152 (38)
Heat transfer coeff	84.6972	83.5069	83.2245	82.4138	82.4138	81.6577	81.6577	81.4178	81.6577	82.9482	82.6779	83.5069 (39)
Average = Sum(39)m / 12 =												82.6483 (39)
HLP	1.0066	0.9925	0.9891	0.9795	0.9795	0.9705	0.9705	0.9676	0.9705	0.9858	0.9826	0.9925 (40)
HLP (average)												0.9823 (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 2.5367 (42)
Average daily hot water use (litres/day) 94.4475 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Energy conte	103.8923	100.1144	96.3365	92.5586	88.7807	85.0028	85.0028	88.7807	92.5586	96.3365	100.1144	103.8923 (44)
Energy content (annual)	154.0692	134.7499	139.0498	121.2270	116.3202	100.3755	93.0127	106.7334	108.0081	125.8730	137.4003	149.2078 (45)
Distribution loss (46)m = 0.15 x (45)m	23.1104	20.2125	20.8575	18.1841	17.4480	15.0563	13.9519	16.0100	16.2012	18.8810	20.6100	22.3812 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	25.3184	22.8666	25.2755	24.4131	25.1926	24.3405	25.1272	25.1696	24.3800	25.2412	24.4811	25.3056 (61)
Total heat required for water heating calculated for each month	179.3876	157.6165	164.3253	145.6401	141.5128	124.7160	118.1399	131.9030	132.3881	151.1142	161.8814	174.5134 (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	179.3876	157.6165	164.3253	145.6401	141.5128	124.7160	118.1399	131.9030	132.3881	151.1142	161.8814	174.5134 (64)
Heat gains from water heating, kWh/month	57.5576	50.5210	52.5529	46.4112	44.9746	39.4600	37.2085	41.7813	42.0077	48.1631	51.8059	55.9380 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	152.2042	152.2042	152.2042	152.2042	152.2042	152.2042	152.2042	152.2042	152.2042	152.2042	152.2042	152.2042 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	54.9418	48.7989	39.6859	30.0448	22.4588	18.9607	20.4877	26.6307	35.7436	45.3848	52.9707	56.4688 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	340.1123	343.6416	334.7478	315.8142	291.9138	269.4508	254.4441	250.9148	259.8086	278.7422	302.6426	325.1056 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.7572	52.7572	52.7572	52.7572	52.7572	52.7572	52.7572	52.7572	52.7572	52.7572	52.7572	52.7572 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-101.4695	-101.4695	-101.4695	-101.4695	-101.4695	-101.4695	-101.4695	-101.4695	-101.4695	-101.4695	-101.4695	-101.4695 (71)
Water heating gains (Table 5)	77.3624	75.1800	70.6357	64.4601	60.4498	54.8055	50.0114	56.1576	58.3440	64.7353	71.9526	75.1855 (72)
Total internal gains	578.9084	574.1124	551.5613	516.8109	481.3143	449.7089	431.4352	440.1950	460.3881	495.3542	534.0578	563.2518 (73)

6. Solar gains

[Jan]		Area	Solar flux	g	Specific data	FF	Access	Gains
		m2	Table 6a	W/m2	or Table 6b	or Table 6c	factor	W
							Table 6d	
North		7.7200	13.8645	0.6300		0.7000	0.7700	32.7111 (74)
South		3.6200	58.2505	0.6300		0.7000	0.7700	64.4437 (78)

Solar gains	97.1547	143.9057	206.0470	283.1495	326.7410	363.2674	336.8255	296.2284	244.1077	170.7633	115.7218	79.1889 (83)
Total gains	676.0631	718.0181	757.6083	799.9604	808.0552	812.9763	768.2607	736.4234	704.4959	666.1175	649.7797	642.4407 (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	56.5661	57.3724	57.5670	58.1333	58.1333	58.6716	58.6716	58.8444	58.6716	57.7588	57.9476	57.3724
alpha	4.7711	4.8248	4.8378	4.8756	4.8756	4.9114	4.9114	4.9230	4.9114	4.8506	4.8632	4.8248
util living area	0.9796	0.9719	0.9489	0.8890	0.7600	0.5474	0.3908	0.4061	0.6552	0.8802	0.9596	0.9826 (86)
MIT	20.1154	20.2193	20.4323	20.6917	20.8944	20.9834	20.9975	20.9970	20.9616	20.7616	20.4356	20.1071 (87)
Th 2	20.0778	20.0896	20.0924	20.1005	20.1005	20.1080	20.1080	20.1104	20.1080	20.0952	20.0978	20.0896 (88)
util rest of house	0.9743	0.9647	0.9355	0.8607	0.7036	0.4665	0.2979	0.3100	0.5728	0.8422	0.9475	0.9779 (89)
MIT 2	19.2933	19.4043	19.6129	19.8616	20.0334	20.1010	20.1074	20.1097	20.0896	19.9238	19.6235	19.2951 (90)
Living area fraction									fLA = Living area / (4) =			0.2042 (91)
MIT	19.4611	19.5707	19.7802	20.0311	20.2092	20.2812	20.2891	20.2909	20.2677	20.0949	19.7893	19.4609 (92)
Temperature adjustment												0.0000
adjusted MIT	19.4611	19.5707	19.7802	20.0311	20.2092	20.2812	20.2891	20.2909	20.2677	20.0949	19.7893	19.4609 (93)

8. Space heating requirement

Utilisation	0.9698	0.9597	0.9301	0.8582	0.7109	0.4826	0.3169	0.3297	0.5883	0.8422	0.9424	0.9739 (94)
Useful gains	655.6714	689.0675	704.6672	686.5453	574.4291	392.3616	243.4895	242.8083	414.4462	561.0170	612.3805	625.6503 (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	1190.9377	1158.2984	1038.6582	859.6680	627.1066	398.5839	244.0869	243.5110	430.1450	688.0461	941.6466	1165.8294 (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	398.2381	315.3232	248.4893	124.6483	39.1920	0.0000	0.0000	0.0000	0.0000	94.5097	237.0716	401.8933 (98)
Space heating												1859.3655 (98)
Space heating per m2												(98) / (4) = 22.0985 (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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												90.7000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2050.0170	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	398.2381	315.3232	248.4893	124.6483	39.1920	0.0000	0.0000	0.0000	0.0000	94.5097	237.0716	401.8933	(98)
Space heating efficiency (main heating system 1)	90.7000	90.7000	90.7000	90.7000	90.7000	0.0000	0.0000	0.0000	0.0000	90.7000	90.7000	90.7000	(210)
Space heating fuel (main heating system)	439.0717	347.6551	273.9684	137.4292	43.2106	0.0000	0.0000	0.0000	0.0000	104.2003	261.3800	443.1018	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	179.3876	157.6165	164.3253	145.6401	141.5128	124.7160	118.1399	131.9030	132.3881	151.1142	161.8814	174.5134	(64)
Efficiency of water heater (217)m	89.5833	89.5028	89.2737	88.7799	87.9360	87.2000	87.2000	87.2000	87.2000	88.5143	89.2465	87.2000	(216)
Fuel for water heating, kWh/month	200.2466	176.1024	184.0692	164.0462	160.9271	143.0229	135.4815	151.2649	151.8213	170.7230	181.3868	194.7454	(219)
Water heating fuel used												2013.8374	(219)
Annual totals kWh/year													
Space heating fuel - main system												2050.0170	(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)												388.1161	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.55 * 1234 * 1.00) =										-543.1645		-543.1645	(233)
Total delivered energy for all uses												3983.8060	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2050.0170	10.2300	209.7167	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	2013.8374	10.2300	206.0156	(247)
Pumps and fans for heating	75.0000	36.7200	27.5400	(249)
Energy for lighting	388.1161	36.7200	142.5162	(250)
Additional standing charges			103.0000	(251)
Energy saving/generation technologies				
PV Unit	-543.1645	36.7200	-199.4500	(252)
Total energy cost			489.3385	(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	2050.0170	0.2160	442.8037	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2013.8374	0.2160	434.9889	(264)
Space and water heating			877.7926	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	388.1161	0.5190	201.4322	(268)
Energy saving/generation technologies				
PV Unit	-543.1645	0.5190	-281.9024	(269)
Total kg/year			836.2474	(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	2050.0170	1.2200	2501.0208	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2013.8374	1.2200	2456.8817	(264)
Space and water heating			4957.9025	(265)
Pumps and fans	75.0000	3.0700	230.2500	(267)
Energy for lighting	388.1161	3.0700	1191.5163	(268)
Energy saving/generation technologies				
PV Unit	-543.1645	3.0700	-1667.5152	(269)
Primary energy kWh/year			4712.1536	(272)
Primary energy kWh/m2/year			56.0037	(273)

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

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 87
Current environmental impact rating: B 90

(For testing purposes):

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

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.2	-£ 85	-193 kg (23.1%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£85 2.29 kg/m²	B 89	A 92
Total Savings	£85 2.29 kg/m²		

Potential energy efficiency rating: B 89
Potential environmental impact rating: A 92

Fuel prices for cost data on this page from database revision number 531 TEST (31 Oct 2023)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Southern England):

	Current	Potential	Saving
Electricity	£170	£188	-£18
Mains gas	£519	£415	£104
Space heating	£340	£340	£0
Water heating	£206	£121	£85
Lighting	£143	£143	£0
Generated (PV)	-£199	-£199	£0
Total cost of fuels	£490	£404	£86
Total cost of uses	£490	£405	£85
Delivered energy	47 kWh/m²	36 kWh/m²	11 kWh/m²
Carbon dioxide emissions	0.8 tonnes	0.6 tonnes	0.2 tonnes
CO2 emissions per m²	10 kg/m²	8 kg/m²	2 kg/m²
Primary energy	56 kWh/m²	43 kWh/m²	13 kWh/m²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	42.0700 (1b)	x 2.3900 (2b)	= 100.5473 (1b) - (3b)
First floor	42.0700 (1c)	x 2.6100 (2c)	= 109.8027 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	84.1400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 210.3500 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (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) =					40.0000 / (5) = 0.1902 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4402 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3741 (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	0.4770	0.4677	0.4583	0.4115	0.4022	0.3554	0.3554	0.3461	0.3741	0.4022	0.4209	0.4396 (22b)
Effective ac	0.6138	0.6094	0.6050	0.5847	0.5809	0.5632	0.5632	0.5599	0.5700	0.5809	0.5886	0.5966 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			2.1500	1.1000	2.3650		(26)
Windows (Uw = 1.20)			11.3400	1.1450	12.9847		(27)
Ground Floor			42.0700	0.1200	5.0484	84.0000	3533.8800 (28a)
Brick and Block	35.8000	11.3100	24.4900	0.2400	5.8776	42.2200	1033.9678 (29a)
Tile Hung	13.8000	2.1800	11.6200	0.2400	2.7888	42.2200	490.5964 (29a)
Step Party Wall	7.6000		7.6000	0.2600	1.9760	58.0600	441.2560 (29a)
Pitched Roof	42.0700		42.0700	0.1000	4.2070	9.1000	382.8370 (30)
Total net area of external elements Aum(A, m ²)			141.3400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	35.2475		(33)
Party Wall 1			42.1600	0.0000	0.0000	110.0000	4637.6000 (32)
Party Wall 2			34.5600	0.0000	0.0000	110.0000	3801.6000 (32)
Ground Floor Stud			62.9600			9.0000	566.6400 (32c)
First Floor Stud			93.8500			9.0000	844.6500 (32c)
Internal Floor 1			42.0700			18.0000	757.2600 (32d)
Internal Ceiling 1			42.0700			18.0000	757.2600 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	17247.5472 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							204.9863 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.8441 (36)
Total fabric heat loss						(33) + (36) =	42.0916 (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	42.6055	42.2988	41.9982	40.5863	40.3221	39.0924	39.0924	38.8646	39.5660	40.3221	40.8565	41.4152 (38)
Heat transfer coeff	84.6972	84.3905	84.0899	82.6779	82.4138	81.1840	81.1840	80.9563	81.6577	82.4138	82.9482	83.5069 (39)
Average = Sum(39)m / 12 =												82.6767 (39)
HLP	1.0066	1.0030	0.9994	0.9826	0.9795	0.9649	0.9649	0.9622	0.9705	0.9795	0.9858	0.9925 (40)
HLP (average)												0.9826 (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 2.5367 (42)
Average daily hot water use (litres/day) 94.4475 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Energy conte	103.8923	100.1144	96.3365	92.5586	88.7807	85.0028	85.0028	88.7807	92.5586	96.3365	100.1144	103.8923 (44)
Energy content (annual)	154.0692	134.7499	139.0498	121.2270	116.3202	100.3755	93.0127	106.7334	108.0081	125.8730	137.4003	149.2078 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum (45)m =		1486.0270 (45)
	23.1104	20.2125	20.8575	18.1841	17.4480	15.0563	13.9519	16.0100	16.2012	18.8810	20.6100	22.3812 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	25.3184	22.8666	25.2755	24.4131	25.1926	24.3405	25.1272	25.1696	24.3800	25.2412	24.4811	25.3056 (61)
Total heat required for water heating calculated for each month	179.3876	157.6165	164.3253	145.6401	141.5128	124.7160	118.1399	131.9030	132.3881	151.1142	161.8814	174.5134 (62)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.7000 (H2)
Collector heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0050 (H3a)
Collector effective heat loss coefficient												1.8063 (H3b)
Collector performance ratio												2.5804 (H4)
Annual solar radiation per m2												1079.5246 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												1813.6014 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.2204 (H8)
Utilisation factor												0.5593 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												94.4475 (H14)
Volume ratio Veff/V												0.7941 (H15)
Solar storage volume factor												0.9539 (H16)
Solar input												-850.7739 (H17)
Solar input	-24.6708	-41.1684	-70.1145	-93.9672	-116.0886	-114.1336	-112.6252	-98.4012	-77.0679	-52.6283	-29.2631	-20.6452 (63)
								Solar input (sum of months) =	Sum (63)m =			-850.7739 (63)
Output from w/h	154.7168	116.4481	94.2108	51.6729	25.4242	10.5824	5.5147	33.5018	55.3202	98.4859	132.6183	153.8682 (64)
								Total per year (kWh/year) =	Sum (64)m =			932.3643 (64)
Heat gains from water heating, kWh/month	57.5576	50.5210	52.5529	46.4112	44.9746	39.4600	37.2085	41.7813	42.0077	48.1631	51.8059	55.9380 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	152.2042	152.2042	152.2042	152.2042	152.2042	152.2042	152.2042	152.2042	152.2042	152.2042	152.2042	152.2042	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	54.9418	48.7989	39.6859	30.0448	22.4588	18.9607	20.4877	26.6307	35.7436	45.3848	52.9707	56.4688	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	340.1123	343.6416	334.7478	315.8142	291.9138	269.4508	254.4441	250.9148	259.8086	278.7422	302.6426	325.1056	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.7572	52.7572	52.7572	52.7572	52.7572	52.7572	52.7572	52.7572	52.7572	52.7572	52.7572	52.7572	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-101.4695	-101.4695	-101.4695	-101.4695	-101.4695	-101.4695	-101.4695	-101.4695	-101.4695	-101.4695	-101.4695	-101.4695	(71)
Water heating gains (Table 5)	77.3624	75.1800	70.6357	64.4601	60.4498	54.8055	50.0114	56.1576	58.3440	64.7353	71.9526	75.1855	(72)
Total internal gains	578.9084	574.1124	551.5613	516.8109	481.3143	449.7089	431.4352	440.1950	460.3881	495.3542	534.0578	563.2518	(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
North					7.7200	10.6334	0.6300	0.7000	0.7700				25.0877 (74)
South					3.6200	46.7521	0.6300	0.7000	0.7700				51.7227 (78)

Solar gains	76.8104	132.6523	189.3719	252.8136	303.3633	311.0132	295.6825	255.8286	210.6694	148.4370	92.2580	65.6075	(83)
Total gains	655.7188	706.7647	740.9332	769.6245	784.6775	760.7221	727.1177	696.0236	671.0575	643.7912	626.3158	628.8594	(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	56.5661	56.7716	56.9746	57.9476	58.1333	59.0139	59.0139	59.1799	58.6716	58.1333	57.7588	57.3724	
alpha	4.7711	4.7848	4.7983	4.8632	4.8756	4.9343	4.9343	4.9453	4.9114	4.8756	4.8506	4.8248	
util living area	0.9861	0.9785	0.9619	0.9179	0.8199	0.6462	0.4837	0.5235	0.7510	0.9242	0.9756	0.9884	(86)
MIT	19.9694	20.1038	20.3189	20.6034	20.8338	20.9620	20.9925	20.9891	20.9196	20.6461	20.2693	19.9479	(87)
Th 2	20.0778	20.0809	20.0838	20.0978	20.1005	20.1127	20.1127	20.1150	20.1080	20.1005	20.0952	20.0896	(88)
util rest of house	0.9827	0.9731	0.9521	0.8962	0.7740	0.5698	0.3898	0.4282	0.6810	0.8998	0.9686	0.9855	(89)
MIT 2	19.1490	19.2837	19.4965	19.7792	19.9857	20.0937	20.1104	20.1113	20.0625	19.8254	19.4597	19.1374	(90)
Living area fraction									fLA = Living area / (4) =			0.2042	(91)
MIT	19.3165	19.4512	19.6645	19.9475	20.1589	20.2710	20.2905	20.2905	20.2375	19.9930	19.6250	19.3029	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.3165	19.4512	19.6645	19.9475	20.1589	20.2710	20.2905	20.2905	20.2375	19.9930	19.6250	19.3029	(93)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9790	0.9685	0.9466	0.8920	0.7773	0.5841	0.4090	0.4476	0.6920	0.8964	0.9640	0.9822	(94)
Useful gains	641.9523	684.5159	701.3903	686.4991	609.9205	444.3243	297.3801	311.5154	464.3691	577.0922	603.7877	617.6876	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1271.8526	1227.9807	1106.9974	913.3855	697.1299	460.3933	299.6096	314.9633	501.1755	774.1130	1038.9233	1261.1973	(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	468.6458	365.2084	301.7717	163.3582	64.8838	0.0000	0.0000	0.0000	0.0000	146.5834	313.2976	478.7712	(98)
Space heating												2302.5202	(98)
Space heating per m2											(98) / (4) =	27.3653	(99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000	(201)
Fraction of space heat from main system(s)													1.0000	(202)
Efficiency of main space heating system 1 (in %)													90.7000	(206)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement													2538.6110	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	468.6458	365.2084	301.7717	163.3582	64.8838	0.0000	0.0000	0.0000	0.0000	146.5834	313.2976	478.7712	(98)	
Space heating efficiency (main heating system 1)	90.7000	90.7000	90.7000	90.7000	90.7000	0.0000	0.0000	0.0000	0.0000	90.7000	90.7000	90.7000	(210)	
Space heating fuel (main heating system)	516.6988	402.6553	332.7141	180.1083	71.5367	0.0000	0.0000	0.0000	0.0000	161.6135	345.4218	527.8624	(211)	
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)	
Water heating														
Water heating requirement	154.7168	116.4481	94.2108	51.6729	25.4242	10.5824	5.5147	33.5018	55.3202	98.4859	132.6183	153.8682	(64)	
Efficiency of water heater	89.8054	89.8283	89.8421	89.8335	89.6866	87.2000	87.2000	87.2000	87.2000	89.2602	89.6301	87.2000	(216)	
(217)m	89.8054	89.8283	89.8421	89.8335	89.6866	87.2000	87.2000	87.2000	87.2000	89.2602	89.6301	87.2000	(217)	
Fuel for water heating, kWh/month	172.2802	129.6341	104.8627	57.5207	28.3479	12.1358	6.3241	38.4194	63.4406	110.3357	147.9618	171.3013	(219)	
Water heating fuel used												1042.5644	(219)	
Annual totals kWh/year														
Space heating fuel - main system												2538.6110	(211)	
Space heating fuel - secondary												0.0000	(215)	
Electricity for pumps and fans:														
central heating pump													30.0000	(230c)
main heating flue fan													45.0000	(230e)
pump for solar water heating													50.0000	(230g)
Total electricity for the above, kWh/year													125.0000	(231)
Electricity for lighting (calculated in Appendix L)													388.1161	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 0.55 * 1080 * 1.00) =										-474.9908		-474.9908	(233)	
Total delivered energy for all uses												3619.3006	(238)	

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2538.6110	3.4800	88.3437 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1042.5644	3.4800	36.2812 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Pump for solar water heating	50.0000	13.1900	6.5950 (249)
Energy for lighting	388.1161	13.1900	51.1925 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-474.9908	13.1900	-62.6513 (252)
Total energy cost			249.6536 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):			0.4200 (256)
Energy cost factor (ECF)		[(255) x (256)] / [(4) + 45.0] =	0.8119 (257)
SAP value			88.6734
SAP rating (Section 12)			89 (258)
SAP band			B

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	2538.6110	0.2160	548.3400 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1042.5644	0.2160	225.1939 (264)
Space and water heating			773.5339 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	388.1161	0.5190	201.4322 (268)
Energy saving/generation technologies			
PV Unit	-474.9908	0.5190	-246.5202 (269)
Total kg/year			793.3209 (272)
CO2 emissions per m2			9.4300 (273)
EI value			91.7682
EI rating			92 (274)
EI band			A

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	42.0700 (1b)	x 2.3900 (2b)	= 100.5473 (1b) - (3b)
First floor	42.0700 (1c)	x 2.6100 (2c)	= 109.8027 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	84.1400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 210.3500 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
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																4 * 10 =	40.0000 (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) =					40.0000 / (5) =	0.1902 (8)	
Pressure test										Yes							
Measured/design AP50										5.0000							
Infiltration rate										0.4402 (18)							
Number of sides sheltered										2 (19)							
Shelter factor										(20) = 1 - [0.075 x (19)] =					0.8500 (20)		
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =					0.3741 (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	0.4770	0.4396	0.4303	0.4022	0.4022	0.3741	0.3741	0.3648	0.3741	0.4209	0.4115	0.4396	(22b)				
Effective ac	0.6138	0.5966	0.5926	0.5809	0.5809	0.5700	0.5700	0.5665	0.5700	0.5886	0.5847	0.5966	(25)				

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			2.1500	1.1000	2.3650		(26)
Windows (Uw = 1.20)			11.3400	1.1450	12.9847		(27)
Ground Floor			42.0700	0.1200	5.0484	84.0000	3533.8800 (28a)
Brick and Block	35.8000	11.3100	24.4900	0.2400	5.8776	42.2200	1033.9678 (29a)
Tile Hung	13.8000	2.1800	11.6200	0.2400	2.7888	42.2200	490.5964 (29a)
Step Party Wall	7.6000		7.6000	0.2600	1.9760	58.0600	441.2560 (29a)
Pitched Roof	42.0700		42.0700	0.1000	4.2070	9.1000	382.8370 (30)
Total net area of external elements Aum(A, m ²)			141.3400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	35.2475		(33)
Party Wall 1			42.1600	0.0000	0.0000	110.0000	4637.6000 (32)
Party Wall 2			34.5600	0.0000	0.0000	110.0000	3801.6000 (32)
Ground Floor Stud			62.9600			9.0000	566.6400 (32c)
First Floor Stud			93.8500			9.0000	844.6500 (32c)
Internal Floor 1			42.0700			18.0000	757.2600 (32d)
Internal Ceiling 1			42.0700			18.0000	757.2600 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	17247.5472 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							204.9863 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.8441 (36)
Total fabric heat loss						(33) + (36) =	42.0916 (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	42.6055	41.4152	41.1328	40.3221	40.3221	39.5660	39.5660	39.3262	39.5660	40.8565	40.5863	41.4152 (38)
Heat transfer coeff	84.6972	83.5069	83.2245	82.4138	82.4138	81.6577	81.6577	81.4178	81.6577	82.9482	82.6779	83.5069 (39)
Average = Sum(39)m / 12 =												82.6483 (39)
HLP	1.0066	0.9925	0.9891	0.9795	0.9795	0.9705	0.9705	0.9676	0.9705	0.9858	0.9826	0.9925 (40)
HLP (average)												0.9823 (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 2.5367 (42)
Average daily hot water use (litres/day) 94.4475 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Energy conte	103.8923	100.1144	96.3365	92.5586	88.7807	85.0028	85.0028	88.7807	92.5586	96.3365	100.1144	103.8923 (44)
Energy content (annual)	154.0692	134.7499	139.0498	121.2270	116.3202	100.3755	93.0127	106.7334	108.0081	125.8730	137.4003	149.2078 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum (45)m =		1486.0270 (45)
	23.1104	20.2125	20.8575	18.1841	17.4480	15.0563	13.9519	16.0100	16.2012	18.8810	20.6100	22.3812 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	25.3184	22.8666	25.2755	24.4131	25.1926	24.3405	25.1272	25.1696	24.3800	25.2412	24.4811	25.3056 (61)
Total heat required for water heating calculated for each month	179.3876	157.6165	164.3253	145.6401	141.5128	124.7160	118.1399	131.9030	132.3881	151.1142	161.8814	174.5134 (62)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.7000 (H2)
Collector heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0050 (H3a)
Collector effective heat loss coefficient												1.8063 (H3b)
Collector performance ratio												2.5804 (H4)
Annual solar radiation per m2												1234.4649 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												2073.9010 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.3956 (H8)
Utilisation factor												0.5116 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												94.4475 (H14)
Volume ratio Veff/V												0.7941 (H15)
Solar storage volume factor												0.9539 (H16)
Solar input	-29.2019	-41.6866	-70.6517	-96.4086	-113.7832	-121.0868	-116.6164	-104.0371	-82.3393	-56.3775	-34.3327	-889.8474 (H17)
Solar input (sum of months) = Sum (63)m =												-23.3258 (63)
Output from w/h	150.1857	115.9299	93.6736	49.2315	27.7296	3.6292	1.5235	27.8659	50.0488	94.7367	127.5487	151.1876 (64)
Total per year (kWh/year) = Sum (64)m =												893.2909 (64)
Heat gains from water heating, kWh/month	57.5576	50.5210	52.5529	46.4112	44.9746	39.4600	37.2085	41.7813	42.0077	48.1631	51.8059	55.9380 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	152.2042	152.2042	152.2042	152.2042	152.2042	152.2042	152.2042	152.2042	152.2042	152.2042	152.2042	152.2042	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	54.9418	48.7989	39.6859	30.0448	22.4588	18.9607	20.4877	26.6307	35.7436	45.3848	52.9707	56.4688	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	340.1123	343.6416	334.7478	315.8142	291.9138	269.4508	254.4441	250.9148	259.8086	278.7422	302.6426	325.1056	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.7572	52.7572	52.7572	52.7572	52.7572	52.7572	52.7572	52.7572	52.7572	52.7572	52.7572	52.7572	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-101.4695	-101.4695	-101.4695	-101.4695	-101.4695	-101.4695	-101.4695	-101.4695	-101.4695	-101.4695	-101.4695	-101.4695	(71)
Water heating gains (Table 5)	77.3624	75.1800	70.6357	64.4601	60.4498	54.8055	50.0114	56.1576	58.3440	64.7353	71.9526	75.1855	(72)
Total internal gains	578.9084	574.1124	551.5613	516.8109	481.3143	449.7089	431.4352	440.1950	460.3881	495.3542	534.0578	563.2518	(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								
North	7.7200	13.8645	0.6300	0.7000	0.7700	32.7111 (74)							
South	3.6200	58.2505	0.6300	0.7000	0.7700	64.4437 (78)							
Solar gains	97.1547	143.9057	206.0470	283.1495	326.7410	363.2674	336.8255	296.2284	244.1077	170.7633	115.7218	79.1889 (83)	
Total gains	676.0631	718.0181	757.6083	799.9604	808.0552	812.9763	768.2607	736.4234	704.4959	666.1175	649.7797	642.4407 (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	56.5661	57.3724	57.5670	58.1333	58.1333	58.6716	58.6716	58.8444	58.6716	57.7588	57.9476	57.3724	
alpha	4.7711	4.8248	4.8378	4.8756	4.8756	4.9114	4.9114	4.9230	4.9114	4.8506	4.8632	4.8248	
util living area	0.9796	0.9719	0.9489	0.8890	0.7600	0.5474	0.3908	0.4061	0.6552	0.8802	0.9596	0.9826 (86)	
MIT	20.1154	20.2193	20.4323	20.6917	20.8944	20.9834	20.9975	20.9970	20.9616	20.7616	20.4356	20.1071 (87)	
Th 2	20.0778	20.0896	20.0924	20.1005	20.1005	20.1080	20.1080	20.1104	20.1080	20.0952	20.0978	20.0896 (88)	
util rest of house	0.9743	0.9647	0.9355	0.8607	0.7036	0.4665	0.2979	0.3100	0.5728	0.8422	0.9475	0.9779 (89)	
MIT 2	19.2933	19.4043	19.6129	19.8616	20.0334	20.1010	20.1074	20.1097	20.0896	19.9238	19.6235	19.2951 (90)	
Living area fraction									fLA = Living area / (4) =			0.2042 (91)	
MIT	19.4611	19.5707	19.7802	20.0311	20.2092	20.2812	20.2891	20.2909	20.2677	20.0949	19.7893	19.4609 (92)	
Temperature adjustment												0.0000	
adjusted MIT	19.4611	19.5707	19.7802	20.0311	20.2092	20.2812	20.2891	20.2909	20.2677	20.0949	19.7893	19.4609 (93)	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9698	0.9597	0.9301	0.8582	0.7109	0.4826	0.3169	0.3297	0.5883	0.8422	0.9424	0.9739	(94)
Useful gains	655.6714	689.0675	704.6672	686.5453	574.4291	392.3616	243.4895	242.8083	414.4462	561.0170	612.3805	625.6503	(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	1190.9377	1158.2984	1038.6582	859.6680	627.1066	398.5839	244.0869	243.5110	430.1450	688.0461	941.6466	1165.8294	(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	398.2381	315.3232	248.4893	124.6483	39.1920	0.0000	0.0000	0.0000	0.0000	94.5097	237.0716	401.8933	(98)
Space heating												1859.3655	(98)
Space heating per m2											(98) / (4) =	22.0985	(99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.7000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													2050.0170 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	398.2381	315.3232	248.4893	124.6483	39.1920	0.0000	0.0000	0.0000	0.0000	94.5097	237.0716	401.8933	(98)
Space heating efficiency (main heating system 1)	90.7000	90.7000	90.7000	90.7000	90.7000	0.0000	0.0000	0.0000	0.0000	90.7000	90.7000	90.7000	(210)
Space heating fuel (main heating system)	439.0717	347.6551	273.9684	137.4292	43.2106	0.0000	0.0000	0.0000	0.0000	104.2003	261.3800	443.1018	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	150.1857	115.9299	93.6736	49.2315	27.7296	3.6292	1.5235	27.8659	50.0488	94.7367	127.5487	151.1876	(64)
Efficiency of water heater	(217)m	89.7139	89.7142	89.6808	89.2162	87.2000	87.2000	87.2000	87.2000	88.9135	89.4441	87.2000	(216)
Fuel for water heating, kWh/month	167.4052	129.1960	104.4134	54.8964	31.0814	4.1619	1.7472	31.9563	57.3955	106.5493	142.6015	168.5187	(219)
Water heating fuel used												999.9227	(219)
Annual totals kWh/year													
Space heating fuel - main system												2050.0170	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
pump for solar water heating													50.0000 (230g)
Total electricity for the above, kWh/year													125.0000 (231)
Electricity for lighting (calculated in Appendix L)													388.1161 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.55 * 1234 * 1.00) =										-543.1645		-543.1645	(233)
Total delivered energy for all uses												3019.8912	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2050.0170	10.2300	209.7167	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	999.9227	10.2300	102.2921	(247)
Pumps and fans for heating	75.0000	36.7200	27.5400	(249)
Pump for solar water heating	50.0000	36.7200	18.3600	(249)
Energy for lighting	388.1161	36.7200	142.5162	(250)
Additional standing charges			103.0000	(251)
Energy saving/generation technologies				
PV Unit	-543.1645	36.7200	-199.4500	(252)
Total energy cost			403.9750	(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	2050.0170	0.2160	442.8037	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	999.9227	0.2160	215.9833	(264)
Space and water heating			658.7870	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	388.1161	0.5190	201.4322	(268)
Energy saving/generation technologies				

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

PV Unit	-543.1645	0.5190	-281.9024 (269)
Total kg/year			643.1918 (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	2050.0170	1.2200	2501.0208 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	999.9227	1.2200	1219.9057 (264)
Space and water heating			3720.9265 (265)
Pumps and fans	125.0000	3.0700	383.7500 (267)
Energy for lighting	388.1161	3.0700	1191.5163 (268)
Energy saving/generation technologies			
PV Unit	-543.1645	3.0700	-1667.5152 (269)
Primary energy kWh/year			3628.6776 (272)
Primary energy kWh/m2/year			43.1267 (273)

U-VALUE CALCULATOR REPORT

Property Reference	SAP 0906 Plot 43	Issued on Date	29/11/2023
Assessment Reference	Rev B	Prop Type Ref	Block Cv
Project			
Calculation Type	New Build (As Designed)		

SAP Rating	87 B	DER	13.63	TER	17.12
Environmental	90 B	% DER<TER	20.40		
CO ₂ Emissions (t/year)	0.84	DFEE	37.87	TFEE	45.44
General Requirements Compliance	Pass	% DFEE<TFEE	16.66		

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

Building Elements

Roof 000002 - Mineral Wool between and above

Roof Type: Pitched Roof, insulated flat ceiling

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

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

Unheated space: None

Total thickness: 463 mm

U-value: 0.10 W/m² K

Kappa: 9.10 kJ/m² K

U-VALUE CALCULATOR REPORT

Property Reference	SAP 0906 Plot 43	Issued on Date	29/11/2023
Assessment Reference	Rev B	Prop Type Ref	Block Cv
Project			
Calculation Type	New Build (As Designed)		

SAP Rating	87 B	DER	13.63	TER	17.12
Environmental	90 B	% DER<TER	20.40		
CO ₂ Emissions (t/year)	0.84	DFEE	37.87	TFEE	45.44
General Requirements Compliance	Pass	% DFEE<TFEE	16.66		

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

Wall 000001

Wall Type: Standard Wall

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

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

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

U-VALUE CALCULATOR REPORT

Property Reference	SAP 0906 Plot 43	Issued on Date	29/11/2023
Assessment Reference	Rev B	Prop Type Ref	Block Cv
Project			
Calculation Type	New Build (As Designed)		

SAP Rating	87 B	DER	13.63	TER	17.12
Environmental	90 B	% DER<TER	20.40		
CO ₂ Emissions (t/year)	0.84	DFEE	37.87	TFEE	45.44
General Requirements Compliance	Pass	% DFEE<TFEE	16.66		

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

Wall Tile Hung

Wall Type: Standard Wall

Layer	Description	Thickness (mm)	Conductivity (W/m ² K)	Resistance (m ² K/W)	Fraction (%)	Density (kg/m ³)	Heat Cap. (J/kgK)
Ext surface				0.1300			
Layer 1	Tiling						
	Main construction	30	1.5000	0.0000	100.00		
Layer 2	Standard cavity						
	Main construction	25	0.0000	0.0000	90.50		
	Main construction	25	0.1300	0.0000	9.50		
	Corrections - Cavity Ventilated, Emissivity: Normal						
Layer 3	Blockwork, dense						
	Main construction	100	1.5900	0.0629	92.97		
	Main construction	100	0.8800	0.1136	7.03		
Layer 4	Supafil 34						
	Main construction	100	0.0340	2.9412	100.00		
	Corrections - Air Gap: Level 0, Fasteners: None or plastic						
Layer 5	Supabloc						
	Main construction	100	0.1100	0.9091	94.04	460	1000
	Main construction	100	0.8803	0.1136	5.96	460	1000
	Corrections - Air Gap: Level 1, Fasteners: None or plastic						
Layer 6	airspace/plaster dabs						
	Main construction	15	0.0882	0.1700	80.00		
	Main construction	15	0.0882	0.1700	20.00		
	Corrections - Cavity Unventilated, Emissivity: Normal						
Layer 7	Plasterboard, standard						
	Main construction	12.5	0.2100	0.0595	100.00	700	1000
Int surface				0.1300			

Total resistance:	Upper limit = 4.349 m ² K/W	Lower limit = 4.137 m ² K/W	Average = 4.243 m ² K/W
	Total correction = 0.0002 m ² K/W	U-value (unrounded) = 0.24 W/m ² K	

Unheated space: None

Total thickness: 383 mm

U-value: 0.24 W/m² K

Kappa: 42.22 kJ/m² K

U-VALUE CALCULATOR REPORT

Property Reference	SAP 0906 Plot 43	Issued on Date	29/11/2023
Assessment Reference	Rev B	Prop Type Ref	Block Cv
Project			
Calculation Type	New Build (As Designed)		

SAP Rating	87 B	DER	13.63	TER	17.12
Environmental	90 B	% DER<TER	20.40		
CO ₂ Emissions (t/year)	0.84	DFEE	37.87	TFEE	45.44
General Requirements Compliance	Pass	% DFEE<TFEE	16.66		

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

Wall 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	Supabloc *7						
	Main construction	100	0.1900	0.5263	94.04		
	Main construction	100	0.8803	0.1136	5.96		
	Corrections - Air Gap: Level 1, Fasteners: None or plastic						
Layer 2	Supafil Party Wall						
	Main construction	100	0.0400	2.5000	100.00		
	Corrections - Air Gap: Level 0, Fasteners: None or plastic						
Layer 3	Supabloc *7						
	Main construction	100	0.1900	0.5263	94.04	680	1000
	Main construction	100	0.8803	0.1136	5.96	680	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 = 3.898 m ² K/W	Lower limit = 3.765 m ² K/W	Average = 3.831 m ² K/W
	Total correction = 0.0003 m ² K/W	U-value (unrounded) = 0.26 W/m ² K	

Unheated space: None		
Total thickness: 328 mm	U-value: 0.26 W/m² K	Kappa: 58.06 kJ/m² K

U-VALUE CALCULATOR REPORT

Property Reference	SAP 0906 Plot 43	Issued on Date	29/11/2023
Assessment Reference	Rev B	Prop Type Ref	Block Cv
Project			
Calculation Type	New Build (As Designed)		

SAP Rating	87 B	DER	13.63	TER	17.12
Environmental	90 B	% DER<TER	20.40		
CO ₂ Emissions (t/year)	0.84	DFEE	37.87	TFEE	45.44
General Requirements Compliance	Pass	% DFEE<TFEE	16.66		

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

Building Elements

Floor 000003 - Worst Case Slab

Floor Type: Slab On Ground Floor

Area = 42.27 m², Perimeter = 18.36 m, Wall thickness = 275.00 mm, Soil: Unknown

Horizontal edge insulation: none

Vertical edge insulation: none

Layer	Description	Thickness (mm)	Conductivity (W/m ² K)	Resistance (m ² K/W)	Fraction (%)	Density (kg/m ³)	Heat Cap. (J/kgK)
Ext surface				0.0400			
Layer 1	Concrete, medium density						
	Main construction	100	1.3500	0.0741	100.00		
Layer 2	Polythene, 1000 gauge						
	Main construction	0.5	0.0000	0.0000	100.00		
Layer 3	Celotex XR4000						
	Main construction	150	0.0220	6.8182	100.00		
	Corrections - Air Gap: Level 1, Fasteners: None or plastic						
Layer 4	Polythene, 500 gauge						
	Main construction	0.5	0.0000	0.0000	100.00		
Layer 5	Screed						
	Main construction	70	1.1500	0.0609	100.00	1200	1000
Int surface				0.1700			

Total resistance: Upper limit = 6.953 m² K/W Lower limit = 6.953 m² K/W Average = 6.953 m² K/W

Total correction = 0.0096 m² K/W

U-value (unrounded) = 0.12 W/m² K

Unheated space: None

Total thickness: 321 mm

U-value: 0.12 W/m² K

Kappa: 84.00 kJ/m² K

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

Property Reference	SAP 0906 Plot 43	Issued on Date	29/11/2023
Assessment Reference	Rev B	Prop Type Ref	Block Cv
Property			

SAP Rating	87 B	DER	13.63	TER	17.12
Environmental	90 B	% DER<TER	20.40		
CO ₂ Emissions (t/year)	0.84	DFEE	37.87	TFEE	45.44
General Requirements Compliance	Pass	% DFEE<TFEE	16.66		

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
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Mid-Terrace
2.0 Number of Storeys	2
3.0 Date Built	2022
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements		Heat Loss Perimeter	Internal Floor Area	Average Storey Height
	Ground Floor:	9.92 m	42.07 m ²	2.39 m
	1st Storey:	9.92 m	42.07 m ²	2.61 m

7.0 Living Area	17.18	m ²
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8.0 Thermal Mass Parameter	Precise calculation	
Thermal Mass	204.99	kJ/m ² K

9.0 External Walls							
Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area (m ²)	Nett Area (m ²)	
Brick and Block	Cavity Wall	Other	0.24	42.22	35.80	24.49	
Tile Hung	Cavity Wall	Other	0.24	42.22	13.80	11.62	
Step Party Wall	Cavity Wall	Other	0.26	58.06	7.60	7.60	

9.1 Party Walls						
Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Area (m ²)	
Party Wall 1	Filled Cavity with Edge Sealing	Single plasterboard on dabs both sides, lightweight aggregate blocks, cavity or cavity fill	0.00	110.00	42.16	
Party Wall 2	Filled Cavity with Edge Sealing	Single plasterboard on dabs both sides, lightweight aggregate blocks, cavity or cavity fill	0.00	110.00	34.56	

9.2 Internal Walls				
Description	Construction		Kappa (kJ/m ² K)	Area (m ²)
Ground Floor Stud	Plasterboard on timber frame		9.00	62.96
First Floor Stud	Plasterboard on timber frame		9.00	93.85

10.0 External Roofs

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Gross Area (m²)	Nett Area (m²)
Pitched Roof	External Plane Roof	Other	0.10	9.10	42.07	42.07

10.2 Internal Ceilings	Description	Construction	Kappa (kJ/m²K)	Area (m²)
	Internal Ceiling 1	Plasterboard ceiling, carpeted chipboard floor	9.00	42.07

11.0 Heat Loss Floors	Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Area (m²)
	Ground Floor	Ground Floor - Solid	Other	0.12	84.00	42.07

11.2 Internal Floors	Description	Construction	Kappa (kJ/m²K)	Area (m²)
	Internal Floor 1	Plasterboard ceiling, carpeted chipboard floor	18.00	42.07

12.0 Opening Types	Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
	Front Door	Manufacturer	Solid Door							1.10
	Windows	Manufacturer	Window	Double Low-E Soft 0.1			0.63		0.70	1.20

13.0 Openings	Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
	Front Door	Solid Door	[1] Brick and Block	South							2.15	
	Front Elevation	Window	[1] Brick and Block	South	None	0.00					1.44	
	Rear Elevation	Window	[1] Brick and Block	North	None	0.00					7.72	
	Front Tiled	Window	[2] Tile Hung	South	None	0.00					2.18	

14.0 Conservatory	None
15.0 Draught Proofing	100 %
16.0 Draught Lobby	No
17.0 Thermal Bridging	Calculate Bridges

17.1 List of Bridges	Source Type	Bridge Type	Length	Psi	Imported	Reference:
	Independently assessed	E2 Other lintels (including other steel lintels)	0.46	0.093	No	Birtley Supatherm
	Independently assessed	E2 Other lintels (including other steel lintels)	0.69	0.077	No	Birtley Supatherm
	Independently assessed	E2 Other lintels (including other steel lintels)	3.75	0.071	No	Birtley Supatherm
	Independently assessed	E2 Other lintels (including other steel lintels)	1.59	0.067	No	Birtley Supatherm
	Independently assessed	E2 Other lintels (including other steel lintels)	1.81	0.061	No	Birtley Supatherm
	Independently assessed	E3 Sill	6.93	0.021	No	Knauf P5
	Independently assessed	E4 Jamb	24.30	0.016	No	Knauf P6
	Table K1 - Approved	E5 Ground floor (normal)	9.92	0.160	No	
	Independently assessed	E6 Intermediate floor within a dwelling	9.92	0.000	No	CD0029
	Independently assessed	E10 Eaves (insulation at ceiling level)	9.92	0.071	No	Knauf P16
	Independently assessed	E12 Gable (insulation at ceiling level)	8.45	0.044	No	Knauf P23
	Independently assessed	E18 Party wall between dwellings	9.10	0.036	No	Knauf P25 Halved
	Independently assessed	E25 Staggered party wall between dwellings	9.10	0.055	No	Knauf P27 Halved
	Table K1 - Default	P1 Party wall - Ground floor	8.45	0.160	No	
	Table K1 - Default	P6 Party wall - Ground floor (inverted)	8.45	0.070	No	
	Table K1 - Default	P2 Party wall - Intermediate floor within a dwelling	16.90	0.000	No	
	Independently assessed	P4 Party wall - Roof (insulation at ceiling level)	8.45	0.035	No	Knauf P29 Halved

Y-value	0.048	W/m²K
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SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

18.0 Pressure Testing	Yes	
Designed AP ₅₀	5.00	m ³ /(h.m ²) @ 50 Pa
Property Tested ?		
As Built AP ₅₀		m ³ /(h.m ²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

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

Mechanical Ventilation

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

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				4
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No
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22.0 Lighting

Internal

Total number of light fittings	19	
Total number of L.E.L. fittings	19	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	Yes
Light and motion sensor	Yes

23.0 Electricity Tariff	Standard
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24.0 Main Heating 1

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

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

Flow Temperature	Normal (> 45°C)
Combi boiler type	Standard Combi
Combi keep hot type	Gas/Oil, time clock
25.0 Main Heating 2	None

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

29.0 Hot Water Cylinder	None
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32.0 Photovoltaic Unit	One Dwelling			
	Orientation	Elevation	Overshading	Connected to Dwelling
	PV Cells kWp			
0.55	South	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£85	B 89	