



SAP Report Submission for Building Regulations Compliance

Client: Foreman Homes

Project: Plot 133

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Report Issue Date: 28/03/2023

EXCELLENCE
IN ENERGY
ASSESSMENT

PREDICTED ENERGY ASSESSMENT

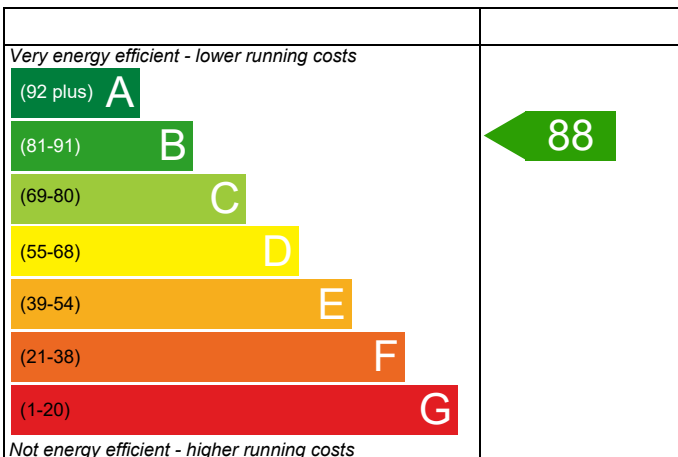
Plot 133

Dwelling type: House, Detached
Date of assessment: 28/03/2023
Produced by: Abacus Energy (UK) Ltd
Total floor area: 97.08 m²
DRRN: 5002-0768-7213

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

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

Energy Efficiency Rating

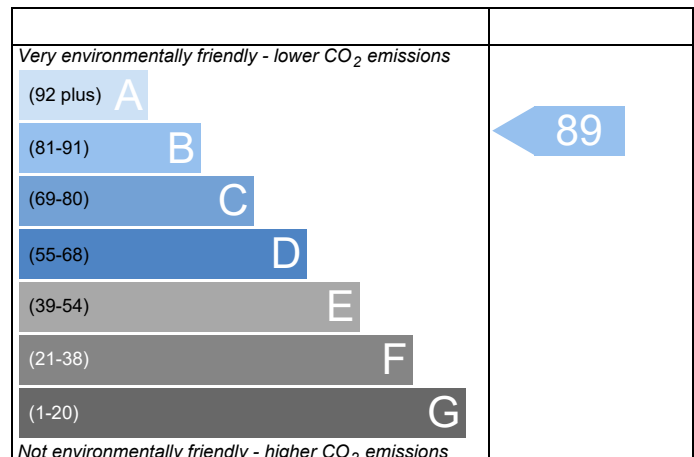


England

EU Directive
2002/91/EC

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

Environmental Impact (CO₂) Rating



England

EU Directive
2002/91/EC

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

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

BUILDING REGULATION COMPLIANCE

Calculation Type: New Build (As Designed)

Property Reference	SAP 0879 Plot 133			Issued on Date	28/03/2023
Assessment Reference	Rev A	Prop Type Ref	Downshire V2		
Property	Plot 133				
SAP Rating	88 B	DER	13.91	TER	18.52
Environmental	89 B	% DER<TER	24.90		
CO ₂ Emissions (t/year)	0.96	DFEE	50.29	TFEE	58.67
General Requirements Compliance	Pass	% DFEE<TFEE	14.28		
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)	18.52	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	13.91	kgCO ₂ /m ²	Pass
	-4.61 (-24.9%)	kgCO ₂ /m ²	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	58.67	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DFEE)	50.29	kWh/m ² /yr	
	-8.4 (-14.3%)	kWh/m ² /yr	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.24 (max. 0.30)	0.24 (max. 0.70)	Pass
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	1.19 (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 36CDi Compact ErP
Combi boiler
Efficiency: 89.8% SEDBUK2009
Minimum: 88.0%

Pass

Secondary heating system

None

5 Cylinder insulation

Hot water storage

No cylinder

6 Controls

Space heating controls

Programmer, room thermostat and TRVs

Pass

Hot water controls

No cylinder

Boiler interlock

Yes

Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings

100 %

Minimum

75 %

Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)

Slight

Pass

Based on:

Overshading

Average

Windows facing North

1.09 m², No overhang

Windows facing East

5.90 m², No overhang

Windows facing South

7.08 m², No overhang

Windows facing South West

1.20 m², No overhang

Windows facing West

5.11 m², No overhang

Windows facing North West

1.20 m², No overhang

Air change rate

4.00 ach

Blinds/curtains

None

Criterion 4 – Building performance consistent with DER and DFEE rate

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals

5.00 (design value) m³/(h.m²) @ 50 Pa

Maximum

10.0 m³/(h.m²) @ 50 Pa

Pass

10 Key features

Roof U-value

0.10 W/m²K

Floor U-value

0.12 W/m²K

Door U-value

1.10 W/m²K

Photovoltaic array

1.00 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	£81	B 89	B 91	Recommended
Photovoltaic			0	0	Already installed
Wind turbine			0	0	Not applicable
Totals	£4,000 - £6,000	£81	B 89	B 91	

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THERMAL BRIDGING

Calculation Type: New Build (As Designed)

Property Reference	SAP 0879 Plot 133	Issued on Date	28/03/2023
Assessment Reference	Rev A	Prop Type Ref	Downshire V2
Property	Plot 133		

SAP Rating	88 B	DER	13.91	TER	18.52
Environmental	89 B	% DER<TER	24.90		
CO ₂ Emissions (t/year)	0.96	DFEE	50.29	TFEE	58.67
General Requirements Compliance	Pass	% DFEE<TFEE	14.28		

Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 07798936079, toby@abacusenergyuk.com	Assessor ID	E477-0001
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Client	Foreman Homes, FORE
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	Junction detail	Source Type	Psi (W/mK)	Length (m)	Result	Reference
External wall	E2 Other lintels (including other steel lintels)	Table K1 - Approved	0.300	3.23	0.97	
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	0.070	1.82	0.13	Birtley Supatherm
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.071	1.32	0.09	Birtley Supatherm
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.067	9.98	0.67	Birtley Supatherm
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.070	1.47	0.10	Birtley Supatherm
External wall	E3 Sill	Independently assessed	0.021	15.11	0.32	Knauf P5
External wall	E4 Jamb	Independently assessed	0.016	39.62	0.63	Knauf P6
External wall	E5 Ground floor (normal)	Table K1 - Approved	0.160	28.86	4.62	
External wall	E6 Intermediate floor within a dwelling	Independently assessed	0.000	28.25	0.00	CD0029
External wall	E10 Eaves (insulation at ceiling level)	Table K1 - Approved	0.060	20.22	1.21	
External wall	E24 Eaves (insulation at ceiling level - inverted)	Table K1 - Default	0.240	2.71	0.65	
External wall	E12 Gable (insulation at ceiling level)	Independently assessed	0.044	11.32	0.50	Knauf P21
External wall	E16 Corner (normal)	Independently assessed	0.039	25.29	0.99	Knauf P23
External wall	E17 Corner (inverted – internal area greater than external area)	Independently assessed	-0.091	4.44	-0.40	Knauf P24

Total: **10.53** W/mK:
Y-Value: **0.043** W/m²K:

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Property Reference	SAP 0879 Plot 133				Issued on Date	28/03/2023
Assessment Reference	Rev A	Prop Type Ref	Downshire V2			
Property	Plot 133					
SAP Rating	88 B	DER	13.91	TER	18.52	
Environmental	89 B	% DER<TER	24.90			
CO ₂ Emissions (t/year)	0.96	DFEE	50.29	TFEE	58.67	
General Requirements Compliance	Pass	% DFEE<TFEE	14.28			
Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 07798936079, toby@abacusenergyuk.com				Assessor ID	E477-0001
Client	Foreman Homes, FORE					

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

DWELLING AS DESIGNED

Detached House, total floor area 97 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) 18.52 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 13.91 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)58.7 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)50.3 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.24 (max. 0.30)	0.24 (max. 0.70)	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	1.19 (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 36CDi Compact ErP
Combi boiler
Efficiency: 89.8% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls: Programmer, room thermostat and TRVs OK

Hot water controls: No cylinder

Boiler interlock

Yes OK

7 Low energy lights

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

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Southern England): Slight OK

Based on:

Overshading: Average
Windows facing North: 1.09 m², No overhang
Windows facing East: 5.90 m², No overhang
Windows facing South: 7.08 m², No overhang
Windows facing South West: 1.20 m², No overhang
Windows facing West: 5.11 m², No overhang
Windows facing North West: 1.20 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

10 Key features

Roof U-value 0.10 W/m²K
Floor U-value 0.12 W/m²K
Door U-value 1.10 W/m²K
Photovoltaic array 1.00 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	49.1900 (1b)	x 2.3900 (2b)	= 117.5641 (1b) - (3b)
First floor	47.8900 (1c)	x 2.8300 (2c)	= 135.5287 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	97.0800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 253.0928 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ 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) = 0.1580 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4080 (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) = 0.3468 (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	0.4422	0.4335	0.4249	0.3815	0.3729	0.3295	0.3295	0.3208	0.3468	0.3729	0.3902	0.4075 (22b)
Effective ac	0.5978	0.5940	0.5903	0.5728	0.5695	0.5543	0.5543	0.5515	0.5601	0.5695	0.5761	0.5830 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			2.1200	1.1000	2.3320		(26)
Windows & Fully Glazed Do (Uw = 1.20)			21.5800	1.1450	24.7099		(27)
Part Glazed			1.9100	1.2000	2.2920		(26a)
Ground Floor			49.1900	0.1200	5.9028	90.0000	4427.1000 (28a)
Brick and Block	104.4700	25.6100	78.8600	0.2400	18.9264	42.2200	3329.4692 (29a)
Tile Hung	44.4500		44.4500	0.2400	10.6680	42.2200	1876.6790 (29a)
External Roof 1	49.1900		49.1900	0.1000	4.9190	9.1000	447.6290 (30)
Total net area of external elements Aum(A, m ²)			247.3000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	69.7501		(33)
GF Block			53.9900			75.0000	4049.2500 (32c)
GF Timber Stud			28.3800			9.0000	255.4200 (32c)
FF Timber Stud			123.1900			9.0000	1108.7100 (32c)
Internal Floor 1			49.1900			18.0000	885.4200 (32d)
Internal Ceiling 1			49.1900			18.0000	885.4200 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 17265.0972 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							177.8440 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.5276 (36)
Total fabric heat loss							(33) + (36) = 80.2777 (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	49.9268	49.6097	49.2989	47.8389	47.5657	46.2941	46.2941	46.0587	46.7839	47.5657	48.1183	48.6961 (38)
Heat transfer coeff	130.2046	129.8874	129.5766	128.1166	127.8435	126.5718	126.5718	126.3364	127.0617	127.8435	128.3961	128.9738 (39)
Average = Sum(39)m / 12 =												128.1153 (39)
HLP	1.3412	1.3379	1.3347	1.3197	1.3169	1.3038	1.3038	1.3014	1.3088	1.3169	1.3226	1.3285 (40)
HLP (average)												1.3197 (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												2.7108 (42)
Average daily hot water use (litres/day)												98.5815 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.4397	104.4964	100.5531	96.6099	92.6666	88.7234	88.7234	92.6666	96.6099	100.5531	104.4964	108.4397 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Energy conte	160.8129	140.6480	145.1361	126.5332	121.4116	104.7690	97.0839	111.4051	112.7357	131.3826	143.4143	155.7387 (45)
Energy content (annual)										Total =	Sum (45)m =	1551.0710 (45)
Distribution loss (46)m = 0.15 x (45)m												
	24.1219	21.0972	21.7704	18.9800	18.2117	15.7153	14.5626	16.7108	16.9104	19.7074	21.5122	23.3608 (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	27.5631	24.8938	27.5492	26.6300	27.4942	26.5802	27.4494	27.4784	26.6074	27.5258	26.6598	27.5549 (61)
Total heat required for water heating calculated for each month												
	188.3760	165.5418	172.6853	153.1632	148.9058	131.3492	124.5332	138.8836	139.3430	158.9084	170.0742	183.2936 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) =	Sum (63)m =			0.0000 (63)
Output from w/h												
	188.3760	165.5418	172.6853	153.1632	148.9058	131.3492	124.5332	138.8836	139.3430	158.9084	170.0742	183.2936 (64)
Heat gains from water heating, kWh/month								Total per year (kWh/year) =	Sum (64)m =			1875.0571 (64)
	60.3611	52.9889	55.1450	48.7298	47.2429	41.4807	39.1427	43.9118	44.1365	50.5662	54.3502	58.6718 (65)

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

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	135.5400	135.5400	135.5400	135.5400	135.5400	135.5400	135.5400	135.5400	135.5400	135.5400	135.5400	135.5400 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	22.4245	19.9172	16.1978	12.2628	9.1666	7.7388	8.3620	10.8693	14.5888	18.5238	21.6200	23.0478 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	251.5189	254.1289	247.5518	233.5500	215.8753	199.2635	188.1658	185.5559	192.1329	206.1347	223.8095	240.4212 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	36.5540	36.5540	36.5540	36.5540	36.5540	36.5540	36.5540	36.5540	36.5540	36.5540	36.5540	36.5540 (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)												
	-108.4320	-108.4320	-108.4320	-108.4320	-108.4320	-108.4320	-108.4320	-108.4320	-108.4320	-108.4320	-108.4320	-108.4320 (71)
Water heating gains (Table 5)												
	81.1304	78.8525	74.1197	67.6803	63.4985	57.6121	52.6112	59.0213	61.3006	67.9653	75.4864	78.8600 (72)
Total internal gains												
	421.7359	419.5607	404.5313	380.1551	355.2024	331.2765	315.8011	322.1084	334.6843	359.2858	387.5779	408.9910 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	Access factor Table 6d	Gains W
North	1.0900	10.6334	0.6300	0.7000	0.7700	3.5422 (74)
East	5.9000	19.6403	0.6300	0.7000	0.7700	35.4137 (76)
South	7.0800	46.7521	0.6300	0.7000	0.7700	101.1593 (78)
Southwest	1.2000	36.7938	0.6300	0.7000	0.7700	13.4936 (79)
West	5.1100	19.6403	0.6300	0.7000	0.7700	30.6719 (80)
Northwest	1.2000	11.2829	0.6300	0.7000	0.7700	4.1379 (81)

Solar gains	188.4185	333.1268	482.0655	631.3869	731.1199	734.4300	704.6327	630.1843	534.4402	375.8463	228.0476	159.6363 (83)
Total gains	610.1544	752.6875	886.5968	1011.5419	1086.3222	1065.7064	1020.4338	952.2927	869.1245	735.1320	615.6255	568.6273 (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	36.8333	36.9232	37.0118	37.4336	37.5135	37.8904	37.8904	37.9610	37.7444	37.5135	37.3521	37.1848
alpha	3.4556	3.4615	3.4675	3.4956	3.5009	3.5260	3.5260	3.5307	3.5163	3.5009	3.4901	3.4790
util living area												
	0.9911	0.9812	0.9595	0.9084	0.8115	0.6626	0.5144	0.5637	0.7820	0.9396	0.9839	0.9930 (86)
MIT	19.1175	19.3766	19.7652	20.2392	20.6294	20.8743	20.9613	20.9463	20.7619	20.2297	19.5801	19.0731 (87)
Th 2	19.8087	19.8112	19.8137	19.8254	19.8276	19.8379	19.8379	19.8398	19.8339	19.8276	19.8232	19.8186 (88)
util rest of house												
	0.9888	0.9765	0.9491	0.8839	0.7602	0.5722	0.3918	0.4403	0.7055	0.9183	0.9791	0.9912 (89)
MIT 2	18.1105	18.3689	18.7524	19.2161	19.5705	19.7735	19.8258	19.8213	19.6945	19.2191	18.5817	18.0737 (90)
Living area fraction									fLA = Living area / (4) =			0.1956 (91)
MIT	18.3075	18.5660	18.9505	19.4163	19.7776	19.9889	20.0479	20.0414	19.9033	19.4168	18.7770	18.2692 (92)
Temperature adjustment												0.0000
adjusted MIT	18.3075	18.5660	18.9505	19.4163	19.7776	19.9889	20.0479	20.0414	19.9033	19.4168	18.7770	18.2692 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9848	0.9698	0.9393	0.8737	0.7577	0.5850	0.4152	0.4632	0.7107	0.9088	0.9731	0.9878 (94)
Useful gains	600.8519	729.9463	832.7821	883.7588	823.1322	623.3860	423.6376	441.1177	617.7178	668.0782	599.0829	561.6970 (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												
	1823.8399	1775.0388	1613.2897	1347.3083	1032.6712	682.0776	436.4082	460.0398	737.3789	1127.1703	1499.2770	1814.5527 (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												
	909.9031	702.3021	580.6977	333.7557	155.8970	0.0000	0.0000	0.0000	0.0000	341.5645	648.1398	932.1247 (98)
Space heating												4604.3845 (98)
Space heating per m2										(98) / (4) =		47.4288 (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														5076.4989 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	909.9031	702.3021	580.6977	333.7557	155.8970	0.0000	0.0000	0.0000	0.0000	341.5645	648.1398	932.1247	(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)	1003.2007	774.3133	640.2400	367.9776	171.8821	0.0000	0.0000	0.0000	0.0000	376.5871	714.5973	1027.7009	(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	188.3760	165.5418	172.6853	153.1632	148.9058	131.3492	124.5332	138.8836	139.3430	158.9084	170.0742	183.2936	(64)	
Efficiency of water heater (217)m	90.2071	90.1522	90.0426	89.8002	89.3102	87.9000	87.9000	87.9000	87.9000	89.7918	90.1034	90.2277	(216)	
Fuel for water heating, kWh/month	208.8260	183.6247	191.7818	170.5600	166.7288	149.4303	141.6760	158.0018	158.5245	176.9742	188.7545	203.1455	(219)	
Water heating fuel used												2098.0282	(219)	
Annual totals kWh/year														
Space heating fuel - main system												5076.4989	(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)													396.0237	(232)
Energy saving/generation technologies (Appendices M,N and Q)														
PV Unit 0 (0.80 + 1.00 + 1068 + 1.00) =										-854.4564			-854.4564	(233)
Total delivered energy for all uses													6791.0944	(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	5076.4989	0.2160	1096.5238	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2098.0282	0.2160	453.1741	(264)
Space and water heating			1549.6978	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	396.0237	0.5190	205.5363	(268)
Energy saving/generation technologies				
PV Unit	-854.4564	0.5190	-443.4629	(269)
Total CO2, kg/year			1350.6963	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.9100	(273)

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

DER			13.9100	ZC1
Total Floor Area		TFA	97.0800	
Assumed number of occupants		N	2.7108	
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190	
CO2 emissions from appliances, equation (L14)			15.3528	ZC2
CO2 emissions from cooking, equation (L16)			1.8960	ZC3
Total CO2 emissions			31.1587	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			31.1587	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	49.1900 (1b)	x 2.3900 (2b)	= 117.5641 (1b) - (3b)
First floor	47.8900 (1c)	x 2.8300 (2c)	= 135.5287 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	97.0800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 253.0928 (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) = 0.1185 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3685 (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) =	0.3133 (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	0.3994	0.3916	0.3837	0.3446	0.3367	0.2976	0.2976	0.2898	0.3133	0.3367	0.3524	0.3681 (22b)
Effective ac	0.5798	0.5767	0.5736	0.5594	0.5567	0.5443	0.5443	0.5420	0.5491	0.5567	0.5621	0.5677 (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			2.1200	1.0000	2.1200		(26)
TER Semi-glazed door			1.9100	1.2000	2.2920		(26a)
TER Opening Type (Uw = 1.40)			20.2700	1.3258	26.8731		(27)
Ground Floor			49.1900	0.1300	6.3947		(28a)
Brick and Block	104.4700	24.3000	80.1700	0.1800	14.4306		(29a)
Tile Hung	44.4500		44.4500	0.1800	8.0010		(29a)
External Roof 1	49.1900		49.1900	0.1300	6.3947		(30)
Total net area of external elements Aum(A, m ²)			247.3000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	66.5061		(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)							12.6989 (36)
Total fabric heat loss						(33) + (36) =	79.2050 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	48.4219	48.1632	47.9096	46.7187	46.4959	45.4586	45.4586	45.2665	45.8582	46.4959	46.9466	47.4179 (38)
Heat transfer coeff	127.6269	127.3682	127.1146	125.9237	125.7009	124.6636	124.6636	124.4715	125.0632	125.7009	126.1517	126.6229 (39)
Average = Sum(39)m / 12 =												125.9226 (39)
HLP	1.3147	1.3120	1.3094	1.2971	1.2948	1.2841	1.2841	1.2822	1.2882	1.2948	1.2995	1.3043 (40)
HLP (average)												1.2971 (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												2.7108 (42)
Average daily hot water use (litres/day)												98.5815 (43)
Daily hot water use	108.4397	104.4964	100.5531	96.6099	92.6666	88.7234	88.7234	92.6666	96.6099	100.5531	104.4964	108.4397 (44)
Energy conte	160.8129	140.6480	145.1361	126.5332	121.4116	104.7690	97.0839	111.4051	112.7357	131.3826	143.4143	155.7387 (45)
Energy content (annual)										Total = Sum(45)m =		1551.0710 (45)
Distribution loss (46)m = 0.15 x (45)m												
24.1219	21.0972	21.7704	18.9800	18.2117	15.7153	14.5626	16.7108	16.9104	19.7074	21.5122	23.3608 (46)	
Water storage loss:												
Total storage loss												

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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	50.9589	46.0274	50.9589	47.6432	47.2219	43.7540	45.2125	47.2219	47.6432	50.9589	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month	211.7718	186.6754	196.0950	174.1764	168.6335	148.5230	142.2963	158.6270	160.3789	182.3415	192.7294	206.6976 (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	211.7718	186.6754	196.0950	174.1764	168.6335	148.5230	142.2963	158.6270	160.3789	182.3415	192.7294	206.6976 (64)
Heat gains from water heating, kWh/month	66.2100	58.2723	60.9975	53.9831	52.1748	45.7742	43.5835	48.8477	49.3954	56.4244	60.0140	64.5228 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	135.5400	135.5400	135.5400	135.5400	135.5400	135.5400	135.5400	135.5400	135.5400	135.5400	135.5400	135.5400	(66)
Lighting gains (calculated in Appendix L9 or L9a), also see Table 5	22.4939	19.9789	16.2479	12.3007	9.1949	7.7628	8.3879	10.9030	14.6339	18.5811	21.6869	23.1191	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	251.5189	254.1289	247.5518	233.5500	215.8753	199.2635	188.1658	185.5559	192.1329	206.1347	223.8095	240.4212	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.5540	36.5540	36.5540	36.5540	36.5540	36.5540	36.5540	36.5540	36.5540	36.5540	36.5540	36.5540	(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)	-108.4320	-108.4320	-108.4320	-108.4320	-108.4320	-108.4320	-108.4320	-108.4320	-108.4320	-108.4320	-108.4320	-108.4320	(71)
Water heating gains (Table 5)	88.9919	86.7147	81.9859	74.9765	70.1275	63.5753	58.5800	65.6555	68.6047	75.8393	83.3528	86.7242	(72)
Total internal gains	429.6668	427.4845	412.4476	387.4893	361.8597	337.2635	321.7957	328.7763	342.0336	367.2171	395.5112	416.9266	(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				1.0200	10.6334		0.6300		0.7000		0.7700		3.3147 (74)
East				5.5400	19.6403		0.6300		0.7000		0.7700		33.2529 (76)
South				6.6500	46.7521		0.6300		0.7000		0.7700		95.0155 (78)
Southwest				1.1300	36.7938		0.6300		0.7000		0.7700		12.7065 (79)
West				4.8000	19.6403		0.6300		0.7000		0.7700		28.8111 (80)
Northwest				1.1300	11.2829		0.6300		0.7000		0.7700		3.8965 (81)
Solar gains	176.9971	312.9310	452.8340	593.0919	686.7688	689.8752	661.8868	591.9595	502.0297	353.0588	214.2235	149.9600	(83)
Total gains	606.6639	740.4155	865.2816	980.5812	1048.6285	1027.1387	983.6826	920.7358	844.0633	720.2759	609.7348	566.8866	(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	52.8233	52.9305	53.0361	53.5377	53.6326	54.0789	54.0789	54.1623	53.9061	53.6326	53.4410	53.2421	
alpha	4.5216	4.5287	4.5357	4.5692	4.5755	4.6053	4.6053	4.6108	4.5937	4.5755	4.5627	4.5495	
util living area	0.9976	0.9936	0.9825	0.9480	0.8622	0.7052	0.5402	0.5936	0.8302	0.9695	0.9947	0.9982	(86)
MIT	19.5665	19.7644	20.0665	20.4402	20.7503	20.9306	20.9838	20.9754	20.8469	20.4260	19.9198	19.5308	(87)
Th 2	19.8294	19.8315	19.8335	19.8431	19.8449	19.8533	19.8533	19.8548	19.8501	19.8449	19.8413	19.8375	(88)
util rest of house	0.9967	0.9914	0.9762	0.9283	0.8107	0.6060	0.4082	0.4595	0.7499	0.9542	0.9925	0.9976	(89)
MIT 2	17.9347	18.2243	18.6629	19.1977	19.6051	19.8084	19.8477	19.8452	19.7310	19.1894	18.4589	17.8880	(90)
Living area fraction	18.2539	18.5256	18.9374	19.4407	19.8291	20.0279	20.0699	20.0663	19.9493	19.4313	18.7447	18.2093	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.2539	18.5256	18.9374	19.4407	19.8291	20.0279	20.0699	20.0663	19.9493	19.4313	18.7447	18.2093	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	603.5841	731.3689	838.8959	901.7578	849.2451	639.2772	427.0050	447.1239	639.7723	681.8857	603.2319	564.7333	(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	1780.8923	1735.4647	1580.9793	1327.3262	1021.8351	676.6604	432.5726	456.3505	731.5269	1110.1065	1468.9960	1773.9013	(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	875.9173	674.7524	552.1101	306.4092	128.4069	0.0000	0.0000	0.0000	0.0000	318.5963	623.3502	899.6210	(98)
Space heating												4379.1633	(98)
Space heating per m2												45.1088	(99)

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.4000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													4688.6117 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	875.9173	674.7524	552.1101	306.4092	128.4069	0.0000	0.0000	0.0000	0.0000	318.5963	623.3502	899.6210	(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)	937.8129	722.4329	591.1243	328.0613	137.4807	0.0000	0.0000	0.0000	0.0000	341.1095	667.3985	963.1917	(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	211.7718	186.6754	196.0950	174.1764	168.6335	148.5230	142.2963	158.6270	160.3789	182.3415	192.7294	206.6976	(64)
Efficiency of water heater (217)m	88.2391	88.0014	87.5151	86.4588	84.3751	80.3000	80.3000	80.3000	80.3000	86.4424	87.7922	88.3244	(216)
Fuel for water heating, kWh/month	239.9976	212.1278	224.0700	201.4561	199.8616	184.9601	177.2059	197.5430	199.7247	210.9399	219.5291	234.0209	(219)
Water heating fuel used												2501.4367	(219)
Annual totals kWh/year													
Space heating fuel - main system												4688.6117	(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)												397.2500	(232)
Total delivered energy for all uses												7662.2984	(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	4688.6117	0.2160	1012.7401 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2501.4367	0.2160	540.3103 (264)
Space and water heating			1553.0504 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	397.2500	0.5190	206.1728 (268)
Total CO2, kg/m2/year			1798.1482 (272)
Emissions per m2 for space and water heating			15.9976 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.1237 (272b)
Emissions per m2 for pumps and fans			0.4010 (272c)
Target Carbon Dioxide Emission Rate (TER) = (15.9976 * 1.00) + 2.1237 + 0.4010, rounded to 2 d.p.			18.5200 (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	49.1900 (1b)	x 2.3900 (2b)	= 117.5641 (1b) - (3b)
First floor	47.8900 (1c)	x 2.8300 (2c)	= 135.5287 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	97.0800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 253.0928 (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) = 0.1185 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3685 (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) =	0.3133 (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	0.3994	0.3916	0.3837	0.3446	0.3367	0.2976	0.2976	0.2898	0.3133	0.3367	0.3524	0.3681 (22b)
Effective ac	0.5798	0.5767	0.5736	0.5594	0.5567	0.5443	0.5443	0.5420	0.5491	0.5567	0.5621	0.5677 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			2.1200	1.1000	2.3320		(26)
Windows & Fully Glazed Do (Uw = 1.20)			21.5800	1.1450	24.7099		(27)
Part Glazed			1.9100	1.2000	2.2920		(26a)
Ground Floor			49.1900	0.1200	5.9028	90.0000	4427.1000 (28a)
Brick and Block	104.4700	25.6100	78.8600	0.2400	18.9264	42.2200	3329.4692 (29a)
Tile Hung	44.4500		44.4500	0.2400	10.6680	42.2200	1876.6790 (29a)
External Roof 1	49.1900		49.1900	0.1000	4.9190	9.1000	447.6290 (30)
Total net area of external elements Aum(A, m ²)			247.3000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	69.7501		(33)
GF Block			53.9900			75.0000	4049.2500 (32c)
GF Timber Stud			28.3800			9.0000	255.4200 (32c)
FF Timber Stud			123.1900			9.0000	1108.7100 (32c)
Internal Floor 1			49.1900			18.0000	885.4200 (32d)
Internal Ceiling 1			49.1900			9.0000	442.7100 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	16822.3872 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							173.2838 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.5276 (36)
Total fabric heat loss						(33) + (36) =	80.2777 (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	48.4219	48.1632	47.9096	46.7187	46.4959	45.4586	45.4586	45.2665	45.8582	46.4959	46.9466	47.4179 (38)
Heat transfer coeff	128.6996	128.4409	128.1874	126.9964	126.7736	125.7363	125.7363	125.5442	126.1359	126.7736	127.2244	127.6956 (39)
Average = Sum(39)m / 12 =												126.9954 (39)
HLP	1.3257	1.3230	1.3204	1.3082	1.3059	1.2952	1.2952	1.2932	1.2993	1.3059	1.3105	1.3154 (40)
HLP (average)												1.3082 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

											2.7108 (42)	
Average daily hot water use (litres/day)											98.5815 (43)	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	108.4397	104.4964	100.5531	96.6099	92.6666	88.7234	88.7234	92.6666	96.6099	100.5531	104.4964	108.4397 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Energy conte	160.8129	140.6480	145.1361	126.5332	121.4116	104.7690	97.0839	111.4051	112.7357	131.3826	143.4143	155.7387	(45)
Energy content (annual)										Total =	Sum (45)m =	1551.0710	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
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	34.1727	29.8877	30.8414	26.8883	25.8000	22.2634	20.6303	23.6736	23.9563	27.9188	30.4755	33.0945	(65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	135.5400	135.5400	135.5400	135.5400	135.5400	135.5400	135.5400	135.5400	135.5400	135.5400	135.5400	135.5400	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	22.4245	19.9172	16.1978	12.2628	9.1666		8.3620	10.8693	14.5888	18.5238	21.6200	23.0478	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	251.5189	254.1289	247.5518	233.5500	215.8753	199.2635	188.1658	185.5559	192.1329	206.1347	223.8095	240.4212	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.5540	36.5540	36.5540	36.5540	36.5540	36.5540	36.5540	36.5540	36.5540	36.5540	36.5540	36.5540	(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)	-108.4320	-108.4320	-108.4320	-108.4320	-108.4320	-108.4320	-108.4320	-108.4320	-108.4320	-108.4320	-108.4320	-108.4320	(71)
Water heating gains (Table 5)	45.9311	44.4757	41.4535	37.3449	34.6774	30.9214	27.7289	31.8193	33.2727	37.5253	42.3271	44.4818	(72)
Total internal gains	383.5365	382.1839	368.8651	346.8197	323.3812	301.5857	287.9188	291.9065	303.6564	325.8458	351.4186	371.6128	(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			1.0900		10.6334		0.6300		0.7000		0.7700		3.5422	(74)
East			5.9000		19.6403		0.6300		0.7000		0.7700		35.4137	(76)
South			7.0800		46.7521		0.6300		0.7000		0.7700		101.1593	(78)
Southwest			1.2000		36.7938		0.6300		0.7000		0.7700		13.4936	(79)
West			5.1100		19.6403		0.6300		0.7000		0.7700		30.6719	(80)
Northwest			1.2000		11.2829		0.6300		0.7000		0.7700		4.1379	(81)
Solar gains	188.4185	333.1268	482.0655	631.3869	731.1199	734.4300	704.6327	630.1843	534.4402	375.8463	228.0476	159.6363	(83)	
Total gains	571.9550	715.3107	850.9307	978.2065	1054.5011	1036.0157	992.5515	922.0908	838.0965	701.6920	579.4662	531.2491	(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	36.3085	36.3816	36.4536	36.7954	36.8601	37.1642	37.1642	37.2210	37.0464	36.8601	36.7295	36.5939		
alpha	3.4206	3.4254	3.4302	3.4530	3.4573	3.4776	3.4776	3.4814	3.4698	3.4573	3.4486	3.4396		
util living area	0.9921	0.9826	0.9616	0.9118	0.8168	0.6704	0.5225	0.5740	0.7907	0.9438	0.9856	0.9938	(86)	
MIT	19.0615	19.3262	19.7234	20.2067	20.6089	20.8640	20.9573	20.9404	20.7440	20.1921	19.5276	19.0133	(87)	
Th 2	19.8208	19.8228	19.8249	19.8344	19.8362	19.8446	19.8446	19.8462	19.8414	19.8362	19.8326	19.8288	(88)	
util rest of house	0.9901	0.9783	0.9518	0.8884	0.7670	0.5811	0.3998	0.4507	0.7166	0.9240	0.9813	0.9922	(89)	
MIT 2	18.0668	18.3306	18.7229	19.1951	19.5621	19.7738	19.8309	19.8251	19.6889	19.1929	18.5398	18.0248	(90)	
Living area fraction									fLA =	Living area / (4) =		0.1956	(91)	
MIT	18.2614	18.5254	18.9186	19.3930	19.7669	19.9870	20.0512	20.0433	19.8953	19.3884	18.7330	18.2181	(92)	
Temperature adjustment												0.0000		
adjusted MIT	18.2614	18.5254	18.9186	19.3930	19.7669	19.9870	20.0512	20.0433	19.8953	19.3884	18.7330	18.2181	(93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9863	0.9719	0.9421	0.8777	0.7636	0.5931	0.4230	0.4733	0.7205	0.9142	0.9756	0.9892	(94)
Useful gains	564.1351	695.1891	801.6544	858.5504	805.2355	614.4707	419.8502	436.4109	603.8749	641.5013	565.3531	525.4980	(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	1796.8215	1750.0531	1591.9063	1332.5706	1022.6694	677.3448	433.9443	457.3921	730.9947	1114.1357	1479.9980	1790.0543	(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	917.1187	708.8686	587.9474	341.2945	161.7708	0.0000	0.0000	0.0000	0.0000	351.6399	658.5443	940.8298	(98)
Space heating												4668.0141	(98)
Space heating per m2										(98) / (4) =		48.0842	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

	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	1181.9215	930.4489	954.1363	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8160	0.8776	0.8514	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	964.4010	816.5475	812.3710	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1314.2929	1261.2669	1180.7123	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	251.9222	330.8712	274.0459	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling													
Cooled fraction													856.8393 (104)
Intermittency factor (Table 10b)													fC = cooled area / (4) = 1.0000 (105)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	62.9805	82.7178	68.5115	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling													
Space cooling per m2													214.2098 (107)
Energy for space heating													2.2065 (108)
Energy for space cooling													48.0842 (99)
Total													2.2065 (108)
Dwelling Fabric Energy Efficiency (DFEE)													50.2907 (109)
													50.3 (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	49.1900 (1b)	x 2.3900 (2b)	= 117.5641 (1b) - (3b)
First floor	47.8900 (1c)	x 2.8300 (2c)	= 135.5287 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	97.0800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 253.0928 (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) = 0.1185 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3685 (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) =	0.3133 (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	0.3994	0.3916	0.3837	0.3446	0.3367	0.2976	0.2976	0.2898	0.3133	0.3367	0.3524	0.3681 (22b)
Effective ac	0.5798	0.5767	0.5736	0.5594	0.5567	0.5443	0.5443	0.5420	0.5491	0.5567	0.5621	0.5677 (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			2.1200	1.0000	2.1200		(26)
TER Semi-glazed door			1.9100	1.2000	2.2920		(26a)
TER Opening Type (Uw = 1.40)			20.2700	1.3258	26.8731		(27)
Ground Floor			49.1900	0.1300	6.3947		(28a)
Brick and Block	104.4700	24.3000	80.1700	0.1800	14.4306		(29a)
Tile Hung	44.4500		44.4500	0.1800	8.0010		(29a)
External Roof 1	49.1900		49.1900	0.1300	6.3947		(30)
Total net area of external elements Aum(A, m ²)			247.3000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	66.5061		(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)							12.6989 (36)
Total fabric heat loss						(33) + (36) =	79.2050 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	48.4219	48.1632	47.9096	46.7187	46.4959	45.4586	45.4586	45.2665	45.8582	46.4959	46.9466	47.4179 (38)
Heat transfer coeff	127.6269	127.3682	127.1146	125.9237	125.7009	124.6636	124.6636	124.4715	125.0632	125.7009	126.1517	126.6229 (39)
Average = Sum(39)m / 12 =												125.9226 (39)
HLP	1.3147	1.3120	1.3094	1.2971	1.2948	1.2841	1.2841	1.2822	1.2882	1.2948	1.2995	1.3043 (40)
HLP (average)												1.2971 (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												2.7108 (42)
Average daily hot water use (litres/day)												98.5815 (43)
Daily hot water use	108.4397	104.4964	100.5531	96.6099	92.6666	88.7234	88.7234	92.6666	96.6099	100.5531	104.4964	108.4397 (44)
Energy conte	160.8129	140.6480	145.1361	126.5332	121.4116	104.7690	97.0839	111.4051	112.7357	131.3826	143.4143	155.7387 (45)
Energy content (annual)										Total = Sum(45)m =		1551.0710 (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												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Heat gains from water heating, kWh/month	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)
	34.1727	29.8877	30.8414	26.8883	25.8000	22.2634	20.6303	23.6736	23.9563	27.9188	30.4755	33.0945 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	135.5400	135.5400	135.5400	135.5400	135.5400	135.5400	135.5400	135.5400	135.5400	135.5400	135.5400	135.5400	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	22.4939	19.9789	16.2479	12.3007	9.1949	7.7628	8.3879	10.9030	14.6339	18.5811	21.6869	23.1191	(67)
Appliances gains (calculated in Appendix L13 or L13a), also see Table 5	251.5189	254.1289	247.5518	233.5500	215.8753	199.2635	188.1658	185.5559	192.1329	206.1347	223.8095	240.4212	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.5540	36.5540	36.5540	36.5540	36.5540	36.5540	36.5540	36.5540	36.5540	36.5540	36.5540	36.5540	(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)	-108.4320	-108.4320	-108.4320	-108.4320	-108.4320	-108.4320	-108.4320	-108.4320	-108.4320	-108.4320	-108.4320	-108.4320	(71)
Water heating gains (Table 5)	45.9311	44.4757	41.4535	37.3449	34.6774	30.9214	27.7289	31.8193	33.2727	37.5253	42.3271	44.4818	(72)
Total internal gains	383.6059	382.2455	368.9153	346.8576	323.4096	301.6097	287.9447	291.9402	303.7015	325.9031	351.4855	371.6842	(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				1.0200	10.6334		0.6300		0.7000		0.7700		3.3147 (74)
East				5.5400	19.6403		0.6300		0.7000		0.7700		33.2529 (76)
South				6.6500	46.7521		0.6300		0.7000		0.7700		95.0155 (78)
Southwest				1.1300	36.7938		0.6300		0.7000		0.7700		12.7065 (79)
West				4.8000	19.6403		0.6300		0.7000		0.7700		28.8111 (80)
Northwest				1.1300	11.2829		0.6300		0.7000		0.7700		3.8965 (81)
Solar gains	176.9971	312.9310	452.8340	593.0919	686.7688	689.8752	661.8868	591.9595	502.0297	353.0588	214.2235	149.9600	(83)
Total gains	560.6030	695.1765	821.7493	939.9495	1010.1784	991.4849	949.8315	883.8997	805.7312	678.9619	565.7091	521.6441	(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	52.8233	52.9305	53.0361	53.5377	53.6326	54.0789	54.0789	54.1623	53.9061	53.6326	53.4410	53.2421	
alpha	4.5216	4.5287	4.5357	4.5692	4.5755	4.6053	4.6053	4.6108	4.5937	4.5755	4.5627	4.5495	
util living area	0.9982	0.9951	0.9856	0.9548	0.8750	0.7226	0.5571	0.6140	0.8482	0.9754	0.9961	0.9987	(86)
MIT	19.5237	19.7231	20.0287	20.4100	20.7312	20.9232	20.9817	20.9718	20.8306	20.3920	19.8793	19.4886	(87)
Th 2	19.8294	19.8315	19.8335	19.8431	19.8449	19.8533	19.8533	19.8548	19.8501	19.8449	19.8413	19.8375	(88)
util rest of house	0.9976	0.9933	0.9803	0.9372	0.8261	0.6237	0.4221	0.4773	0.7716	0.9626	0.9945	0.9983	(89)
MIT 2	18.4931	18.6933	18.9974	19.3748	19.6665	19.8188	19.8489	19.8472	19.7581	19.3656	18.8573	18.4643	(90)
Living area fraction									fLA = Living area / (4) =			0.1956	(91)
MIT	18.6947	18.8947	19.1992	19.5773	19.8747	20.0348	20.0705	20.0672	19.9679	19.5664	19.0572	18.6647	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6947	18.8947	19.1992	19.5773	19.8747	20.0348	20.0705	20.0672	19.9679	19.5664	19.0572	18.6647	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9968	0.9914	0.9765	0.9321	0.8276	0.6408	0.4488	0.5043	0.7809	0.9584	0.9928	0.9976	(94)
Ext temp.	558.7819	689.1801	802.4202	876.1549	836.0006	635.3883	426.2646	445.7097	629.1624	650.7323	561.6642	520.4118	(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	1837.1534	1782.4796	1614.2497	1344.5206	1027.5725	677.5276	432.6425	456.4581	733.8604	1127.0789	1508.4259	1831.5574	(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	951.1084	734.6973	604.0012	337.2233	142.5295	0.0000	0.0000	0.0000	0.0000	354.4018	681.6684	975.4923	(98)
Space heating per m2												4781.1221	(98)
										(98) / (4) =		49.2493	(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	1171.8381	922.5108	945.9837	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8507	0.9131	0.8880	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	996.8977	842.3602	840.0220	0.0000	0.0000	0.0000	0.0000	(102)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1262.2758	1211.3689	1136.1181	0.0000	0.0000	0.0000	0.0000 (103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling kWh												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	191.0723	274.5424	220.2955	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												685.9102 (104)
Cooled fraction									fC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)												
Intermittency factor	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	47.7681	68.6356	55.0739	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												171.4776 (107)
Space cooling per m2												1.7664 (108)
Energy for space heating												49.2493 (99)
Energy for space cooling												1.7664 (108)
Total												51.0157 (109)
Target Fabric Energy Efficiency (TFEE)												58.7 (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	49.1900 (1b)	x 2.3900 (2b)	= 117.5641 (1b) - (3b)
First floor	47.8900 (1c)	x 2.8300 (2c)	= 135.5287 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	97.0800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 253.0928 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ 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) = 0.1580 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4080 (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) =		0.3468 (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												
Effective ac	0.4422	0.4075	0.3989	0.3729	0.3729	0.3468	0.3468	0.3382	0.3468	0.3902	0.3815	0.4075 (22b)
	0.5978	0.5830	0.5795	0.5695	0.5695	0.5601	0.5601	0.5572	0.5601	0.5761	0.5728	0.5830 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			2.1200	1.1000	2.3320		(26)
Windows & Fully Glazed Do (Uw = 1.20)			21.5800	1.1450	24.7099		(27)
Part Glazed			1.9100	1.2000	2.2920		(26a)
Ground Floor			49.1900	0.1200	5.9028	90.0000	4427.1000 (28a)
Brick and Block	104.4700	25.6100	78.8600	0.2400	18.9264	42.2200	3329.4692 (29a)
Tile Hung	44.4500		44.4500	0.2400	10.6680	42.2200	1876.6790 (29a)
External Roof 1	49.1900		49.1900	0.1000	4.9190	9.1000	447.6290 (30)
Total net area of external elements Aum(A, m ²)			247.3000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	69.7501		(33)
GF Block			53.9900			75.0000	4049.2500 (32c)
GF Timber Stud			28.3800			9.0000	255.4200 (32c)
FF Timber Stud			123.1900			9.0000	1108.7100 (32c)
Internal Floor 1			49.1900			18.0000	885.4200 (32d)
Internal Ceiling 1			49.1900			18.0000	885.4200 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	17265.0972 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							177.8440 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.5276 (36)
Total fabric heat loss						(33) + (36) =	80.2777 (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	49.9268	48.6961	48.4041	47.5657	47.5657	46.7839	46.7839	46.5359	46.7839	48.1183	47.8389	48.6961 (38)
Heat transfer coeff	130.2046	128.9738	128.6818	127.8435	127.8435	127.0617	127.0617	126.8136	127.0617	128.3961	128.1166	128.9738 (39)
Average = Sum(39)m / 12 =												128.0860 (39)
HLP	1.3412	1.3285	1.3255	1.3169	1.3169	1.3088	1.3088	1.3063	1.3088	1.3226	1.3197	1.3285 (40)
HLP (average)												1.3194 (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												2.7108 (42)
Average daily hot water use (litres/day)												98.5815 (43)
Jan	108.4397	104.4964	100.5531	96.6099	92.6666	88.7234	88.7234	92.6666	96.6099	100.5531	104.4964	108.4397 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Energy content (annual)	160.8129	140.6480	145.1361	126.5332	121.4116	104.7690	97.0839	111.4051	112.7357	131.3826	143.4143	155.7387 (45)
Distribution loss (46)m = 0.15 x (45)m	24.1219	21.0972	21.7704	18.9800	18.2117	15.7153	14.5626	16.7108	16.9104	19.7074	21.5122	23.3608 (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	27.5631	24.8938	27.5492	26.6300	27.4942	26.5802	27.4494	27.4784	26.6074	27.5258	26.6598	27.5549 (61)
Total heat required for water heating calculated for each month	188.3760	165.5418	172.6853	153.1632	148.9058	131.3492	124.5332	138.8836	139.3430	158.9084	170.0742	183.2936 (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	188.3760	165.5418	172.6853	153.1632	148.9058	131.3492	124.5332	138.8836	139.3430	158.9084	170.0742	183.2936 (64)
RHI water heating demand												
Heat gains from water heating, kWh/month	60.3611	52.9889	55.1450	48.7298	47.2429	41.4807	39.1427	43.9118	44.1365	50.5662	54.3502	58.6718 (65)
												1875 (64)
												1875 (64)

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

Metabolic gains (Table 5), Watts												
(66)m	162.6480	162.6480	162.6480	162.6480	162.6480	162.6480	162.6480	162.6480	162.6480	162.6480	162.6480	162.6480 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	56.0613	49.7931	40.4945	30.6569	22.9164	19.3470	20.9051	27.1733	36.4719	46.3095	54.0500	57.6194 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	375.4013	379.2968	369.4803	348.5821	322.2019	297.4082	280.8445	276.9490	286.7656	307.6637	334.0440	358.8376 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.9756	53.9756	53.9756	53.9756	53.9756	53.9756	53.9756	53.9756	53.9756	53.9756	53.9756	53.9756 (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)	-108.4320	-108.4320	-108.4320	-108.4320	-108.4320	-108.4320	-108.4320	-108.4320	-108.4320	-108.4320	-108.4320	-108.4320 (71)
Water heating gains (Table 5)	81.1304	78.8525	74.1197	67.6803	63.4985	57.6121	52.6112	59.0213	61.3006	67.9653	75.4864	78.8600 (72)
Total internal gains	623.7847	619.1341	595.2861	558.1109	519.8085	485.5590	465.5524	474.3352	495.7297	533.1301	574.7720	606.5086 (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					1.0900	13.8645	0.6300	0.7000			0.7700			4.6185 (74)
East					5.9000	25.9136	0.6300	0.7000			0.7700			46.7253 (76)
South					7.0800	58.2505	0.6300	0.7000			0.7700			126.0390 (78)
Southwest					1.2000	46.3896	0.6300	0.7000			0.7700			17.0127 (79)
West					5.1100	25.9136	0.6300	0.7000			0.7700			40.4689 (80)
Northwest					1.2000	15.0428	0.6300	0.7000			0.7700			5.5167 (81)
Solar gains	240.3812	363.4182	523.9050	700.9270	777.9043	847.1009	792.6941	721.9323	616.5083	433.8390	288.3172	194.4525 (83)		
Total gains	864.1658	982.5523	1119.1911	1259.0379	1297.7128	1332.6599	1258.2465	1196.2675	1112.2380	966.9690	863.0892	800.9611 (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	36.8333	37.1848	37.2692	37.5135	37.5135	37.7444	37.7444	37.8182	37.7444	37.3521	37.4336	37.1848
alpha	3.4556	3.4790	3.4846	3.5009	3.5009	3.5163	3.5163	3.5212	3.5163	3.4901	3.4956	3.4790
util living area	0.9693	0.9536	0.9138	0.8309	0.6992	0.5048	0.3662	0.3833	0.6156	0.8479	0.9445	0.9747 (86)
MIT	19.5686	19.7535	20.1091	20.5041	20.7993	20.9531	20.9887	20.9870	20.9062	20.5648	20.0370	19.5346 (87)
Th 2	19.8087	19.8186	19.8209	19.8276	19.8276	19.8339	19.8339	19.8359	19.8339	19.8232	19.8254	19.8186 (88)
util rest of house	0.9618	0.9425	0.8934	0.7923	0.6323	0.4107	0.2543	0.2669	0.5193	0.8012	0.9286	0.9683 (89)
MIT 2	18.5555	18.7423	19.0852	19.4538	19.7029	19.8145	19.8315	19.8331	19.7897	19.5156	19.0273	18.5302 (90)
Living area fraction									fLA = Living area / (4) =			0.1956 (91)
MIT	18.7537	18.9401	19.2855	19.6592	19.9173	20.0372	20.0579	20.0588	20.0081	19.7208	19.2248	18.7267 (92)
Temperature adjustment												0.0000
adjusted MIT	18.7537	18.9401	19.2855	19.6592	19.9173	20.0372	20.0579	20.0588	20.0081	19.7208	19.2248	18.7267 (93)

8. Space heating requirement

Utilisation	0.9530	0.9322	0.8823	0.7860	0.6379	0.4278	0.2762	0.2897	0.5348	0.7965	0.9184	0.9604 (94)
Useful gains	823.5537	915.9612	987.4891	989.5926	827.7619	570.0930	347.5887	346.5840	594.7831	770.1638	792.6207	769.2706 (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	1738.7101	1707.6305	1542.3107	1286.0069	935.4733	589.2132	350.4202	349.8591	636.3388	1017.0032	1386.8344	1705.8985 (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	680.8763	532.0018	412.7873	213.4183	80.1373	0.0000	0.0000	0.0000	0.0000	183.6485	427.8339	696.8512 (98)
Space heating												3227.5546 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

RHI space heating demand

3228 (98)

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	49.1900 (1b)	x 2.3900 (2b)	= 117.5641 (1b) - (3b)
First floor	47.8900 (1c)	x 2.8300 (2c)	= 135.5287 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	97.0800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 253.0928 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ 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) = 0.1580 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4080 (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)	=	0.3468 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
Effective ac	0.4422	0.4335	0.4249	0.3815	0.3729	0.3295	0.3295	0.3208	0.3468	0.3729	0.3902	0.4075 (22b)
	0.5978	0.5940	0.5903	0.5728	0.5695	0.5543	0.5543	0.5515	0.5601	0.5695	0.5761	0.5830 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			2.1200	1.1000	2.3320		(26)
Windows & Fully Glazed Do (Uw = 1.20)			21.5800	1.1450	24.7099		(27)
Part Glazed			1.9100	1.2000	2.2920		(26a)
Ground Floor			49.1900	0.1200	5.9028	90.0000	4427.1000 (28a)
Brick and Block	104.4700	25.6100	78.8600	0.2400	18.9264	42.2200	3329.4692 (29a)
Tile Hung	44.4500		44.4500	0.2400	10.6680	42.2200	1876.6790 (29a)
External Roof 1	49.1900		49.1900	0.1000	4.9190	9.1000	447.6290 (30)
Total net area of external elements Aum(A, m ²)			247.3000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	69.7501		(33)
GF Block			53.9900			75.0000	4049.2500 (32c)
GF Timber Stud			28.3800			9.0000	255.4200 (32c)
FF Timber Stud			123.1900			9.0000	1108.7100 (32c)
Internal Floor 1			49.1900			18.0000	885.4200 (32d)
Internal Ceiling 1			49.1900			18.0000	885.4200 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	17265.0972 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							177.8440 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.5276 (36)
Total fabric heat loss						(33) + (36) =	80.2777 (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	49.9268	49.6097	49.2989	47.8389	47.5657	46.2941	46.2941	46.0587	46.7839	47.5657	48.1183	48.6961 (38)
Heat transfer coeff	130.2046	129.8874	129.5766	128.1166	127.8435	126.5718	126.5718	126.3364	127.0617	127.8435	128.3961	128.9738 (39)
Average = Sum(39)m / 12 =												128.1153 (39)
HLP	1.3412	1.3379	1.3347	1.3197	1.3169	1.3038	1.3038	1.3014	1.3088	1.3169	1.3226	1.3285 (40)
HLP (average)												1.3197 (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												2.7108 (42)
Average daily hot water use (litres/day)												98.5815 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.4397	104.4964	100.5531	96.6099	92.6666	88.7234	88.7234	92.6666	96.6099	100.5531	104.4964	108.4397 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Energy conte	160.8129	140.6480	145.1361	126.5332	121.4116	104.7690	97.0839	111.4051	112.7357	131.3826	143.4143	155.7387 (45)
Energy content (annual)	Total = Sum (45)m = 1551.0710 (45)											
Distribution loss (46)m = 0.15 x (45)m	24.1219	21.0972	21.7704	18.9800	18.2117	15.7153	14.5626	16.7108	16.9104	19.7074	21.5122	23.3608 (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	27.5631	24.8938	27.5492	26.6300	27.4942	26.5802	27.4494	27.4784	26.6074	27.5258	26.6598	27.5549 (61)
Total heat required for water heating calculated for each month	188.3760	165.5418	172.6853	153.1632	148.9058	131.3492	124.5332	138.8836	139.3430	158.9084	170.0742	183.2936 (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	188.3760	165.5418	172.6853	153.1632	148.9058	131.3492	124.5332	138.8836	139.3430	158.9084	170.0742	183.2936 (64)
Heat gains from water heating, kWh/month	60.3611	52.9889	55.1450	48.7298	47.2429	41.4807	39.1427	43.9118	44.1365	50.5662	54.3502	58.6718 (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	162.6480	162.6480	162.6480	162.6480	162.6480	162.6480	162.6480	162.6480	162.6480	162.6480	162.6480	162.6480	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	56.0613	49.7931	40.4945	30.6569	22.9164	19.3470	20.9051	27.1733	36.4719	46.3095	54.0500	57.6194	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	375.4013	379.2968	369.4803	348.5821	322.2019	297.4082	280.8445	276.9490	286.7656	307.6637	334.0440	358.8376	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.9756	53.9756	53.9756	53.9756	53.9756	53.9756	53.9756	53.9756	53.9756	53.9756	53.9756	53.9756	(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)	-108.4320	-108.4320	-108.4320	-108.4320	-108.4320	-108.4320	-108.4320	-108.4320	-108.4320	-108.4320	-108.4320	-108.4320	(71)
Water heating gains (Table 5)	81.1304	78.8525	74.1197	67.6803	63.4985	57.6121	52.6112	59.0213	61.3006	67.9653	75.4864	78.8600	(72)
Total internal gains	623.7847	619.1341	595.2861	558.1109	519.8085	485.5590	465.5524	474.3352	495.7297	533.1301	574.7720	606.5086	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	Access factor Table 6d	Gains W
North	1.0900	10.6334	0.6300	0.7000	0.7700	3.5422 (74)
East	5.9000	19.6403	0.6300	0.7000	0.7700	35.4137 (76)
South	7.0800	46.7521	0.6300	0.7000	0.7700	101.1593 (78)
Southwest	1.2000	36.7938	0.6300	0.7000	0.7700	13.4936 (79)
West	5.1100	19.6403	0.6300	0.7000	0.7700	30.6719 (80)
Northwest	1.2000	11.2829	0.6300	0.7000	0.7700	4.1379 (81)

Solar gains	188.4185	333.1268	482.0655	631.3869	731.1199	734.4300	704.6327	630.1843	534.4402	375.8463	228.0476	159.6363 (83)
Total gains	812.2032	952.2609	1077.3516	1189.4978	1250.9283	1219.9890	1170.1852	1104.5195	1030.1699	908.9764	802.8196	766.1449 (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	36.8333	36.9232	37.0118	37.4336	37.5135	37.8904	37.8904	37.9610	37.7444	37.5135	37.3521	37.1848
alpha	3.4556	3.4615	3.4675	3.4956	3.5009	3.5260	3.5260	3.5307	3.5163	3.5009	3.4901	3.4790
util living area	0.9789	0.9631	0.9323	0.8675	0.7577	0.6015	0.4571	0.4988	0.7121	0.8980	0.9652	0.9825 (86)
MIT	19.3458	19.5910	19.9498	20.3754	20.7092	20.9079	20.9733	20.9635	20.8270	20.3810	19.7838	19.2993 (87)
Th 2	19.8087	19.8112	19.8137	19.8254	19.8276	19.8379	19.8379	19.8398	19.8339	19.8276	19.8232	19.8186 (88)
util rest of house	0.9739	0.9545	0.9164	0.8361	0.7009	0.5126	0.3445	0.3845	0.6298	0.8666	0.9556	0.9783 (89)
MIT 2	18.3356	18.5777	18.9275	19.3372	19.6319	19.7924	19.8298	19.8277	19.7375	19.3550	18.7797	18.2972 (90)
Living area fraction	18.5332	18.7759	19.1275	19.5403	19.8426	20.0106	20.0535	20.0499	19.9506	19.5557	18.9761	18.4932 (91)
MIT	18.5332	18.7759	19.1275	19.5403	19.8426	20.0106	20.0535	20.0499	19.9506	19.5557	18.9761	18.4932 (92)
Temperature adjustment	18.5332	18.7759	19.1275	19.5403	19.8426	20.0106	20.0535	20.0499	19.9506	19.5557	18.9761	18.4932 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9667	0.9450	0.9051	0.8273	0.7017	0.5267	0.3662	0.4061	0.6389	0.8578	0.9465	0.9719 (94)
Useful gains	785.1422	899.8715	975.1465	984.0583	877.7579	642.5079	428.5147	448.5832	658.1520	779.7271	759.9012	744.6171 (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	1853.2257	1802.3059	1636.2295	1363.1933	1040.9813	684.8252	437.1172	461.1167	743.3931	1144.9243	1524.8426	1843.4540 (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	794.6542	606.4359	491.8458	272.9772	121.4382	0.0000	0.0000	0.0000	0.0000	271.7067	550.7578	817.5347 (98)
Space heating												3927.3505 (98)
Space heating per m2												(98) / (4) = 40.4548 (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													4330.0447 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	794.6542	606.4359	491.8458	272.9772	121.4382	0.0000	0.0000	0.0000	0.0000	271.7067	550.7578	817.5347	(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)	876.1347	668.6173	542.2776	300.9672	133.8900	0.0000	0.0000	0.0000	0.0000	299.5664	607.2302	901.3612	(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	188.3760	165.5418	172.6853	153.1632	148.9058	131.3492	124.5332	138.8836	139.3430	158.9084	170.0742	183.2936	(64)
Efficiency of water heater (217)m	90.1497	90.0846	89.9554	89.6733	89.1361	87.9000	87.9000	87.9000	87.9000	89.6462	90.0234	90.1739	(216)
Fuel for water heating, kWh/month	208.9590	183.7624	191.9677	170.8013	167.0545	149.4303	141.6760	158.0018	158.5245	177.2617	188.9222	203.2667	(219)
Water heating fuel used												2099.6281	(219)
Annual totals kWh/year													
Space heating fuel - main system												4330.0447	(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)												396.0237	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.00 * 1068 * 1.00) =										-854.4564		-854.4564	(233)
Total delivered energy for all uses												6046.2401	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	4330.0447	3.4800	150.6856 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2099.6281	3.4800	73.0671 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	396.0237	13.1900	52.2355 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-854.4564	13.1900	-112.7028 (252)
Total energy cost			293.1778 (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] =	0.8667 (257)
SAP value		87.9101
SAP rating (Section 12)		88 (258)
SAP band		B

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	4330.0447	0.2160	935.2896 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2099.6281	0.2160	453.5197 (264)
Space and water heating			1388.8093 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	396.0237	0.5190	205.5363 (268)
Energy saving/generation technologies			
PV Unit	-854.4564	0.5190	-443.4629 (269)
Total kg/year			1189.8078 (272)
CO2 emissions per m2			12.2600 (273)
EI value			88.7786
EI rating			89 (274)
EI band			B

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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	$3.48 / 0.8920 = 3.901$, stars = 4
Water heating environmental impact	$0.216 / 0.8920 = 0.2421$, 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	49.1900 (1b)	x 2.3900 (2b)	= 117.5641 (1b) - (3b)
First floor	47.8900 (1c)	x 2.8300 (2c)	= 135.5287 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	97.0800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 253.0928 (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) = 0.1580 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4080 (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) =	0.3468 (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	0.4422	0.4075	0.3989	0.3729	0.3729	0.3468	0.3468	0.3382	0.3468	0.3902	0.3815	0.4075 (22b)
Effective ac	0.5978	0.5830	0.5795	0.5695	0.5695	0.5601	0.5601	0.5572	0.5601	0.5761	0.5728	0.5830 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			2.1200	1.1000	2.3320		(26)
Windows & Fully Glazed Do (Uw = 1.20)			21.5800	1.1450	24.7099		(27)
Part Glazed			1.9100	1.2000	2.2920		(26a)
Ground Floor			49.1900	0.1200	5.9028	90.0000	4427.1000 (28a)
Brick and Block	104.4700	25.6100	78.8600	0.2400	18.9264	42.2200	3329.4692 (29a)
Tile Hung	44.4500		44.4500	0.2400	10.6680	42.2200	1876.6790 (29a)
External Roof 1	49.1900		49.1900	0.1000	4.9190	9.1000	447.6290 (30)
Total net area of external elements Aum(A, m ²)			247.3000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	69.7501		(33)
GF Block			53.9900			75.0000	4049.2500 (32c)
GF Timber Stud			28.3800			9.0000	255.4200 (32c)
FF Timber Stud			123.1900			9.0000	1108.7100 (32c)
Internal Floor 1			49.1900			18.0000	885.4200 (32d)
Internal Ceiling 1			49.1900			18.0000	885.4200 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	17265.0972 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							177.8440 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.5276 (36)
Total fabric heat loss						(33) + (36) =	80.2777 (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	49.9268	48.6961	48.4041	47.5657	47.5657	46.7839	46.7839	46.5359	46.7839	48.1183	47.8389	48.6961 (38)
Heat transfer coeff	130.2046	128.9738	128.6818	127.8435	127.8435	127.0617	127.0617	126.8136	127.0617	128.3961	128.1166	128.9738 (39)
Average = Sum(39)m / 12 =												128.0860 (39)
HLP	1.3412	1.3285	1.3255	1.3169	1.3169	1.3088	1.3088	1.3063	1.3088	1.3226	1.3197	1.3285 (40)
HLP (average)												1.3194 (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												2.7108 (42)
Average daily hot water use (litres/day)												98.5815 (43)
Jan	108.4397	104.4964	100.5531	96.6099	92.6666	88.7234	88.7234	92.6666	96.6099	100.5531	104.4964	108.4397 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Energy conte	160.8129	140.6480	145.1361	126.5332	121.4116	104.7690	97.0839	111.4051	112.7357	131.3826	143.4143	155.7387 (45)
Energy content (annual)										Total =	Sum (45)m =	1551.0710 (45)
Distribution loss (46)m = 0.15 x (45)m	24.1219	21.0972	21.7704	18.9800	18.2117	15.7153	14.5626	16.7108	16.9104	19.7074	21.5122	23.3608 (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	27.5631	24.8938	27.5492	26.6300	27.4942	26.5802	27.4494	27.4784	26.6074	27.5258	26.6598	27.5549 (61)
Total heat required for water heating calculated for each month	188.3760	165.5418	172.6853	153.1632	148.9058	131.3492	124.5332	138.8836	139.3430	158.9084	170.0742	183.2936 (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	188.3760	165.5418	172.6853	153.1632	148.9058	131.3492	124.5332	138.8836	139.3430	158.9084	170.0742	183.2936 (64)
Heat gains from water heating, kWh/month	60.3611	52.9889	55.1450	48.7298	47.2429	41.4807	39.1427	43.9118	44.1365	50.5662	54.3502	58.6718 (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	162.6480	162.6480	162.6480	162.6480	162.6480	162.6480	162.6480	162.6480	162.6480	162.6480	162.6480	162.6480 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	56.0613	49.7931	40.4945	30.6569	22.9164	19.3470	20.9051	27.1733	36.4719	46.3095	54.0500	57.6194 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	375.4013	379.2968	369.4803	348.5821	322.2019	297.4082	280.8445	276.9490	286.7656	307.6637	334.0440	358.8376 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.9756	53.9756	53.9756	53.9756	53.9756	53.9756	53.9756	53.9756	53.9756	53.9756	53.9756	53.9756 (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)	-108.4320	-108.4320	-108.4320	-108.4320	-108.4320	-108.4320	-108.4320	-108.4320	-108.4320	-108.4320	-108.4320	-108.4320 (71)
Water heating gains (Table 5)	81.1304	78.8525	74.1197	67.6803	63.4985	57.6121	52.6112	59.0213	61.3006	67.9653	75.4864	78.8600 (72)
Total internal gains	623.7847	619.1341	595.2861	558.1109	519.8085	485.5590	465.5524	474.3352	495.7297	533.1301	574.7720	606.5086 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	Access factor Table 6d	Gains W
North	1.0900	13.8645	0.6300	0.7000	0.7700	4.6185 (74)
East	5.9000	25.9136	0.6300	0.7000	0.7700	46.7253 (76)
South	7.0800	58.2505	0.6300	0.7000	0.7700	126.0390 (78)
Southwest	1.2000	46.3896	0.6300	0.7000	0.7700	17.0127 (79)
West	5.1100	25.9136	0.6300	0.7000	0.7700	40.4689 (80)
Northwest	1.2000	15.0428	0.6300	0.7000	0.7700	5.5167 (81)

Solar gains	240.3812	363.4182	523.9050	700.9270	777.9043	847.1009	792.6941	721.9323	616.5083	433.8390	288.3172	194.4525 (83)
Total gains	864.1658	982.5523	1119.1911	1259.0379	1297.7128	1332.6599	1258.2465	1196.2675	1112.2380	966.9690	863.0892	800.9611 (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	36.8333	37.1848	37.2692	37.5135	37.5135	37.7444	37.7444	37.8182	37.7444	37.3521	37.4336	37.1848
alpha	3.4556	3.4790	3.4846	3.5009	3.5009	3.5163	3.5163	3.5212	3.5163	3.4901	3.4956	3.4790
util living area	0.9693	0.9536	0.9138	0.8309	0.6992	0.5048	0.3662	0.3833	0.6156	0.8479	0.9445	0.9747 (86)
MIT	19.5686	19.7535	20.1091	20.5041	20.7993	20.9531	20.9887	20.9870	20.9062	20.5648	20.0370	19.5346 (87)
Th 2	19.8087	19.8186	19.8209	19.8276	19.8276	19.8339	19.8339	19.8359	19.8339	19.8232	19.8254	19.8186 (88)
util rest of house	0.9618	0.9425	0.8934	0.7923	0.6323	0.4107	0.2543	0.2669	0.5193	0.8012	0.9286	0.9683 (89)
MIT 2	18.5555	18.7423	19.0852	19.4538	19.7029	19.8145	19.8315	19.8331	19.7897	19.5156	19.0273	18.5302 (90)
Living area fraction	18.7537	18.9401	19.2855	19.6592	19.9173	20.0372	20.0579	20.0588	20.0081	19.7208	19.2248	18.7267 (91)
MIT	18.7537	18.9401	19.2855	19.6592	19.9173	20.0372	20.0579	20.0588	20.0081	19.7208	19.2248	18.7267 (92)
Temperature adjustment												0.0000
adjusted MIT	18.7537	18.9401	19.2855	19.6592	19.9173	20.0372	20.0579	20.0588	20.0081	19.7208	19.2248	18.7267 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	823.5537	915.9612	987.4891	989.5926	827.7619	570.0930	347.5887	346.5840	594.7831	770.1638	792.6207	769.2706 (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	1738.7101	1707.6305	1542.3107	1286.0069	935.4733	589.2132	350.4202	349.8591	636.3388	1017.0032	1386.8344	1705.8985 (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	680.8763	532.0018	412.7873	213.4183	80.1373	0.0000	0.0000	0.0000	0.0000	183.6485	427.8339	696.8512 (98)
Space heating												3227.5546 (98)
Space heating per m2												(98) / (4) = 33.2463 (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													3558.4946 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	680.8763	532.0018	412.7873	213.4183	80.1373	0.0000	0.0000	0.0000	0.0000	183.6485	427.8339	696.8512	(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)	750.6906	586.5511	455.1127	235.3013	88.3543	0.0000	0.0000	0.0000	0.0000	202.4791	471.7022	768.3034	(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	188.3760	165.5418	172.6853	153.1632	148.9058	131.3492	124.5332	138.8836	139.3430	158.9084	170.0742	183.2936	(64)
Efficiency of water heater (217)m	90.0782	90.0195	89.8558	89.5087	88.8598	87.9000	87.9000	87.9000	87.9000	89.3793	89.8856	87.9000	(216)
Fuel for water heating, kWh/month	209.1250	183.8955	192.1805	171.1154	167.5739	149.4303	141.6760	158.0018	158.5245	177.7911	189.2119	203.4283	(219)
Water heating fuel used												2101.9542	(219)
Annual totals kWh/year													
Space heating fuel - main system												3558.4946	(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)												396.0237	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.00 * 1212 * 1.00) =										-969.4472		-969.4472	(233)
Total delivered energy for all uses												5162.0253	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3558.4946	9.7400	346.5974 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2101.9542	9.7400	204.7303 (247)
Pumps and fans for heating	75.0000	36.8500	27.6375 (249)
Energy for lighting	396.0237	36.8500	145.9348 (250)
Additional standing charges			104.0000 (251)
Energy saving/generation technologies			
PV Unit	-969.4472	36.8500	-357.2413 (252)
Total energy cost			471.6587 (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	3558.4946	0.2160	768.6348 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2101.9542	0.2160	454.0221 (264)
Space and water heating			1222.6569 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	396.0237	0.5190	205.5363 (268)
Energy saving/generation technologies			
PV Unit	-969.4472	0.5190	-503.1431 (269)
Total kg/year			963.9751 (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	3558.4946	1.2200	4341.3634 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2101.9542	1.2200	2564.3842 (264)
Space and water heating			6905.7476 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	396.0237	3.0700	1215.7929 (268)
Energy saving/generation technologies			

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Calculation Type: New Build (As Designed)

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

PV Unit	-969.4472	3.0700	-2976.2030 (269)
Primary energy kWh/year			5375.5874 (272)
Primary energy kWh/m2/year			55.3728 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating:	B 88
Current environmental impact rating:	B 89

(For testing purposes):

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

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.1	-£ 81	-196 kg (20.3%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£81 2.01 kg/m²	B 89	B 91
Total Savings	£81 2.01 kg/m²		
Potential energy efficiency rating:		B 89	
Potential environmental impact rating:			B 91

Fuel prices for cost data on this page from database revision number 513 TEST (28 Feb 2023)
Recommendation texts revision number 4.9c (22 Feb 2014)

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

	Current	Potential	Saving
Electricity	£174	£192	-£18
Mains gas	£655	£555	£100
Space heating	£478	£478	£0
Water heating	£205	£123	£81
Lighting	£146	£146	£0
Generated (PV)	-£357	-£357	£0
Total cost of fuels	£472	£390	£82
Total cost of uses	£472	£390	£81
Delivered energy	53 kWh/m²	43 kWh/m²	10 kWh/m²
Carbon dioxide emissions	1.0 tonnes	0.8 tonnes	0.2 tonnes
CO2 emissions per m²	10 kg/m²	8 kg/m²	2 kg/m²
Primary energy	55 kWh/m²	44 kWh/m²	11 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	49.1900 (1b)	x 2.3900 (2b)	= 117.5641 (1b) - (3b)
First floor	47.8900 (1c)	x 2.8300 (2c)	= 135.5287 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	97.0800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 253.0928 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ 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) = 0.1580 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4080 (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) =	0.3468 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
Effective ac	0.4422	0.4335	0.4249	0.3815	0.3729	0.3295	0.3295	0.3208	0.3468	0.3729	0.3902	0.4075 (22b)
	0.5978	0.5940	0.5903	0.5728	0.5695	0.5543	0.5543	0.5515	0.5601	0.5695	0.5761	0.5830 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			2.1200	1.1000	2.3320		(26)
Windows & Fully Glazed Do (Uw = 1.20)			21.5800	1.1450	24.7099		(27)
Part Glazed			1.9100	1.2000	2.2920		(26a)
Ground Floor			49.1900	0.1200	5.9028	90.0000	4427.1000 (28a)
Brick and Block	104.4700	25.6100	78.8600	0.2400	18.9264	42.2200	3329.4692 (29a)
Tile Hung	44.4500		44.4500	0.2400	10.6680	42.2200	1876.6790 (29a)
External Roof 1	49.1900		49.1900	0.1000	4.9190	9.1000	447.6290 (30)
Total net area of external elements Aum(A, m ²)			247.3000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	69.7501		(33)
GF Block			53.9900			75.0000	4049.2500 (32c)
GF Timber Stud			28.3800			9.0000	255.4200 (32c)
FF Timber Stud			123.1900			9.0000	1108.7100 (32c)
Internal Floor 1			49.1900			18.0000	885.4200 (32d)
Internal Ceiling 1			49.1900			18.0000	885.4200 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	17265.0972 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							177.8440 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.5276 (36)
Total fabric heat loss						(33) + (36) =	80.2777 (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	49.9268	49.6097	49.2989	47.8389	47.5657	46.2941	46.2941	46.0587	46.7839	47.5657	48.1183	48.6961 (38)
Heat transfer coeff	130.2046	129.8874	129.5766	128.1166	127.8435	126.5718	126.5718	126.3364	127.0617	127.8435	128.3961	128.9738 (39)
Average = Sum(39)m / 12 =												128.1153 (39)
HLP	1.3412	1.3379	1.3347	1.3197	1.3169	1.3038	1.3038	1.3014	1.3088	1.3169	1.3226	1.3285 (40)
HLP (average)												1.3197 (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												2.7108 (42)
Average daily hot water use (litres/day)												98.5815 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.4397	104.4964	100.5531	96.6099	92.6666	88.7234	88.7234	92.6666	96.6099	100.5531	104.4964	108.4397 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Energy content (annual)	160.8129	140.6480	145.1361	126.5332	121.4116	104.7690	97.0839	111.4051	112.7357	131.3826	143.4143	155.7387 (45)
Distribution loss (46)m = 0.15 x (45)m	24.1219	21.0972	21.7704	18.9800	18.2117	15.7153	14.5626	16.7108	16.9104	19.7074	21.5122	23.3608 (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	27.5631	24.8938	27.5492	26.6300	27.4942	26.5802	27.4494	27.4784	26.6074	27.5258	26.6598	27.5549 (61)
Total heat required for water heating calculated for each month	188.3760	165.5418	172.6853	153.1632	148.9058	131.3492	124.5332	138.8836	139.3430	158.9084	170.0742	183.2936 (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												1.1693 (H8)
Utilisation factor												0.5748 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												98.5815 (H14)
Volume ratio Veff/V												0.7608 (H15)
Solar storage volume factor												0.9453 (H16)
Solar input												-866.5370 (H17)
Solar input	-25.1278	-41.9311	-71.4135	-95.7082	-118.2395	-116.2482	-114.7119	-100.2244	-78.4958	-53.6034	-29.8052	-21.0277 (63)
Solar input (sum of months) = Sum (63)m =												-866.5370 (63)
Output from w/h	163.2481	123.6106	101.2717	57.4550	30.6663	15.1010	9.8213	38.6592	60.8472	105.3050	140.2689	162.2658 (64)
Total per year (kWh/year) = Sum (64)m =												1008.5202 (64)
Heat gains from water heating, kWh/month	60.3611	52.9889	55.1450	48.7298	47.2429	41.4807	39.1427	43.9118	44.1365	50.5662	54.3502	58.6718 (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	162.6480	162.6480	162.6480	162.6480	162.6480	162.6480	162.6480	162.6480	162.6480	162.6480	162.6480	162.6480	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	56.0613	49.7931	40.4945	30.6569	22.9164	19.3470	20.9051	27.1733	36.4719	46.3095	54.0500	57.6194	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	375.4013	379.2968	369.4803	348.5821	322.2019	297.4082	280.8445	276.9490	286.7656	307.6637	334.0440	358.8376	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.9756	53.9756	53.9756	53.9756	53.9756	53.9756	53.9756	53.9756	53.9756	53.9756	53.9756	53.9756	(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)	-108.4320	-108.4320	-108.4320	-108.4320	-108.4320	-108.4320	-108.4320	-108.4320	-108.4320	-108.4320	-108.4320	-108.4320	(71)
Water heating gains (Table 5)	81.1304	78.8525	74.1197	67.6803	63.4985	57.6121	52.6112	59.0213	61.3006	67.9653	75.4864	78.8600	(72)
Total internal gains	623.7847	619.1341	595.2861	558.1109	519.8085	485.5590	465.5524	474.3352	495.7297	533.1301	574.7720	606.5086	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data g or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	1.0900	10.6334	0.6300	0.7000	0.7700	3.5422 (74)
East	5.9000	19.6403	0.6300	0.7000	0.7700	35.4137 (76)
South	7.0800	46.7521	0.6300	0.7000	0.7700	101.1593 (78)
Southwest	1.2000	36.7938	0.6300	0.7000	0.7700	13.4936 (79)
West	5.1100	19.6403	0.6300	0.7000	0.7700	30.6719 (80)
Northwest	1.2000	11.2829	0.6300	0.7000	0.7700	4.1379 (81)

Solar gains	188.4185	333.1268	482.0655	631.3869	731.1199	734.4300	704.6327	630.1843	534.4402	375.8463	228.0476	159.6363 (83)
Total gains	812.2032	952.2609	1077.3516	1189.4978	1250.9283	1219.9890	1170.1852	1104.5195	1030.1699	908.9764	802.8196	766.1449 (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	36.8333	36.9232	37.0118	37.4336	37.5135	37.8904	37.8904	37.9610	37.7444	37.5135	37.3521	37.1848
alpha	3.4556	3.4615	3.4675	3.4956	3.5009	3.5260	3.5260	3.5307	3.5163	3.5009	3.4901	3.4790
util living area	0.9789	0.9631	0.9323	0.8675	0.7577	0.6015	0.4571	0.4988	0.7121	0.8980	0.9652	0.9825 (86)
MIT	19.3458	19.5910	19.9498	20.3754	20.7092	20.9079	20.9733	20.9635	20.8270	20.3810	19.7838	19.2993 (87)
Th 2	19.8087	19.8112	19.8137	19.8254	19.8276	19.8379	19.8379	19.8398	19.8339	19.8276	19.8232	19.8186 (88)
util rest of house	0.9739	0.9545	0.9164	0.8361	0.7009	0.5126	0.3445	0.3845	0.6298	0.8666	0.9556	0.9783 (89)
MIT 2	18.3356	18.5777	18.9275	19.3372	19.6319	19.7924	19.8298	19.8277	19.7375	19.3550	18.7797	18.2972 (90)
Living area fraction	fLA = Living area / (4) = 0.1956 (91)											
MIT	18.5332	18.7759	19.1275	19.5403	19.8426	20.0106	20.0535	20.0499	19.9506	19.5557	18.9761	18.4932 (92)
Temperature adjustment	0.0000											

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adjusted MIT 18.5332 18.7759 19.1275 19.5403 19.8426 20.0106 20.0535 20.0499 19.9506 19.5557 18.9761 18.4932 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9667	0.9450	0.9051	0.8273	0.7017	0.5267	0.3662	0.4061	0.6389	0.8578	0.9465	0.9719	(94)
Useful gains	785.1422	899.8715	975.1465	984.0583	877.7579	642.5079	428.5147	448.5832	658.1520	779.7271	759.9012	744.6171	(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	1853.2257	1802.3059	1636.2295	1363.1933	1040.9813	684.8252	437.1172	461.1167	743.3931	1144.9243	1524.8426	1843.4540	(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	794.6542	606.4359	491.8458	272.9772	121.4382	0.0000	0.0000	0.0000	0.0000	271.7067	550.7578	817.5347	(98)
Space heating												3927.3505	(98)
Space heating per m2												(98) / (4) =	40.4548 (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													4330.0447 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	794.6542	606.4359	491.8458	272.9772	121.4382	0.0000	0.0000	0.0000	0.0000	271.7067	550.7578	817.5347	(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)	876.1347	668.6173	542.2776	300.9672	133.8900	0.0000	0.0000	0.0000	0.0000	299.5664	607.2302	901.3612	(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	163.2481	123.6106	101.2717	57.4550	30.6663	15.1010	9.8213	38.6592	60.8472	105.3050	140.2689	162.2658	(64)
Efficiency of water heater (217)m	90.2103	90.2134	90.2094	90.2004	90.1212	87.9000	87.9000	87.9000	87.9000	89.9001	90.1173	90.2240	(216)
Fuel for water heating, kWh/month	180.9640	137.0202	112.2630	63.6970	34.0279	17.1797	11.1732	43.9809	69.2232	117.1355	155.6515	179.8477	(219)
Water heating fuel used												1122.1639	(219)
Annual totals kWh/year													
Space heating fuel - main system												4330.0447	(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)												396.0237	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.00 * 1068 * 1.00) =										-854.4564		-854.4564	(233)
Total delivered energy for all uses												5118.7759	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	4330.0447	3.4800	150.6856 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1122.1639	3.4800	39.0513 (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	396.0237	13.1900	52.2355 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-854.4564	13.1900	-112.7028 (252)
Total energy cost			265.7571 (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] =	0.7856 (257)
SAP value		89.0409
SAP rating (Section 12)		89 (258)
SAP band		B

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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	4330.0447	0.2160	935.2896 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1122.1639	0.2160	242.3874 (264)
Space and water heating			1177.6770 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	396.0237	0.5190	205.5363 (268)
Energy saving/generation technologies			
PV Unit	-854.4564	0.5190	-443.4629 (269)
Total kg/year			1004.6255 (272)
CO2 emissions per m2			10.3500 (273)
EI value			90.5251
EI rating			91 (274)
EI band			B

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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	49.1900 (1b)	x 2.3900 (2b)	= 117.5641 (1b) - (3b)
First floor	47.8900 (1c)	x 2.8300 (2c)	= 135.5287 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	97.0800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 253.0928 (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) = 0.1580 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4080 (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) =		0.3468 (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	0.4422	0.4075	0.3989	0.3729	0.3729	0.3468	0.3468	0.3382	0.3468	0.3902	0.3815	0.4075 (22b)
Effective ac	0.5978	0.5830	0.5795	0.5695	0.5695	0.5601	0.5601	0.5572	0.5601	0.5761	0.5728	0.5830 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			2.1200	1.1000	2.3320		(26)
Windows & Fully Glazed Do (Uw = 1.20)			21.5800	1.1450	24.7099		(27)
Part Glazed			1.9100	1.2000	2.2920		(26a)
Ground Floor			49.1900	0.1200	5.9028	90.0000	4427.1000 (28a)
Brick and Block	104.4700	25.6100	78.8600	0.2400	18.9264	42.2200	3329.4692 (29a)
Tile Hung	44.4500		44.4500	0.2400	10.6680	42.2200	1876.6790 (29a)
External Roof 1	49.1900		49.1900	0.1000	4.9190	9.1000	447.6290 (30)
Total net area of external elements Aum(A, m ²)			247.3000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	69.7501		(33)
GF Block			53.9900			75.0000	4049.2500 (32c)
GF Timber Stud			28.3800			9.0000	255.4200 (32c)
FF Timber Stud			123.1900			9.0000	1108.7100 (32c)
Internal Floor 1			49.1900			18.0000	885.4200 (32d)
Internal Ceiling 1			49.1900			18.0000	885.4200 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	17265.0972 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							177.8440 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.5276 (36)
Total fabric heat loss						(33) + (36) =	80.2777 (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	49.9268	48.6961	48.4041	47.5657	47.5657	46.7839	46.7839	46.5359	46.7839	48.1183	47.8389	48.6961 (38)
Heat transfer coeff	130.2046	128.9738	128.6818	127.8435	127.8435	127.0617	127.0617	126.8136	127.0617	128.3961	128.1166	128.9738 (39)
Average = Sum(39)m / 12 =												128.0860 (39)
HLP	1.3412	1.3285	1.3255	1.3169	1.3169	1.3088	1.3088	1.3063	1.3088	1.3226	1.3197	1.3285 (40)
HLP (average)												1.3194 (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												2.7108 (42)
Average daily hot water use (litres/day)												98.5815 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.4397	104.4964	100.5531	96.6099	92.6666	88.7234	88.7234	92.6666	96.6099	100.5531	104.4964	108.4397 (44)

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

Energy content (annual)	160.8129	140.6480	145.1361	126.5332	121.4116	104.7690	97.0839	111.4051	112.7357	131.3826	143.4143	155.7387 (45)
Distribution loss (46)m = 0.15 x (45)m	24.1219	21.0972	21.7704	18.9800	18.2117	15.7153	14.5626	16.7108	16.9104	19.7074	21.5122	1551.0710 (45)
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	27.5631	24.8938	27.5492	26.6300	27.4942	26.5802	27.4494	27.4784	26.6074	27.5258	26.6598	27.5549 (61)
Total heat required for water heating calculated for each month	188.3760	165.5418	172.6853	153.1632	148.9058	131.3492	124.5332	138.8836	139.3430	158.9084	170.0742	183.2936 (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												1.3371 (H8)
Utilisation factor												0.5266 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												98.5815 (H14)
Volume ratio Veff/V												0.7608 (H15)
Solar storage volume factor												0.9453 (H16)
Solar input												-907.8527 (H17)
Solar input	-29.7928	-42.5301	-72.0812	-98.3593	-116.0855	-123.5369	-118.9760	-106.1422	-84.0054	-57.5183	-35.0273	-23.7978 (63)
Solar input (sum of months) = Sum (63)m =												-907.8527 (63)
Output from w/h	158.5832	123.0117	100.6040	54.8039	32.8203	7.8123	5.5572	32.7413	55.3377	101.3901	135.0468	159.4958 (64)
Total per year (kWh/year) = Sum (64)m =												967.2044 (64)
Heat gains from water heating, kWh/month	60.3611	52.9889	55.1450	48.7298	47.2429	41.4807	39.1427	43.9118	44.1365	50.5662	54.3502	58.6718 (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	162.6480	162.6480	162.6480	162.6480	162.6480	162.6480	162.6480	162.6480	162.6480	162.6480	162.6480	162.6480	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	56.0613	49.7931	40.4945	30.6569	22.9164	19.3470	20.9051	27.1733	36.4719	46.3095	54.0500	57.6194	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	375.4013	379.2968	369.4803	348.5821	322.2019	297.4082	280.8445	276.9490	286.7656	307.6637	334.0440	358.8376	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.9756	53.9756	53.9756	53.9756	53.9756	53.9756	53.9756	53.9756	53.9756	53.9756	53.9756	53.9756	(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)	-108.4320	-108.4320	-108.4320	-108.4320	-108.4320	-108.4320	-108.4320	-108.4320	-108.4320	-108.4320	-108.4320	-108.4320	(71)
Water heating gains (Table 5)	81.1304	78.8525	74.1197	67.6803	63.4985	57.6121	52.6112	59.0213	61.3006	67.9653	75.4864	78.8600	(72)
Total internal gains	623.7847	619.1341	595.2861	558.1109	519.8085	485.5590	465.5524	474.3352	495.7297	533.1301	574.7720	606.5086	(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	1.0900	13.8645	0.6300	0.7000	0.7700	4.6185 (74)
East	5.9000	25.9136	0.6300	0.7000	0.7700	46.7253 (76)
South	7.0800	58.2505	0.6300	0.7000	0.7700	126.0390 (78)
Southwest	1.2000	46.3896	0.6300	0.7000	0.7700	17.0127 (79)
West	5.1100	25.9136	0.6300	0.7000	0.7700	40.4689 (80)
Northwest	1.2000	15.0428	0.6300	0.7000	0.7700	5.5167 (81)

Solar gains	240.3812	363.4182	523.9050	700.9270	777.9043	847.1009	792.6941	721.9323	616.5083	433.8390	288.3172	194.4525 (83)
Total gains	864.1658	982.5523	1119.1911	1259.0379	1297.7128	1332.6599	1258.2465	1196.2675	1112.2380	966.9690	863.0892	800.9611 (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	36.8333	37.1848	37.2692	37.5135	37.5135	37.7444	37.7444	37.8182	37.7444	37.3521	37.4336	37.1848
alpha	3.4556	3.4790	3.4846	3.5009	3.5009	3.5163	3.5163	3.5212	3.5163	3.4901	3.4956	3.4790
util living area	0.9693	0.9536	0.9138	0.8309	0.6992	0.5048	0.3662	0.3833	0.6156	0.8479	0.9445	0.9747 (86)
MIT	19.5686	19.7535	20.1091	20.5041	20.7993	20.9531	20.9887	20.9870	20.9062	20.5648	20.0370	19.5346 (87)
Th 2	19.8087	19.8186	19.8209	19.8276	19.8276	19.8339	19.8339	19.8359	19.8339	19.8232	19.8254	19.8186 (88)
util rest of house	0.9618	0.9425	0.8934	0.7923	0.6323	0.4107	0.2543	0.2669	0.5193	0.8012	0.9286	0.9683 (89)
MIT 2	18.5555	18.7423	19.0852	19.4538	19.7029	19.8145	19.8315	19.8331	19.7897	19.5156	19.0273	18.5302 (90)
Living area fraction	fLA = Living area / (4) = 0.1956 (91)											
MIT	18.7537	18.9401	19.2855	19.6592	19.9173	20.0372	20.0579	20.0588	20.0081	19.7208	19.2248	18.7267 (92)
Temperature adjustment	0.0000											

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

adjusted MIT 18.7537 18.9401 19.2855 19.6592 19.9173 20.0372 20.0579 20.0588 20.0081 19.7208 19.2248 18.7267 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9530	0.9322	0.8823	0.7860	0.6379	0.4278	0.2762	0.2897	0.5348	0.7965	0.9184	0.9604	(94)
Useful gains	823.5537	915.9612	987.4891	989.5926	827.7619	570.0930	347.5887	346.5840	594.7831	770.1638	792.6207	769.2706	(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	1738.7101	1707.6305	1542.3107	1286.0069	935.4733	589.2132	350.4202	349.8591	636.3388	1017.0032	1386.8344	1705.8985	(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	680.8763	532.0018	412.7873	213.4183	80.1373	0.0000	0.0000	0.0000	0.0000	183.6485	427.8339	696.8512	(98)
Space heating													
Space heating per m2													(98) / (4) = 33.2463 (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													3558.4946 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	680.8763	532.0018	412.7873	213.4183	80.1373	0.0000	0.0000	0.0000	0.0000	183.6485	427.8339	696.8512	(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)	750.6906	586.5511	455.1127	235.3013	88.3543	0.0000	0.0000	0.0000	0.0000	202.4791	471.7022	768.3034	(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	158.5832	123.0117	100.6040	54.8039	32.8203	7.8123	5.5572	32.7413	55.3377	101.3901	135.0468	159.4958	(64)
Efficiency of water heater (217)m	90.1575	90.1606	90.1373	90.1135	89.8682	87.9000	87.9000	87.9000	87.9000	89.6838	90.0121	90.1651	(216)
Fuel for water heating, kWh/month	175.8958	136.4361	111.6119	60.8165	36.5205	8.8877	6.3222	37.2484	62.9553	113.0529	150.0319	176.8931	(219)
Water heating fuel used													1076.6724 (219)
Annual totals kWh/year													
Space heating fuel - main system													3558.4946 (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)													396.0237 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.00 * 1212 * 1.00) =										-969.4472			-969.4472 (233)
Total delivered energy for all uses													4186.7435 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3558.4946	9.7400	346.5974	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1076.6724	9.7400	104.8679	(247)
Pumps and fans for heating	75.0000	36.8500	27.6375	(249)
Pump for solar water heating	50.0000	36.8500	18.4250	(249)
Energy for lighting	396.0237	36.8500	145.9348	(250)
Additional standing charges			104.0000	(251)
Energy saving/generation technologies				
PV Unit	-969.4472	36.8500	-357.2413	(252)
Total energy cost			390.2212	(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	3558.4946	0.2160	768.6348	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1076.6724	0.2160	232.5612	(264)
Space and water heating			1001.1961	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)

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 for lighting	396.0237	0.5190	205.5363 (268)
Energy saving/generation technologies			
PV Unit	-969.4472	0.5190	-503.1431 (269)
Total kg/year			768.4643 (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	3558.4946	1.2200	4341.3634 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1076.6724	1.2200	1313.5403 (264)
Space and water heating			5654.9037 (265)
Pumps and fans	125.0000	3.0700	383.7500 (267)
Energy for lighting	396.0237	3.0700	1215.7929 (268)
Energy saving/generation technologies			
PV Unit	-969.4472	3.0700	-2976.2030 (269)
Primary energy kWh/year			4278.2436 (272)
Primary energy kWh/m2/year			44.0693 (273)

U-VALUE CALCULATOR REPORT

Property Reference	SAP 0879 Plot 133	Issued on Date	28/03/2023
Assessment Reference	Rev A	Prop Type Ref	Downshire V2
Project	Plot 133		
Calculation Type	New Build (As Designed)		

SAP Rating	88 B	DER	13.91	TER	18.52
Environmental	89 B	% DER<TER	24.90		
CO ₂ Emissions (t/year)	0.96	DFEE	50.29	TFEE	58.67
General Requirements Compliance	Pass	% DFEE<TFEE	14.28		

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

Building Elements

Roof 000002 - Mineral Wool between and above

Roof Type: Pitched Roof, insulated flat ceiling

Layer	Description	Thickness (mm)	Conductivity (W/m ² K)	Resistance (m ² K/W)	Fraction (%)	Density (kg/m ³)	Heat Cap. (J/kgK)
Ext surface				0.0400			
Layer 1	Earthwool Loft Roll 40						
	Main construction	150	0.0400	3.7500	100.00		
	Corrections - Air Gap: Level 1, Fasteners: None or plastic						
Layer 2	Earthwool Loft Roll 40						
	Main construction	200	0.0400	5.0000	100.00		
	Corrections - Air Gap: Level 1, Fasteners: None or plastic						
Layer 3	Earthwool Loft Roll 40						
	Main construction	100	0.0400	2.5000	87.50		
	Main construction	100	0.1300	0.7692	12.50		
	Corrections - Air Gap: Level 1, Fasteners: None or plastic						
Layer 4	Plasterboard, standard						
	Main construction	12.5	0.2100	0.0595	100.00	700	1000
Int surface				0.1000			

Total resistance:	Upper limit = 11.200 m ² K/W	Lower limit = 10.901 m ² K/W	Average = 11.050 m ² K/W
	Total correction = 0.0065 m ² K/W	U-value (unrounded) = 0.1 W/m ² K	

Unheated space: None

Total thickness: 463 mm

U-value: 0.10 W/m² K

Kappa: 9.10 kJ/m² K

U-VALUE CALCULATOR REPORT

Property Reference	SAP 0879 Plot 133	Issued on Date	28/03/2023
Assessment Reference	Rev A	Prop Type Ref	Downshire V2
Project	Plot 133		
Calculation Type	New Build (As Designed)		

SAP Rating	88 B	DER	13.91	TER	18.52
Environmental	89 B	% DER<TER	24.90		
CO ₂ Emissions (t/year)	0.96	DFEE	50.29	TFEE	58.67
General Requirements Compliance	Pass	% DFEE<TFEE	14.28		

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

Wall 000001

Wall Type: Standard Wall

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

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

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

U-VALUE CALCULATOR REPORT

Property Reference	SAP 0879 Plot 133	Issued on Date	28/03/2023
Assessment Reference	Rev A	Prop Type Ref	Downshire V2
Project	Plot 133		
Calculation Type	New Build (As Designed)		

SAP Rating	88 B	DER	13.91	TER	18.52
Environmental	89 B	% DER<TER	24.90		
CO ₂ Emissions (t/year)	0.96	DFEE	50.29	TFEE	58.67
General Requirements Compliance	Pass	% DFEE<TFEE	14.28		

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, concrete						
	Main construction	30	1.5000	0.0000	100.00		
Layer 2	Standard cavity						
	Main construction	25	0.0000	0.0000	87.63		
	Main construction	25	0.1300	0.0000	12.37		
	Corrections - Cavity Ventilated, Emissivity: Normal						
Layer 3	Blockwork, dense						
	Main construction	100	1.5900	0.0629	93.18		
	Main construction	100	0.8800	0.1136	6.82		
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 0879 Plot 133	Issued on Date	28/03/2023
Assessment Reference	Rev A	Prop Type Ref	Downshire V2
Project	Plot 133		
Calculation Type	New Build (As Designed)		

SAP Rating	88 B	DER	13.91	TER	18.52
Environmental	89 B	% DER<TER	24.90		
CO ₂ Emissions (t/year)	0.96	DFEE	50.29	TFEE	58.67
General Requirements Compliance	Pass	% DFEE<TFEE	14.28		

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

Floor 000003

Floor Type: Suspended Floor

Area = 75.58 m², Perimeter = 39.03 m, Wall thickness = 275.00 mm, Soil: Unknown

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

Floor height above ground: h = 0.200 m

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

Ventilation openings per perimeter length: e = 0.0015 %

Mean wind speed: v = 5.000 m/s

Resistance on solum: R_g = 0.000 m²K/W

Layer	Description	Thickness (mm)	Conductivity (W/m ² K)	Resistance (m ² K/W)	Fraction (%)	Density (kg/m ³)	Heat Cap. (J/kgK)
Ext surface				0.1700			
Layer 1	Extruded polystyrene						
	Main construction	44	0.0300	1.4667	83.11		
	Main construction	44	2.0000	0.0220	16.89		
	Corrections - Air Gap: Level 1, Fasteners: None or plastic						
Layer 2	Extruded polystyrene						
	Main construction	106	0.0300	3.5333	90.20		
	Main construction	106	2.0000	0.0530	9.80		
	Corrections - Air Gap: Level 1, Fasteners: None or plastic						
Layer 3	Extruded polystyrene						
	Main construction	150	0.0300	5.0000	100.00		
	Corrections - Air Gap: Level 1, Fasteners: None or plastic						
Layer 4	Screed						
	Main construction	75	1.1500	0.0652	100.00	1200	1000
Int surface				0.1700			

Total resistance:	Upper limit = 9.631 m ² K/W	Lower limit = 6.002 m ² K/W	Average = 7.817 m ² K/W
	Total correction = 0.0041 m ² K/W	U-value (unrounded) = 0.12 W/m ² K	

Unheated space: None

Total thickness: 375 mm

U-value: 0.12 W/m² K

Kappa: 90.00 kJ/m² K

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

Property Reference	SAP 0879 Plot 133			Issued on Date	28/03/2023
Assessment Reference	Rev A	Prop Type Ref	Downshire V2		
Property	Plot 133				
SAP Rating	88 B	DER	13.91	TER	18.52
Environmental	89 B	% DER<TER	24.90		
CO ₂ Emissions (t/year)	0.96	DFEE	50.29	TFEE	58.67
General Requirements Compliance	Pass	% DFEE<TFEE	14.28		
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	Suburban						
1.0 Property Type	House, Detached						
2.0 Number of Storeys	2						
3.0 Date Built	2022						
4.0 Sheltered Sides	2						
5.0 Sunlight/Shade	Average or unknown						
6.0 Measurements							
			Heat Loss Perimeter		Internal Floor Area	Average Storey Height	
		Ground Floor:	28.86 m		49.19 m ²	2.39 m	
		1st Storey:	28.25 m		47.89 m ²	2.83 m	
7.0 Living Area	18.99			m ²			
8.0 Thermal Mass Parameter	Precise calculation						
Thermal Mass	177.84			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	104.47 78.86
Tile Hung	Cavity Wall	Other			0.24	42.22	44.45 44.45
9.2 Internal Walls							
Description	Construction					Kappa (kJ/m ² K)	Area (m ²)
GF Block	Dense block, plasterboard on dabs					75.00	53.99
GF Timber Stud	Plasterboard on timber frame					9.00	28.38
FF Timber Stud	Plasterboard on timber frame					9.00	123.19
10.0 External Roofs							
Description	Type	Construction			U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area (m ²) Nett Area (m ²)
External Roof 1	External Plane Roof	Other			0.10	9.10	49.19 49.19
10.2 Internal Ceilings							
Description	Construction					Kappa (kJ/m ² K)	Area (m ²)
Internal Ceiling 1	Plasterboard ceiling, carpeted chipboard floor					9.00	49.19

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

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	90.00	49.19

11.2 Internal Floors

Description	Construction	Kappa (kJ/m²K)	Area (m²)
Internal Floor 1	Plasterboard ceiling, carpeted chipboard floor	18.00	49.19

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 & Fully Glazed Door	Manufacturer	Window	Double Low-E Soft 0.1			0.63		0.70	1.20
Part Glazed Door	Manufacturer	Half Glazed Door	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							2.12	
Front Elevation	Window	[1] Brick and Block	South	None	0.00					7.08	
Front Bays	Window	[1] Brick and Block	North West	None	0.00					1.20	
Front Bays	Window	[1] Brick and Block	South West	None	0.00					1.20	
Side Elevation	Window	[1] Brick and Block	West	None	0.00					5.11	
Side Elevation	Half Glazed Door	[1] Brick and Block	North							1.91	
Side Elevation	Window	[1] Brick and Block	North	None	0.00					1.09	
Rear Elevation	Window	[1] Brick and Block	East	None	0.00					5.90	

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
Table K1 - Approved	E2 Other lintels (including other steel lintels)	3.23	0.300	No
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)	1.82	0.070	No Birtley Supatherm
Independently assessed	E2 Other lintels (including other steel lintels)	1.32	0.071	No Birtley Supatherm
Independently assessed	E2 Other lintels (including other steel lintels)	9.98	0.067	No Birtley Supatherm
Independently assessed	E2 Other lintels (including other steel lintels)	1.47	0.070	No Birtley Supatherm
Independently assessed	E3 Sill	15.11	0.021	No Knauf P5
Independently assessed	E4 Jamb	39.62	0.016	No Knauf P6
Table K1 - Approved	E5 Ground floor (normal)	28.86	0.160	No
Independently assessed	E6 Intermediate floor within a dwelling	28.25	0.000	No CD0029
Table K1 - Approved	E10 Eaves (insulation at ceiling level)	20.22	0.060	No
Table K1 - Default	E24 Eaves (insulation at ceiling level - inverted)	2.71	0.240	No
Independently assessed	E12 Gable (insulation at ceiling level)	11.32	0.044	No Knauf P21
Independently assessed	E16 Corner (normal)	25.29	0.039	No Knauf P23
Independently assessed	E17 Corner (inverted – internal area greater than external area)	4.44	-0.091	No Knauf P24

Y-value

0.043

W/m²K

18.0 Pressure Testing

Yes

Designed AP₅₀

5.00

m³/(h.m²) @ 50 Pa

Property Tested ?

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

As Built AP₅₀

m³/(h.m²) @ 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

22.0 Lighting

Internal

Total number of light fittings	22	
Total number of L.E.L. fittings	22	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	Yes
Light and motion sensor	Yes

23.0 Electricity Tariff

Standard

24.0 Main Heating 1

	Database	
Description	Gas System	
Percentage of Heat	100	%
Database Ref. No.	17515	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.7	
In Summer	87.9	
Controls	CBE Programmer, room thermostat and TRVs	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2106	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	Gas/Oil, time clock	

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

25.0 Main Heating 2

Community Heating

28.0 Water Heating

Water Heating

Flue Gas Heat Recovery System

Waste Water Heat Recovery Instantaneous System 1

Waste Water Heat Recovery Instantaneous System 2

Waste Water Heat Recovery Storage System

Solar Panel

Water use <= 125 litres/person/day

SAP Code

29.0 Hot Water Cylinder

32.0 Photovoltaic Unit

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
1.00	South	45°	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	£81	B 89	