



SAP Report Submission for Building Regulations Compliance

Client: Foreman Homes

Project: 7 Starling Road
BOTLEY, SO32 2DN

Contact: Tobias Whiting
Abacus Energy (UK) Ltd
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Report Issue Date: 17/06/2025

EXCELLENCE
IN ENERGY
ASSESSMENT

BUILDING REGULATION COMPLIANCE

Calculation Type: New Build (As Built)

Property Reference	SAP 0906 Plot 11			Issued on Date	17/06/2025
Assessment Reference	As Built	Prop Type Ref	House Type Ah		
Property	7 Starling Road, BOTLEY, SO32 2DN				
SAP Rating	88 B	DER	14.03	TER	18.17
Environmental	88 B	% DER<TER	22.79		
CO ₂ Emissions (t/year)	1.16	DFEE	50.75	TFEE	59.96
General Requirements Compliance	Pass	% DFEE<TFEE	15.36		
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 Built)

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)	18.17	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	14.03	kgCO ₂ /m ²	Pass
	-4.14 (-22.8%)	kgCO ₂ /m ²	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	59.96	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DFEE)	50.75	kWh/m ² /yr	
	-9.2 (-15.3%)	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
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.13 (max. 0.25)	0.15 (max. 0.70)	Pass
Roof	0.10 (max. 0.20)	0.17 (max. 0.35)	Pass
Openings	1.20 (max. 2.00)	1.30 (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	4.81 (measured in this dwelling)	m ³ /(h.m ²) @ 50 Pa	
Maximum	10.0	m ³ /(h.m ²) @ 50 Pa	Pass

Limiting System Efficiencies

4 Heating efficiency

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

BUILDING REGULATION COMPLIANCE

Calculation Type: New Build (As Built)

Main heating system

Boiler system with radiators or underfloor - Mains gas
Data from database
Worcester Greenstar 4000 GR4700iW 15 S NG

Efficiency: 89.8% SEDBUK2009
Minimum: 88.0%

Pass

Secondary heating system

None

5 Cylinder insulation

Hot water storage

Measured cylinder loss: 1.87 kWh/day
Permitted by DBSCG 2.24

Pass

Primary pipework insulated

Yes

Pass

6 Controls

Space heating controls

Programmer and at least two room thermostats

Pass

Hot water controls

Cylinderstat

Pass

Independent timer for DHW

Pass

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

4.95 m², Overhang twice as wide as window, ratio 0.63

Windows facing East

1.81 m², No overhang

Windows facing South

9.13 m², No overhang

Air change rate

4.00 ach

Blinds/curtains

None

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type

U-value

W/m²K

Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals

4.81 (measured in this dwelling) m³/(h.m²) @ 50 Pa

Maximum

10.0 m³/(h.m²) @ 50 Pa

Pass

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BUILDING REGULATION COMPLIANCE

Calculation Type: New Build (As Built)

10 Key features

Party wall U-value	0.00	W/m ² K
Roof U-value	0.10	W/m ² K
Floor U-value	0.12	W/m ² K
Door U-value	1.10	W/m ² K
Photovoltaic array	1.21	kW

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THERMAL BRIDGING

Calculation Type: New Build (As Built)

Property Reference	SAP 0906 Plot 11	Issued on Date	17/06/2025
Assessment Reference	As Built	Prop Type Ref	House Type Ah
Property	7 Starling Road, BOTLEY, SO32 2DN		

SAP Rating	88 B	DER	14.03	TER	18.17
Environmental	88 B	% DER<TER	22.79		
CO ₂ Emissions (t/year)	1.16	DFEE	50.75	TFEE	59.96
General Requirements Compliance	Pass	% DFEE<TFEE	15.36		

Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 07798936079, toby@abacusenergyuk.com	Assessor ID	E477-0001
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Client	Foreman Homes, FORE
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	Junction detail	Source Type	Psi (W/mK)	Length (m)	Result	Reference
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.077	0.69	0.05	Birtley Supatherm
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.070	0.76	0.05	Birtley Supatherm
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.071	3.64	0.26	Birtley Supatherm
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.064	4.99	0.32	Birtley Supatherm
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.067	1.59	0.11	Birtley Supatherm
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.057	2.33	0.13	Birtley Supatherm
External wall	E3 Sill	Independently assessed	0.021	11.53	0.24	Knauf P5
External wall	E4 Jamb	Independently assessed	0.016	35.40	0.57	Knauf P6
External wall	E5 Ground floor (normal)	Table K1 - Approved	0.160	27.77	4.44	
External wall	E20 Exposed floor (normal)	Table K1 - Default	0.320	12.07	3.86	
External wall	E21 Exposed floor (inverted)	Table K1 - Default	0.320	6.01	1.92	
External wall	E6 Intermediate floor within a dwelling	Independently assessed	0.000	22.13	0.00	CD0029
External wall	E10 Eaves (insulation at ceiling level)	Independently assessed	0.071	21.41	1.52	Knauf P16
External wall	E11 Eaves (insulation at rafter level)	Independently assessed	0.010	2.12	0.02	Knauf P20
External wall	E12 Gable (insulation at ceiling level)	Independently assessed	0.044	9.95	0.44	Knauf P21
External wall	E13 Gable (insulation at rafter level)	Independently assessed	0.010	1.26	0.01	Knauf P20
External wall	E16 Corner (normal)	Independently assessed	0.039	21.57	0.84	Knauf P23
External wall	E17 Corner (inverted – internal area greater than external area)	Independently assessed	-0.091	1.57	-0.14	Knauf P24
External roof	R1 Head of roof window	Table K1 - Default	0.080	0.91	0.07	
External roof	R2 Sill of roof window	Table K1 - Default	0.060	0.91	0.05	
External roof	R3 Jamb of roof window	Table K1 - Default	0.080	2.40	0.19	
External roof	R6 Flat ceiling	Table K1 - Default	0.060	3.03	0.18	
External roof	R7 Flat ceiling (inverted)	Table K1 - Default	0.040	3.05	0.12	
External roof	R8 Roof to wall (rafter)	Table K1 - Default	0.060	1.85	0.11	
External roof	R9 Roof to wall (flat ceiling)	Table K1 - Default	0.040	3.18	0.13	

THERMAL BRIDGING

Calculation Type: New Build (As Built)

Total:	15.51	W/mK:
Y-Value:	0.054	W/m²K:

FULL SAP CALCULATION PRINTOUT

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

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DWELLING AS BUILT

Detached House, total floor area 108 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) 18.17 kgCO₂/m²

Dwelling Carbon Dioxide Emission Rate (DER) 14.03 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 60.0 kWh/m²/yr

Dwelling Fabric Energy Efficiency (DFEE) 50.8 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.24 (max. 0.30)	0.24 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.13 (max. 0.25)	0.15 (max. 0.70)	OK
Roof	0.10 (max. 0.20)	0.17 (max. 0.35)	OK
Openings	1.20 (max. 2.00)	1.30 (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: 4.81 (measured in this dwelling)
Maximum 10.0 OK

4 Heating efficiency

Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Worcester Greenstar 4000 GR4700iW 15 S NG

Efficiency: 89.8% SEDBUK2009

Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation

Hot water storage Measured cylinder loss: 1.87 kWh/day
Permitted by DBSCG 2.24 OK
Primary pipework insulated: Yes OK

6 Controls

Space heating controls: Programmer and at least two room thermostats OK

Hot water controls: Cylinderstat OK
Independent timer for DHW OK

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: 4.95 m², Overhang twice as wide as window, ratio 0.63
Windows facing East: 1.81 m², No overhang
Windows facing South: 9.13 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

10 Key features

Party wall U-value 0.00 W/m²K
Roof U-value 0.10 W/m²K
Floor U-value 0.12 W/m²K
Door U-value 1.10 W/m²K
Photovoltaic array 1.21 kW

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (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	43.9300 (1b)	x 2.6800 (2b)	= 117.7324 (1b) - (3b)
First floor	64.0900 (1c)	x 2.3100 (2c)	= 148.0479 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	108.0200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 265.7803 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																5 * 10 =	50.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =					50.0000 / (5) =	0.1881 (8)	
Pressure test															Yes		
Measured/design AP50																4.8100	
Infiltration rate																0.4286 (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) =	0.3643 (21)	
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
Wind factor	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)				
Adj infilt rate	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)				
	0.4645	0.4554	0.4463	0.4008	0.3917	0.3461	0.3461	0.3370	0.3643	0.3917	0.4099	0.4281	(22b)				
Effective ac	0.6079	0.6037	0.5996	0.5803	0.5767	0.5599	0.5599	0.5568	0.5664	0.5767	0.5840	0.5916	(25)				

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K						
Front Door			2.1500	1.1000	2.3650			(26)					
Windows (Uw = 1.20)			15.8900	1.1450	18.1947			(27)					
Personnel Door			1.6000	1.3000	2.0800			(26)					
Ground Floor			43.9300	0.1200	5.2716	84.0000	3690.1200	(28a)					
Exposed Over Garage			20.2200	0.1500	3.0330	20.0000	404.4000	(28b)					
Brick and Block	141.4400	16.9500	124.4900	0.2400	29.8776	42.2200	5255.9678	(29a)					
Wall to Garage	16.0500	1.6000	14.4500	0.2400	3.4680	42.2200	610.0790	(29a)					
Dormer	1.8600	1.0900	0.7700	0.1700	0.1309	9.1000	7.0070	(29a)					
Pitched Roof	61.7600		61.7600	0.1000	6.1760	9.1000	562.0160	(30)					
Sloping Roof	2.4300		2.4300	0.1700	0.4131	9.1000	22.1130	(30)					
Total net area of external elements Aum(A, m2)			287.6900					(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	71.0099			(33)					
Ground Floor Stud			73.8400			9.0000	664.5600	(32c)					
Internal Wall 2			152.2100			9.0000	1369.8900	(32c)					
Internal Floor 1			43.9300			18.0000	790.7400	(32d)					
Internal Ceiling 1			43.9300			18.0000	790.7400	(32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	14167.6328	(34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							131.1575	(35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							15.5123	(36)					
Total fabric heat loss						(33) + (36) =	86.5221	(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 53.3166	Feb 52.9491	Mar 52.5889	Apr 50.8972	May 50.5807	Jun 49.1072	Jul 49.1072	Aug 48.8344	Sep 49.6748	Oct 50.5807	Nov 51.2210	Dec 51.8904	(38)
Heat transfer coeff	139.8387	139.4712	139.1111	137.4193	137.1028	135.6294	135.6294	135.3565	136.1969	137.1028	137.7431	138.4125	(39)
Average = Sum(39)m / 12 =												137.4178	(39)
HLP	Jan 1.2946	Feb 1.2912	Mar 1.2878	Apr 1.2722	May 1.2692	Jun 1.2556	Jul 1.2556	Aug 1.2531	Sep 1.2608	Oct 1.2692	Nov 1.2752	Dec 1.2814	(40)
HLP (average)												1.2722	(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												2.8024 (42)
Average daily hot water use (litres/day)												100.7571 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

FULL SAP CALCULATION PRINTOUT

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Daily hot water use	110.8328	106.8025	102.7722	98.7420	94.7117	90.6814	90.6814	94.7117	98.7420	102.7722	106.8025	110.8328 (44)
Energy conte	164.3618	143.7519	148.3391	129.3256	124.0910	107.0811	99.2264	113.8637	115.2236	134.2820	146.5793	159.1757 (45)
Energy content (annual)												
Distribution loss (46)m = 0.15 x (45)m												
	24.6543	21.5628	22.2509	19.3988	18.6137	16.0622	14.8840	17.0796	17.2835	20.1423	21.9869	23.8764 (46)
Water storage loss:												
Store volume												200.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.8700 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.0098 (55)
Total storage loss												
	31.3038	28.2744	31.3038	30.2940	31.3038	30.2940	31.3038	31.3038	30.2940	31.3038	30.2940	31.3038 (56)
If cylinder contains dedicated solar storage												
	31.3038	28.2744	31.3038	30.2940	31.3038	30.2940	31.3038	31.3038	30.2940	31.3038	30.2940	31.3038 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month												
	218.9280	193.0375	202.9053	182.1316	178.6572	159.8871	153.7926	168.4299	168.0296	188.8482	199.3853	213.7419 (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)
												0.0000 (63)
Output from w/h												
	218.9280	193.0375	202.9053	182.1316	178.6572	159.8871	153.7926	168.4299	168.0296	188.8482	199.3853	213.7419 (64)
Heat gains from water heating, kWh/month												
	98.3033	87.2260	92.9757	85.2456	84.9132	77.8493	76.6457	81.5127	80.5567	88.3017	90.9824	96.5789 (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	140.1202	140.1202	140.1202	140.1202	140.1202	140.1202	140.1202	140.1202	140.1202	140.1202	140.1202	140.1202 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	25.4251	22.5823	18.3652	13.9036	10.3931	8.7743	9.4809	12.3237	16.5408	21.0024	24.5129	26.1317 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	268.6800	271.4681	264.4422	249.4851	230.6044	212.8592	201.0044	198.2163	205.2421	220.1992	239.0799	256.8251 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	37.0120	37.0120	37.0120	37.0120	37.0120	37.0120	37.0120	37.0120	37.0120	37.0120	37.0120	37.0120 (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)												
	-112.0962	-112.0962	-112.0962	-112.0962	-112.0962	-112.0962	-112.0962	-112.0962	-112.0962	-112.0962	-112.0962	-112.0962 (71)
Water heating gains (Table 5)												
	132.1281	129.8006	124.9674	118.3966	114.1307	108.1240	103.0185	109.5600	111.8842	118.6851	126.3645	129.8103 (72)
Total internal gains												
	494.2692	491.8870	475.8108	449.8214	423.1643	397.7936	381.5398	388.1361	401.7033	427.9228	457.9934	480.8032 (73)

6. Solar gains												

[Jan]												
			Area		Solar flux		g	FF		Access		Gains
			m2		Table 6a		Specific data			factor		W
					W/m2		or Table 6b			Table 6d		
North			4.9500		10.6334		0.6300		0.7000	0.7700		16.0860 (74)
East			1.8100		19.6403		0.6300		0.7000	0.7700		10.8642 (76)
South			9.1300		46.7521		0.6300		0.7000	0.7700		130.4498 (78)

Solar gains	157.4000	265.6371	359.3805	442.5326	496.1057	493.4958	475.3177	434.6794	387.7982	292.2457	188.0181	135.0649 (83)
Total gains	651.6692	757.5241	835.1913	892.3540	919.2700	891.2894	856.8576	822.8155	789.5015	720.1685	646.0114	615.8681 (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	28.1428	28.2170	28.2900	28.6383	28.7044	29.0162	29.0162	29.0747	28.8953	28.7044	28.5710	28.4328
alpha	2.8762	2.8811	2.8860	2.9092	2.9136	2.9344	2.9344	2.9383	2.9264	2.9136	2.9047	2.8955
util living area	0.9815	0.9706	0.9525	0.9169	0.8510	0.7359	0.6001	0.6349	0.8062	0.9273	0.9714	0.9842 (86)
MIT	18.7337	18.9797	19.3642	19.8641	20.3368	20.7134	20.8885	20.8645	20.5908	19.9797	19.2704	18.6938 (87)
Th 2	19.8451	19.8478	19.8504	19.8627	19.8650	19.8758	19.8758	19.8778	19.8716	19.8650	19.8603	19.8555 (88)
util rest of house												
	0.9779	0.9649	0.9426	0.8980	0.8126	0.6592	0.4792	0.5187	0.7437	0.9070	0.9647	0.9811 (89)
MIT 2	17.7915	18.0366	18.4177	18.9143	19.3637	19.7028	19.8303	19.8184	19.6032	19.0344	18.3359	17.7592 (90)
Living area fraction									fLA = Living area / (4) =			0.1485 (91)
MIT	17.9314	18.1766	18.5583	19.0553	19.5082	19.8529	19.9874	19.9737	19.7499	19.1748	18.4747	17.8980 (92)
Temperature adjustment												0.0000
adjusted MIT	17.9314	18.1766	18.5583	19.0553	19.5082	19.8529	19.9874	19.9737	19.7499	19.1748	18.4747	17.8980 (93)

8. Space heating requirement												

Utilisation	0.9695	0.9536	0.9281	0.8811	0.7981	0.6574	0.4925	0.5299	0.7357	0.8911	0.9537	0.9736 (94)
Useful gains	631.7873	722.3461	775.1532	786.2790	733.7036	585.9389	421.9898	435.9813	580.8112	641.7368	616.1157	599.6365 (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												
	1906.2011	1851.7082	1677.4394	1395.5401	1070.5229	712.4419	459.4318	483.7293	769.4946	1175.6296	1566.7848	1895.9737 (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												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

	948.1639	758.9313	671.3009	438.6680	250.5935	0.0000	0.0000	0.0000	0.0000	397.2163	684.4818	964.4749 (98)
Space heating												5113.8306 (98)
Space heating per m2												(98) / (4) = 47.3415 (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 %)												90.8000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												5631.9721 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	948.1639	758.9313	671.3009	438.6680	250.5935	0.0000	0.0000	0.0000	0.0000	397.2163	684.4818	964.4749 (98)
Space heating efficiency (main heating system 1)	90.8000	90.8000	90.8000	90.8000	90.8000	0.0000	0.0000	0.0000	0.0000	90.8000	90.8000	90.8000 (210)
Space heating fuel (main heating system)	1044.2333	835.8275	739.3182	483.1145	275.9841	0.0000	0.0000	0.0000	0.0000	437.4629	753.8346	1062.1971 (211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)

Water heating requirement	218.9280	193.0375	202.9053	182.1316	178.6572	159.8871	153.7926	168.4299	168.0296	188.8482	199.3853	213.7419 (64)
Efficiency of water heater (217)m	88.5803	88.4053	88.0694	87.3757	86.0176	80.1000	80.1000	80.1000	80.1000	87.0528	88.1439	80.1000 (216)
Fuel for water heating, kWh/month	247.1519	218.3551	230.3925	208.4466	207.6985	199.6094	192.0007	210.2746	209.7748	216.9352	226.2044	88.6517 (217)
Water heating fuel used												241.1031 (219)
Annual totals kWh/year												2607.9468 (219)
Space heating fuel - main system												5631.9721 (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)												449.0145 (232)

Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 1.21 * 1068 * 1.00) =												
Total delivered energy for all uses										-1033.8922		-1033.8922 (233)
												7730.0412 (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	5631.9721	0.2160	1216.5060 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2607.9468	0.2160	563.3165 (264)
Space and water heating			1779.8225 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	449.0145	0.5190	233.0385 (268)

Energy saving/generation technologies			
PV Unit	-1033.8922	0.5190	-536.5901 (269)
Total CO2, kg/year			1515.1960 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			14.0300 (273)

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

DER			14.0300 ZC1
Total Floor Area		TFA	108.0200
Assumed number of occupants		N	2.8024
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190
CO2 emissions from appliances, equation (L14)			14.7393 ZC2
CO2 emissions from cooking, equation (L16)			1.7243 ZC3
Total CO2 emissions			30.4936 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			30.4936 ZC8

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (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	43.9300 (1b)	x 2.6800 (2b)	= 117.7324 (1b) - (3b)
First floor	64.0900 (1c)	x 2.3100 (2c)	= 148.0479 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	108.0200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 265.7803 (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) = 0.1505 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4005 (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) =		0.3404 (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	0.4340	0.4255	0.4170	0.3745	0.3660	0.3234	0.3234	0.3149	0.3404	0.3660	0.3830	0.4000 (22b)
Effective ac	0.5942	0.5905	0.5870	0.5701	0.5670	0.5523	0.5523	0.5496	0.5579	0.5670	0.5733	0.5800 (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			3.7500	1.0000	3.7500		(26)
TER Opening Type (Uw = 1.40)			15.8900	1.3258	21.0663		(27)
Ground Floor			43.9300	0.1300	5.7109		(28a)
Exposed Over Garage			20.2200	0.1300	2.6286		(28b)
Brick and Block	141.4400	16.9500	124.4900	0.1800	22.4082		(29a)
Wall to Garage	16.0500	1.6000	14.4500	0.1800	2.6010		(29a)
Dormer	1.8600	1.0900	0.7700	0.1800	0.1386		(29a)
Pitched Roof	61.7600		61.7600	0.1300	8.0288		(30)
Sloping Roof	2.4300		2.4300	0.1300	0.3159		(30)
Total net area of external elements Aum(A, m ²)			287.6900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	66.6483		(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)							18.0039 (36)
Total fabric heat loss						(33) + (36) =	84.6522 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	52.1155	51.7947	51.4802	50.0032	49.7268	48.4404	48.4404	48.2022	48.9359	49.7268	50.2859	50.8703 (38)
Heat transfer coeff	136.7677	136.4468	136.1324	134.6554	134.3790	133.0926	133.0926	132.8544	133.5881	134.3790	134.9381	135.5225 (39)
Average = Sum(39)m / 12 =												134.6541 (39)
HLP	1.2661	1.2632	1.2603	1.2466	1.2440	1.2321	1.2321	1.2299	1.2367	1.2440	1.2492	1.2546 (40)
HLP (average)												1.2466 (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												2.8024 (42)
Average daily hot water use (litres/day)												100.7571 (43)
Daily hot water use	110.8328	106.8025	102.7722	98.7420	94.7117	90.6814	90.6814	94.7117	98.7420	102.7722	106.8025	110.8328 (44)
Energy conte	164.3618	143.7519	148.3391	129.3256	124.0910	107.0811	99.2264	113.8637	115.2236	134.2820	146.5793	159.1757 (45)
Energy content (annual)												1585.3014 (45)
Distribution loss (46)m = 0.15 x (45)m	24.6543	21.5628	22.2509	19.3988	18.6137	16.0622	14.8840	17.0796	17.2835	20.1423	21.9869	23.8764 (46)

8. Space heating requirement												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9957	0.9910	0.9807	0.9536	0.8843	0.7269	0.5241	0.5698	0.8193	0.9604	0.9911	0.9967 (94)
Useful gains	644.9550	746.8445	815.2566	847.1837	809.4457	645.0615	447.0445	466.5729	643.6116	687.8574	636.4120	609.9091 (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	1908.4160	1852.9987	1678.5185	1398.5833	1074.6278	714.8539	458.4171	483.4663	773.2197	1178.6199	1569.7567	1900.2355 (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	940.0150	743.3356	642.2669	397.0078	197.2955	0.0000	0.0000	0.0000	0.0000	365.1273	672.0082	960.0028 (98)
Space heating												4917.0591 (98)
Space heating per m2												(98) / (4) = 45.5199 (99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 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 %)												93.5000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												5258.8867 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	940.0150	743.3356	642.2669	397.0078	197.2955	0.0000	0.0000	0.0000	0.0000	365.1273	672.0082	960.0028 (98)
Space heating efficiency (main heating system 1)	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000 (210)
Space heating fuel (main heating system)	1005.3637	795.0113	686.9165	424.6072	211.0112	0.0000	0.0000	0.0000	0.0000	390.5105	718.7254	1026.7410 (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	215.2879	189.7497	199.2652	178.6089	175.0171	156.3644	150.1525	164.7898	164.5069	185.2081	195.8626	210.1017 (64)
Efficiency of water heater (217)m	88.2938	88.0978	87.7151	86.8851	85.1339	79.8000	79.8000	79.8000	79.8000	86.5925	87.8419	79.8000 (216)
Fuel for water heating, kWh/month	243.8312	215.3852	227.1733	205.5691	205.5785	195.9454	188.1610	206.5035	206.1490	213.8846	222.9719	237.7460 (219)
Water heating fuel used												2568.8987 (219)
Annual totals kWh/year												
Space heating fuel - main system												5258.8867 (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)												449.0145 (232)
Total delivered energy for all uses												8351.8000 (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	5258.8867	0.2160	1135.9195 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2568.8987	0.2160	554.8821 (264)
Space and water heating			1690.8017 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	449.0145	0.5190	233.0385 (268)
Total CO2, kg/m2/year			1962.7652 (272)
Emissions per m2 for space and water heating			15.6527 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.1574 (272b)
Emissions per m2 for pumps and fans			0.3603 (272c)
Target Carbon Dioxide Emission Rate (TER) = (15.6527 * 1.00) + 2.1574 + 0.3603, rounded to 2 d.p.			18.1700 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (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	43.9300 (1b)	x 2.6800 (2b)	= 117.7324 (1b) - (3b)
First floor	64.0900 (1c)	x 2.3100 (2c)	= 148.0479 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	108.0200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 265.7803 (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) = 0.1505 (8)
Pressure test					Yes
Measured/design AP50					4.8100
Infiltration rate					0.3910 (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) =	0.3324 (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	0.4237	0.4154	0.4071	0.3656	0.3573	0.3157	0.3157	0.3074	0.3324	0.3573	0.3739	0.3905 (22b)
Effective ac	0.5898	0.5863	0.5829	0.5668	0.5638	0.5498	0.5498	0.5473	0.5552	0.5638	0.5699	0.5762 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			2.1500	1.1000	2.3650		(26)
Windows (Uw = 1.20)			15.8900	1.1450	18.1947		(27)
Personnel Door			1.6000	1.3000	2.0800		(26)
Ground Floor			43.9300	0.1200	5.2716	84.0000	3690.1200 (28a)
Exposed Over Garage			20.2200	0.1500	3.0330	20.0000	404.4000 (28b)
Brick and Block	141.4400	16.9500	124.4900	0.2400	29.8776	42.2200	5255.9678 (29a)
Wall to Garage	16.0500	1.6000	14.4500	0.2400	3.4680	42.2200	610.0790 (29a)
Dormer	1.8600	1.0900	0.7700	0.1700	0.1309	9.1000	7.0070 (29a)
Pitched Roof	61.7600		61.7600	0.1000	6.1760	9.1000	562.0160 (30)
Sloping Roof	2.4300		2.4300	0.1700	0.4131	9.1000	22.1130 (30)
Total net area of external elements Aum(A, m ²)			287.6900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	71.0099		(33)
Ground Floor Stud			73.8400			9.0000	664.5600 (32c)
Internal Wall 2			152.2100			9.0000	1369.8900 (32c)
Internal Floor 1			43.9300			18.0000	790.7400 (32d)
Internal Ceiling 1			43.9300			9.0000	395.3700 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 13772.2628 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 127.4973 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 15.5123 (36)
Total fabric heat loss (33) + (36) = 86.5221 (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	51.7282	51.4224	51.1227	49.7149	49.4515	48.2254	48.2254	47.9983	48.6977	49.4515	49.9844	50.5414 (38)
Heat transfer coeff	138.2503	137.9445	137.6448	136.2370	135.9737	134.7475	134.7475	134.5205	135.2198	135.9737	136.5065	137.0635 (39)
Average = Sum(39)m / 12 =												136.2358 (39)
HLP	1.2799	1.2770	1.2743	1.2612	1.2588	1.2474	1.2474	1.2453	1.2518	1.2588	1.2637	1.2689 (40)
HLP (average)												1.2612 (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												2.8024 (42)
Average daily hot water use (litres/day)												100.7571 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Daily hot water use	110.8328	106.8025	102.7722	98.7420	94.7117	90.6814	90.6814	94.7117	98.7420	102.7722	106.8025	110.8328 (44)
Energy conte	164.3618	143.7519	148.3391	129.3256	124.0910	107.0811	99.2264	113.8637	115.2236	134.2820	146.5793	159.1757 (45)
Energy content (annual)												1585.3014 (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	34.9269	30.5473	31.5221	27.4817	26.3693	22.7547	21.0856	24.1960	24.4850	28.5349	31.1481	33.8248 (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	140.1202	140.1202	140.1202	140.1202	140.1202	140.1202	140.1202	140.1202	140.1202	140.1202	140.1202	140.1202 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.4251	22.5823	18.3652	13.9036	10.3931	8.7743	9.4809	12.3237	16.5408	21.0024	24.5129	26.1317 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	268.6800	271.4681	264.4422	249.4851	230.6044	212.8592	201.0044	198.2163	205.2421	220.1992	239.0799	256.8251 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.0120	37.0120	37.0120	37.0120	37.0120	37.0120	37.0120	37.0120	37.0120	37.0120	37.0120	37.0120 (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)	-112.0962	-112.0962	-112.0962	-112.0962	-112.0962	-112.0962	-112.0962	-112.0962	-112.0962	-112.0962	-112.0962	-112.0962 (71)
Water heating gains (Table 5)	46.9447	45.4573	42.3684	38.1690	35.4427	31.6038	28.3409	32.5216	34.0070	38.3534	43.2613	45.4635 (72)
Total internal gains	406.0859	404.5437	390.2118	366.5938	341.4763	318.2734	303.8622	308.0976	320.8260	344.5911	371.8902	393.4564 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data g or Table 6b	Specific data FF or Table 6c	Access factor Table 6d	Gains W
North	4.9500	10.6334	0.6300	0.7000	0.7700	16.0860 (74)
East	1.8100	19.6403	0.6300	0.7000	0.7700	10.8642 (76)
South	9.1300	46.7521	0.6300	0.7000	0.7700	130.4498 (78)

Solar gains	157.4000	265.6371	359.3805	442.5326	496.1057	493.4958	475.3177	434.6794	387.7982	292.2457	188.0181	135.0649 (83)
Total gains	563.4859	670.1807	749.5923	809.1264	837.5820	811.7692	779.1800	742.7770	708.6242	636.8368	559.9082	528.5213 (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	27.6718	27.7331	27.7935	28.0807	28.1351	28.3911	28.3911	28.4390	28.2919	28.1351	28.0253	27.9114
alpha	2.8448	2.8489	2.8529	2.8720	2.8757	2.8927	2.8927	2.8959	2.8861	2.8757	2.8684	2.8608
util living area	0.9863	0.9768	0.9609	0.9296	0.8705	0.7651	0.6349	0.6721	0.8344	0.9419	0.9785	0.9885 (86)
MIT	18.6046	18.8580	19.2542	19.7687	20.2639	20.6672	20.8645	20.8350	20.5293	19.8806	19.1474	18.5598 (87)
Th 2	19.8566	19.8589	19.8611	19.8713	19.8733	19.8822	19.8822	19.8839	19.8788	19.8733	19.8694	19.8653 (88)
util rest of house	0.9836	0.9722	0.9527	0.9132	0.8360	0.6925	0.5140	0.5574	0.7778	0.9253	0.9735	0.9863 (89)
MIT 2	17.6752	17.9280	18.3215	18.8331	19.3080	19.6758	19.8246	19.8085	19.5616	18.9499	18.2248	17.6366 (90)
Living area fraction									fLA = Living area / (4) =			0.1485 (91)
MIT	17.8132	18.0661	18.4600	18.9720	19.4500	19.8230	19.9791	19.9609	19.7053	19.0881	18.3618	17.7737 (92)
Temperature adjustment												0.0000
adjusted MIT	17.8132	18.0661	18.4600	18.9720	19.4500	19.8230	19.9791	19.9609	19.7053	19.0881	18.3618	17.7737 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9767	0.9623	0.9393	0.8966	0.8201	0.6880	0.5258	0.5664	0.7671	0.9099	0.9642	0.9803 (94)
Ext temp.	550.3487	644.9339	704.1251	725.4736	686.9198	558.4716	409.6778	420.7044	543.5906	579.4806	539.8606	518.1044 (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	1868.2002	1816.1917	1646.2283	1372.1803	1053.7901	703.7928	455.3186	479.0136	757.9486	1154.1599	1537.3056	1860.4627 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000 (97a)
Space heating per m2	980.4815	787.0853	700.9247	465.6288	272.9515	0.0000	0.0000	0.0000	0.0000	427.5615	718.1604	998.7146 (98)
												5351.5082 (98)
										(98) / (4) =		49.5418 (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
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FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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	1266.6268	997.1317	1022.3556	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.6733	0.7509	0.7266	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	852.7972	748.7036	742.8212	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1058.7181	1018.2808	977.9078	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	148.2631	200.5654	174.9044	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling													
Cooled fraction									fC = cooled area / (4) =			523.7329	(104)
Intermittency factor (Table 10b)												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	37.0658	50.1414	43.7261	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling													
Space cooling per m2												130.9332	(107)
Energy for space heating												1.2121	(108)
Energy for space cooling												49.5418	(99)
Total												1.2121	(108)
Dwelling Fabric Energy Efficiency (DFEE)												50.7539	(109)
												50.8	(109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (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	43.9300 (1b)	x 2.6800 (2b)	= 117.7324 (1b) - (3b)
First floor	64.0900 (1c)	x 2.3100 (2c)	= 148.0479 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	108.0200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 265.7803 (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) = 0.1505 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4005 (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)	=	0.3404 (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	0.4340	0.4255	0.4170	0.3745	0.3660	0.3234	0.3234	0.3149	0.3404	0.3660	0.3830	0.4000 (22b)
Effective ac	0.5942	0.5905	0.5870	0.5701	0.5670	0.5523	0.5523	0.5496	0.5579	0.5670	0.5733	0.5800 (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			3.7500	1.0000	3.7500		(26)
TER Opening Type (Uw = 1.40)			15.8900	1.3258	21.0663		(27)
Ground Floor			43.9300	0.1300	5.7109		(28a)
Exposed Over Garage			20.2200	0.1300	2.6286		(28b)
Brick and Block	141.4400	16.9500	124.4900	0.1800	22.4082		(29a)
Wall to Garage	16.0500	1.6000	14.4500	0.1800	2.6010		(29a)
Dormer	1.8600	1.0900	0.7700	0.1800	0.1386		(29a)
Pitched Roof	61.7600		61.7600	0.1300	8.0288		(30)
Sloping Roof	2.4300		2.4300	0.1300	0.3159		(30)
Total net area of external elements Aum(A, m ²)			287.6900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	66.6483		(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)							18.0039 (36)
Total fabric heat loss						(33) + (36) =	84.6522 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	52.1155	51.7947	51.4802	50.0032	49.7268	48.4404	48.4404	48.2022	48.9359	49.7268	50.2859	50.8703 (38)
Heat transfer coeff	136.7677	136.4468	136.1324	134.6554	134.3790	133.0926	133.0926	132.8544	133.5881	134.3790	134.9381	135.5225 (39)
Average = Sum(39)m / 12 =												134.6541 (39)
HLP	1.2661	1.2632	1.2603	1.2466	1.2440	1.2321	1.2321	1.2299	1.2367	1.2440	1.2492	1.2546 (40)
HLP (average)												1.2466 (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												2.8024 (42)
Average daily hot water use (litres/day)												100.7571 (43)
Daily hot water use	110.8328	106.8025	102.7722	98.7420	94.7117	90.6814	90.6814	94.7117	98.7420	102.7722	106.8025	110.8328 (44)
Energy conte	164.3618	143.7519	148.3391	129.3256	124.0910	107.0811	99.2264	113.8637	115.2236	134.2820	146.5793	159.1757 (45)
Energy content (annual)										Total = Sum(45)m =		1585.3014 (45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	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	34.9269	30.5473	31.5221	27.4817	26.3693	22.7547	21.0856	24.1960	24.4850	28.5349	31.1481	33.8248	(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	140.1202	140.1202	140.1202	140.1202	140.1202	140.1202	140.1202	140.1202	140.1202	140.1202	140.1202	140.1202	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.4251	22.5823	18.3652	13.9036	10.3931	8.7743	9.4809	12.3237	16.5408	21.0024	24.5129	26.1317	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	268.6800	271.4681	264.4422	249.4851	230.6044	212.8592	201.0044	198.2163	205.2421	220.1992	239.0799	256.8251	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.0120	37.0120	37.0120	37.0120	37.0120	37.0120	37.0120	37.0120	37.0120	37.0120	37.0120	37.0120	(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)	-112.0962	-112.0962	-112.0962	-112.0962	-112.0962	-112.0962	-112.0962	-112.0962	-112.0962	-112.0962	-112.0962	-112.0962	(71)
Water heating gains (Table 5)	46.9447	45.4573	42.3684	38.1690	35.4427	31.6038	28.3409	32.5216	34.0070	38.3534	43.2613	45.4635	(72)
Total internal gains	406.0859	404.5437	390.2118	366.5938	341.4763	318.2734	303.8622	308.0976	320.8260	344.5911	371.8902	393.4564	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	FF	Access factor Table 6d	Gains W
North	4.9500	10.6334	0.6300		0.7000	0.7700	16.0860 (74)
East	1.8100	19.6403	0.6300		0.7000	0.7700	10.8642 (76)
South	9.1300	46.7521	0.6300		0.7000	0.7700	130.4498 (78)

Solar gains	157.4000	265.6371	359.3805	442.5326	496.1057	493.4958	475.3177	434.6794	387.7982	292.2457	188.0181	135.0649	(83)
Total gains	563.4859	670.1807	749.5923	809.1264	837.5820	811.7692	779.1800	742.7770	708.6242	636.8368	559.9082	528.5213	(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	54.8477	54.9766	55.1036	55.7081	55.8226	56.3622	56.3622	56.4632	56.1531	55.8226	55.5913	55.3516	
alpha	4.6565	4.6651	4.6736	4.7139	4.7215	4.7575	4.7575	4.7642	4.7435	4.7215	4.7061	4.6901	
util living area	0.9989	0.9973	0.9933	0.9811	0.9445	0.8456	0.6921	0.7375	0.9148	0.9865	0.9976	0.9992	(86)
MIT	19.5346	19.6980	19.9522	20.2861	20.6080	20.8583	20.9603	20.9457	20.7659	20.3424	19.8752	19.5081	(87)
Th 2	19.8675	19.8698	19.8721	19.8829	19.8849	19.8944	19.8944	19.8962	19.8908	19.8849	19.8808	19.8766	(88)
util rest of house	0.9985	0.9963	0.9906	0.9727	0.9166	0.7632	0.5462	0.5985	0.8600	0.9791	0.9966	0.9989	(89)
MIT 2	18.5337	18.6986	18.9535	19.2918	19.6010	19.8215	19.8833	19.8791	19.7503	19.3514	18.8846	18.5144	(90)
Living area fraction									fLA = Living area / (4) =			0.1485	(91)
MIT	18.6823	18.8470	19.1018	19.4395	19.7505	19.9755	20.0433	20.0375	19.9011	19.4986	19.0317	18.6619	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6823	18.8470	19.1018	19.4395	19.7505	19.9755	20.0433	20.0375	19.9011	19.4986	19.0317	18.6619	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	562.2932	666.8360	740.7027	783.4859	764.0901	625.3616	442.4183	459.4762	609.8952	621.2124	557.3684	527.6946	(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	1967.0379	1903.0198	1715.5091	1419.1954	1081.8208	715.4336	458.2724	483.2536	774.9543	1195.7803	1610.0351	1959.9191	(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	1045.1300	830.7155	725.2560	457.7108	236.3917	0.0000	0.0000	0.0000	0.0000	427.4785	757.9200	1065.5750	(98)
Space heating												5546.1776	(98)
Space heating per m2												51.3440	(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	1251.0705	984.8853	1009.6933	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7510	0.8398	0.8130	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	939.5939	827.1031	820.9185	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1058.7181	1018.2808	977.9078	0.0000	0.0000	0.0000	0.0000	(103)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Month fraction	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	85.7694	142.2362	116.8000	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												344.8056 (104)
Cooled fraction									fC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	21.4423	35.5591	29.2000	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												86.2014 (107)
Space cooling per m2												0.7980 (108)
Energy for space heating												51.3440 (99)
Energy for space cooling												0.7980 (108)
Total												52.1420 (109)
Target Fabric Energy Efficiency (TFEE)												60.0 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (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	43.9300 (1b)	x 2.6800 (2b)	= 117.7324 (1b) - (3b)
First floor	64.0900 (1c)	x 2.3100 (2c)	= 148.0479 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	108.0200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 265.7803 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour										
										heating	heating													
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)							
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)							
Number of intermittent fans																5 * 10 =	50.0000 (7a)							
Number of passive vents																0 * 10 =	0.0000 (7b)							
Number of flueless gas fires																0 * 40 =	0.0000 (7c)							
										Air changes per hour														
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =					50.0000	/ (5) =	0.1881 (8)							
Pressure test										Yes														
Measured/design AP50										4.8100														
Infiltration rate										0.4286 (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) =					0.3643 (21)									
													Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed													4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000 (22)
Wind factor													1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250 (22a)
Adj infilt rate													0.3825	0.3552	0.3643	0.3461	0.3461	0.3370	0.3279	0.3188	0.3097	0.3370	0.3188	0.3370 (22b)
Effective ac													0.5732	0.5631	0.5664	0.5599	0.5599	0.5568	0.5538	0.5508	0.5480	0.5568	0.5508	0.5568 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Front Door			2.1500	1.1000	2.3650		(26)					
Windows (Uw = 1.20)			15.8900	1.1450	18.1947		(27)					
Personnel Door			1.6000	1.3000	2.0800		(26)					
Ground Floor			43.9300	0.1200	5.2716	84.0000	3690.1200 (28a)					
Exposed Over Garage			20.2200	0.1500	3.0330	20.0000	404.4000 (28b)					
Brick and Block	141.4400	16.9500	124.4900	0.2400	29.8776	42.2200	5255.9678 (29a)					
Wall to Garage	16.0500	1.6000	14.4500	0.2400	3.4680	42.2200	610.0790 (29a)					
Dormer	1.8600	1.0900	0.7700	0.1700	0.1309	9.1000	7.0070 (29a)					
Pitched Roof	61.7600		61.7600	0.1000	6.1760	9.1000	562.0160 (30)					
Sloping Roof	2.4300		2.4300	0.1700	0.4131	9.1000	22.1130 (30)					
Total net area of external elements Aum(A, m2)			287.6900				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	71.0099		(33)					
Ground Floor Stud			73.8400			9.0000	664.5600 (32c)					
Internal Wall 2			152.2100			9.0000	1369.8900 (32c)					
Internal Floor 1			43.9300			18.0000	790.7400 (32d)					
Internal Ceiling 1			43.9300			18.0000	790.7400 (32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	14167.6328 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							131.1575 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							15.5123 (36)					
Total fabric heat loss						(33) + (36) =	86.5221 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 50.2714	Feb 49.3874	Mar 49.6748	Apr 49.1072	May 49.1072	Jun 48.8344	Jul 48.5688	Aug 48.3105	Sep 48.0594	Oct 48.8344	Nov 48.3105	Dec 48.8344 (38)
Heat transfer coeff	136.7936	135.9095	136.1969	135.6294	135.6294	135.3565	135.0909	134.8326	134.5816	135.3565	134.8326	135.3565 (39)
Average = Sum(39)m / 12 =												135.4638 (39)
HLP	Jan 1.2664	Feb 1.2582	Mar 1.2608	Apr 1.2556	May 1.2556	Jun 1.2531	Jul 1.2506	Aug 1.2482	Sep 1.2459	Oct 1.2531	Nov 1.2482	Dec 1.2531 (40)
HLP (average)												1.2541 (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												2.8024 (42)
Average daily hot water use (litres/day)												100.7571 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Daily hot water use	110.8328	106.8025	102.7722	98.7420	94.7117	90.6814	90.6814	94.7117	98.7420	102.7722	106.8025	110.8328 (44)
Energy conte	164.3618	143.7519	148.3391	129.3256	124.0910	107.0811	99.2264	113.8637	115.2236	134.2820	146.5793	159.1757 (45)
Energy content (annual)												
Distribution loss (46)m = 0.15 x (45)m												
	24.6543	21.5628	22.2509	19.3988	18.6137	16.0622	14.8840	17.0796	17.2835	20.1423	21.9869	23.8764 (46)
Water storage loss:												
Store volume												200.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.8700 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.0098 (55)
Total storage loss												
	31.3038	28.2744	31.3038	30.2940	31.3038	30.2940	31.3038	31.3038	30.2940	31.3038	30.2940	31.3038 (56)
If cylinder contains dedicated solar storage												
	31.3038	28.2744	31.3038	30.2940	31.3038	30.2940	31.3038	31.3038	30.2940	31.3038	30.2940	31.3038 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month												
	218.9280	193.0375	202.9053	182.1316	178.6572	159.8871	153.7926	168.4299	168.0296	188.8482	199.3853	213.7419 (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)
												0.0000 (63)
Output from w/h												
	218.9280	193.0375	202.9053	182.1316	178.6572	159.8871	153.7926	168.4299	168.0296	188.8482	199.3853	213.7419 (64)
RHI water heating demand												
Heat gains from water heating, kWh/month	98.3033	87.2260	92.9757	85.2456	84.9132	77.8493	76.6457	81.5127	80.5567	88.3017	90.9824	96.5789 (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	168.1442	168.1442	168.1442	168.1442	168.1442	168.1442	168.1442	168.1442	168.1442	168.1442	168.1442	168.1442 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	63.5627	56.4558	45.9129	34.7590	25.9828	21.9358	23.7024	30.8092	41.3521	52.5060	61.2822	65.3293 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	401.0149	405.1762	394.6899	372.3658	344.1857	317.7003	300.0065	295.8452	306.3315	328.6556	356.8357	383.3211 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	54.6168	54.6168	54.6168	54.6168	54.6168	54.6168	54.6168	54.6168	54.6168	54.6168	54.6168	54.6168 (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)												
	-112.0962	-112.0962	-112.0962	-112.0962	-112.0962	-112.0962	-112.0962	-112.0962	-112.0962	-112.0962	-112.0962	-112.0962 (71)
Water heating gains (Table 5)												
	132.1281	129.8006	124.9674	118.3966	114.1307	108.1240	103.0185	109.5600	111.8842	118.6851	126.3645	129.8103 (72)
Total internal gains												
	710.3705	705.0975	679.2351	639.1864	597.9641	561.4250	540.3922	549.8794	573.2328	613.5116	658.1474	692.1256 (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				4.9500	13.4839	0.6300	0.7000			0.7700	20.3982 (74)	
East				1.8100	25.1925	0.6300	0.7000			0.7700	13.9355 (76)	
South				9.1300	56.7559	0.6300	0.7000			0.7700	158.3629 (78)	
Solar gains	192.6966	276.7155	378.4540	472.5302	507.4765	550.3471	525.0975	488.8241	432.4414	328.6337	229.3838	162.5942 (83)
Total gains	903.0671	981.8130	1057.6891	1111.7167	1105.4406	1111.7722	1065.4898	1038.7035	1005.6742	942.1453	887.5311	854.7198 (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	28.7693	28.9564	28.8953	29.0162	29.0162	29.0747	29.1319	29.1877	29.2421	29.0747	29.1877	29.0747
alpha	2.9180	2.9304	2.9264	2.9344	2.9344	2.9383	2.9421	2.9458	2.9495	2.9383	2.9458	2.9383
util living area	0.9549	0.9417	0.9119	0.8555	0.7613	0.5988	0.4609	0.4701	0.6800	0.8511	0.9298	0.9596 (86)
MIT	19.1948	19.3673	19.7287	20.1776	20.5794	20.8569	20.9516	20.9492	20.7778	20.3272	19.7258	19.1805 (87)
Th 2	19.8673	19.8737	19.8716	19.8758	19.8758	19.8778	19.8797	19.8816	19.8835	19.8778	19.8816	19.8778 (88)
util rest of house	0.9465	0.9311	0.8952	0.8260	0.7075	0.5081	0.3416	0.3494	0.5991	0.8143	0.9148	0.9520 (89)
MIT 2	18.2606	18.4337	18.7838	19.2151	19.5808	19.8038	19.8642	19.8652	19.7546	19.3635	18.7935	18.2549 (90)
Living area fraction												
MIT	18.3993	18.5723	18.9241	19.3580	19.7291	19.9602	20.0256	20.0262	19.9066	19.5066	18.9319	18.3924 (92)
Temperature adjustment												0.0000
adjusted MIT	18.3993	18.5723	18.9241	19.3580	19.7291	19.9602	20.0256	20.0262	19.9066	19.5066	18.9319	18.3924 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9325	0.9156	0.8779	0.8100	0.6995	0.5154	0.3581	0.3659	0.6010	0.7999	0.8987	0.9388 (94)
Useful gains	842.1419	898.9628	928.5499	900.5454	773.2935	572.9665	381.5140	380.0929	604.3920	753.5793	797.6127	802.4137 (95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000 (96)
Heat loss rate W												
	1846.6242	1803.8352	1624.0252	1337.0382	980.4773	630.7871	395.2279	394.5405	700.7074	1097.2875	1487.4638	1812.7462 (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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF HEAT DEMAND 09 Jan 2014

Space heating kWh	747.3349	608.0743	517.4336	314.2748	154.1448	0.0000	0.0000	0.0000	0.0000	255.7189	496.6928	751.6874 (98)
Space heating												3845.3614 (98)
RHI space heating demand												3845 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (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	43.9300 (1b)	x 2.6800 (2b)	= 117.7324 (1b) - (3b)
First floor	64.0900 (1c)	x 2.3100 (2c)	= 148.0479 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	108.0200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	265.7803 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																5 * 10 =	50.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =					50.0000	/ (5) =	0.1881 (8)
Pressure test										Yes							
Measured/design AP50										4.8100							
Infiltration rate										0.4286 (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) =					0.3643 (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	0.4645	0.4554	0.4463	0.4008	0.3917	0.3461	0.3461	0.3370	0.3643	0.3917	0.4099	0.4281	(22b)				
Effective ac	0.6079	0.6037	0.5996	0.5803	0.5767	0.5599	0.5599	0.5568	0.5664	0.5767	0.5840	0.5916	(25)				

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K						
Front Door			2.1500	1.1000	2.3650			(26)					
Windows (Uw = 1.20)			15.8900	1.1450	18.1947			(27)					
Personnel Door			1.6000	1.3000	2.0800			(26)					
Ground Floor			43.9300	0.1200	5.2716	84.0000	3690.1200	(28a)					
Exposed Over Garage			20.2200	0.1500	3.0330	20.0000	404.4000	(28b)					
Brick and Block	141.4400	16.9500	124.4900	0.2400	29.8776	42.2200	5255.9678	(29a)					
Wall to Garage	16.0500	1.6000	14.4500	0.2400	3.4680	42.2200	610.0790	(29a)					
Dormer	1.8600	1.0900	0.7700	0.1700	0.1309	9.1000	7.0070	(29a)					
Pitched Roof	61.7600		61.7600	0.1000	6.1760	9.1000	562.0160	(30)					
Sloping Roof	2.4300		2.4300	0.1700	0.4131	9.1000	22.1130	(30)					
Total net area of external elements Aum(A, m2)			287.6900					(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	71.0099			(33)					
Ground Floor Stud			73.8400			9.0000	664.5600	(32c)					
Internal Wall 2			152.2100			9.0000	1369.8900	(32c)					
Internal Floor 1			43.9300			18.0000	790.7400	(32d)					
Internal Ceiling 1			43.9300			18.0000	790.7400	(32e)					
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		14167.6328	(34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							131.1575	(35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							15.5123	(36)					
Total fabric heat loss						(33) + (36) =	86.5221	(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 53.3166	Feb 52.9491	Mar 52.5889	Apr 50.8972	May 50.5807	Jun 49.1072	Jul 49.1072	Aug 48.8344	Sep 49.6748	Oct 50.5807	Nov 51.2210	Dec 51.8904	(38)
Heat transfer coeff	139.8387	139.4712	139.1111	137.4193	137.1028	135.6294	135.6294	135.3565	136.1969	137.1028	137.7431	138.4125	(39)
Average = Sum(39)m / 12 =												137.4178	(39)
HLP	Jan 1.2946	Feb 1.2912	Mar 1.2878	Apr 1.2722	May 1.2692	Jun 1.2556	Jul 1.2556	Aug 1.2531	Sep 1.2608	Oct 1.2692	Nov 1.2752	Dec 1.2814	(40)
HLP (average)												1.2722	(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												2.8024 (42)
Average daily hot water use (litres/day)												100.7571 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Daily hot water use	110.8328	106.8025	102.7722	98.7420	94.7117	90.6814	90.6814	94.7117	98.7420	102.7722	106.8025	110.8328 (44)
Energy conte	164.3618	143.7519	148.3391	129.3256	124.0910	107.0811	99.2264	113.8637	115.2236	134.2820	146.5793	159.1757 (45)
Energy content (annual)										Total = Sum(45)m =		1585.3014 (45)
Distribution loss (46)m = 0.15 x (45)m												
	24.6543	21.5628	22.2509	19.3988	18.6137	16.0622	14.8840	17.0796	17.2835	20.1423	21.9869	23.8764 (46)
Water storage loss:												
Store volume												200.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.8700 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.0098 (55)
Total storage loss												
	31.3038	28.2744	31.3038	30.2940	31.3038	30.2940	31.3038	31.3038	30.2940	31.3038	30.2940	31.3038 (56)
If cylinder contains dedicated solar storage												
	31.3038	28.2744	31.3038	30.2940	31.3038	30.2940	31.3038	31.3038	30.2940	31.3038	30.2940	31.3038 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month												
	218.9280	193.0375	202.9053	182.1316	178.6572	159.8871	153.7926	168.4299	168.0296	188.8482	199.3853	213.7419 (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												
	218.9280	193.0375	202.9053	182.1316	178.6572	159.8871	153.7926	168.4299	168.0296	188.8482	199.3853	213.7419 (64)
								Total per year (kWh/year) = Sum(64)m =				2227.7744 (64)
Heat gains from water heating, kWh/month												
	98.3033	87.2260	92.9757	85.2456	84.9132	77.8493	76.6457	81.5127	80.5567	88.3017	90.9824	96.5789 (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	168.1442	168.1442	168.1442	168.1442	168.1442	168.1442	168.1442	168.1442	168.1442	168.1442	168.1442	168.1442 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	63.5627	56.4558	45.9129	34.7590	25.9828	21.9358	23.7024	30.8092	41.3521	52.5060	61.2822	65.3293 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	401.0149	405.1762	394.6899	372.3658	344.1857	317.7003	300.0065	295.8452	306.3315	328.6556	356.8357	383.3211 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.6168	54.6168	54.6168	54.6168	54.6168	54.6168	54.6168	54.6168	54.6168	54.6168	54.6168	54.6168 (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)	-112.0962	-112.0962	-112.0962	-112.0962	-112.0962	-112.0962	-112.0962	-112.0962	-112.0962	-112.0962	-112.0962	-112.0962 (71)
Water heating gains (Table 5)	132.1281	129.8006	124.9674	118.3966	114.1307	108.1240	103.0185	109.5600	111.8842	118.6851	126.3645	129.8103 (72)
Total internal gains	710.3705	705.0975	679.2351	639.1864	597.9641	561.4250	540.3922	549.8794	573.2328	613.5116	658.1474	692.1256 (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					4.9500	10.6334		0.6300	0.7000	0.7700	16.0860 (74)	
East					1.8100	19.6403		0.6300	0.7000	0.7700	10.8642 (76)	
South					9.1300	46.7521		0.6300	0.7000	0.7700	130.4498 (78)	
Solar gains	157.4000	265.6371	359.3805	442.5326	496.1057	493.4958	475.3177	434.6794	387.7982	292.2457	188.0181	135.0649 (83)
Total gains	867.7706	970.7345	1038.6156	1081.7190	1094.0698	1054.9208	1015.7100	984.5588	961.0310	905.7573	846.1654	827.1905 (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	28.1428	28.2170	28.2900	28.6383	28.7044	29.0162	29.0162	29.0747	28.8953	28.7044	28.5710	28.4328
alpha	2.8762	2.8811	2.8860	2.9092	2.9136	2.9344	2.9344	2.9383	2.9264	2.9136	2.9047	2.8955
util living area	0.9628	0.9473	0.9227	0.8771	0.7984	0.6693	0.5295	0.5600	0.7369	0.8829	0.9457	0.9671 (86)
MIT	18.9954	19.2262	19.5823	20.0397	20.4595	20.7811	20.9203	20.9036	20.6876	20.1572	19.5025	18.9538 (87)
Th 2	19.8451	19.8478	19.8504	19.8627	19.8650	19.8758	19.8758	19.8778	19.8716	19.8650	19.8603	18.9555 (88)
util rest of house	0.9559	0.9377	0.9080	0.8518	0.7530	0.5891	0.4148	0.4479	0.6664	0.8540	0.9342	0.9611 (89)
MIT 2	18.0485	18.2765	18.6264	19.0759	19.4670	19.7486	19.8447	19.8376	19.6751	19.1964	18.5606	18.0151 (90)
Living area fraction									fLA = Living area / (4) =			0.1485 (91)
MIT	18.1891	18.4176	18.7683	19.2190	19.6144	19.9019	20.0045	19.9959	19.8255	19.3391	18.7005	18.1545 (92)
Temperature adjustment												0.0000
adjusted MIT	18.1891	18.4176	18.7683	19.2190	19.6144	19.9019	20.0045	19.9959	19.8255	19.3391	18.7005	18.1545 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9430	0.9224	0.8908	0.8348	0.7414	0.5911	0.4289	0.4607	0.6631	0.8377	0.9190	0.9491 (94)
Useful gains	818.2845	895.4488	925.1834	902.9675	811.1497	623.5996	435.6553	453.6049	637.2733	758.7414	777.6345	785.0509 (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												
	1942.2319	1885.3114	1706.6592	1418.0289	1085.0876	719.0947	461.7438	486.7256	779.7894	1198.1527	1597.8888	1931.4734 (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												

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Space heating	836.2169	665.1877	581.4180	370.8442	203.8098	0.0000	0.0000	0.0000	0.0000	326.9220	590.5831	852.9383 (98)
Space heating per m2												4427.9201 (98)
											(98) / (4) =	40.9917 (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 %)												90.8000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												4876.5639 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	836.2169	665.1877	581.4180	370.8442	203.8098	0.0000	0.0000	0.0000	0.0000	326.9220	590.5831	852.9383 (98)
Space heating efficiency (main heating system 1)	90.8000	90.8000	90.8000	90.8000	90.8000	0.0000	0.0000	0.0000	0.0000	90.8000	90.8000	90.8000 (210)
Space heating fuel (main heating system)	920.9437	732.5855	640.3282	408.4187	224.4601	0.0000	0.0000	0.0000	0.0000	360.0463	650.4219	939.3594 (211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating requirement	218.9280	193.0375	202.9053	182.1316	178.6572	159.8871	153.7926	168.4299	168.0296	188.8482	199.3853	213.7419 (64)
Efficiency of water heater (217)m	88.3512	88.1514	87.7669	86.9734	85.4669	80.1000	80.1000	80.1000	80.1000	86.5660	87.8384	80.1000 (216)
Fuel for water heating, kWh/month	247.7929	218.9841	231.1865	209.4108	209.0366	199.6094	192.0007	210.2746	209.7748	218.1553	226.9910	88.4329 (217)
Water heating fuel used												241.6996 (219)
Annual totals kWh/year												2614.9163 (219)
Space heating fuel - main system												4876.5639 (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)												449.0145 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 1.21 * 1068 * 1.00) =										-1033.8922		-1033.8922 (233)
Total delivered energy for all uses												6981.6026 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	4876.5639	3.4800	169.7044 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2614.9163	3.4800	90.9991 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	449.0145	13.1900	59.2250 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-1033.8922	13.1900	-136.3704 (252)
Total energy cost			313.4506 (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] =	0.8603 (257)
SAP value		87.9983
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	4876.5639	0.2160	1053.3378 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2614.9163	0.2160	564.8219 (264)
Space and water heating			1618.1597 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	449.0145	0.5190	233.0385 (268)
Energy saving/generation technologies			
PV Unit	-1033.8922	0.5190	-536.5901 (269)
Total kg/year			1353.5332 (272)
CO2 emissions per m2			12.5300 (273)
EI value			88.1471

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EI rating 88 (274)
EI band B

Calculation of stars for heating and DHW

Main heating energy efficiency $3.48 \times (1 + 0.29 \times 0.00) / 0.9080 = 3.833$, stars = 4
Main heating environmental impact $0.216 \times (1 + 0.29 \times 0.00) / 0.9080 = 0.2379$, stars = 4
Water heating energy efficiency $3.48 / 0.8500 = 4.094$, stars = 4
Water heating environmental impact $0.216 / 0.8500 = 0.2541$, stars = 4

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

SAP 2012 WORKSHEET FOR New Build (As Built) (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	43.9300 (1b)	x 2.6800 (2b)	= 117.7324 (1b) - (3b)
First floor	64.0900 (1c)	x 2.3100 (2c)	= 148.0479 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	108.0200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	265.7803 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																5 * 10 =	50.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =					50.0000 / (5) =	0.1881 (8)	
Pressure test										Yes							
Measured/design AP50										4.8100							
Infiltration rate										0.4286 (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) =					0.3643 (21)		
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000 (22)					
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250 (22a)					
Adj infilt rate	0.3825	0.3552	0.3643	0.3461	0.3461	0.3370	0.3279	0.3188	0.3097	0.3370	0.3188	0.3370 (22b)					
Effective ac	0.5732	0.5631	0.5664	0.5599	0.5599	0.5568	0.5538	0.5508	0.5480	0.5568	0.5508	0.5568 (25)					

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Front Door			2.1500	1.1000	2.3650		(26)					
Windows (Uw = 1.20)			15.8900	1.1450	18.1947		(27)					
Personnel Door			1.6000	1.3000	2.0800		(26)					
Ground Floor			43.9300	0.1200	5.2716	84.0000	3690.1200 (28a)					
Exposed Over Garage			20.2200	0.1500	3.0330	20.0000	404.4000 (28b)					
Brick and Block	141.4400	16.9500	124.4900	0.2400	29.8776	42.2200	5255.9678 (29a)					
Wall to Garage	16.0500	1.6000	14.4500	0.2400	3.4680	42.2200	610.0790 (29a)					
Dormer	1.8600	1.0900	0.7700	0.1700	0.1309	9.1000	7.0070 (29a)					
Pitched Roof	61.7600		61.7600	0.1000	6.1760	9.1000	562.0160 (30)					
Sloping Roof	2.4300		2.4300	0.1700	0.4131	9.1000	22.1130 (30)					
Total net area of external elements Aum(A, m2)			287.6900				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	71.0099		(33)					
Ground Floor Stud			73.8400			9.0000	664.5600 (32c)					
Internal Wall 2			152.2100			9.0000	1369.8900 (32c)					
Internal Floor 1			43.9300			18.0000	790.7400 (32d)					
Internal Ceiling 1			43.9300			18.0000	790.7400 (32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	14167.6328 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							131.1575 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							15.5123 (36)					
Total fabric heat loss						(33) + (36) =	86.5221 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 50.2714	Feb 49.3874	Mar 49.6748	Apr 49.1072	May 49.1072	Jun 48.8344	Jul 48.5688	Aug 48.3105	Sep 48.0594	Oct 48.8344	Nov 48.3105	Dec 48.8344 (38)
Heat transfer coeff	136.7936	135.9095	136.1969	135.6294	135.6294	135.3565	135.0909	134.8326	134.5816	135.3565	134.8326	135.3565 (39)
Average = Sum(39)m / 12 =												135.4638 (39)
HLP	Jan 1.2664	Feb 1.2582	Mar 1.2608	Apr 1.2556	May 1.2556	Jun 1.2531	Jul 1.2506	Aug 1.2482	Sep 1.2459	Oct 1.2531	Nov 1.2482	Dec 1.2531 (40)
HLP (average)												1.2541 (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												2.8024 (42)
Average daily hot water use (litres/day)												100.7571 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

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Daily hot water use	110.8328	106.8025	102.7722	98.7420	94.7117	90.6814	90.6814	94.7117	98.7420	102.7722	106.8025	110.8328 (44)
Energy content (annual)	164.3618	143.7519	148.3391	129.3256	124.0910	107.0811	99.2264	113.8637	115.2236	134.2820	146.5793	159.1757 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		1585.3014 (45)
	24.6543	21.5628	22.2509	19.3988	18.6137	16.0622	14.8840	17.0796	17.2835	20.1423	21.9869	23.8764 (46)
Water storage loss:												
Store volume												200.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.8700 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.0098 (55)
Total storage loss												
	31.3038	28.2744	31.3038	30.2940	31.3038	30.2940	31.3038	31.3038	30.2940	31.3038	30.2940	31.3038 (56)
If cylinder contains dedicated solar storage												
	31.3038	28.2744	31.3038	30.2940	31.3038	30.2940	31.3038	31.3038	30.2940	31.3038	30.2940	31.3038 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month												
	218.9280	193.0375	202.9053	182.1316	178.6572	159.8871	153.7926	168.4299	168.0296	188.8482	199.3853	213.7419 (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												
	218.9280	193.0375	202.9053	182.1316	178.6572	159.8871	153.7926	168.4299	168.0296	188.8482	199.3853	213.7419 (64)
								Total per year (kWh/year) = Sum(64)m =				2227.7744 (64)
Heat gains from water heating, kWh/month												
	98.3033	87.2260	92.9757	85.2456	84.9132	77.8493	76.6457	81.5127	80.5567	88.3017	90.9824	96.5789 (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	168.1442	168.1442	168.1442	168.1442	168.1442	168.1442	168.1442	168.1442	168.1442	168.1442	168.1442	168.1442 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	63.5627	56.4558	45.9129	34.7590	25.9828	21.9358	23.7024	30.8092	41.3521	52.5060	61.2822	65.3293 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	401.0149	405.1762	394.6899	372.3658	344.1857	317.7003	300.0065	295.8452	306.3315	328.6556	356.8357	383.3211 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	54.6168	54.6168	54.6168	54.6168	54.6168	54.6168	54.6168	54.6168	54.6168	54.6168	54.6168	54.6168 (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)												
	-112.0962	-112.0962	-112.0962	-112.0962	-112.0962	-112.0962	-112.0962	-112.0962	-112.0962	-112.0962	-112.0962	-112.0962 (71)
Water heating gains (Table 5)												
	132.1281	129.8006	124.9674	118.3966	114.1307	108.1240	103.0185	109.5600	111.8842	118.6851	126.3645	129.8103 (72)
Total internal gains												
	710.3705	705.0975	679.2351	639.1864	597.9641	561.4250	540.3922	549.8794	573.2328	613.5116	658.1474	692.1256 (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	4.9500				13.4839		0.6300		0.7000		0.7700	20.3982 (74)
East	1.8100				25.1925		0.6300		0.7000		0.7700	13.9355 (76)
South	9.1300				56.7559		0.6300		0.7000		0.7700	158.3629 (78)

Solar gains	192.6966	276.7155	378.4540	472.5302	507.4765	550.3471	525.0975	488.8241	432.4414	328.6337	229.3838	162.5942 (83)
Total gains	903.0671	981.8130	1057.6891	1111.7167	1105.4406	1111.7722	1065.4898	1038.7035	1005.6742	942.1453	887.5311	854.7198 (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	28.7693	28.9564	28.8953	29.0162	29.0162	29.0747	29.1319	29.1877	29.2421	29.0747	29.1877	29.0747
alpha	2.9180	2.9304	2.9264	2.9344	2.9344	2.9383	2.9421	2.9458	2.9495	2.9383	2.9458	2.9383
util living area	0.9549	0.9417	0.9119	0.8555	0.7613	0.5988	0.4609	0.4701	0.6800	0.8511	0.9298	0.9596 (86)
MIT	19.1948	19.3673	19.7287	20.1776	20.5794	20.8569	20.9516	20.9492	20.7778	20.3272	19.7258	19.1805 (87)
Th 2	19.8673	19.8737	19.8716	19.8758	19.8758	19.8778	19.8797	19.8816	19.8835	19.8778	19.8816	19.8778 (88)
util rest of house	0.9465	0.9311	0.8952	0.8260	0.7075	0.5081	0.3416	0.3494	0.5991	0.8143	0.9148	0.9520 (89)
MIT 2	18.2606	18.4337	18.7838	19.2151	19.5808	19.8038	19.8642	19.8652	19.7546	19.3635	18.7935	18.2549 (90)
Living area fraction									fLA = Living area / (4) =			0.1485 (91)
MIT	18.3993	18.5723	18.9241	19.3580	19.7291	19.9602	20.0256	20.0262	19.9066	19.5066	18.9319	18.3924 (92)
Temperature adjustment												0.0000
adjusted MIT	18.3993	18.5723	18.9241	19.3580	19.7291	19.9602	20.0256	20.0262	19.9066	19.5066	18.9319	18.3924 (93)

8. Space heating requirement												

Utilisation	0.9325	0.9156	0.8779	0.8100	0.6995	0.5154	0.3581	0.3659	0.6010	0.7999	0.8987	0.9388 (94)
Useful gains	842.1419	898.9628	928.5499	900.5454	773.2935	572.9665	381.5140	380.0929	604.3920	753.5793	797.6127	802.4137 (95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000 (96)
Heat loss rate W	1846.6242	1803.8352	1624.0252	1337.0382	980.4773	630.7871	395.2279	394.5405	700.7074	1097.2875	1487.4638	1812.7462 (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												

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	747.3349	608.0743	517.4336	314.2748	154.1448	0.0000	0.0000	0.0000	0.0000	255.7189	496.6928	751.6874 (98)
Space heating												3845.3614 (98)
Space heating per m2											(98) / (4) =	35.5986 (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 %)												90.8000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												4234.9795 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	747.3349	608.0743	517.4336	314.2748	154.1448	0.0000	0.0000	0.0000	0.0000	255.7189	496.6928	751.6874 (98)
Space heating efficiency (main heating system 1)	90.8000	90.8000	90.8000	90.8000	90.8000	0.0000	0.0000	0.0000	0.0000	90.8000	90.8000	90.8000 (210)
Space heating fuel (main heating system)	823.0560	669.6853	569.8608	346.1176	169.7630	0.0000	0.0000	0.0000	0.0000	281.6287	547.0185	827.8496 (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	218.9280	193.0375	202.9053	182.1316	178.6572	159.8871	153.7926	168.4299	168.0296	188.8482	199.3853	213.7419 (64)
Efficiency of water heater (217)m	88.1326	87.9684	87.5073	86.5577	84.7243	80.1000	80.1000	80.1000	80.1000	85.9242	87.4537	88.1000 (216)
Fuel for water heating, kWh/month	248.4077	219.4395	231.8724	210.4165	210.8688	199.6094	192.0007	210.2746	209.7748	219.7846	227.9896	242.3604 (219)
Water heating fuel used												2622.7991 (219)
Annual totals kWh/year												
Space heating fuel - main system												4234.9795 (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)												449.0145 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 1.21 * 1187 * 1.00) =										-1148.5689		-1148.5689 (233)
Total delivered energy for all uses												6233.2243 (238)

10a. Fuel costs - using BEDF prices (572)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	4234.9795	5.7300	242.6643 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2622.7991	5.7300	150.2864 (247)
Pumps and fans for heating	75.0000	24.1800	18.1350 (249)
Energy for lighting	449.0145	24.1800	108.5717 (250)
Additional standing charges			114.0000 (251)
Energy saving/generation technologies			
PV Unit	-1148.5689	24.1800	-277.7240 (252)
Total energy cost			355.9335 (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	4234.9795	0.2160	914.7556 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2622.7991	0.2160	566.5246 (264)
Space and water heating			1481.2802 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	449.0145	0.5190	233.0385 (268)
Energy saving/generation technologies			
PV Unit	-1148.5689	0.5190	-596.1072 (269)
Total kg/year			1157.1365 (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	4234.9795	1.2200	5166.6750 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2622.7991	1.2200	3199.8149 (264)
Space and water heating			8366.4899 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)

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Energy for lighting	449.0145	3.0700	1378.4746 (268)
Energy saving/generation technologies			
PV Unit	-1148.5689	3.0700	-3526.1064 (269)
Primary energy kWh/year			6449.1081 (272)
Primary energy kWh/m2/year			59.7029 (273)

SAP 2012 EPC IMPROVEMENTS

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

(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	+ 1.5	-£ 66	-269 kg (23.3%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£66 2.49 kg/m²	B 89	B 90
Total Savings	£66 2.49 kg/m²		

Potential energy efficiency rating: B 89
Potential environmental impact rating: B 90

Fuel prices for cost data on this page from database revision number 572 TEST (30 May 2025)
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	£127	£139	-£12
Mains gas	£507	£429	£78
Space heating	£375	£378	-£3
Water heating	£150	£81	£69
Lighting	£109	£109	£0
Generated (PV)	-£278	-£278	£0
Total cost of fuels	£356	£290	£66
Total cost of uses	£356	£290	£66
Delivered energy	58 kWh/m²	46 kWh/m²	12 kWh/m²
Carbon dioxide emissions	1.2 tonnes	0.9 tonnes	0.3 tonnes
CO2 emissions per m²	11 kg/m²	8 kg/m²	2 kg/m²
Primary energy	60 kWh/m²	46 kWh/m²	14 kWh/m²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (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	43.9300 (1b)	x 2.6800 (2b)	= 117.7324 (1b) - (3b)
First floor	64.0900 (1c)	x 2.3100 (2c)	= 148.0479 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	108.0200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 265.7803 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																5 * 10 =	50.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =					50.0000	/ (5) =	0.1881 (8)
Pressure test										Yes							
Measured/design AP50										4.8100							
Infiltration rate										0.4286 (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) =					0.3643 (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	0.4645	0.4554	0.4463	0.4008	0.3917	0.3461	0.3461	0.3370	0.3643	0.3917	0.4099	0.4281	(22b)				
Effective ac	0.6079	0.6037	0.5996	0.5803	0.5767	0.5599	0.5599	0.5568	0.5664	0.5767	0.5840	0.5916	(25)				

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K						
Front Door			2.1500	1.1000	2.3650			(26)					
Windows (Uw = 1.20)			15.8900	1.1450	18.1947			(27)					
Personnel Door			1.6000	1.3000	2.0800			(26)					
Ground Floor			43.9300	0.1200	5.2716	84.0000	3690.1200	(28a)					
Exposed Over Garage			20.2200	0.1500	3.0330	20.0000	404.4000	(28b)					
Brick and Block	141.4400	16.9500	124.4900	0.2400	29.8776	42.2200	5255.9678	(29a)					
Wall to Garage	16.0500	1.6000	14.4500	0.2400	3.4680	42.2200	610.0790	(29a)					
Dormer	1.8600	1.0900	0.7700	0.1700	0.1309	9.1000	7.0070	(29a)					
Pitched Roof	61.7600		61.7600	0.1000	6.1760	9.1000	562.0160	(30)					
Sloping Roof	2.4300		2.4300	0.1700	0.4131	9.1000	22.1130	(30)					
Total net area of external elements Aum(A, m2)			287.6900					(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	71.0099			(33)					
Ground Floor Stud			73.8400			9.0000	664.5600	(32c)					
Internal Wall 2			152.2100			9.0000	1369.8900	(32c)					
Internal Floor 1			43.9300			18.0000	790.7400	(32d)					
Internal Ceiling 1			43.9300			18.0000	790.7400	(32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	14167.6328	(34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							131.1575	(35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							15.5123	(36)					
Total fabric heat loss						(33) + (36) =	86.5221	(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 53.3166	Feb 52.9491	Mar 52.5889	Apr 50.8972	May 50.5807	Jun 49.1072	Jul 49.1072	Aug 48.8344	Sep 49.6748	Oct 50.5807	Nov 51.2210	Dec 51.8904	(38)
Heat transfer coeff	139.8387	139.4712	139.1111	137.4193	137.1028	135.6294	135.6294	135.3565	136.1969	137.1028	137.7431	138.4125	(39)
Average = Sum(39)m / 12 =												137.4178	(39)
HLP	Jan 1.2946	Feb 1.2912	Mar 1.2878	Apr 1.2722	May 1.2692	Jun 1.2556	Jul 1.2556	Aug 1.2531	Sep 1.2608	Oct 1.2692	Nov 1.2752	Dec 1.2814	(40)
HLP (average)												1.2722	(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												2.8024 (42)
Average daily hot water use (litres/day)												100.7571 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Daily hot water use	110.8328	106.8025	102.7722	98.7420	94.7117	90.6814	90.6814	94.7117	98.7420	102.7722	106.8025	110.8328 (44)
Energy conte	164.3618	143.7519	148.3391	129.3256	124.0910	107.0811	99.2264	113.8637	115.2236	134.2820	146.5793	159.1757 (45)
Energy content (annual)												1585.3014 (45)
Distribution loss (46)m = 0.15 x (45)m												
	24.6543	21.5628	22.2509	19.3988	18.6137	16.0622	14.8840	17.0796	17.2835	20.1423	21.9869	23.8764 (46)
Water storage loss:												
Store volume												200.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.8700 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.0098 (55)
Total storage loss												
	31.3038	28.2744	31.3038	30.2940	31.3038	30.2940	31.3038	31.3038	30.2940	31.3038	30.2940	31.3038 (56)
If cylinder contains dedicated solar storage												
	19.5649	17.6715	19.5649	18.9338	19.5649	18.9338	19.5649	19.5649	18.9338	19.5649	18.9338	19.5649 (57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month												
	207.1891	182.4346	189.7706	164.0178	154.1240	135.9201	129.0267	144.5946	151.2665	175.7136	188.0251	202.0029 (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												1.1440 (H8)
Utilisation factor												0.5828 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												112.5000 (H13)
Daily hot water demand												100.7571 (H14)
Volume ratio Veff/V												1.1165 (H15)
Solar storage volume factor												1.0000 (H16)
Solar input												-929.3364 (H17)
Solar input	-26.9489	-44.9700	-76.5890	-102.6444	-126.8085	-124.6729	-123.0253	-107.4878	-84.1845	-57.4881	-31.9653	-22.5516 (63)
Solar input (sum of months) = Sum(63)m =												-929.3364 (63)
Output from w/h												
	180.2402	137.4646	113.1816	61.3734	27.3155	11.2472	6.0014	37.1067	67.0820	118.2254	156.0598	179.4513 (64)
Total per year (kWh/year) = Sum(64)m =												1094.7493 (64)
Heat gains from water heating, kWh/month												
	88.9121	78.7437	82.4680	70.7545	65.2866	58.6757	56.8330	62.4444	67.1462	77.7940	81.8942	87.1877 (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	168.1442	168.1442	168.1442	168.1442	168.1442	168.1442	168.1442	168.1442	168.1442	168.1442	168.1442	168.1442 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	63.5627	56.4558	45.9129	34.7590	25.9828	21.9358	23.7024	30.8092	41.3521	52.5060	61.2822	65.3293 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	401.0149	405.1762	394.6899	372.3658	344.1857	317.7003	300.0065	295.8452	306.3315	328.6556	356.8357	383.3211 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.6168	54.6168	54.6168	54.6168	54.6168	54.6168	54.6168	54.6168	54.6168	54.6168	54.6168	54.6168 (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)	-112.0962	-112.0962	-112.0962	-112.0962	-112.0962	-112.0962	-112.0962	-112.0962	-112.0962	-112.0962	-112.0962	-112.0962 (71)
Water heating gains (Table 5)	119.5056	117.1781	110.8441	98.2701	87.7508	81.4940	76.3885	83.9306	93.2585	104.5618	113.7420	117.1878 (72)
Total internal gains	697.7480	692.4750	665.1118	619.0599	571.5842	534.7950	513.7623	524.2500	554.6071	599.3883	645.5249	679.5031 (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				4.9500	10.6334	0.6300	0.7000	0.7700	16.0860 (74)			
East				1.8100	19.6403	0.6300	0.7000	0.7700	10.8642 (76)			
South				9.1300	46.7521	0.6300	0.7000	0.7700	130.4498 (78)			
Solar gains	157.4000	265.6371	359.3805	442.5326	496.1057	493.4958	475.3177	434.6794	387.7982	292.2457	188.0181	135.0649 (83)
Total gains	855.1481	958.1120	1024.4923	1061.5925	1067.6900	1028.2908	989.0800	958.9294	942.4053	891.6340	833.5429	814.5680 (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	28.1428	28.2170	28.2900	28.6383	28.7044	29.0162	29.0162	29.0747	28.8953	28.7044	28.5710	28.4328
alpha	2.8762	2.8811	2.8860	2.9092	2.9136	2.9344	2.9344	2.9383	2.9264	2.9136	2.9047	2.8955
util living area	0.9640	0.9488	0.9250	0.8815	0.8064	0.6797	0.5404	0.5710	0.7443	0.8865	0.9475	0.9683 (86)
MIT	18.9807	19.2122	19.5679	20.0222	20.4426	20.7715	20.9159	20.8985	20.6784	20.1447	19.4885	18.9388 (87)
Th 2	19.8451	19.8478	19.8504	19.8627	19.8650	19.8758	19.8758	19.8778	19.8716	19.8650	19.8603	19.8555 (88)
util rest of house	0.9574	0.9395	0.9106	0.8569	0.7618	0.5998	0.4245	0.4580	0.6744	0.8582	0.9363	0.9624 (89)
MIT 2	18.0340	18.2630	18.6127	19.0600	19.4531	19.7422	19.8428	19.8351	19.6685	19.1852	18.5472	18.0003 (90)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Living area fraction									fLA = Living area / (4) =				0.1485 (91)
MIT	18.1746	18.4040	18.7546	19.2029	19.6000	19.8951	20.0021	19.9930	19.8185	19.3277	18.6870	18.1397 (92)	
Temperature adjustment													0.0000
adjusted MIT	18.1746	18.4040	18.7546	19.2029	19.6000	19.8951	20.0021	19.9930	19.8185	19.3277	18.6870	18.1397 (93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9447	0.9244	0.8935	0.8397	0.7498	0.6013	0.4386	0.4706	0.6706	0.8418	0.9214	0.9507	(94)
Useful gains	807.8538	885.7055	915.3767	891.4636	800.5495	618.2964	433.7748	451.3186	631.9833	750.5997	768.0089	774.4156	(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													
Month fracti	1940.2060	1883.4129	1704.7472	1415.8195	1083.1111	718.1680	461.4275	486.3398	778.8373	1196.5913	1596.0282	1929.4258	(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	842.4701	670.4594	587.2917	377.5363	210.2259	0.0000	0.0000	0.0000	0.0000	331.8178	596.1739	859.3276	(98)
Space heating per m2												4475.3026	(98)
												(98) / (4) =	41.4303 (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 %)													90.8000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													4928.7473 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	842.4701	670.4594	587.2917	377.5363	210.2259	0.0000	0.0000	0.0000	0.0000	331.8178	596.1739	859.3276	(98)
Space heating efficiency (main heating system 1)	90.8000	90.8000	90.8000	90.8000	90.8000	0.0000	0.0000	0.0000	0.0000	90.8000	90.8000	90.8000	(210)
Space heating fuel (main heating system)	927.8305	738.3914	646.7970	415.7888	231.5263	0.0000	0.0000	0.0000	0.0000	365.4381	656.5791	946.3960	(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	180.2402	137.4646	113.1816	61.3734	27.3155	11.2472	6.0014	37.1067	67.0820	118.2254	156.0598	179.4513	(64)
Efficiency of water heater (217)m	88.7115	88.7821	88.8816	89.1350	89.4263	80.1000	80.1000	80.1000	80.1000	87.7217	88.3515	88.7519	(216)
Fuel for water heating, kWh/month	203.1757	154.8337	127.3398	68.8544	30.5453	14.0415	7.4924	46.3255	83.7478	134.7733	176.6352	202.1944	(219)
Water heating fuel used												1249.9589	(219)
Annual totals kWh/year													
Space heating fuel - main system												4928.7473	(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)												449.0145	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.21 * 1068 * 1.00) =									-1033.8922			-1033.8922	(233)
Total delivered energy for all uses												5718.8286	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4928.7473	3.4800	171.5204	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1249.9589	3.4800	43.4986	(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	449.0145	13.1900	59.2250	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-1033.8922	13.1900	-136.3704	(252)
Total energy cost			274.3611	(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] =	0.7530 (257)
SAP value		89.4950
SAP rating (Section 12)		89 (258)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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	4928.7473	0.2160	1064.6094 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1249.9589	0.2160	269.9911 (264)
Space and water heating			1334.6006 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	449.0145	0.5190	233.0385 (268)
Energy saving/generation technologies			
PV Unit	-1033.8922	0.5190	-536.5901 (269)
Total kg/year			1095.9240 (272)
CO2 emissions per m2			10.1500 (273)
EI value			90.4030
EI rating			90 (274)
EI band			B

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

SAP 2012 WORKSHEET FOR New Build (As Built) (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	43.9300 (1b)	x 2.6800 (2b)	= 117.7324 (1b) - (3b)
First floor	64.0900 (1c)	x 2.3100 (2c)	= 148.0479 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	108.0200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 265.7803 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																5 * 10 =	50.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =					50.0000	/ (5) =	0.1881 (8)
Pressure test										Yes							
Measured/design AP50										4.8100							
Infiltration rate										0.4286 (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) =					0.3643 (21)		
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000	(22)				
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250	(22a)				
Adj infilt rate	0.3825	0.3552	0.3643	0.3461	0.3461	0.3370	0.3279	0.3188	0.3097	0.3370	0.3188	0.3370	(22b)				
Effective ac	0.5732	0.5631	0.5664	0.5599	0.5599	0.5568	0.5538	0.5508	0.5480	0.5568	0.5508	0.5568	(25)				

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Front Door			2.1500	1.1000	2.3650		(26)					
Windows (Uw = 1.20)			15.8900	1.1450	18.1947		(27)					
Personnel Door			1.6000	1.3000	2.0800		(26)					
Ground Floor			43.9300	0.1200	5.2716	84.0000	3690.1200 (28a)					
Exposed Over Garage			20.2200	0.1500	3.0330	20.0000	404.4000 (28b)					
Brick and Block	141.4400	16.9500	124.4900	0.2400	29.8776	42.2200	5255.9678 (29a)					
Wall to Garage	16.0500	1.6000	14.4500	0.2400	3.4680	42.2200	610.0790 (29a)					
Dormer	1.8600	1.0900	0.7700	0.1700	0.1309	9.1000	7.0070 (29a)					
Pitched Roof	61.7600		61.7600	0.1000	6.1760	9.1000	562.0160 (30)					
Sloping Roof	2.4300		2.4300	0.1700	0.4131	9.1000	22.1130 (30)					
Total net area of external elements Aum(A, m2)			287.6900				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	71.0099		(33)					
Ground Floor Stud			73.8400			9.0000	664.5600 (32c)					
Internal Wall 2			152.2100			9.0000	1369.8900 (32c)					
Internal Floor 1			43.9300			18.0000	790.7400 (32d)					
Internal Ceiling 1			43.9300			18.0000	790.7400 (32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	14167.6328 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							131.1575 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							15.5123 (36)					
Total fabric heat loss						(33) + (36) =	86.5221 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 50.2714	Feb 49.3874	Mar 49.6748	Apr 49.1072	May 49.1072	Jun 48.8344	Jul 48.5688	Aug 48.3105	Sep 48.0594	Oct 48.8344	Nov 48.3105	Dec 48.8344 (38)
Heat transfer coeff	136.7936	135.9095	136.1969	135.6294	135.6294	135.3565	135.0909	134.8326	134.5816	135.3565	134.8326	135.3565 (39)
Average = Sum(39)m / 12 =												135.4638 (39)
HLP	Jan 1.2664	Feb 1.2582	Mar 1.2608	Apr 1.2556	May 1.2556	Jun 1.2531	Jul 1.2506	Aug 1.2482	Sep 1.2459	Oct 1.2531	Nov 1.2482	Dec 1.2531 (40)
HLP (average)												1.2541 (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												2.8024 (42)
Average daily hot water use (litres/day)												100.7571 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Daily hot water use	110.8328	106.8025	102.7722	98.7420	94.7117	90.6814	90.6814	94.7117	98.7420	102.7722	106.8025	110.8328 (44)
Energy conte	164.3618	143.7519	148.3391	129.3256	124.0910	107.0811	99.2264	113.8637	115.2236	134.2820	146.5793	159.1757 (45)
Energy content (annual)												1585.3014 (45)
Distribution loss (46)m = 0.15 x (45)m												
	24.6543	21.5628	22.2509	19.3988	18.6137	16.0622	14.8840	17.0796	17.2835	20.1423	21.9869	23.8764 (46)
Water storage loss:												
Store volume												200.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.8700 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.0098 (55)
Total storage loss												
	31.3038	28.2744	31.3038	30.2940	31.3038	30.2940	31.3038	31.3038	30.2940	31.3038	30.2940	31.3038 (56)
If cylinder contains dedicated solar storage												
	19.5649	17.6715	19.5649	18.9338	19.5649	18.9338	19.5649	19.5649	18.9338	19.5649	18.9338	19.5649 (57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month												
	207.1891	182.4346	189.7706	164.0178	154.1240	135.9201	129.0267	144.5946	151.2665	175.7136	188.0251	202.0029 (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												1208.1510 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												2029.6937 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.2803 (H8)
Utilisation factor												0.5421 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												112.5000 (H13)
Daily hot water demand												100.7571 (H14)
Volume ratio Veff/V												1.1165 (H15)
Solar storage volume factor												1.0000 (H16)
Solar input												-967.4431 (H17)
Solar input	-31.5603	-44.8768	-77.1324	-104.0695	-122.2359	-130.5672	-127.8213	-114.4040	-89.5704	-61.9259	-37.3276	-25.9518 (63)
Solar input (sum of months) = Sum(63)m =												-967.4431 (63)
Output from w/h												
	175.6288	137.5578	112.6382	59.9483	31.8881	5.3529	1.2054	30.1906	61.6961	113.7876	150.6975	176.0512 (64)
Total per year (kWh/year) = Sum(64)m =												1056.6426 (64)
Heat gains from water heating, kWh/month												
	88.9121	78.7437	82.4680	70.7545	65.2866	58.6757	56.8330	62.4444	67.1462	77.7940	81.8942	87.1877 (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	168.1442	168.1442	168.1442	168.1442	168.1442	168.1442	168.1442	168.1442	168.1442	168.1442	168.1442	168.1442 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	63.5627	56.4558	45.9129	34.7590	25.9828	21.9358	23.7024	30.8092	41.3521	52.5060	61.2822	65.3293 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	401.0149	405.1762	394.6899	372.3658	344.1857	317.7003	300.0065	295.8452	306.3315	328.6556	356.8357	383.3211 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.6168	54.6168	54.6168	54.6168	54.6168	54.6168	54.6168	54.6168	54.6168	54.6168	54.6168	54.6168 (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)	-112.0962	-112.0962	-112.0962	-112.0962	-112.0962	-112.0962	-112.0962	-112.0962	-112.0962	-112.0962	-112.0962	-112.0962 (71)
Water heating gains (Table 5)	119.5056	117.1781	110.8441	98.2701	87.7508	81.4940	76.3885	83.9306	93.2585	104.5618	113.7420	117.1878 (72)
Total internal gains	697.7480	692.4750	665.1118	619.0599	571.5842	534.7950	513.7623	524.2500	554.6071	599.3883	645.5249	679.5031 (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				4.9500	13.4839		0.6300		0.7000		0.7700		20.3982 (74)
East				1.8100	25.1925		0.6300		0.7000		0.7700		13.9355 (76)
South				9.1300	56.7559		0.6300		0.7000		0.7700		158.3629 (78)
Solar gains	192.6966	276.7155	378.4540	472.5302	507.4765	550.3471	525.0975	488.8241	432.4414	328.6337	229.3838	162.5942	(83)
Total gains	890.4446	969.1905	1043.5658	1091.5902	1079.0607	1085.1422	1038.8598	1013.0740	987.0485	928.0220	874.9086	842.0973	(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	28.7693	28.9564	28.8953	29.0162	29.0162	29.0747	29.1319	29.1877	29.2421	29.0747	29.1877	29.0747
alpha	2.9180	2.9304	2.9264	2.9344	2.9344	2.9383	2.9421	2.9458	2.9495	2.9383	2.9458	2.9383
util living area	0.9563	0.9434	0.9144	0.8604	0.7699	0.6089	0.4707	0.4799	0.6876	0.8553	0.9320	0.9610 (86)
MIT	19.1803	19.3535	19.7148	20.1615	20.5649	20.8502	20.9488	20.9463	20.7708	20.3162	19.7125	19.1658 (87)
Th 2	19.8673	19.8737	19.8716	19.8758	19.8758	19.8778	19.8797	19.8816	19.8835	19.8778	19.8816	19.8778 (88)
util rest of house	0.9482	0.9331	0.8980	0.8315	0.7169	0.5180	0.3497	0.3575	0.6070	0.8191	0.9174	0.9536 (89)
MIT 2	18.2466	18.4204	18.7707	19.2008	19.5694	19.7999	19.8632	19.8641	19.7500	19.3539	18.7809	18.2406 (90)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Living area fraction									fLA = Living area / (4) =			0.1485 (91)
MIT	18.3852	18.5589	18.9109	19.3434	19.7172	19.9559	20.0244	20.0248	19.9016	19.4968	18.9192	18.3780 (92)
Temperature adjustment												0.0000
adjusted MIT	18.3852	18.5589	18.9109	19.3434	19.7172	19.9559	20.0244	20.0248	19.9016	19.4968	18.9192	18.3780 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9345	0.9177	0.8808	0.8154	0.7084	0.5249	0.3663	0.3742	0.6084	0.8044	0.9014	0.9407	(94)
Useful gains	832.0831	889.4647	919.1955	890.0675	764.4479	569.5543	380.4966	379.0419	600.5330	746.5184	788.6470	792.1507	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W	1844.6933	1802.0146	1622.2286	1335.0562	978.8665	630.2063	395.0571	394.3642	700.0346	1095.9583	1485.7530	1810.7930	(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	753.3820	613.2335	523.0566	320.3919	159.5274	0.0000	0.0000	0.0000	0.0000	259.9833	501.9163	757.8699	(98)
Space heating												3889.3609	(98)
Space heating per m2												(98) / (4) =	36.0059 (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 %)	90.8000 (206)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)
Space heating requirement	4283.4371 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	753.3820	613.2335	523.0566	320.3919	159.5274	0.0000	0.0000	0.0000	0.0000	259.9833	501.9163	757.8699	(98)
Space heating efficiency (main heating system 1)	90.8000	90.8000	90.8000	90.8000	90.8000	0.0000	0.0000	0.0000	0.0000	90.8000	90.8000	90.8000	(210)
Space heating fuel (main heating system)	829.7158	675.3673	576.0536	352.8545	175.6910	0.0000	0.0000	0.0000	0.0000	286.3252	552.7712	834.6585	(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	175.6288	137.5578	112.6382	59.9483	31.8881	5.3529	1.2054	30.1906	61.6961	113.7876	150.6975	176.0512	(64)
Efficiency of water heater (217)m	88.5634	88.6308	88.7005	88.9276	88.8233	80.1000	80.1000	80.1000	80.1000	87.2517	88.0830	80.1000	(216)
Fuel for water heating, kWh/month	198.3085	155.2032	126.9871	67.4125	35.9006	6.6828	1.5048	37.6911	77.0238	130.4130	171.0859	198.7713	(219)
Water heating fuel used												1206.9847	(219)
Annual totals kWh/year													
Space heating fuel - main system												4283.4371	(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)												449.0145	(232)

Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.21 * 1187 * 1.00) =									-1148.5689			-1148.5689	(233)
Total delivered energy for all uses												4915.8675	(238)

10a. Fuel costs - using BEDF prices (572)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4283.4371	5.7300	245.4409	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1206.9847	5.7300	69.1602	(247)
Pumps and fans for heating	75.0000	24.1800	18.1350	(249)
Pump for solar water heating	50.0000	24.1800	12.0900	(249)
Energy for lighting	449.0145	24.1800	108.5717	(250)
Additional standing charges			114.0000	(251)
Energy saving/generation technologies				
PV Unit	-1148.5689	24.1800	-277.7240	(252)
Total energy cost			289.6739	(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	4283.4371	0.2160	925.2224	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Water heating (other fuel)	1206.9847	0.2160	260.7087 (264)
Space and water heating			1185.9311 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	449.0145	0.5190	233.0385 (268)
Energy saving/generation technologies			
PV Unit	-1148.5689	0.5190	-596.1072 (269)
Total kg/year			887.7374 (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	4283.4371	1.2200	5225.7932 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1206.9847	1.2200	1472.5213 (264)
Space and water heating			6698.3146 (265)
Pumps and fans	125.0000	3.0700	383.7500 (267)
Energy for lighting	449.0145	3.0700	1378.4746 (268)
Energy saving/generation technologies			
PV Unit	-1148.5689	3.0700	-3526.1064 (269)
Primary energy kWh/year			4934.4328 (272)
Primary energy kWh/m2/year			45.6807 (273)

U-VALUE CALCULATOR REPORT

Property Reference	SAP 0906 Plot 11	Issued on Date	17/06/2025
Assessment Reference	As Built	Prop Type Ref	House Type Ah
Project	7 Starling Road, BOTLEY, SO32 2DN		
Calculation Type	New Build (As Built)		

SAP Rating	88 B	DER	14.03	TER	18.17
Environmental	88 B	% DER<TER	22.79		
CO ₂ Emissions (t/year)	1.16	DFEE	50.75	TFEE	59.96
General Requirements Compliance	Pass	% DFEE<TFEE	15.36		

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

Building Elements

Roof 000002 - Mineral Wool between and above

Roof Type: Pitched Roof, insulated flat ceiling

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

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

Unheated space: None

Total thickness: 463 mm

U-value: 0.10 W/m² K

Kappa: 9.10 kJ/m² K

U-VALUE CALCULATOR REPORT

Property Reference	SAP 0906 Plot 11	Issued on Date	17/06/2025
Assessment Reference	As Built	Prop Type Ref	House Type Ah
Project	7 Starling Road, BOTLEY, SO32 2DN		
Calculation Type	New Build (As Built)		

SAP Rating	88 B	DER	14.03	TER	18.17
Environmental	88 B	% DER<TER	22.79		
CO ₂ Emissions (t/year)	1.16	DFEE	50.75	TFEE	59.96
General Requirements Compliance	Pass	% DFEE<TFEE	15.36		

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

Roof 000004 - Insulation between and below

Roof Type: Pitched Roof, insulated sloping ceiling

Layer	Description	Thickness (mm)	Conductivity (W/m ² K)	Resistance (m ² K/W)	Fraction (%)	Density (kg/m ³)	Heat Cap. (J/kgK)
Ext surface				0.0400			
Layer 1	Tiling						
	Main construction	30	1.5000	0.0200	100.00		
Layer 2	airspace/timber battens						
	Main construction	25	0.2500	0.1000	91.59		
	Main construction	25	0.1563	0.1600	8.41		
	Corrections - Cavity Unventilated, Emissivity: Normal						
Layer 3	Breather membrane						
	Main construction	1	0.0000	0.0000	100.00		
Layer 4	Standard cavity						
	Main construction	50	0.2948	0.1696	87.50		
	Main construction	50	0.1300	0.3846	12.50		
	Corrections - Cavity Unventilated, Emissivity: Low Emissivity (BR443)						
Layer 5	Celotex GA4000						
	Main construction	100	0.0220	4.5455	87.50		
	Main construction	100	0.1300	0.7692	12.50		
	Corrections - Air Gap: Level 1, Fasteners: None or plastic						
Layer 6	Celotex GA4000						
	Main construction	50	0.0220	2.2727	100.00		
	Corrections - Air Gap: Level 1, Fasteners: None or plastic						
Layer 7	Plasterboard, standard						
	Main construction	12.5	0.2100	0.0595	100.00	700	1000
Int surface				0.1000			

Total resistance:	Upper limit = 6.480 m ² K/W	Lower limit = 5.595 m ² K/W	Average = 6.037 m ² K/W
	Total correction = 0.0036 m ² K/W	U-value (unrounded) = 0.17 W/m ² K	

Unheated space: None

Total thickness: 269 mm

U-value: 0.17 W/m² K

Kappa: 9.10 kJ/m² K

U-VALUE CALCULATOR REPORT

Property Reference	SAP 0906 Plot 11	Issued on Date	17/06/2025
Assessment Reference	As Built	Prop Type Ref	House Type Ah
Project	7 Starling Road, BOTLEY, SO32 2DN		
Calculation Type	New Build (As Built)		

SAP Rating	88 B	DER	14.03	TER	18.17
Environmental	88 B	% DER<TER	22.79		
CO ₂ Emissions (t/year)	1.16	DFEE	50.75	TFEE	59.96
General Requirements Compliance	Pass	% DFEE<TFEE	15.36		

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

Wall 000001

Wall Type: Standard Wall

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

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

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

U-VALUE CALCULATOR REPORT

Property Reference	SAP 0906 Plot 11	Issued on Date	17/06/2025
Assessment Reference	As Built	Prop Type Ref	House Type Ah
Project	7 Starling Road, BOTLEY, SO32 2DN		
Calculation Type	New Build (As Built)		

SAP Rating	88 B	DER	14.03	TER	18.17
Environmental	88 B	% DER<TER	22.79		
CO ₂ Emissions (t/year)	1.16	DFEE	50.75	TFEE	59.96
General Requirements Compliance	Pass	% DFEE<TFEE	15.36		

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 Dormers

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	Code 5 Lead						
	Main construction	1.5	35.0000	0.0000	100.00		
Layer 2	Breather membrane						
	Main construction	0.5	0.0000	0.0000	100.00		
Layer 3	Orientated Strand Board						
	Main construction	9	0.1300	0.0692	100.00		
Layer 4	Celotex GA4000						
	Main construction	100	0.0220	4.5455	87.50	30	1400
	Main construction	100	0.1300	0.7692	12.50	30	1400
	Corrections - Air Gap: Level 1, Fasteners: None or plastic						
Layer 5	Celotex GA4000						
	Main construction	50	0.0220	2.2727	100.00	30	1400
	Corrections - Air Gap: Level 1, Fasteners: None or plastic						
Layer 6	Plasterboard, standard						
	Main construction	12.5	0.2100	0.0595	100.00	700	1000
Int surface				0.1300			

Total resistance:	Upper limit = 6.236 m ² K/W	Lower limit = 5.388 m ² K/W	Average = 5.812 m ² K/W
	Total correction = 0.0039 m ² K/W	U-value (unrounded) = 0.17 W/m ² K	

Unheated space: None

Total thickness: 174 mm

U-value: 0.17 W/m² K

Kappa: 9.10 kJ/m² K

U-VALUE CALCULATOR REPORT

Property Reference	SAP 0906 Plot 11	Issued on Date	17/06/2025
Assessment Reference	As Built	Prop Type Ref	House Type Ah
Project	7 Starling Road, BOTLEY, SO32 2DN		
Calculation Type	New Build (As Built)		

SAP Rating	88 B	DER	14.03	TER	18.17
Environmental	88 B	% DER<TER	22.79		
CO ₂ Emissions (t/year)	1.16	DFEE	50.75	TFEE	59.96
General Requirements Compliance	Pass	% DFEE<TFEE	15.36		

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

Building Elements

Floor 000003 - Worst Case Slab

Floor Type: Slab On Ground Floor

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

Horizontal edge insulation: none

Vertical edge insulation: none

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

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

Total correction = 0.0096 m² K/W

U-value (unrounded) = 0.12 W/m² K

Unheated space: None

Total thickness: 321 mm

U-value: 0.12 W/m² K

Kappa: 84.00 kJ/m² K

U-VALUE CALCULATOR REPORT

Property Reference	SAP 0906 Plot 11	Issued on Date	17/06/2025
Assessment Reference	As Built	Prop Type Ref	House Type Ah
Project	7 Starling Road, BOTLEY, SO32 2DN		
Calculation Type	New Build (As Built)		

SAP Rating	88 B	DER	14.03	TER	18.17
Environmental	88 B	% DER<TER	22.79		
CO ₂ Emissions (t/year)	1.16	DFEE	50.75	TFEE	59.96
General Requirements Compliance	Pass	% DFEE<TFEE	15.36		

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 000005 - New exposed above Garage

Floor Type: Exposed Floor

Layer	Description	Thickness (mm)	Conductivity (W/m ² K)	Resistance (m ² K/W)	Fraction (%)
Ext surface				0.0400	
Layer 1	Plasterboard, high density				
	Main construction	15	0.2500	0.0600	100.00
Layer 2	Celotex GA4000				
	Main construction	50	0.0220	2.2727	100.00
	Corrections - Air Gap: Level 1, Fasteners: None or plastic				
Layer 3	Polythene, 500 gauge				
	Main construction	0.5	0.0000	0.0000	100.00
Layer 4	Mineral wool batt				
	Main construction	290	0.0380	7.6316	98.75
	Main construction	290	50.0000	0.0058	1.25
	Corrections - Air Gap: Level 1, Fasteners: None or plastic				
Layer 5	Chipboard				
	Main construction	22	0.1300	0.1692	100.00
Int surface				0.1700	

Total resistance:	Upper limit = 9.993 m ² K/W	Lower limit = 3.150 m ² K/W	Average = 6.571 m ² K/W
	Total correction = 0.0012 m ² K/W	U-value (unrounded) = 0.15 W/m ² K	

Unheated space: None

Total thickness: 378 mm

U-value: 0.15 W/m² K

Kappa: n/a

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

Property Reference	SAP 0906 Plot 11				Issued on Date	17/06/2025
Assessment Reference	As Built			Prop Type Ref	House Type Ah	
Property	7 Starling Road, BOTLEY, SO32 2DN					
SAP Rating		88 B	DER	14.03	TER	18.17
Environmental		88 B	% DER<TER	22.79		
CO ₂ Emissions (t/year)		1.16	DFEE	50.75	TFEE	59.96
General Requirements Compliance		Pass	% DFEE<TFEE	15.36		
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 Built)

Orientation	North
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
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: 27.77 m	43.93 m ²	2.68 m
	1st Storey: 34.49 m	64.09 m ²	2.31 m

7.0 Living Area	16.04	m ²
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8.0 Thermal Mass Parameter	Precise calculation	
Thermal Mass	131.16	kJ/m²K

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	141.44	124.49
Wall to Garage	Cavity Wall	Other	0.24	42.22	16.05	14.45
Dormer	Timber Frame	Other	0.17	9.10	1.86	0.77

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

9.2 Internal Walls				
Description	Construction		Kappa (kJ/m ² K)	Area (m ²)
Ground Floor Stud	Plasterboard on timber frame		9.00	73.84
Internal Wall 2	Plasterboard on timber frame		9.00	152.21

10.0 External Roofs

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Gross Area (m²)	Nett Area (m²)
Pitched Roof	External Plane Roof	Other	0.10	9.10	61.76	61.76
Sloping Roof	External Slope Roof	Other	0.17	9.10	2.43	2.43

10.2 Internal Ceilings

Description	Construction	Kappa (kJ/m²K)	Area (m²)
Internal Ceiling 1	Plasterboard ceiling, carpeted chipboard floor	9.00	43.93

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Area (m²)
Ground Floor	Ground Floor - Solid	Other	0.12	84.00	43.93
Exposed Over Garage	Exposed Floor - Timber	Timber exposed floor, insulation between joists	0.15	20.00	20.22

11.2 Internal Floors

Description	Construction	Kappa (kJ/m²K)	Area (m²)
Internal Floor 1	Plasterboard ceiling, carpeted chipboard floor	18.00	43.93

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Front Door	Manufacturer	Solid Door							1.10
Windows	Manufacturer	Window	Double Low-E Soft 0.1			0.63		0.70	1.20
Personnel Door	Manufacturer	Solid Door							1.30

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	North							2.15	
Front Elevation Shad	Window	[1] Brick and Block	North	None	0.63	Yes				0.72	
Front Elevation	Window	[1] Brick and Block	North	None	0.00					3.14	
Personnel Door	Solid Door	[2] Wall to Garage	West							1.60	
Rear Elevation	Window	[1] Brick and Block	South	None	0.00					9.13	
Side Elevation	Window	[1] Brick and Block	East	None	0.00					1.81	
Dormer	Window	[3] Dormer	North	None	0.00					1.09	

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

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

Source Type	Bridge Type	Length	Psi	Imported	Reference:
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)	0.76	0.070	No	Birtley Supatherm
Independently assessed	E2 Other lintels (including other steel lintels)	3.64	0.071	No	Birtley Supatherm
Independently assessed	E2 Other lintels (including other steel lintels)	4.99	0.064	No	Birtley Supatherm
Independently assessed	E2 Other lintels (including other steel lintels)	1.59	0.067	No	Birtley Supatherm
Independently assessed	E2 Other lintels (including other steel lintels)	2.33	0.057	No	Birtley Supatherm
Independently assessed	E3 Sill	11.53	0.021	No	Knauf P5
Independently assessed	E4 Jamb	35.40	0.016	No	Knauf P6
Table K1 - Approved	E5 Ground floor (normal)	27.77	0.160	No	
Table K1 - Default	E20 Exposed floor (normal)	12.07	0.320	No	
Table K1 - Default	E21 Exposed floor (inverted)	6.01	0.320	No	
Independently assessed	E6 Intermediate floor within a dwelling	22.13	0.000	No	CD0029
Independently assessed	E10 Eaves (insulation at ceiling level)	21.41	0.071	No	Knauf P16
Independently assessed	E11 Eaves (insulation at rafter level)	2.12	0.010	No	Knauf P20
Independently assessed	E12 Gable (insulation at ceiling level)	9.95	0.044	No	Knauf P21
Independently assessed	E13 Gable (insulation at rafter level)	1.26	0.010	No	Knauf P20
Independently assessed	E16 Corner (normal)	21.57	0.039	No	Knauf P23
Independently assessed	E17 Corner (inverted – internal area greater than external area)	1.57	-0.091	No	Knauf P24
Table K1 - Default	R1 Head of roof window	0.91	0.080	No	
Table K1 - Default	R2 Sill of roof window	0.91	0.060	No	
Table K1 - Default	R3 Jamb of roof window	2.40	0.080	No	
Table K1 - Default	R6 Flat ceiling	3.03	0.060	No	
Table K1 - Default	R7 Flat ceiling (inverted)	3.05	0.040	No	
Table K1 - Default	R8 Roof to wall (rafter)	1.85	0.060	No	
Table K1 - Default	R9 Roof to wall (flat ceiling)	3.18	0.040	No	

Y-value W/m²K

18.0 Pressure Testing

Designed AP₅₀ m³/(h.m²) @ 50 Pa
 Property Tested ?
 As Built AP₅₀ m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

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

Mechanical Ventilation

Mechanical Ventilation System Present

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				5
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System

22.0 Lighting

Internal

Total number of light fittings
 Total number of L.E.L. fittings

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

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	Mains Gas System	
Percentage of Heat	100	%
Database Ref. No.	18912	
Fuel Type	Mains gas	
Main Heating	BGB	
SAP Code	102	
In Winter	90.8	
In Summer	80.1	
Controls	CBV Programmer and at least two room thermostats	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2105	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
25.0 Main Heating 2	None	
Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	
29.0 Hot Water Cylinder	Hot Water Cylinder	
Cylinder Stat	Yes	
Cylinder In Heated Space	Yes	
Independent Time Control	Yes	
Insulation Type	Measured Loss	
Cylinder Volume	200.00	L
Loss	1.87	kWh/day

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

Pipes insulation

31.0 Thermal Store

32.0 Photovoltaic Unit

PV Cells kWp

1.21

Orientation

South

Elevation

45°

Overshading

None Or Little

Connected to Dwelling

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	£66	B 89	