



SAP Report Submission for Building Regulations Compliance

Client: Foreman Homes

Project: 24, Fieldfare Crescent
Botley, SO32 2TW

Contact: Tobias Whiting
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Report Issue Date: 14/08/2023

EXCELLENCE
IN ENERGY
ASSESSMENT

BUILDING REGULATION COMPLIANCE

Calculation Type: New Build (As Built)

Property Reference	SAP 0645 Plot 26			Issued on Date	14/08/2023
Assessment Reference	As Built	Prop Type Ref	A		
Property	24, Fieldfare Crescent, Botley, SO32 2TW				
SAP Rating	88 B	DER	14.52	TER	18.48
Environmental	88 B	% DER<TER	21.42		
CO ₂ Emissions (t/year)	1.17	DFEE	52.67	TFEE	61.55
General Requirements Compliance	Pass	% DFEE<TFEE	14.43		
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)	18.48	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	14.52	kgCO ₂ /m ²	Pass
	-3.96 (-21.4%)	kgCO ₂ /m ²	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	61.55	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DFEE)	52.67	kWh/m ² /yr	
	-8.8 (-14.3%)	kWh/m ² /yr	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.24 (max. 0.30)	0.24 (max. 0.70)	Pass
Floor	0.12 (max. 0.25)	0.12 (max. 0.70)	Pass
Roof	0.10 (max. 0.20)	0.17 (max. 0.35)	Pass
Openings	1.25 (max. 2.00)	1.80 (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	4.98 (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 12 S NG

Efficiency: 89.8% SEDBUK2009
Minimum: 88.0%

Pass

Secondary heating system

None

5 Cylinder insulation

Hot water storage

Measured cylinder loss: 1.94 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 South East

8.75 m², No overhang

Windows facing South West

1.14 m², No overhang

Windows facing North West

4.89 m², Overhang twice as wide as window, ratio 0.71

Air change rate

4.00 ach

Blinds/curtains

None

Criterion 4 – Building performance consistent with DER and DFEE rate

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals

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

Maximum

10.0 m³/(h.m²) @ 50 Pa

Pass

10 Key features

Roof U-value

0.10 W/m²K

Floor U-value

0.12 W/m²K

Door U-value

1.10 W/m²K

Photovoltaic array

1.28 kW

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THERMAL BRIDGING

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General Requirements Compliance	Pass	% DFEE<TFEE	14.43		

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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	1.26	0.10	Birtley Supatherm
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.070	0.84	0.06	Birtley Supatherm
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.071	1.01	0.07	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	0.071	0.92	0.07	Birtley Supatherm
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.067	4.80	0.32	Birtley Supatherm
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.067	1.51	0.10	Birtley Supatherm
External wall	E3 Sill	Independently assessed	0.021	10.62	0.22	Knauf P5
External wall	E4 Jamb	Independently assessed	0.016	36.45	0.58	Knauf P6
External wall	E5 Ground floor (normal)	Independently assessed	0.062	27.75	1.72	BE-E5-23902
External wall	E20 Exposed floor (normal)	Table K1 - Default	0.320	12.69	4.06	
External wall	E21 Exposed floor (inverted)	Table K1 - Default	0.320	6.04	1.93	
External wall	E6 Intermediate floor within a dwelling	Independently assessed	0.000	21.73	0.00	
External wall	E10 Eaves (insulation at ceiling level)	Independently assessed	0.120	23.72	2.85	
External wall	E11 Eaves (insulation at rafter level)	Table K1 - Approved	0.040	2.00	0.08	
External wall	E12 Gable (insulation at ceiling level)	Independently assessed	0.054	10.59	0.57	
External wall	E13 Gable (insulation at rafter level)	Table K1 - Approved	0.040	3.40	0.14	
External wall	E16 Corner (normal)	Independently assessed	0.050	23.20	1.16	
External wall	E17 Corner (inverted – internal area greater than external area)	Independently assessed	-0.065	1.54	-0.10	
External roof	R6 Flat ceiling	Table K1 - Default	0.060	3.02	0.18	
External roof	R7 Flat ceiling (inverted)	Table K1 - Default	0.040	0.92	0.04	
External roof	R8 Roof to wall (rafter)	Table K1 - Default	0.060	2.70	0.16	
External roof	R9 Roof to wall (flat ceiling)	Table K1 - Default	0.040	0.92	0.04	

Total: **14.61** W/mK:
Y-Value: **0.050** W/m²K:

FULL SAP CALCULATION PRINTOUT

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

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

DWELLING AS BUILT

Detached House, total floor area 109 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) 18.48 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 14.52 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)61.5 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)52.7 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.24 (max. 0.30)	0.24 (max. 0.70)	OK
Floor	0.12 (max. 0.25)	0.12 (max. 0.70)	OK
Roof	0.10 (max. 0.20)	0.17 (max. 0.35)	OK
Openings	1.25 (max. 2.00)	1.80 (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: 4.98 (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 12 S NG

Efficiency: 89.8% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation

Hot water storage Measured cylinder loss: 1.94 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 South East: 8.75 m², No overhang
Windows facing South West: 1.14 m², No overhang
Windows facing North West: 4.89 m², Overhang twice as wide as window, ratio 0.71
Air change rate: 4.00 ach
Blinds/curtains: None

10 Key features

Roof U-value 0.10 W/m²K
Floor U-value 0.12 W/m²K
Door U-value 1.10 W/m²K
Photovoltaic array 1.28 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	44.2000 (1b)	x 2.6800 (2b)	= 118.4560 (1b) - (3b)
First floor	64.4300 (1c)	x 2.3500 (2c)	= 151.4105 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	108.6300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 269.8665 (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					5 * 10 = 50.0000 (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)					50.0000 / (5) = 0.1853 (8)
Pressure test					Yes
Measured/design AP50					4.9800
Infiltration rate					0.4343 (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)	=	0.3691 (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	0.4706	0.4614	0.4522	0.4060	0.3968	0.3507	0.3507	0.3415	0.3691	0.3968	0.4153	0.4337 (22b)
Effective ac	0.6108	0.6065	0.6022	0.5824	0.5787	0.5615	0.5615	0.5583	0.5681	0.5787	0.5862	0.5941 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			2.1200	1.1000	2.3320		(26a)
Windows (Uw = 1.20)			14.7800	1.1450	16.9237		(27)
Personnel Door			1.7700	1.8000	3.1860		(26)
Ground Floor			44.2000	0.1200	5.3040	140.0000	6188.0000 (28a)
Exposed over Garage			20.2300	0.1215	2.4574	22.4400	453.9612 (28b)
Brick and Block	144.5100	16.9000	127.6100	0.2400	30.6264	42.2200	5387.6942 (29a)
Wall to Garage	16.1500	1.7700	14.3800	0.1966	2.8277	58.0600	834.9028 (29a)
Pitched Roof	61.5400		61.5400	0.1000	6.1540	9.0000	553.8600 (30)
Sloping Ceiling	3.2800		3.2800	0.1700	0.5576	9.0000	29.5200 (30)
Total net area of external elements Aum(A, m ²)			289.9100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	70.3687		(33)
Ground Floor Block			48.7500			75.0000	3656.2500 (32c)
Ground Floor Stud			26.2800			9.0000	236.5200 (32c)
First Floor Stud			154.6100			9.0000	1391.4900 (32c)
Internal Floor 1			44.3200			18.0000	797.7600 (32d)
Internal Ceiling 1			44.2000			18.0000	795.6000 (32e)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		20325.5582 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							187.1081 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							14.6053 (36)
Total fabric heat loss						(33) + (36) =	84.9741 (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	54.3913	54.0083	53.6329	51.8696	51.5396	50.0038	50.0038	49.7194	50.5954	51.5396	52.2071	52.9048 (38)
Heat transfer coeff	139.3654	138.9824	138.6070	136.8436	136.5137	134.9779	134.9779	134.6935	135.5695	136.5137	137.1811	137.8789 (39)
Average = Sum(39)m / 12 =												136.8420 (39)
HLP	1.2829	1.2794	1.2760	1.2597	1.2567	1.2425	1.2425	1.2399	1.2480	1.2567	1.2628	1.2693 (40)
HLP (average)												1.2597 (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												2.8063 (42)
Average daily hot water use (litres/day)												100.8508 (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	110.9358	106.9018	102.8678	98.8337	94.7997	90.7657	90.7657	94.7997	98.8337	102.8678	106.9018	110.9358 (44)
Energy content (annual)	164.5146	143.8855	148.4770	129.4458	124.2064	107.1807	99.3186	113.9696	115.3307	134.4069	146.7156	159.3236 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		1586.7751 (45)
	24.6772	21.5828	22.2715	19.4169	18.6310	16.0771	14.8978	17.0954	17.2996	20.1610	22.0073	23.8985 (46)
Water storage loss:												
Store volume												200.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.9400 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.0476 (55)
Total storage loss												
	32.4756	29.3328	32.4756	31.4280	32.4756	31.4280	32.4756	32.4756	31.4280	32.4756	31.4280	32.4756 (56)
If cylinder contains dedicated solar storage												
	32.4756	29.3328	32.4756	31.4280	32.4756	31.4280	32.4756	32.4756	31.4280	32.4756	31.4280	32.4756 (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												
	220.2526	194.2295	204.2150	183.3858	179.9444	161.1207	155.0566	169.7076	169.2707	190.1449	200.6556	215.0616 (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												
	220.2526	194.2295	204.2150	183.3858	179.9444	161.1207	155.0566	169.7076	169.2707	190.1449	200.6556	215.0616 (64)
								Total per year (kWh/year) = Sum(64)m =				2243.0451 (64)
Heat gains from water heating, kWh/month												
	99.2915	88.1171	93.9590	86.1927	85.8890	78.7896	77.6138	82.4853	81.4995	89.2807	91.9349	97.5655 (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	140.3174	140.3174	140.3174	140.3174	140.3174	140.3174	140.3174	140.3174	140.3174	140.3174	140.3174	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	25.9441	23.0433	18.7401	14.1874	10.6053	8.9534	9.6745	12.5753	16.8785	21.4311	25.0133	26.6651 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	269.5728	272.3701	265.3210	250.3141	231.3707	213.5666	201.6723	198.8750	205.9241	220.9310	239.8744	257.6785 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	37.0317	37.0317	37.0317	37.0317	37.0317	37.0317	37.0317	37.0317	37.0317	37.0317	37.0317	(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	(70)
Losses e.g. evaporation (negative values) (Table 5)												
	-112.2539	-112.2539	-112.2539	-112.2539	-112.2539	-112.2539	-112.2539	-112.2539	-112.2539	-112.2539	-112.2539	(71)
Water heating gains (Table 5)												
	133.4563	131.1267	126.2890	119.7121	115.4422	109.4300	104.3197	110.8673	113.1937	120.0009	127.6874	(72)
Total internal gains												
	497.0684	494.6353	478.4452	452.3089	425.5134	400.0451	383.7617	390.4128	404.0915	430.4582	460.6703	(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					
Southeast			8.7500	36.7938	0.6300	0.7000	0.7700	98.3909 (77)				
Southwest			1.1400	36.7938	0.6300	0.7000	0.7700	12.8189 (79)				
Northwest			4.8900	11.2829	0.6300	0.7000	0.7700	16.8618 (81)				

Solar gains	128.0716	223.7541	321.0268	422.7034	496.2232	502.6462	480.4383	424.0587	355.9973	251.3071	154.4202	108.9426 (83)
Total gains	625.1400	718.3894	799.4720	875.0124	921.7366	902.6913	864.1999	814.4714	760.0888	681.7653	615.0905	592.5179 (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	40.5121	40.6238	40.7338	41.2587	41.3584	41.8290	41.8290	41.9173	41.6465	41.3584	41.1572	40.9489
alpha	3.7008	3.7083	3.7156	3.7506	3.7572	3.7886	3.7886	3.7945	3.7764	3.7572	3.7438	3.7299
util living area	0.9943	0.9899	0.9801	0.9547	0.8948	0.7734	0.6250	0.6725	0.8639	0.9659	0.9902	0.9954 (86)
MIT	19.2132	19.3998	19.7136	20.1362	20.5313	20.8249	20.9432	20.9240	20.7057	20.1980	19.6345	19.1859 (87)
Th 2	19.8542	19.8570	19.8597	19.8725	19.8749	19.8861	19.8861	19.8882	19.8818	19.8749	19.8701	19.8650 (88)
util rest of house	0.9928	0.9872	0.9744	0.9404	0.8580	0.6899	0.4924	0.5443	0.8026	0.9524	0.9870	0.9942 (89)
MIT 2	18.2337	18.4212	18.7343	19.1579	19.5323	19.7902	19.8671	19.8601	19.6984	19.2250	18.6656	18.2146 (90)
Living area fraction									fLA = Living area / (4) =			0.1606 (91)
MIT	18.3910	18.5784	18.8916	19.3151	19.6928	19.9564	20.0400	20.0310	19.8602	19.3813	18.8213	18.3706 (92)
Temperature adjustment												0.0000
adjusted MIT	18.3910	18.5784	18.8916	19.3151	19.6928	19.9564	20.0400	20.0310	19.8602	19.3813	18.8213	18.3706 (93)

8. Space heating requirement												

Utilisation	0.9901	0.9830	0.9679	0.9313	0.8507	0.6959	0.5124	0.5626	0.8012	0.9445	0.9829	0.9918 (94)
Useful gains	618.9483	706.1586	773.8418	814.8864	784.1640	628.1642	442.8034	458.1835	608.9702	643.9047	604.5776	587.6815 (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	1963.7995	1901.0602	1717.5639	1425.2345	1091.1255	722.9926	464.3180	489.0730	780.9038	1198.7691	1607.9364	1953.8271 (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

1000.5692	802.9739	702.1292	439.4507	228.3794	0.0000	0.0000	0.0000	0.0000	412.8191	722.4183	1016.4123 (98)
Space heating											5325.1522 (98)
Space heating per m2											(98) / (4) = 49.0210 (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	5864.7051 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1000.5692	802.9739	702.1292	439.4507	228.3794	0.0000	0.0000	0.0000	0.0000	412.8191	722.4183	1016.4123	(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)	1101.9485	884.3325	773.2701	483.9765	251.5192	0.0000	0.0000	0.0000	0.0000	454.6466	795.6149	1119.3968	(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	220.2526	194.2295	204.2150	183.3858	179.9444	161.1207	155.0566	169.7076	169.2707	190.1449	200.6556	215.0616	(64)
Efficiency of water heater (217)m	88.6632	88.4974	88.1469	87.3638	85.7519	80.1000	80.1000	80.1000	80.1000	87.1296	88.2378	88.7301	(217)
Fuel for water heating, kWh/month	248.4149	219.4748	231.6757	209.9105	209.8430	201.1494	193.5788	211.8696	211.3243	218.2322	227.4033	242.3775	(219)
Water heating fuel used												2625.2540	(219)
Annual totals kWh/year													
Space heating fuel - main system												5864.7051	(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)												458.1801	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.28 * 1004 * 1.00) =										-1028.0921		-1028.0921	(233)
Total delivered energy for all uses												7995.0471	(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	5864.7051	0.2160	1266.7763	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2625.2540	0.2160	567.0549	(264)
Space and water heating			1833.8312	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	458.1801	0.5190	237.7955	(268)
Energy saving/generation technologies				
PV Unit	-1028.0921	0.5190	-533.5798	(269)
Total CO2, kg/year			1576.9718	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			14.5200	(273)

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

DER		14.5200	ZC1
Total Floor Area	TFA	108.6300	
Assumed number of occupants	N	2.8063	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		14.7053	ZC2
CO2 emissions from cooking, equation (L16)		1.7155	ZC3
Total CO2 emissions		30.9407	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		30.9407	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	44.2000 (1b)	x 2.6800 (2b)	= 118.4560 (1b) - (3b)
First floor	64.4300 (1c)	x 2.3500 (2c)	= 151.4105 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	108.6300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 269.8665 (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) = 0.1482 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3982 (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) =	0.3385 (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	0.4316	0.4231	0.4146	0.3723	0.3639	0.3216	0.3216	0.3131	0.3385	0.3639	0.3808	0.3977 (22b)
Effective ac	0.5931	0.5895	0.5860	0.5693	0.5662	0.5517	0.5517	0.5490	0.5573	0.5662	0.5725	0.5791 (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			1.7700	1.0000	1.7700		(26)
TER Semi-glazed door			2.1200	1.2000	2.5440		(26a)
TER Opening Type (Uw = 1.40)			14.7800	1.3258	19.5947		(27)
Ground Floor			44.2000	0.1300	5.7460		(28a)
Exposed over Garage			20.2300	0.1300	2.6299		(28b)
Brick and Block	144.5100	16.9000	127.6100	0.1800	22.9698		(29a)
Wall to Garage	16.1500	1.7700	14.3800	0.1800	2.5884		(29a)
Pitched Roof	61.5400		61.5400	0.1300	8.0002		(30)
Sloping Ceiling	3.2800		3.2800	0.1300	0.4264		(30)
Total net area of external elements Aum(A, m ²)			289.9100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	66.2694		(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)							18.2629 (36)
Total fabric heat loss						(33) + (36) =	84.5323 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	52.8215	52.4995	52.1838	50.7011	50.4237	49.1323	49.1323	48.8932	49.6297	50.4237	50.9849	51.5716 (38)
Heat transfer coeff	137.3538	137.0318	136.7161	135.2334	134.9560	133.6646	133.6646	133.4255	134.1620	134.9560	135.5172	136.1039 (39)
Average = Sum(39)m / 12 =												135.2321 (39)
HLP	1.2644	1.2615	1.2585	1.2449	1.2423	1.2305	1.2305	1.2283	1.2350	1.2423	1.2475	1.2529 (40)
HLP (average)												1.2449 (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												2.8063 (42)
Average daily hot water use (litres/day)												100.8508 (43)
Daily hot water use	110.9358	106.9018	102.8678	98.8337	94.7997	90.7657	90.7657	94.7997	98.8337	102.8678	106.9018	110.9358 (44)
Energy conte	164.5146	143.8855	148.4770	129.4458	124.2064	107.1807	99.3186	113.9696	115.3307	134.4069	146.7156	159.3236 (45)
Energy content (annual)										Total = Sum(45)m =		1586.7751 (45)
Distribution loss (46)m = 0.15 x (45)m	24.6772	21.5828	22.2715	19.4169	18.6310	16.0771	14.8978	17.0954	17.2996	20.1610	22.0073	23.8985 (46)

Water storage loss:												200.0000 (47)	
Store volume													
a) If manufacturer declared loss factor is known (kWh/day):												1.6525 (48)	
Temperature factor from Table 2b												0.5400 (49)	
Enter (49) or (54) in (55)												0.8924 (55)	
Total storage loss													
	27.6637	24.9865	27.6637	26.7713	27.6637	26.7713	27.6637	27.6637	26.7713	27.6637	26.7713	27.6637 (56)	
If cylinder contains dedicated solar storage													
	27.6637	24.9865	27.6637	26.7713	27.6637	26.7713	27.6637	27.6637	26.7713	27.6637	26.7713	27.6637 (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													
	215.4407	189.8833	199.4031	178.7291	175.1324	156.4640	150.2447	164.8957	164.6140	185.3329	195.9989	210.2497 (52)	
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	215.4407	189.8833	199.4031	178.7291	175.1324	156.4640	150.2447	164.8957	164.6140	185.3329	195.9989	210.2497 (64)	
								Total per year (kWh/year) =	Sum(64)m =				2186.3885 (64)
Heat gains from water heating, kWh/month													
	95.4420	84.6401	90.1095	82.4674	82.0395	75.0642	73.7643	78.6357	77.7741	85.4311	88.2096	93.7160 (65)	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9965	0.9929	0.9840	0.9575	0.8859	0.7250	0.5248	0.5796	0.8373	0.9679	0.9929	0.9973 (94)
Useful gains	617.7768	708.1586	781.5945	832.8781	812.0115	650.7215	450.8329	469.0609	632.0727	654.8625	605.6019	585.7290 (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	1914.7506	1856.9602	1682.2098	1403.8775	1081.0322	720.0739	462.3253	487.2861	776.1058	1179.9737	1573.7088	1907.0790 (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	964.9485	771.9946	670.0577	411.1196	200.1515	0.0000	0.0000	0.0000	0.0000	390.6827	697.0370	983.0844 (98)
Space heating												5089.0760 (98)
Space heating per m2												46.8478 (99)
										(98) / (4) =		

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												5442.8620 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	964.9485	771.9946	670.0577	411.1196	200.1515	0.0000	0.0000	0.0000	0.0000	390.6827	697.0370	983.0844 (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)	1032.0305	825.6627	716.6393	439.7001	214.0657	0.0000	0.0000	0.0000	0.0000	417.8425	745.4941	1051.4272 (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	215.4407	189.8833	199.4031	178.7291	175.1324	156.4640	150.2447	164.8957	164.6140	185.3329	195.9989	210.2497 (64)
Efficiency of water heater (217)m	88.3381	88.1663	87.8000	86.9666	85.1706	79.8000	79.8000	79.8000	79.8000	86.7571	87.9129	79.8000 (216)
Fuel for water heating, kWh/month	243.8819	215.3695	227.1105	205.5146	205.6254	196.0701	188.2766	206.6362	206.2833	213.6227	222.9468	237.8085 (219)
Water heating fuel used												2569.1460 (219)
Annual totals kWh/year												
Space heating fuel - main system												5442.8620 (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)												458.1801 (232)
Total delivered energy for all uses												8545.1880 (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	5442.8620	0.2160	1175.6582 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2569.1460	0.2160	554.9355 (264)
Space and water heating			1730.5937 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	458.1801	0.5190	237.7955 (268)
Total CO2, kg/m2/year			2007.3142 (272)
Emissions per m2 for space and water heating			15.9311 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.1890 (272b)
Emissions per m2 for pumps and fans			0.3583 (272c)
Target Carbon Dioxide Emission Rate (TER) = (15.9311 * 1.00) + 2.1890 + 0.3583, rounded to 2 d.p.			18.4800 (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	44.2000 (1b)	x 2.6800 (2b)	= 118.4560 (1b) - (3b)
First floor	64.4300 (1c)	x 2.3500 (2c)	= 151.4105 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	108.6300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 269.8665 (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) = 0.1482 (8)
Pressure test					Yes
Measured/design AP50					4.9800
Infiltration rate					0.3972 (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) =		0.3376 (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	0.4305	0.4220	0.4136	0.3714	0.3630	0.3208	0.3208	0.3123	0.3376	0.3630	0.3798	0.3967 (22b)
Effective ac	0.5927	0.5891	0.5855	0.5690	0.5659	0.5514	0.5514	0.5488	0.5570	0.5659	0.5721	0.5787 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			2.1200	1.1000	2.3320		(26a)
Windows (Uw = 1.20)			14.7800	1.1450	16.9237		(27)
Personnel Door			1.7700	1.8000	3.1860		(26)
Ground Floor			44.2000	0.1200	5.3040	140.0000	6188.0000 (28a)
Exposed over Garage			20.2300	0.1215	2.4574	22.4400	453.9612 (28b)
Brick and Block	144.5100	16.9000	127.6100	0.2400	30.6264	42.2200	5387.6942 (29a)
Wall to Garage	16.1500	1.7700	14.3800	0.1966	2.8277	58.0600	834.9028 (29a)
Pitched Roof	61.5400		61.5400	0.1000	6.1540	9.0000	553.8600 (30)
Sloping Ceiling	3.2800		3.2800	0.1700	0.5576	9.0000	29.5200 (30)
Total net area of external elements Aum(A, m ²)			289.9100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	70.3687		(33)
Ground Floor Block			48.7500			75.0000	3656.2500 (32c)
Ground Floor Stud			26.2800			9.0000	236.5200 (32c)
First Floor Stud			154.6100			9.0000	1391.4900 (32c)
Internal Floor 1			44.3200			18.0000	797.7600 (32d)
Internal Ceiling 1			44.2000			9.0000	397.8000 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	19927.7582 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							183.4462 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							14.6053 (36)
Total fabric heat loss						(33) + (36) =	84.9741 (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	52.7799	52.4595	52.1454	50.6701	50.3941	49.1092	49.1092	48.8713	49.6041	50.3941	50.9525	51.5363 (38)
Heat transfer coeff	137.7540	137.4336	137.1195	135.6442	135.3682	134.0833	134.0833	133.8453	134.5782	135.3682	135.9266	136.5103 (39)
Average = Sum(39)m / 12 =												135.6429 (39)
HLP	1.2681	1.2652	1.2623	1.2487	1.2461	1.2343	1.2343	1.2321	1.2389	1.2461	1.2513	1.2567 (40)
HLP (average)												1.2487 (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												2.8063 (42)
Average daily hot water use (litres/day)												100.8508 (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	110.9358	106.9018	102.8678	98.8337	94.7997	90.7657	90.7657	94.7997	98.8337	102.8678	106.9018	110.9358 (44)
Energy conte	164.5146	143.8855	148.4770	129.4458	124.2064	107.1807	99.3186	113.9696	115.3307	134.4069	146.7156	159.3236 (45)
Energy content (annual)										Total = Sum (45)m =		1586.7751 (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	34.9594	30.5757	31.5514	27.5072	26.3939	22.7759	21.1052	24.2185	24.5078	28.5615	31.1771	33.8563 (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	140.3174	140.3174	140.3174	140.3174	140.3174	140.3174	140.3174	140.3174	140.3174	140.3174	140.3174	140.3174 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.9441	23.0433	18.7401	14.1874	10.6053	8.9534	9.6745	12.5753	16.8785	21.4311	25.0133	26.6651 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	269.5728	272.3701	265.3210	250.3141	231.3707	213.5666	201.6723	198.8750	205.9241	220.9310	239.8744	257.6785 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.0317	37.0317	37.0317	37.0317	37.0317	37.0317	37.0317	37.0317	37.0317	37.0317	37.0317	37.0317 (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)	-112.2539	-112.2539	-112.2539	-112.2539	-112.2539	-112.2539	-112.2539	-112.2539	-112.2539	-112.2539	-112.2539	-112.2539 (71)
Water heating gains (Table 5)	46.9884	45.4995	42.4077	38.2045	35.4756	31.6332	28.3672	32.5518	34.0386	38.3891	43.3015	45.5057 (72)
Total internal gains	407.6005	406.0081	391.5640	367.8013	342.5468	319.2484	304.8092	309.0972	321.9364	345.8463	373.2843	394.9446 (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
-----	-----	-----	-----	-----	-----	-----
Southeast	8.7500	36.7938	0.6300	0.7000	0.7700	98.3909 (77)
Southwest	1.1400	36.7938	0.6300	0.7000	0.7700	12.8189 (79)
Northwest	4.8900	11.2829	0.6300	0.7000	0.7700	16.8618 (81)

Solar gains	128.0716	223.7541	321.0268	422.7034	496.2232	502.6462	480.4383	424.0587	355.9973	251.3071	154.4202	108.9426 (83)
Total gains	535.6720	629.7622	712.5908	790.5047	838.7700	821.8945	785.2475	733.1559	677.9337	597.1534	527.7045	503.8872 (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	40.1839	40.2776	40.3698	40.8089	40.8921	41.2840	41.2840	41.3573	41.1321	40.8921	40.7241	40.5500
alpha	3.6789	3.6852	3.6913	3.7206	3.7261	3.7523	3.7523	3.7572	3.7421	3.7261	3.7149	3.7033
util living area	0.9964	0.9930	0.9853	0.9647	0.9139	0.8063	0.6653	0.7160	0.8927	0.9760	0.9937	0.9971 (86)
MIT	19.1167	19.3069	19.6273	20.0592	20.4725	20.7900	20.9275	20.9025	20.6530	20.1162	19.5394	19.0860 (87)
Th 2	19.8659	19.8682	19.8705	19.8813	19.8833	19.8926	19.8926	19.8944	19.8890	19.8833	19.8792	19.8749 (88)
util rest of house	0.9954	0.9911	0.9811	0.9532	0.8822	0.7281	0.5319	0.5896	0.8402	0.9662	0.9916	0.9964 (89)
MIT 2	18.1486	18.3397	18.6599	19.0932	19.4893	19.7732	19.8671	19.8563	19.6643	19.1552	18.5805	18.1247 (90)
Living area fraction									fLA = Living area / (4) =			0.1606 (91)
MIT	18.3041	18.4951	18.8153	19.2484	19.6472	19.9365	20.0374	20.0243	19.8231	19.3095	18.7345	18.2791 (92)
Temperature adjustment												0.0000
adjusted MIT	18.3041	18.4951	18.8153	19.2484	19.6472	19.9365	20.0374	20.0243	19.8231	19.3095	18.7345	18.2791 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9935	0.9879	0.9757	0.9447	0.8740	0.7318	0.5513	0.6065	0.8363	0.9592	0.9886	0.9948 (94)
Ext temp.	532.1924	622.1270	695.2416	746.8221	733.0587	601.4234	432.8892	444.6547	566.9629	572.8100	521.7100	501.2694 (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	1929.1242	1868.4227	1688.6654	1403.7032	1075.8048	715.5415	460.8988	485.1018	770.2044	1178.9939	1581.4434	1921.9468 (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	1039.3173	837.5107	739.1073	472.9544	255.0031	0.0000	0.0000	0.0000	0.0000	451.0008	763.0081	1056.9840 (98)
												5614.8857 (98)
										(98) / (4) =		51.6882 (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	1260.3829	992.2163	1017.2246	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7211	0.8025	0.7694	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	908.8760	796.2930	782.7033	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1071.0527	1025.8794	967.2426	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	116.7672	170.8123	137.2972	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling													
Cooled fraction									FC = cooled area / (4) =			424.8768	(104)
Intermittency factor (Table 10b)												1.0000	(105)
Intermittency factor	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	29.1918	42.7031	34.3243	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling													
Space cooling per m2												106.2192	(107)
Energy for space heating												0.9778	(108)
Energy for space cooling												51.6882	(99)
Total												0.9778	(108)
Dwelling Fabric Energy Efficiency (DFEE)												52.6660	(109)
												52.7	(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	44.2000 (1b)	x 2.6800 (2b)	= 118.4560 (1b) - (3b)
First floor	64.4300 (1c)	x 2.3500 (2c)	= 151.4105 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	108.6300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 269.8665 (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) = 0.1482 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3982 (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) =		0.3385 (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	0.4316	0.4231	0.4146	0.3723	0.3639	0.3216	0.3216	0.3131	0.3385	0.3639	0.3808	0.3977 (22b)
Effective ac	0.5931	0.5895	0.5860	0.5693	0.5662	0.5517	0.5517	0.5490	0.5573	0.5662	0.5725	0.5791 (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			1.7700	1.0000	1.7700		(26)
TER Semi-glazed door			2.1200	1.2000	2.5440		(26a)
TER Opening Type (Uw = 1.40)			14.7800	1.3258	19.5947		(27)
Ground Floor			44.2000	0.1300	5.7460		(28a)
Exposed over Garage			20.2300	0.1300	2.6299		(28b)
Brick and Block	144.5100	16.9000	127.6100	0.1800	22.9698		(29a)
Wall to Garage	16.1500	1.7700	14.3800	0.1800	2.5884		(29a)
Pitched Roof	61.5400		61.5400	0.1300	8.0002		(30)
Sloping Ceiling	3.2800		3.2800	0.1300	0.4264		(30)
Total net area of external elements Aum(A, m ²)			289.9100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	66.2694		(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)							18.2629 (36)
Total fabric heat loss						(33) + (36) =	84.5323 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	52.8215	52.4995	52.1838	50.7011	50.4237	49.1323	49.1323	48.8932	49.6297	50.4237	50.9849	51.5716 (38)
Heat transfer coeff	137.3538	137.0318	136.7161	135.2334	134.9560	133.6646	133.6646	133.4255	134.1620	134.9560	135.5172	136.1039 (39)
Average = Sum(39)m / 12 =												135.2321 (39)
HLP	1.2644	1.2615	1.2585	1.2449	1.2423	1.2305	1.2305	1.2283	1.2350	1.2423	1.2475	1.2529 (40)
HLP (average)												1.2449 (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												2.8063 (42)
Average daily hot water use (litres/day)												100.8508 (43)
Daily hot water use	110.9358	106.9018	102.8678	98.8337	94.7997	90.7657	90.7657	94.7997	98.8337	102.8678	106.9018	110.9358 (44)
Energy conte	164.5146	143.8855	148.4770	129.4458	124.2064	107.1807	99.3186	113.9696	115.3307	134.4069	146.7156	159.3236 (45)
Energy content (annual)										Total = Sum(45)m =		1586.7751 (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	34.9594	30.5757	31.5514	27.5072	26.3939	22.7759	21.1052	24.2185	24.5078	28.5615	31.1771	33.8563	(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	140.3174	140.3174	140.3174	140.3174	140.3174	140.3174	140.3174	140.3174	140.3174	140.3174	140.3174	140.3174	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.9441	23.0433	18.7401	14.1874	10.6053	8.9534	9.6745	12.5753	16.8785	21.4311	25.0133	26.6651	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	269.5728	272.3701	265.3210	250.3141	231.3707	213.5666	201.6723	198.8750	205.9241	220.9310	239.8744	257.6785	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.0317	37.0317	37.0317	37.0317	37.0317	37.0317	37.0317	37.0317	37.0317	37.0317	37.0317	37.0317	(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)	-112.2539	-112.2539	-112.2539	-112.2539	-112.2539	-112.2539	-112.2539	-112.2539	-112.2539	-112.2539	-112.2539	-112.2539	(71)
Water heating gains (Table 5)	46.9884	45.4995	42.4077	38.2045	35.4756	31.6332	28.3672	32.5518	34.0386	38.3891	43.3015	45.5057	(72)
Total internal gains	407.6005	406.0081	391.5640	367.8013	342.5468	319.2484	304.8092	309.0972	321.9364	345.8463	373.2843	394.9446	(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	
				8.7500	36.7938	0.6300	0.7000		0.7700		98.3909 (77)	
				1.1400	36.7938	0.6300	0.7000		0.7700		12.8189 (79)	
				4.8900	11.2829	0.6300	0.7000		0.7700		16.8618 (81)	
Solar gains	128.0716	223.7541	321.0268	422.7034	496.2232	502.6462	480.4383	424.0587	355.9973	251.3071	154.4202	108.9426 (83)
Total gains	535.6720	629.7622	712.5908	790.5047	838.7700	821.8945	785.2475	733.1559	677.9337	597.1534	527.7045	503.8872 (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	54.9220	55.0511	55.1782	55.7832	55.8979	56.4379	56.4379	56.5391	56.2287	55.8979	55.6664	55.4264		
alpha	4.6615	4.6701	4.6785	4.7189	4.7265	4.7625	4.7625	4.7693	4.7486	4.7265	4.7111	4.6951		
util living area	0.9991	0.9980	0.9946	0.9830	0.9452	0.8426	0.6904	0.7461	0.9268	0.9898	0.9982	0.9994	(86)	
MIT	19.5106	19.6631	19.9202	20.2698	20.6069	20.8612	20.9608	20.9431	20.7468	20.3092	19.8473	19.4869	(87)	
Th 2	19.8688	19.8712	19.8734	19.8842	19.8863	19.8957	19.8957	19.8975	19.8921	19.8863	19.8822	19.8779	(88)	
util rest of house	0.9988	0.9972	0.9925	0.9755	0.9175	0.7596	0.5447	0.6075	0.8773	0.9840	0.9974	0.9991	(89)	
MIT 2	18.5109	18.6649	18.9230	19.2772	19.6012	19.8245	19.8848	19.8794	19.7368	19.3203	18.8578	18.4943	(90)	
Living area fraction									fLA = Living area / (4) =			0.1606	(91)	
MIT	18.6715	18.8253	19.0832	19.4366	19.7628	19.9910	20.0577	20.0502	19.8991	19.4792	19.0168	18.6537	(92)	
Temperature adjustment												0.0000		
adjusted MIT	18.6715	18.8253	19.0832	19.4366	19.7628	19.9910	20.0577	20.0502	19.8991	19.4792	19.0168	18.6537	(93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9983	0.9962	0.9905	0.9714	0.9136	0.7681	0.5682	0.6293	0.8777	0.9810	0.9965	0.9988	(94)
Ext temp.	534.7783	627.3764	705.7880	767.8992	766.2650	631.2599	446.1830	461.3661	595.0047	585.8046	525.8730	503.2609	(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	1973.9791	1908.2054	1720.3250	1424.9052	1088.1213	720.5923	462.1678	487.0345	778.0150	1198.2978	1614.9306	1967.2108	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating per m2	1070.7654	860.7171	754.8155	473.0443	239.4610	0.0000	0.0000	0.0000	0.0000	455.6949	784.1215	1089.1787	(98)
												527.7984	(98)
												52.7276	(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	1256.4473	989.1181	1014.0335	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.7547	0.8066	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	948.2100	832.0392	817.8992	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1071.0527	1025.8794	967.2426	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	88.4468	144.2179	111.1115	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												343.7762 (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	22.1117	36.0545	27.7779	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												85.9441 (107)
Space cooling per m2												0.7912 (108)
Energy for space heating												52.7276 (99)
Energy for space cooling												0.7912 (108)
Total												53.5188 (109)
Target Fabric Energy Efficiency (TFEE)												61.5 (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	44.2000 (1b)	x 2.6800 (2b)	= 118.4560 (1b) - (3b)
First floor	64.4300 (1c)	x 2.3500 (2c)	= 151.4105 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	108.6300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 269.8665 (5)

2. Ventilation rate

	main heating	+	secondary heating	+	other	=	total	m3 per hour				
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000 (6a)				
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000 (6b)				
Number of intermittent fans							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) =	0.1853 (8)				
Pressure test							Yes					
Measured/design AP50								4.9800				
Infiltration rate								0.4343 (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) =	0.3691 (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	0.3876	0.3599	0.3691	0.3507	0.3507	0.3415	0.3322	0.3230	0.3138	0.3415	0.3230	0.3415 (22b)
Effective ac	0.5751	0.5648	0.5681	0.5615	0.5615	0.5583	0.5552	0.5522	0.5492	0.5583	0.5522	0.5583 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K						
Front Door			2.1200	1.1000	2.3320			(26a)					
Windows (Uw = 1.20)			14.7800	1.1450	16.9237			(27)					
Personnel Door			1.7700	1.8000	3.1860			(26)					
Ground Floor			44.2000	0.1200	5.3040	140.0000	6188.0000	(28a)					
Exposed over Garage			20.2300	0.1215	2.4574	22.4400	453.9612	(28b)					
Brick and Block	144.5100	16.9000	127.6100	0.2400	30.6264	42.2200	5387.6942	(29a)					
Wall to Garage	16.1500	1.7700	14.3800	0.1966	2.8277	58.0600	834.9028	(29a)					
Pitched Roof	61.5400		61.5400	0.1000	6.1540	9.0000	553.8600	(30)					
Sloping Ceiling	3.2800		3.2800	0.1700	0.5576	9.0000	29.5200	(30)					
Total net area of external elements Aum(A, m2)			289.9100					(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	70.3687			(33)					
Ground Floor Block			48.7500			75.0000	3656.2500	(32c)					
Ground Floor Stud			26.2800			9.0000	236.5200	(32c)					
First Floor Stud			154.6100			9.0000	1391.4900	(32c)					
Internal Floor 1			44.3200			18.0000	797.7600	(32d)					
Internal Ceiling 1			44.2000			18.0000	795.6000	(32e)					
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		20325.5582	(34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							187.1081	(35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							14.6053	(36)					
Total fabric heat loss						(33) + (36) =	84.9741	(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 51.2173	Feb 50.2958	Mar 50.5954	Apr 50.0038	May 50.0038	Jun 49.7194	Jul 49.4426	Aug 49.1733	Sep 48.9117	Oct 49.7194	Nov 49.1733	Dec 49.7194	(38)
Heat transfer coeff	136.1914	135.2699	135.5695	134.9779	134.9779	134.6935	134.4167	134.1474	133.8858	134.6935	134.1474	134.6935	(39)
Average = Sum(39)m / 12 =												134.8053	(39)
HLP	Jan 1.2537	Feb 1.2452	Mar 1.2480	Apr 1.2425	May 1.2425	Jun 1.2399	Jul 1.2374	Aug 1.2349	Sep 1.2325	Oct 1.2399	Nov 1.2349	Dec 1.2399	(40)
HLP (average)												1.2410	(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												2.8063 (42)
Average daily hot water use (litres/day)												100.8508 (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	110.9358	106.9018	102.8678	98.8337	94.7997	90.7657	90.7657	94.7997	98.8337	102.8678	106.9018	110.9358 (44)
Energy conte	164.5146	143.8855	148.4770	129.4458	124.2064	107.1807	99.3186	113.9696	115.3307	134.4069	146.7156	159.3236 (45)
Energy content (annual)												Total = Sum (45)m = 1586.7751 (45)
Distribution loss (46)m = 0.15 x (45)m	24.6772	21.5828	22.2715	19.4169	18.6310	16.0771	14.8978	17.0954	17.2996	20.1610	22.0073	23.8985 (46)
Water storage loss:												
Store volume												200.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.9400 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.0476 (55)
Total storage loss	32.4756	29.3328	32.4756	31.4280	32.4756	31.4280	32.4756	32.4756	31.4280	32.4756	31.4280	32.4756 (56)
If cylinder contains dedicated solar storage	32.4756	29.3328	32.4756	31.4280	32.4756	31.4280	32.4756	32.4756	31.4280	32.4756	31.4280	32.4756 (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	220.2526	194.2295	204.2150	183.3858	179.9444	161.1207	155.0566	169.7076	169.2707	190.1449	200.6556	215.0616 (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	220.2526	194.2295	204.2150	183.3858	179.9444	161.1207	155.0566	169.7076	169.2707	190.1449	200.6556	215.0616 (64)
Total per year (kWh/year) = Sum (64)m =												2243.0451 (64)
RHI water heating demand												2243 (64)
Heat gains from water heating, kWh/month	99.2915	88.1171	93.9590	86.1927	85.8890	78.7896	77.6138	82.4853	81.4995	89.2807	91.9349	97.5655 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	168.3809	168.3809	168.3809	168.3809	168.3809	168.3809	168.3809	168.3809	168.3809	168.3809	168.3809	168.3809 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	64.8601	57.6082	46.8501	35.4686	26.5132	22.3835	24.1862	31.4381	42.1962	53.5778	62.5332	66.6628 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	402.3475	406.5226	396.0014	373.6032	345.3294	318.7561	301.0034	296.8283	307.3495	329.7477	358.0215	384.5948 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.6444	54.6444	54.6444	54.6444	54.6444	54.6444	54.6444	54.6444	54.6444	54.6444	54.6444	54.6444 (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)	-112.2539	-112.2539	-112.2539	-112.2539	-112.2539	-112.2539	-112.2539	-112.2539	-112.2539	-112.2539	-112.2539	-112.2539 (71)
Water heating gains (Table 5)	133.4563	131.1267	126.2890	119.7121	115.4422	109.4300	104.3197	110.8673	113.1937	120.0009	127.6874	131.1364 (72)
Total internal gains	714.4353	709.0289	682.9119	642.5553	601.0562	564.3409	543.2807	552.9052	576.5107	617.0978	662.0134	696.1655 (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			
Southeast				8.7500	45.1778	0.6300	0.7000	0.7700	120.8106 (77)			
Southwest				1.1400	45.1778	0.6300	0.7000	0.7700	15.7399 (79)			
Northwest				4.8900	14.6176	0.6300	0.7000	0.7700	21.8453 (81)			
Solar gains	158.3959	235.9936	342.9874	457.5820	513.1576	565.7239	536.0640	482.9606	402.8099	286.4052	190.4483	132.4023 (83)
Total gains	872.8312	945.0225	1025.8993	1100.1373	1114.2138	1130.0649	1079.3446	1035.8657	979.3206	903.5030	852.4617	828.5677 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	41.4563	41.7387	41.6465	41.8290	41.8290	41.9173	42.0036	42.0879	42.1702	41.9173	42.0879	41.9173
alpha	3.7638	3.7826	3.7764	3.7886	3.7886	3.7945	3.8002	3.8059	3.8113	3.7945	3.8059	3.7945
util living area	0.9810	0.9735	0.9525	0.9021	0.8026	0.6198	0.4691	0.4858	0.7293	0.9058	0.9661	0.9835 (86)
MIT	19.5910	19.7285	20.0279	20.4084	20.7325	20.9288	20.9811	20.9788	20.8631	20.4980	20.0114	19.5826 (87)
Th 2	19.8773	19.8840	19.8818	19.8861	19.8861	19.8882	19.8902	19.8922	19.8941	19.8882	19.8922	19.8882 (88)
util rest of house	0.9761	0.9668	0.9399	0.8749	0.7451	0.5203	0.3434	0.3568	0.6409	0.8731	0.9560	0.9792 (89)
MIT 2	18.6250	18.7653	19.0562	19.4217	19.7099	19.8564	19.8855	19.8869	19.8224	19.5133	19.0518	18.6255 (90)
Living area fraction	18.7802	18.9200	19.2123	19.5802	19.8741	20.0287	20.0615	20.0623	fLA = Living area / (4) =	19.9895	19.6715	19.2059
MIT	18.7802	18.9200	19.2123	19.5802	19.8741	20.0287	20.0615	20.0623	19.9895	19.6715	19.2059	18.7792 (92)
Temperature adjustment												0.0000
adjusted MIT	18.7802	18.9200	19.2123	19.5802	19.8741	20.0287	20.0615	20.0623	19.9895	19.6715	19.2059	18.7792 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	846.5380	906.6050	954.6290	952.6807	829.4186	603.2133	392.3542	390.9280	636.0226	781.8237	808.0045	806.6048 (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	1890.3589	1842.3737	1655.6112	1360.6022	995.3454	636.9258	398.0757	397.3819	708.1941	1114.1182	1516.6627	1855.9713 (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	776.6028	628.8365	521.5308	293.7035	123.4496	0.0000	0.0000	0.0000	0.0000	247.2272	510.2339	780.7287 (98)
Space heating												3882.3129 (98)
RHI space heating demand												3882 (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	44.2000 (1b)	x 2.6800 (2b)	= 118.4560 (1b) - (3b)
First floor	64.4300 (1c)	x 2.3500 (2c)	= 151.4105 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	108.6300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 269.8665 (5)

2. Ventilation rate

	main heating	+	secondary heating	+	other	=	total	m3 per hour				
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000 (6a)				
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000 (6b)				
Number of intermittent fans							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) =	0.1853 (8)				
Pressure test							Yes					
Measured/design AP50								4.9800				
Infiltration rate								0.4343 (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) =	0.3691 (21)				
Wind speed	Jan 5.1000	Feb 5.0000	Mar 4.9000	Apr 4.4000	May 4.3000	Jun 3.8000	Jul 3.8000	Aug 3.7000	Sep 4.0000	Oct 4.3000	Nov 4.5000	Dec 4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4706	0.4614	0.4522	0.4060	0.3968	0.3507	0.3507	0.3415	0.3691	0.3968	0.4153	0.4337 (22b)
Effective ac	0.6108	0.6065	0.6022	0.5824	0.5787	0.5615	0.5615	0.5583	0.5681	0.5787	0.5862	0.5941 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			2.1200	1.1000	2.3320		(26a)
Windows (Uw = 1.20)			14.7800	1.1450	16.9237		(27)
Personnel Door			1.7700	1.8000	3.1860		(26)
Ground Floor			44.2000	0.1200	5.3040	140.0000	6188.0000 (28a)
Exposed over Garage			20.2300	0.1215	2.4574	22.4400	453.9612 (28b)
Brick and Block	144.5100	16.9000	127.6100	0.2400	30.6264	42.2200	5387.6942 (29a)
Wall to Garage	16.1500	1.7700	14.3800	0.1966	2.8277	58.0600	834.9028 (29a)
Pitched Roof	61.5400		61.5400	0.1000	6.1540	9.0000	553.8600 (30)
Sloping Ceiling	3.2800		3.2800	0.1700	0.5576	9.0000	29.5200 (30)
Total net area of external elements Aum(A, m ²)			289.9100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	70.3687		(33)
Ground Floor Block			48.7500			75.0000	3656.2500 (32c)
Ground Floor Stud			26.2800			9.0000	236.5200 (32c)
First Floor Stud			154.6100			9.0000	1391.4900 (32c)
Internal Floor 1			44.3200			18.0000	797.7600 (32d)
Internal Ceiling 1			44.2000			18.0000	795.6000 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	20325.5582 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							187.1081 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							14.6053 (36)
Total fabric heat loss						(33) + (36) =	84.9741 (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	54.3913	54.0083	53.6329	51.8696	51.5396	50.0038	50.0038	49.7194	50.5954	51.5396	52.2071	52.9048 (38)
Heat transfer coeff	139.3654	138.9824	138.6070	136.8436	136.5137	134.9779	134.9779	134.6935	135.5695	136.5137	137.1811	137.8789 (39)
Average = Sum(39)m / 12 =												136.8420 (39)
HLP	1.2829	1.2794	1.2760	1.2597	1.2567	1.2425	1.2425	1.2399	1.2480	1.2567	1.2628	1.2693 (40)
HLP (average)												1.2597 (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												2.8063 (42)
Average daily hot water use (litres/day)												100.8508 (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														
	110.9358	106.9018	102.8678	98.8337	94.7997	90.7657	90.7657	94.7997	98.8337	102.8678	106.9018	110.9358 (44)		
Energy conte	164.5146	143.8855	148.4770	129.4458	124.2064	107.1807	99.3186	113.9696	115.3307	134.4069	146.7156	159.3236 (45)		
Energy content (annual)														
Distribution loss (46)m = 0.15 x (45)m														
	24.6772	21.5828	22.2715	19.4169	18.6310	16.0771	14.8978	17.0954	17.2996	20.1610	22.0073	23.8985 (46)		
Water storage loss:														
Store volume														
a) If manufacturer declared loss factor is known (kWh/day):														
Temperature factor from Table 2b														
Enter (49) or (54) in (55)														
Total storage loss														
	32.4756	29.3328	32.4756	31.4280	32.4756	31.4280	32.4756	32.4756	31.4280	32.4756	31.4280	32.4756 (56)		
If cylinder contains dedicated solar storage														
	32.4756	29.3328	32.4756	31.4280	32.4756	31.4280	32.4756	32.4756	31.4280	32.4756	31.4280	32.4756 (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														
	220.2526	194.2295	204.2150	183.3858	179.9444	161.1207	155.0566	169.7076	169.2707	190.1449	200.6556	215.0616 (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														
	220.2526	194.2295	204.2150	183.3858	179.9444	161.1207	155.0566	169.7076	169.2707	190.1449	200.6556	215.0616 (64)		
Total per year (kWh/year) = Sum(64)m =												2243.0451 (64)		
Heat gains from water heating, kWh/month														
	99.2915	88.1171	93.9590	86.1927	85.8890	78.7896	77.6138	82.4853	81.4995	89.2807	91.9349	97.5655 (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	168.3809	168.3809	168.3809	168.3809	168.3809	168.3809	168.3809	168.3809	168.3809	168.3809	168.3809	168.3809 (66)		
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5														
	64.8601	57.6082	46.8501	35.4686	26.5132	22.3835	24.1862	31.4381	42.1962	53.5778	62.5332	66.6628 (67)		
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5														
	402.3475	406.5226	396.0014	373.6032	345.3294	318.7561	301.0034	296.8283	307.3495	329.7477	358.0215	384.5948 (68)		
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5														
	54.6444	54.6444	54.6444	54.6444	54.6444	54.6444	54.6444	54.6444	54.6444	54.6444	54.6444	54.6444 (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)														
	-112.2539	-112.2539	-112.2539	-112.2539	-112.2539	-112.2539	-112.2539	-112.2539	-112.2539	-112.2539	-112.2539	-112.2539 (71)		
Water heating gains (Table 5)														
	133.4563	131.1267	126.2890	119.7121	115.4422	109.4300	104.3197	110.8673	113.1937	120.0009	127.6874	131.1364 (72)		
Total internal gains	714.4353	709.0289	682.9119	642.5553	601.0562	564.3409	543.2807	552.9052	576.5107	617.0978	662.0134	696.1655 (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		
Southeast				8.7500		36.7938		0.6300		0.7000		0.7700		98.3909 (77)
Southwest				1.1400		36.7938		0.6300		0.7000		0.7700		12.8189 (79)
Northwest				4.8900		11.2829		0.6300		0.7000		0.7700		16.8618 (81)

Solar gains	128.0716	223.7541	321.0268	422.7034	496.2232	502.6462	480.4383	424.0587	355.9973	251.3071	154.4202	108.9426 (83)		
Total gains	842.5069	932.7829	1003.9388	1065.2587	1097.2794	1066.9871	1023.7190	976.9638	932.5080	868.4048	816.4336	805.1081 (84)		

7. Mean internal temperature (heating season)														

Temperature during heating periods in the living area from Table 9, Th1 (C)														
Utilisation factor for gains for living area, nil,m (see Table 9a)														
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
tau	40.5121	40.6238	40.7338	41.2587	41.3584	41.8290	41.8290	41.9173	41.6465	41.3584	41.1572	40.9489		
alpha	3.7008	3.7083	3.7156	3.7506	3.7572	3.7886	3.7886	3.7945	3.7764	3.7572	3.7438	3.7299		
util living area	0.9850	0.9769	0.9605	0.9222	0.8432	0.7008	0.5467	0.5878	0.7919	0.9322	0.9757	0.9872 (86)		
MIT	19.4313	19.6095	19.9032	20.2910	20.6372	20.8773	20.9638	20.9520	20.7920	20.3571	19.8318	19.4014 (87)		
Th 2	19.8542	19.8570	19.8597	19.8725	19.8749	19.8861	19.8861	19.8882	19.8818	19.8749	19.8701	19.8650 (88)		
util rest of house	0.9813	0.9711	0.9501	0.9003	0.7964	0.6123	0.4228	0.4649	0.7172	0.9086	0.9685	0.9840 (89)		
MIT 2	18.4495	18.6274	18.9177	19.3013	19.6198	19.8224	19.8747	19.8717	19.7604	19.3722	18.8588	18.4281 (90)		
Living area fraction	fLA = Living area / (4) =													
MIT	18.6072	18.7851	19.0760	19.4603	19.7833	19.9919	20.0497	20.0452	19.9261	19.5304	19.0151	18.5844 (92)		
Temperature adjustment														
adjusted MIT	18.6072	18.7851	19.0760	19.4603	19.7833	19.9919	20.0497	20.0452	19.9261	19.5304	19.0151	18.5844 (93)		

8. Space heating requirement														

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation	0.9758	0.9640	0.9410	0.8905	0.7920	0.6215	0.4420	0.4835	0.7206	0.8996	0.9613	0.9791 (94)		
Useful gains	822.0837	899.1654	944.7483	948.6648	869.0582	663.1359	452.4956	472.3508	671.9578	781.2016	784.8753	788.3033 (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	1993.9342	1929.7911	1743.1265	1445.1122	1103.4766	727.7861	465.6309	490.9853	789.8384	1219.1281	1634.5327	1983.3076 (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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871.8567	692.5805	593.9934	357.4421	174.4073	0.0000	0.0000	0.0000	0.0000	325.8173	611.7533	889.0832 (98)
Space heating											4516.9339 (98)
Space heating per m2										(98) / (4) =	41.5809 (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												4974.5968 (211)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	871.8567	692.5805	593.9934	357.4421	174.4073	0.0000	0.0000	0.0000	0.0000	325.8173	611.7533	889.0832 (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)	960.1947	762.7539	654.1777	393.6587	192.0786	0.0000	0.0000	0.0000	0.0000	358.8296	673.7371	979.1665 (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	220.2526	194.2295	204.2150	183.3858	179.9444	161.1207	155.0566	169.7076	169.2707	190.1449	200.6556	215.0616 (64)
Efficiency of water heater (217)m	88.4180	88.2189	87.7994	86.8654	85.0318	80.1000	80.1000	80.1000	80.1000	86.5398	87.8999	80.1000 (216)
Fuel for water heating, kWh/month	249.1039	220.1676	232.5928	211.1150	211.6200	201.1494	193.5788	211.8696	211.3243	219.7196	228.2774	88.4974 (217)
Water heating fuel used												243.0146 (219)
Annual totals kWh/year												2633.5332 (219)
Space heating fuel - main system												4974.5968 (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)												458.1801 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 1.28 * 1004 * 1.00) =										-1028.0921		-1028.0921 (233)
Total delivered energy for all uses												7113.2179 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	4974.5968	3.4800	173.1160 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2633.5332	3.4800	91.6470 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	458.1801	13.1900	60.4340 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-1028.0921	13.1900	-135.6053 (252)
Total energy cost			319.4840 (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] =	0.8734 (257)
SAP value		87.8158
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	4974.5968	0.2160	1074.5129 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2633.5332	0.2160	568.8432 (264)
Space and water heating			1643.3561 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	458.1801	0.5190	237.7955 (268)
Energy saving/generation technologies			
PV Unit	-1028.0921	0.5190	-533.5798 (269)
Total kg/year			1386.4967 (272)
CO2 emissions per m2			12.7600 (273)
EI value			87.9066

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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	$3.48 / 0.8497 = 4.095$, stars = 4
Water heating environmental impact	$0.216 / 0.8497 = 0.2542$, 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	44.2000 (1b)	x 2.6800 (2b)	= 118.4560 (1b) - (3b)
First floor	64.4300 (1c)	x 2.3500 (2c)	= 151.4105 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	108.6300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 269.8665 (5)

2. Ventilation rate

	main heating	+	secondary heating	+	other	=	total	m3 per hour				
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000 (6a)				
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000 (6b)				
Number of intermittent fans							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) =	0.1853 (8)				
Pressure test							Yes					
Measured/design AP50								4.9800				
Infiltration rate								0.4343 (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) =	0.3691 (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	0.3876	0.3599	0.3691	0.3507	0.3507	0.3415	0.3322	0.3230	0.3138	0.3415	0.3230	0.3415 (22b)
Effective ac	0.5751	0.5648	0.5681	0.5615	0.5615	0.5583	0.5552	0.5522	0.5492	0.5583	0.5522	0.5583 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K						
Front Door			2.1200	1.1000	2.3320			(26a)					
Windows (Uw = 1.20)			14.7800	1.1450	16.9237			(27)					
Personnel Door			1.7700	1.8000	3.1860			(26)					
Ground Floor			44.2000	0.1200	5.3040	140.0000	6188.0000	(28a)					
Exposed over Garage			20.2300	0.1215	2.4574	22.4400	453.9612	(28b)					
Brick and Block	144.5100	16.9000	127.6100	0.2400	30.6264	42.2200	5387.6942	(29a)					
Wall to Garage	16.1500	1.7700	14.3800	0.1966	2.8277	58.0600	834.9028	(29a)					
Pitched Roof	61.5400		61.5400	0.1000	6.1540	9.0000	553.8600	(30)					
Sloping Ceiling	3.2800		3.2800	0.1700	0.5576	9.0000	29.5200	(30)					
Total net area of external elements Aum(A, m2)			289.9100					(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	70.3687			(33)					
Ground Floor Block			48.7500			75.0000	3656.2500	(32c)					
Ground Floor Stud			26.2800			9.0000	236.5200	(32c)					
First Floor Stud			154.6100			9.0000	1391.4900	(32c)					
Internal Floor 1			44.3200			18.0000	797.7600	(32d)					
Internal Ceiling 1			44.2000			18.0000	795.6000	(32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	20325.5582	(34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							187.1081	(35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							14.6053	(36)					
Total fabric heat loss						(33) + (36) =	84.9741	(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 51.2173	Feb 50.2958	Mar 50.5954	Apr 50.0038	May 50.0038	Jun 49.7194	Jul 49.4426	Aug 49.1733	Sep 48.9117	Oct 49.7194	Nov 49.1733	Dec 49.7194	(38)
Heat transfer coeff	136.1914	135.2699	135.5695	134.9779	134.9779	134.6935	134.4167	134.1474	133.8858	134.6935	134.1474	134.6935	(39)
Average = Sum(39)m / 12 =												134.8053	(39)
HLP	Jan 1.2537	Feb 1.2452	Mar 1.2480	Apr 1.2425	May 1.2425	Jun 1.2399	Jul 1.2374	Aug 1.2349	Sep 1.2325	Oct 1.2399	Nov 1.2349	Dec 1.2399	(40)
HLP (average)												1.2410	(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												2.8063 (42)
Average daily hot water use (litres/day)												100.8508 (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 09 Jan 2014

Daily hot water use	110.9358	106.9018	102.8678	98.8337	94.7997	90.7657	90.7657	94.7997	98.8337	102.8678	106.9018	110.9358 (44)
Energy content (annual)	164.5146	143.8855	148.4770	129.4458	124.2064	107.1807	99.3186	113.9696	115.3307	134.4069	146.7156	159.3236 (45)
Distribution loss (46)m = 0.15 x (45)m	24.6772	21.5828	22.2715	19.4169	18.6310	16.0771	14.8978	17.0954	17.2996	20.1610	22.0073	23.8985 (46)
Water storage loss:												
Store volume												200.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.9400 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.0476 (55)
Total storage loss	32.4756	29.3328	32.4756	31.4280	32.4756	31.4280	32.4756	32.4756	31.4280	32.4756	31.4280	32.4756 (56)
If cylinder contains dedicated solar storage	32.4756	29.3328	32.4756	31.4280	32.4756	31.4280	32.4756	32.4756	31.4280	32.4756	31.4280	32.4756 (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	220.2526	194.2295	204.2150	183.3858	179.9444	161.1207	155.0566	169.7076	169.2707	190.1449	200.6556	215.0616 (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	220.2526	194.2295	204.2150	183.3858	179.9444	161.1207	155.0566	169.7076	169.2707	190.1449	200.6556	215.0616 (64)
								Total per year (kWh/year) = Sum (64)m =				2243.0451 (64)
Heat gains from water heating, kWh/month	99.2915	88.1171	93.9590	86.1927	85.8890	78.7896	77.6138	82.4853	81.4995	89.2807	91.9349	97.5655 (65)

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

Metabolic gains (Table 5), Watts												
Jan	168.3809	168.3809	168.3809	168.3809	168.3809	168.3809	168.3809	168.3809	168.3809	168.3809	168.3809	168.3809 (66)
Feb	168.3809	168.3809	168.3809	168.3809	168.3809	168.3809	168.3809	168.3809	168.3809	168.3809	168.3809	168.3809 (66)
Mar	168.3809	168.3809	168.3809	168.3809	168.3809	168.3809	168.3809	168.3809	168.3809	168.3809	168.3809	168.3809 (66)
Apr	168.3809	168.3809	168.3809	168.3809	168.3809	168.3809	168.3809	168.3809	168.3809	168.3809	168.3809	168.3809 (66)
May	168.3809	168.3809	168.3809	168.3809	168.3809	168.3809	168.3809	168.3809	168.3809	168.3809	168.3809	168.3809 (66)
Jun	168.3809	168.3809	168.3809	168.3809	168.3809	168.3809	168.3809	168.3809	168.3809	168.3809	168.3809	168.3809 (66)
Jul	168.3809	168.3809	168.3809	168.3809	168.3809	168.3809	168.3809	168.3809	168.3809	168.3809	168.3809	168.3809 (66)
Aug	168.3809	168.3809	168.3809	168.3809	168.3809	168.3809	168.3809	168.3809	168.3809	168.3809	168.3809	168.3809 (66)
Sep	168.3809	168.3809	168.3809	168.3809	168.3809	168.3809	168.3809	168.3809	168.3809	168.3809	168.3809	168.3809 (66)
Oct	168.3809	168.3809	168.3809	168.3809	168.3809	168.3809	168.3809	168.3809	168.3809	168.3809	168.3809	168.3809 (66)
Nov	168.3809	168.3809	168.3809	168.3809	168.3809	168.3809	168.3809	168.3809	168.3809	168.3809	168.3809	168.3809 (66)
Dec	168.3809	168.3809	168.3809	168.3809	168.3809	168.3809	168.3809	168.3809	168.3809	168.3809	168.3809	168.3809 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	64.8601	57.6082	46.8501	35.4686	26.5132	22.3835	24.1862	31.4381	42.1962	53.5778	62.5332	66.6628 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	402.3475	406.5226	396.0014	373.6032	345.3294	318.7561	301.0034	296.8283	307.3495	329.7477	358.0215	384.5948 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.6444	54.6444	54.6444	54.6444	54.6444	54.6444	54.6444	54.6444	54.6444	54.6444	54.6444	54.6444 (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)	-112.2539	-112.2539	-112.2539	-112.2539	-112.2539	-112.2539	-112.2539	-112.2539	-112.2539	-112.2539	-112.2539	-112.2539 (71)
Water heating gains (Table 5)	133.4563	131.1267	126.2890	119.7121	115.4422	109.4300	104.3197	110.8673	113.1937	120.0009	127.6874	131.1364 (72)
Total internal gains	714.4353	709.0289	682.9119	642.5553	601.0562	564.3409	543.2807	552.9052	576.5107	617.0978	662.0134	696.1655 (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							
Southeast	8.7500	45.1778	0.6300	0.7000	0.7700	120.8106 (77)						
Southwest	1.1400	45.1778	0.6300	0.7000	0.7700	15.7399 (79)						
Northwest	4.8900	14.6176	0.6300	0.7000	0.7700	21.8453 (81)						

Solar gains	158.3959	235.9936	342.9874	457.5820	513.1576	565.7239	536.0640	482.9606	402.8099	286.4052	190.4483	132.4023 (83)
Total gains	872.8312	945.0225	1025.8993	1100.1373	1114.2138	1130.0649	1079.3446	1035.8657	979.3206	903.5030	852.4617	828.5677 (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	41.4563	41.7387	41.6465	41.8290	41.8290	41.9173	42.0036	42.0879	42.1702	41.9173	42.0879	41.9173
Feb	41.7387	41.7387	41.6465	41.8290	41.8290	41.9173	42.0036	42.0879	42.1702	41.9173	42.0879	41.9173
Mar	41.6465	41.7387	41.6465	41.8290	41.8290	41.9173	42.0036	42.0879	42.1702	41.9173	42.0879	41.9173
Apr	41.8290	41.7387	41.6465	41.8290	41.8290	41.9173	42.0036	42.0879	42.1702	41.9173	42.0879	41.9173
May	41.8290	41.7387	41.6465	41.8290	41.8290	41.9173	42.0036	42.0879	42.1702	41.9173	42.0879	41.9173
Jun	41.9173	41.7387	41.6465	41.8290	41.8290	41.9173	42.0036	42.0879	42.1702	41.9173	42.0879	41.9173
Jul	42.0036	41.7387	41.6465	41.8290	41.8290	41.9173	42.0036	42.0879	42.1702	41.9173	42.0879	41.9173
Aug	42.0879	41.7387	41.6465	41.8290	41.8290	41.9173	42.0036	42.0879	42.1702	41.9173	42.0879	41.9173
Sep	42.1702	41.7387	41.6465	41.8290	41.8290	41.9173	42.0036	42.0879	42.1702	41.9173	42.0879	41.9173
Oct	41.9173	41.7387	41.6465	41.8290	41.8290	41.9173	42.0036	42.0879	42.1702	41.9173	42.0879	41.9173
Nov	42.0879	41.7387	41.6465	41.8290	41.8290	41.9173	42.0036	42.0879	42.1702	41.9173	42.0879	41.9173
Dec	41.9173	41.7387	41.6465	41.8290	41.8290	41.9173	42.0036	42.0879	42.1702	41.9173	42.0879	41.9173
util living area	0.9810	0.9735	0.9525	0.9021	0.8026	0.6198	0.4691	0.4858	0.7293	0.9058	0.9661	0.9835 (86)
MIT	19.5910	19.7285	20.0279	20.4084	20.7325	20.9288	20.9811	20.9788	20.8631	20.4980	20.0114	19.5826 (87)
Th 2	19.8773	19.8840	19.8818	19.8861	19.8861	19.8882	19.8902	19.8922	19.8941	19.8882	19.8922	19.8882 (88)
util rest of house	0.9761	0.9668	0.9399	0.8749	0.7451	0.5203	0.3434	0.3568	0.6409	0.8731	0.9560	0.9792 (89)
MIT 2	18.6250	18.7653	19.0562	19.4217	19.7099	19.8564	19.8855	19.8869	19.8224	19.5133	19.0518	18.6255 (90)
Living area fraction									fLA = Living area / (4) =			0.1606 (91)
MIT	18.7802	18.9200	19.2123	19.5802	19.8741	20.0287	20.0615	20.0623	19.9895	19.6715	19.2059	18.7792 (92)
Temperature adjustment												0.0000
adjusted MIT	18.7802	18.9200	19.2123	19.5802	19.8741	20.0287	20.0615	20.0623	19.9895	19.6715	19.2059	18.7792 (93)

8. Space heating requirement												

Utilisation	0.9699	0.9593	0.9305	0.8660	0.7444	0.5338	0.3635	0.3774	0.6495	0.8653	0.9478	0.9735 (94)
Useful gains	846.5380	906.6050	954.6290	952.6807	829.4186	603.2133	392.3542	390.9280	636.0226	781.8237	808.0045	806.6048 (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	1890.3589	1842.3737	1655.6112	1360.6022	995.3454	636.9258	398.0757	397.3819	708.1941	1114.1182	1516.6627	1855.9713 (97)
Month fraction	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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776.6028	628.8365	521.5308	293.7035	123.4496	0.0000	0.0000	0.0000	0.0000	247.2272	510.2339	780.7287 (98)
Space heating											3882.3129 (98)
Space heating per m2										(98) / (4) =	35.7389 (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		4275.6750 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	776.6028	628.8365	521.5308	293.7035	123.4496	0.0000	0.0000	0.0000	0.0000	247.2272	510.2339	780.7287	(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)	855.2894	692.5513	574.3731	323.4620	135.9577	0.0000	0.0000	0.0000	0.0000	272.2766	561.9316	859.8334	(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	220.2526	194.2295	204.2150	183.3858	179.9444	161.1207	155.0566	169.7076	169.2707	190.1449	200.6556	215.0616	(64)
Efficiency of water heater (217)m	88.1969	88.0252	87.5106	86.3654	84.1342	80.1000	80.1000	80.1000	80.1000	85.8163	87.5008	80.1000	(216)
Fuel for water heating, kWh/month	249.7284	220.6523	233.3603	212.3372	213.8779	201.1494	193.5788	211.8696	211.3243	221.5720	229.3187	243.6852	(219)
Water heating fuel used												2642.4541	(219)
Annual totals kWh/year													
Space heating fuel - main system												4275.6750	(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)												458.1801	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.28 * 1122 * 1.00) =										-1148.8467		-1148.8467	(233)
Total delivered energy for all uses												6302.4624	(238)

10a. Fuel costs - using BEDF prices (524)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4275.6750	10.2300	437.4015	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	2642.4541	10.2300	270.3231	(247)
Pumps and fans for heating	75.0000	36.7200	27.5400	(249)
Energy for lighting	458.1801	36.7200	168.2437	(250)
Additional standing charges			103.0000	(251)
Energy saving/generation technologies				
PV Unit	-1148.8467	36.7200	-421.8565	(252)
Total energy cost			584.6518	(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	4275.6750	0.2160	923.5458	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2642.4541	0.2160	570.7701	(264)
Space and water heating			1494.3159	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	458.1801	0.5190	237.7955	(268)
Energy saving/generation technologies				
PV Unit	-1148.8467	0.5190	-596.2515	(269)
Total kg/year			1174.7849	(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	4275.6750	1.2200	5216.3235	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2642.4541	1.2200	3223.7940	(264)
Space and water heating			8440.1175	(265)
Pumps and fans	75.0000	3.0700	230.2500	(267)

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Energy for lighting	458.1801	3.0700	1406.6128 (268)
Energy saving/generation technologies			
PV Unit	-1148.8467	3.0700	-3526.9594 (269)
Primary energy kWh/year			6550.0208 (272)
Primary energy kWh/m ² /year			60.2966 (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	-£ 121	-269 kg (22.9%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£121 2.48 kg/m ²	B 89	B 90
Total Savings	£121 2.48 kg/m ²		

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

Fuel prices for cost data on this page from database revision number 524 TEST (01 Aug 2023)
Recommendation texts revision number 4.9c (22 Feb 2014)

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

	Current	Potential	Saving
Electricity	£196	£214	-£18
Mains gas	£811	£671	£140
Space heating	£568	£574	-£6
Water heating	£270	£143	£127
Lighting	£168	£168	£0
Generated (PV)	-£422	-£422	£0
Total cost of fuels	£585	£463	£122
Total cost of uses	£584	£463	£121
Delivered energy	58 kWh/m ²	46 kWh/m ²	12 kWh/m ²
Carbon dioxide emissions	1.2 tonnes	0.9 tonnes	0.3 tonnes
CO2 emissions per m ²	11 kg/m ²	8 kg/m ²	2 kg/m ²
Primary energy	60 kWh/m ²	46 kWh/m ²	14 kWh/m ²

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	44.2000 (1b)	x 2.6800 (2b)	= 118.4560 (1b) - (3b)
First floor	64.4300 (1c)	x 2.3500 (2c)	= 151.4105 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	108.6300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 269.8665 (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					5 * 10 = 50.0000 (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) =					50.0000 / (5) = 0.1853 (8)
Pressure test					Yes
Measured/design AP50					4.9800
Infiltration rate					0.4343 (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) =	0.3691 (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	0.4706	0.4614	0.4522	0.4060	0.3968	0.3507	0.3507	0.3415	0.3691	0.3968	0.4153	0.4337 (22b)
Effective ac	0.6108	0.6065	0.6022	0.5824	0.5787	0.5615	0.5615	0.5583	0.5681	0.5787	0.5862	0.5941 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			2.1200	1.1000	2.3320		(26a)
Windows (Uw = 1.20)			14.7800	1.1450	16.9237		(27)
Personnel Door			1.7700	1.8000	3.1860		(26)
Ground Floor			44.2000	0.1200	5.3040	140.0000	6188.0000 (28a)
Exposed over Garage			20.2300	0.1215	2.4574	22.4400	453.9612 (28b)
Brick and Block	144.5100	16.9000	127.6100	0.2400	30.6264	42.2200	5387.6942 (29a)
Wall to Garage	16.1500	1.7700	14.3800	0.1966	2.8277	58.0600	834.9028 (29a)
Pitched Roof	61.5400		61.5400	0.1000	6.1540	9.0000	553.8600 (30)
Sloping Ceiling	3.2800		3.2800	0.1700	0.5576	9.0000	29.5200 (30)
Total net area of external elements Aum(A, m ²)			289.9100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	70.3687		(33)
Ground Floor Block			48.7500			75.0000	3656.2500 (32c)
Ground Floor Stud			26.2800			9.0000	236.5200 (32c)
First Floor Stud			154.6100			9.0000	1391.4900 (32c)
Internal Floor 1			44.3200			18.0000	797.7600 (32d)
Internal Ceiling 1			44.2000			18.0000	795.6000 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	20325.5582 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							187.1081 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							14.6053 (36)
Total fabric heat loss						(33) + (36) =	84.9741 (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	54.3913	54.0083	53.6329	51.8696	51.5396	50.0038	50.0038	49.7194	50.5954	51.5396	52.2071	52.9048 (38)
Heat transfer coeff	139.3654	138.9824	138.6070	136.8436	136.5137	134.9779	134.9779	134.6935	135.5695	136.5137	137.1811	137.8789 (39)
Average = Sum(39)m / 12 =												136.8420 (39)
HLP	1.2829	1.2794	1.2760	1.2597	1.2567	1.2425	1.2425	1.2399	1.2480	1.2567	1.2628	1.2693 (40)
HLP (average)												1.2597 (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												2.8063 (42)
Average daily hot water use (litres/day)												100.8508 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

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CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Daily hot water use	110.9358	106.9018	102.8678	98.8337	94.7997	90.7657	90.7657	94.7997	98.8337	102.8678	106.9018	110.9358 (44)
Energy conte	164.5146	143.8855	148.4770	129.4458	124.2064	107.1807	99.3186	113.9696	115.3307	134.4069	146.7156	159.3236 (45)
Energy content (annual)										Total = Sum(45)m =		1586.7751 (45)
Distribution loss	(46)m = 0.15 x (45)m											
	24.6772	21.5828	22.2715	19.4169	18.6310	16.0771	14.8978	17.0954	17.2996	20.1610	22.0073	23.8985 (46)
Water storage loss:												
Store volume												200.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.9400 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.0476 (55)
Total storage loss												
	32.4756	29.3328	32.4756	31.4280	32.4756	31.4280	32.4756	32.4756	31.4280	32.4756	31.4280	32.4756 (56)
If cylinder contains dedicated solar storage												
	20.2973	18.3330	20.2973	19.6425	20.2973	19.6425	20.2973	20.2973	19.6425	20.2973	19.6425	20.2973 (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												
	208.0743	183.2297	190.6409	164.8467	154.9717	136.7284	129.8513	145.4328	152.0824	176.5708	188.8701	202.8833 (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												1.1429 (H8)
Utilisation factor												0.5831 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												112.5000 (H13)
Daily hot water demand												100.8508 (H14)
Volume ratio Veff/V												1.1155 (H15)
Solar storage volume factor												1.0000 (H16)
Solar input												-929.8768 (H17)
Solar input	-26.9646	-44.9961	-76.6335	-102.7041	-126.8822	-124.7454	-123.0969	-107.5503	-84.2335	-57.5216	-31.9839	-22.5647 (63)
								Solar input (sum of months) = Sum(63)m =				-929.8768 (63)
Output from w/h												
	181.1097	138.2336	114.0074	62.1427	28.0895	11.9830	6.7545	37.8824	67.8489	119.0492	156.8862	180.3185 (64)
								Total per year (kWh/year) = Sum(64)m =				1104.3057 (64)
Heat gains from water heating, kWh/month												
	89.5488	79.3173	83.0997	71.3615	65.9109	59.2758	57.4496	63.0654	67.7488	78.4214	82.5065	87.8228 (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	168.3809	168.3809	168.3809	168.3809	168.3809	168.3809	168.3809	168.3809	168.3809	168.3809	168.3809	168.3809 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	64.8601	57.6082	46.8501	35.4686	26.5132	22.3835	24.1862	31.4381	42.1962	53.5778	62.5332	66.6628 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	402.3475	406.5226	396.0014	373.6032	345.3294	318.7561	301.0034	296.8283	307.3495	329.7477	358.0215	384.5948 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.6444	54.6444	54.6444	54.6444	54.6444	54.6444	54.6444	54.6444	54.6444	54.6444	54.6444	54.6444 (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)	-112.2539	-112.2539	-112.2539	-112.2539	-112.2539	-112.2539	-112.2539	-112.2539	-112.2539	-112.2539	-112.2539	-112.2539 (71)
Water heating gains (Table 5)	120.3613	118.0317	111.6932	99.1131	88.5899	82.3275	77.2172	84.7654	94.0955	105.4051	114.5924	118.0414 (72)
Total internal gains	701.3403	695.9339	668.3161	621.9563	574.2039	537.2385	516.1782	526.8032	557.4125	602.5020	648.9184	683.0705 (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
Southeast				8.7500	36.7938		0.6300		0.7000		0.7700		98.3909 (77)
Southwest				1.1400	36.7938		0.6300		0.7000		0.7700		12.8189 (79)
Northwest				4.8900	11.2829		0.6300		0.7000		0.7700		16.8618 (81)
Solar gains	128.0716	223.7541	321.0268	422.7034	496.2232	502.6462	480.4383	424.0587	355.9973	251.3071	154.4202		108.9426 (83)
Total gains	829.4119	919.6879	989.3430	1044.6597	1070.4271	1039.8846	996.6165	950.8619	913.4098	853.8090	803.3386		792.0131 (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	40.5121	40.6238	40.7338	41.2587	41.3584	41.8290	41.8290	41.9173	41.6465	41.3584	41.1572	40.9489
alpha	3.7008	3.7083	3.7156	3.7506	3.7572	3.7886	3.7886	3.7945	3.7764	3.7572	3.7438	3.7299
util living area	0.9858	0.9779	0.9622	0.9261	0.8514	0.7124	0.5589	0.6003	0.8000	0.9352	0.9769	0.9879 (86)
MIT	19.4185	19.5971	19.8902	20.2753	20.6225	20.8699	20.9610	20.9484	20.7839	20.3455	19.8194	19.3883 (87)
Th 2	19.8542	19.8570	19.8597	19.8725	19.8749	19.8861	19.8861	19.8882	19.8818	19.8749	19.8701	19.8650 (88)
util rest of house	0.9822	0.9723	0.9522	0.9050	0.8059	0.6243	0.4333	0.4763	0.7264	0.9125	0.9700	0.9849 (89)
MIT 2	18.4368	18.6152	18.9053	19.2870	19.6080	19.8181	19.8737	19.8703	19.7547	19.3617	18.8468	18.4152 (90)

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CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Living area fraction									fLA = Living area / (4) =			0.1606 (91)
MIT	18.5945	18.7729	19.0635	19.4458	19.7710	19.9871	20.0484	20.0435	19.9201	19.5198	19.0030	18.5715 (92)
Temperature adjustment												0.0000
adjusted MIT	18.5945	18.7729	19.0635	19.4458	19.7710	19.9871	20.0484	20.0435	19.9201	19.5198	19.0030	18.5715 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9768	0.9653	0.9432	0.8952	0.8010	0.6331	0.4528	0.4949	0.7293	0.9034	0.9630	0.9801	(94)
Useful gains	810.1946	887.8087	933.1568	935.2309	857.4633	658.3432	451.2230	470.6021	666.1323	771.3517	773.6379	776.2622	(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	1992.1623	1928.0933	1741.3879	1443.1194	1101.8031	727.1350	465.4585	490.7498	789.0220	1217.6687	1632.8674	1981.5302	(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	879.3839	699.0712	601.3239	365.6797	181.7889	0.0000	0.0000	0.0000	0.0000	332.0599	618.6452	896.7194	(98)
Space heating												4574.6722	(98)
Space heating per m2												42.1124	(99)
										(98) / (4) =			

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													5038.1852 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	879.3839	699.0712	601.3239	365.6797	181.7889	0.0000	0.0000	0.0000	0.0000	332.0599	618.6452	896.7194	(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)	968.4845	769.9022	662.2510	402.7310	200.2080	0.0000	0.0000	0.0000	0.0000	365.7047	681.3274	987.5764	(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	181.1097	138.2336	114.0074	62.1427	28.0895	11.9830	6.7545	37.8824	67.8489	119.0492	156.8862	180.3185	(64)
Efficiency of water heater (217)m	88.7748	88.8407	88.9072	89.0717	89.2052	80.1000	80.1000	80.1000	80.1000	87.7080	88.4109	88.8137	(216)
Fuel for water heating, kWh/month	204.0103	155.5971	128.2319	69.7670	31.4886	14.9601	8.4326	47.2939	84.7052	135.7335	177.4513	203.0301	(219)
Water heating fuel used												1260.7017	(219)
Annual totals kWh/year													
Space heating fuel - main system												5038.1852	(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)												458.1801	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.28 * 1004 * 1.00) =										-1028.0921		-1028.0921	(233)
Total delivered energy for all uses												5853.9749	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	5038.1852	3.4800	175.3288	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1260.7017	3.4800	43.8724	(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	458.1801	13.1900	60.4340	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-1028.0921	13.1900	-135.6053	(252)
Total energy cost			280.5174	(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] =	0.7669 (257)
SAP value		89.3019
SAP rating (Section 12)		89 (258)

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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	5038.1852	0.2160	1088.2480 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1260.7017	0.2160	272.3116 (264)
Space and water heating			1360.5596 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	458.1801	0.5190	237.7955 (268)
Energy saving/generation technologies			
PV Unit	-1028.0921	0.5190	-533.5798 (269)
Total kg/year			1129.6502 (272)
CO2 emissions per m2			10.4000 (273)
EI value			90.1469
EI rating			90 (274)
EI band			B

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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	44.2000 (1b)	x 2.6800 (2b)	= 118.4560 (1b) - (3b)
First floor	64.4300 (1c)	x 2.3500 (2c)	= 151.4105 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	108.6300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 269.8665 (5)

2. Ventilation rate

	main heating	+	secondary heating	+	other	=	total	m3 per hour				
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000 (6a)				
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000 (6b)				
Number of intermittent fans							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) =	0.1853 (8)				
Pressure test							Yes					
Measured/design AP50								4.9800				
Infiltration rate								0.4343 (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) =	0.3691 (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	0.3876	0.3599	0.3691	0.3507	0.3507	0.3415	0.3322	0.3230	0.3138	0.3415	0.3230	0.3415 (22b)
Effective ac	0.5751	0.5648	0.5681	0.5615	0.5615	0.5583	0.5552	0.5522	0.5492	0.5583	0.5522	0.5583 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K						
Front Door			2.1200	1.1000	2.3320			(26a)					
Windows (Uw = 1.20)			14.7800	1.1450	16.9237			(27)					
Personnel Door			1.7700	1.8000	3.1860			(26)					
Ground Floor			44.2000	0.1200	5.3040	140.0000	6188.0000	(28a)					
Exposed over Garage			20.2300	0.1215	2.4574	22.4400	453.9612	(28b)					
Brick and Block	144.5100	16.9000	127.6100	0.2400	30.6264	42.2200	5387.6942	(29a)					
Wall to Garage	16.1500	1.7700	14.3800	0.1966	2.8277	58.0600	834.9028	(29a)					
Pitched Roof	61.5400		61.5400	0.1000	6.1540	9.0000	553.8600	(30)					
Sloping Ceiling	3.2800		3.2800	0.1700	0.5576	9.0000	29.5200	(30)					
Total net area of external elements Aum(A, m2)			289.9100					(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	70.3687			(33)					
Ground Floor Block			48.7500			75.0000	3656.2500	(32c)					
Ground Floor Stud			26.2800			9.0000	236.5200	(32c)					
First Floor Stud			154.6100			9.0000	1391.4900	(32c)					
Internal Floor 1			44.3200			18.0000	797.7600	(32d)					
Internal Ceiling 1			44.2000			18.0000	795.6000	(32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	20325.5582	(34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							187.1081	(35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							14.6053	(36)					
Total fabric heat loss						(33) + (36) =	84.9741	(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 51.2173	Feb 50.2958	Mar 50.5954	Apr 50.0038	May 50.0038	Jun 49.7194	Jul 49.4426	Aug 49.1733	Sep 48.9117	Oct 49.7194	Nov 49.1733	Dec 49.7194	(38)
Heat transfer coeff	136.1914	135.2699	135.5695	134.9779	134.9779	134.6935	134.4167	134.1474	133.8858	134.6935	134.1474	134.6935	(39)
Average = Sum(39)m / 12 =												134.8053	(39)
HLP	Jan 1.2537	Feb 1.2452	Mar 1.2480	Apr 1.2425	May 1.2425	Jun 1.2399	Jul 1.2374	Aug 1.2349	Sep 1.2325	Oct 1.2399	Nov 1.2349	Dec 1.2399	(40)
HLP (average)												1.2410	(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												2.8063 (42)
Average daily hot water use (litres/day)												100.8508 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

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

Daily hot water use												
	110.9358	106.9018	102.8678	98.8337	94.7997	90.7657	90.7657	94.7997	98.8337	102.8678	106.9018	110.9358 (44)
Energy conte	164.5146	143.8855	148.4770	129.4458	124.2064	107.1807	99.3186	113.9696	115.3307	134.4069	146.7156	159.3236 (45)
Energy content (annual)												
Distribution loss (46)m = 0.15 x (45)m												
	24.6772	21.5828	22.2715	19.4169	18.6310	16.0771	14.8978	17.0954	17.2996	20.1610	22.0073	23.8985 (46)
Water storage loss:												
Store volume												
a) If manufacturer declared loss factor is known (kWh/day):												
Temperature factor from Table 2b												
Enter (49) or (54) in (55)												
Total storage loss												
	32.4756	29.3328	32.4756	31.4280	32.4756	31.4280	32.4756	32.4756	31.4280	32.4756	31.4280	32.4756 (56)
If cylinder contains dedicated solar storage												
	20.2973	18.3330	20.2973	19.6425	20.2973	19.6425	20.2973	20.2973	19.6425	20.2973	19.6425	20.2973 (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												
	208.0743	183.2297	190.6409	164.8467	154.9717	136.7284	129.8513	145.4328	152.0824	176.5708	188.8701	202.8833 (62)
Aperture area of solar collector												
Zero-loss collector efficiency												
Collector heat loss coefficient												
Collector 2nd order heat loss coefficient												
Collector effective heat loss coefficient												
Collector performance ratio												
Annual solar radiation per m2												
Overshading factor												
Solar energy available												
Adjustment factor for showers												
Solar-to-load ratio												
Utilisation factor												
Collector performance factor												
Dedicated solar storage volume												
Effective solar volume												
Daily hot water demand												
Volume ratio Veff/V												
Solar storage volume factor												
Solar input												
Solar input	-31.5797	-44.9043	-77.1797	-104.1333	-122.3108	-130.6473	-127.8997	-114.4741	-89.6253	-61.9639	-37.3504	-25.9677 (63)
Solar input (sum of months) = Sum(63)m =												
Output from w/h												
	176.4946	138.3255	113.4612	60.7135	32.6609	6.0812	1.9516	30.9587	62.4570	114.6069	151.5197	176.9156 (64)
Total per year (kWh/year) = Sum(64)m =												
Heat gains from water heating, kWh/month												
	89.5488	79.3173	83.0997	71.3615	65.9109	59.2758	57.4496	63.0654	67.7488	78.4214	82.5065	87.8228 (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	168.3809	168.3809	168.3809	168.3809	168.3809	168.3809	168.3809	168.3809	168.3809	168.3809	168.3809	168.3809 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	64.8601	57.6082	46.8501	35.4686	26.5132	22.3835	24.1862	31.4381	42.1962	53.5778	62.5332	66.6628 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	402.3475	406.5226	396.0014	373.6032	345.3294	318.7561	301.0034	296.8283	307.3495	329.7477	358.0215	384.5948 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	54.6444	54.6444	54.6444	54.6444	54.6444	54.6444	54.6444	54.6444	54.6444	54.6444	54.6444	54.6444 (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)												
	-112.2539	-112.2539	-112.2539	-112.2539	-112.2539	-112.2539	-112.2539	-112.2539	-112.2539	-112.2539	-112.2539	-112.2539 (71)
Water heating gains (Table 5)												
	120.3613	118.0317	111.6932	99.1131	88.5899	82.3275	77.2172	84.7654	94.0955	105.4051	114.5924	118.0414 (72)
Total internal gains												
	701.3403	695.9339	668.3161	621.9563	574.2039	537.2385	516.1782	526.8032	557.4125	602.5020	648.9184	683.0705 (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		
Southeast				8.7500	45.1778		0.6300	0.7000	0.7700	120.8106 (77)		
Southwest				1.1400	45.1778		0.6300	0.7000	0.7700	15.7399 (79)		
Northwest				4.8900	14.6176		0.6300	0.7000	0.7700	21.8453 (81)		
Solar gains	158.3959	235.9936	342.9874	457.5820	513.1576	565.7239	536.0640	482.9606	402.8099	286.4052	190.4483	132.4023 (83)
Total gains	859.7362	931.9275	1011.3035	1079.5383	1087.3614	1102.9624	1052.2422	1009.7638	960.2224	888.9072	839.3667	815.4727 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	41.4563	41.7387	41.6465	41.8290	41.8290	41.9173	42.0036	42.0879	42.1702	41.9173	42.0879	41.9173
alpha	3.7638	3.7826	3.7764	3.7886	3.7886	3.7945	3.8002	3.8059	3.8113	3.7945	3.8059	3.7945
util living area	0.9819	0.9746	0.9544	0.9067	0.8119	0.6311	0.4799	0.4968	0.7380	0.9096	0.9677	0.9843 (86)
MIT	19.5782	19.7161	20.0153	20.3939	20.7204	20.9243	20.9796	20.9772	20.8572	20.4876	19.9994	19.5697 (87)
Th 2	19.8773	19.8840	19.8818	19.8861	19.8861	19.8882	19.8902	19.8922	19.8941	19.8882	19.8922	19.8882 (88)
util rest of house	0.9772	0.9682	0.9423	0.8803	0.7555	0.5311	0.3518	0.3655	0.6501	0.8778	0.9579	0.9802 (89)
MIT 2	18.6125	18.7532	19.0442	19.4088	19.7007	19.8542	19.8851	19.8864	19.8187	19.5043	19.0403	18.6128 (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) =			0.1606 (91)
MIT	18.7676	18.9079	19.2002	19.5671	19.8645	20.0261	20.0609	20.0616	19.9856	19.6623	19.1943	18.7665 (92)
Temperature adjustment												0.0000
adjusted MIT	18.7676	18.9079	19.2002	19.5671	19.8645	20.0261	20.0609	20.0616	19.9856	19.6623	19.1943	18.7665 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9711	0.9609	0.9330	0.8713	0.7543	0.5445	0.3723	0.3865	0.6583	0.8699	0.9500	0.9747	(94)
Useful gains	834.9313	895.4709	943.5300	940.5607	820.1889	600.5498	391.7883	390.2936	632.0972	773.2764	797.3610	794.8388	(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	1888.6531	1840.7394	1653.9722	1358.8313	994.0458	636.5701	397.9971	397.2941	707.6603	1112.8725	1515.1064	1854.2588	(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	783.9690	635.2204	528.5690	301.1548	129.3495	0.0000	0.0000	0.0000	0.0000	252.6595	516.7766	788.2085	(98)
Space heating												3935.9075	(98)
Space heating per m2										(98) / (4) =		36.2322	(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													4334.6999 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	783.9690	635.2204	528.5690	301.1548	129.3495	0.0000	0.0000	0.0000	0.0000	252.6595	516.7766	788.2085	(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)	863.4020	699.5820	582.1245	331.6683	142.4554	0.0000	0.0000	0.0000	0.0000	278.2593	569.1373	868.0711	(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	176.4946	138.3255	113.4612	60.7135	32.6609	6.0812	1.9516	30.9587	62.4570	114.6069	151.5197	176.9156	(64)
Efficiency of water heater (217)m	88.6245	88.6816	88.7059	88.8096	88.4189	80.1000	80.1000	80.1000	80.1000	87.1665	88.1308	88.6297	(216)
Fuel for water heating, kWh/month	199.1487	155.9798	127.9072	68.3636	36.9388	7.5920	2.4365	38.6500	77.9738	131.4805	171.9259	199.6120	(219)
Water heating fuel used												1218.0088	(219)
Annual totals kWh/year													
Space heating fuel - main system												4334.6999	(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)												458.1801	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.28 * 1122 * 1.00) =									-1148.8467			-1148.8467	(233)
Total delivered energy for all uses												4987.0420	(238)

10a. Fuel costs - using BEDF prices (524)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4334.6999	10.2300	443.4398	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1218.0088	10.2300	124.6023	(247)
Pumps and fans for heating	75.0000	36.7200	27.5400	(249)
Pump for solar water heating	50.0000	36.7200	18.3600	(249)
Energy for lighting	458.1801	36.7200	168.2437	(250)
Additional standing charges			103.0000	(251)
Energy saving/generation technologies				
PV Unit	-1148.8467	36.7200	-421.8565	(252)
Total energy cost			463.3293	(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	4334.6999	0.2160	936.2952	(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)	1218.0088	0.2160	263.0899 (264)
Space and water heating			1199.3851 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	458.1801	0.5190	237.7955 (268)
Energy saving/generation technologies			
PV Unit	-1148.8467	0.5190	-596.2515 (269)
Total kg/year			905.8041 (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	4334.6999	1.2200	5288.3338 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1218.0088	1.2200	1485.9707 (264)
Space and water heating			6774.3046 (265)
Pumps and fans	125.0000	3.0700	383.7500 (267)
Energy for lighting	458.1801	3.0700	1406.6128 (268)
Energy saving/generation technologies			
PV Unit	-1148.8467	3.0700	-3526.9594 (269)
Primary energy kWh/year			5037.7079 (272)
Primary energy kWh/m2/year			46.3749 (273)

U-VALUE CALCULATOR REPORT

Property Reference	SAP 0645 Plot 26	Issued on Date	14/08/2023
Assessment Reference	As Built	Prop Type Ref	A
Project	24, Fieldfare Crescent, Botley, SO32 2TW		
Calculation Type	New Build (As Built)		

SAP Rating	88 B	DER	14.52	TER	18.48
Environmental	88 B	% DER<TER	21.42		
CO ₂ Emissions (t/year)	1.17	DFEE	52.67	TFEE	61.55
General Requirements Compliance	Pass	% DFEE<TFEE	14.43		

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 (%)
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
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: n/a

U-VALUE CALCULATOR REPORT

Property Reference	SAP 0645 Plot 26	Issued on Date	14/08/2023
Assessment Reference	As Built	Prop Type Ref	A
Project	24, Fieldfare Crescent, Botley, SO32 2TW		
Calculation Type	New Build (As Built)		

SAP Rating	88 B	DER	14.52	TER	18.48
Environmental	88 B	% DER<TER	21.42		
CO ₂ Emissions (t/year)	1.17	DFEE	52.67	TFEE	61.55
General Requirements Compliance	Pass	% DFEE<TFEE	14.43		

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 (%)
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				
	Main construction	45	0.0220	2.0455	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
Int surface				0.1000	

Total resistance:	Upper limit = 6.229 m ² K/W	Lower limit = 5.367 m ² K/W	Average = 5.798 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: 264 mm

U-value: 0.17 W/m² K

Kappa: n/a

U-VALUE CALCULATOR REPORT

Property Reference	SAP 0645 Plot 26	Issued on Date	14/08/2023
Assessment Reference	As Built	Prop Type Ref	A
Project	24, Fieldfare Crescent, Botley, SO32 2TW		
Calculation Type	New Build (As Built)		

SAP Rating	88 B	DER	14.52	TER	18.48
Environmental	88 B	% DER<TER	21.42		
CO ₂ Emissions (t/year)	1.17	DFEE	52.67	TFEE	61.55
General Requirements Compliance	Pass	% DFEE<TFEE	14.43		

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 000006

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 0645 Plot 26	Issued on Date	14/08/2023
Assessment Reference	As Built	Prop Type Ref	A
Project	24, Fieldfare Crescent, Botley, SO32 2TW		
Calculation Type	New Build (As Built)		

SAP Rating	88 B	DER	14.52	TER	18.48
Environmental	88 B	% DER<TER	21.42		
CO ₂ Emissions (t/year)	1.17	DFEE	52.67	TFEE	61.55
General Requirements Compliance	Pass	% DFEE<TFEE	14.43		

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 000007

Wall Type: Standard Wall

Layer	Description	Thickness (mm)	Conductivity (W/m ² K)	Resistance (m ² K/W)	Fraction (%)	Density (kg/m ³)	Heat Cap. (J/kgK)
Ext surface				0.0400			
Layer 1	Plasterboard, standard						
	Main construction	12.5	0.2100	0.0595	100.00		
Layer 2	airspace/plaster dabs						
	Main construction	15	0.0882	0.1700	80.00		
	Main construction	15	0.0882	0.1700	20.00		
	Corrections - Cavity Unventilated, Emissivity: Normal						
Layer 3	Supabloc *7						
	Main construction	100	0.1900	0.5263	94.04		
	Main construction	100	0.8803	0.1136	5.96		
	Corrections - Air Gap: Level 1, Fasteners: None or plastic						
Layer 4	Supafil 34						
	Main construction	100	0.0340	2.9412	100.00		
	Corrections - Air Gap: Level 0, Fasteners: None or plastic						
Layer 5	Supabloc *7						
	Main construction	100	0.1900	0.5263	94.04	680	1000
	Main construction	100	0.8803	0.1136	5.96	680	1000
	Corrections - Air Gap: Level 1, Fasteners: None or plastic						
Layer 6	airspace/plaster dabs						
	Main construction	15	0.0882	0.1700	80.00		
	Main construction	15	0.0882	0.1700	20.00		
	Corrections - Cavity Unventilated, Emissivity: Normal						
Layer 7	Plasterboard, standard						
	Main construction	12.5	0.2100	0.0595	100.00	700	1000
Int surface				0.1300			

Total resistance:	Upper limit = 4.569 m ² K/W	Lower limit = 4.435 m ² K/W	Average = 4.502 m ² K/W
	Total correction = 0.0002 m ² K/W	U-value (unrounded) = 0.22 W/m ² K	

U-VALUE CALCULATOR REPORT

Unheated space: None

Total thickness: 355 mm

U-value: 0.22 W/m² K

Kappa: 58.06 kJ/m² K

U-VALUE CALCULATOR REPORT

Property Reference	SAP 0645 Plot 26	Issued on Date	14/08/2023
Assessment Reference	As Built	Prop Type Ref	A
Project	24, Fieldfare Crescent, Botley, SO32 2TW		
Calculation Type	New Build (As Built)		

SAP Rating	88 B	DER	14.52	TER	18.48
Environmental	88 B	% DER<TER	21.42		
CO ₂ Emissions (t/year)	1.17	DFEE	52.67	TFEE	61.55
General Requirements Compliance	Pass	% DFEE<TFEE	14.43		

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 000008 - Floor - suspended beam-and-block floor

Floor Type: Suspended Floor

Area = 44.20 m², Perimeter = 27.75 m, Wall thickness = 300.00 mm, Soil: Clay

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

Floor height above ground: h = 0.000 m

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

Ventilation openings per perimeter length: e = 0.0015 %

Mean wind speed: v = 5.000 m/s

Resistance on solum: R_g = 0.000 m²K/W

Layer	Description	Thickness (mm)	Conductivity (W/m ² K)	Resistance (m ² K/W)	Fraction (%)	Density (kg/m ³)	Heat Cap. (J/kgK)
Ext surface				0.1700			
Layer 1	Extruded polystyrene						
	Main construction	100	0.0270	3.7037	100.00		
	Corrections - Air Gap: Level 1, Fasteners: None or plastic						
Layer 2	Extruded polystyrene						
	Main construction	200	0.0270	7.4074	91.67		
	Main construction	200	2.3000	0.0870	8.33		
	Corrections - Air Gap: Level 1, Fasteners: None or plastic						
Layer 3	Concrete, reinforced (1% steel)						
	Main construction	75	2.3000	0.0326	100.00	2000	1000
Layer 4	Screed						
	Main construction	75	1.1500	0.0652	100.00	1200	1000
Int surface				0.1700			

Total resistance: Upper limit = 10.093 m² K/W Lower limit = 5.066 m² K/W Average = 7.579 m² K/W

Total correction = 0.0025 m² K/W

U-value (unrounded) = 0.12 W/m² K

Unheated space: None

Total thickness: 450 mm

U-value: 0.12 W/m² K

Kappa: 140.00 kJ/m² K

U-VALUE CALCULATOR REPORT

Property Reference	SAP 0645 Plot 26	Issued on Date	14/08/2023
Assessment Reference	As Built	Prop Type Ref	A
Project	24, Fieldfare Crescent, Botley, SO32 2TW		
Calculation Type	New Build (As Built)		

SAP Rating	88 B	DER	14.52	TER	18.48
Environmental	88 B	% DER<TER	21.42		
CO ₂ Emissions (t/year)	1.17	DFEE	52.67	TFEE	61.55
General Requirements Compliance	Pass	% DFEE<TFEE	14.43		

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 000009 - New exposed above Garage

Floor Type: Exposed Floor

Layer	Description	Thickness (mm)	Conductivity (W/m ² K)	Resistance (m ² K/W)	Fraction (%)	Density (kg/m ³)	Heat Cap. (J/kgK)
Ext surface				0.0400			
Layer 1	Plasterboard, high density						
	Main construction	12.5	0.2500	0.0500	100.00		
Layer 2	Celotex GA4000						
	Main construction	50	0.0220	2.2727	100.00	30	1400
	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	253	0.0380	6.6579	87.50		
	Main construction	253	0.1300	1.9462	12.50		
	Corrections - Air Gap: Level 1, Fasteners: None or plastic						
Layer 5	Chipboard						
	Main construction	22	0.1300	0.1692	100.00	600	1700
Int surface				0.1700			

Total resistance:	Upper limit = 8.307 m ² K/W	Lower limit = 7.813 m ² K/W	Average = 8.060 m ² K/W
	Total correction = 0.0048 m ² K/W	U-value (unrounded) = 0.13 W/m ² K	

Unheated space: None

Total thickness: 338 mm

U-value: 0.13 W/m² K

Kappa: 22.44 kJ/m² K

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

Property Reference	SAP 0645 Plot 26			Issued on Date	14/08/2023
Assessment Reference	As Built	Prop Type Ref	A		
Property	24, Fieldfare Crescent, Botley, SO32 2TW				
SAP Rating	88 B	DER	14.52	TER	18.48
Environmental	88 B	% DER<TER	21.42		
CO ₂ Emissions (t/year)	1.17	DFEE	52.67	TFEE	61.55
General Requirements Compliance	Pass	% DFEE<TFEE	14.43		
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 West					
Property Tenure	Unknown					
Transaction Type	New dwelling					
Terrain Type	Suburban					
1.0 Property Type	House, Detached					
2.0 Number of Storeys	2					
3.0 Date Built	2019					
4.0 Sheltered Sides	2					
5.0 Sunlight/Shade	Average or unknown					
6.0 Measurements						
		Ground Floor:	Heat Loss Perimeter	Internal Floor Area	Average Storey Height	
			27.75 m	44.20 m²	2.68 m	
		1st Storey:	34.54 m	64.43 m²	2.35 m	
7.0 Living Area	17.45			m²		
8.0 Thermal Mass Parameter						
Thermal Mass		Precise calculation				
		187.11			kJ/m²K	
9.0 External Walls						
Description	Type	Construction		U-Value (W/m²K)	Kappa (kJ/m²K)	Gross Area (m²) Nett Area (m²)
Brick and Block	Cavity Wall	Other		0.24	42.22	144.51 127.61
Wall to Garage	Cavity Wall	Other		0.22	58.06	16.15 14.38
9.2 Internal Walls						
Description	Construction				Kappa (kJ/m²K)	Area (m²)
Ground Floor Block	Dense block, plasterboard on dabs				75.00	48.75
Ground Floor Stud	Plasterboard on timber frame				9.00	26.28
First Floor Stud	Plasterboard on timber frame				9.00	154.61
10.0 External Roofs						
Description	Type	Construction		U-Value (W/m²K)	Kappa (kJ/m²K)	Gross Area (m²) Nett Area (m²)
Pitched Roof	External Plane Roof	Plasterboard, insulated at ceiling level		0.10	9.00	61.54 61.54
Sloping Ceiling	External Slope Roof	Plasterboard, insulated slope		0.17	9.00	3.28 3.28
10.2 Internal Ceilings						

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

Description	Construction	Kappa (kJ/m²K)	Area (m²)
Internal Ceiling 1	Plasterboard ceiling, carpeted chipboard floor	9.00	44.20

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	140.00	44.20
Exposed over Garage	Exposed Floor - Timber	Other	0.13	22.44	20.23

11.2 Internal Floors

Description	Construction	Kappa (kJ/m²K)	Area (m²)
Internal Floor 1	Plasterboard ceiling, carpeted chipboard floor	18.00	44.32

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	Half Glazed Door	Double Low-E Soft 0.1			0.63		0.70	1.10
Windows	Manufacturer	Window	Double Low-E Soft 0.1			0.63		0.70	1.20
Personnel Door	Manufacturer	Solid Door							1.80

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
Front Elevation	Half Glazed Door	[1] Brick and Block	North West							2.12	
Front Elevation	Window	[1] Brick and Block	North West	None	0.71	Yes				0.66	
Front Elevation	Window	[1] Brick and Block	North West	None	0.00					4.23	
Side Elevation	Window	[1] Brick and Block	South West	None	0.00					1.14	
Rear Elevation	Window	[1] Brick and Block	South East	None	0.00					8.75	
North Elevation	Solid Door	[2] Wall to Garage	North East							1.77	

14.0 Conservatory

15.0 Draught Proofing

%

16.0 Draught Lobby

17.0 Thermal Bridging

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)	1.26	0.077	No	Birtley Supatherm
Independently assessed	E2 Other lintels (including other steel lintels)	0.84	0.070	No	Birtley Supatherm
Independently assessed	E2 Other lintels (including other steel lintels)	1.01	0.071	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)	0.92	0.071	No	Birtley Supatherm
Independently assessed	E2 Other lintels (including other steel lintels)	4.80	0.067	No	Birtley Supatherm
Independently assessed	E2 Other lintels (including other steel lintels)	1.51	0.067	No	Birtley Supatherm
Independently assessed	E3 Sill	10.62	0.021	No	Knauf P5
Independently assessed	E4 Jamb	36.45	0.016	No	Knauf P6
Independently assessed	E5 Ground floor (normal)	27.75	0.062	No	BE-E5-23902
Table K1 - Default	E20 Exposed floor (normal)	12.69	0.320	No	
Table K1 - Default	E21 Exposed floor (inverted)	6.04	0.320	No	
Independently assessed	E6 Intermediate floor within a dwelling	21.73	0.000	No	
Independently assessed	E10 Eaves (insulation at ceiling level)	23.72	0.120	No	
Table K1 - Approved	E11 Eaves (insulation at rafter level)	2.00	0.040	No	
Independently assessed	E12 Gable (insulation at ceiling level)	10.59	0.054	No	
Table K1 - Approved	E13 Gable (insulation at rafter level)	3.40	0.040	No	
Independently assessed	E16 Corner (normal)	23.20	0.050	No	
Independently assessed	E17 Corner (inverted – internal area greater than external area)	1.54	-0.065	No	
Table K1 - Default	R6 Flat ceiling	3.02	0.060	No	
Table K1 - Default	R7 Flat ceiling (inverted)	0.92	0.040	No	
Table K1 - Default	R8 Roof to wall (rafter)	2.70	0.060	No	
Table K1 - Default	R9 Roof to wall (flat ceiling)	0.92	0.040	No	

Y-value	0.050	W/m ² K
18.0 Pressure Testing	Yes	
Designed AP ₅₀	5.00	m ³ /(h.m ²) @ 50 Pa
Property Tested ?	Yes	
As Built AP ₅₀	4.98	m ³ /(h.m ²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

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

Mechanical Ventilation

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

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				5
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No
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22.0 Lighting

Internal

Total number of light fittings	24	
Total number of L.E.L. fittings	24	
Percentage of L.E.L. fittings	100.00	%

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

External		
External lights fitted	Yes	
Light and motion sensor	Yes	
23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Description	Combi Boiler	
Percentage of Heat	100	%
Database Ref. No.	18913	
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	1.94	kWh/day
Pipes insulation	Fully insulated primary pipework	

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

31.0 Thermal Store

None

32.0 Photovoltaic Unit

One Dwelling

PV Cells kWp

1.28

Orientation

South East

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	£121	B 89	