



SAP Report Submission for Building Regulations Compliance

Client: Foreman Homes

Project: 10, Fieldfare Crescent
Botley, Southampton, SO32 2TW

Contact: Tobias Whiting
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Report Issue Date: 05/05/2023

EXCELLENCE
IN ENERGY
ASSESSMENT

BUILDING REGULATION COMPLIANCE

Calculation Type: New Build (As Built)

Property Reference	SAP 0645 Plot 36	Issued on Date	05/05/2023
Assessment Reference	As Built	Prop Type Ref	ZI
Property	10, Fieldfare Crescent, Botley, Southampton, SO32 2TW		
SAP Rating	89 B	DER	11.98
Environmental	89 B	TER	15.63
CO ₂ Emissions (t/year)	1.53	% DER<TER	23.36
General Requirements Compliance	Pass	DfEE	47.96
		TfEE	58.14
		% DfEE<TfEE	17.51
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)	15.63	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	11.98	kgCO ₂ /m ²	Pass
	-3.65 (-23.4%)	kgCO ₂ /m ²	

1b TfEE and DfEE

Target Fabric Energy Efficiency (TfEE)	58.14	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DfEE)	47.96	kWh/m ² /yr	
	-10.1 (-17.4%)	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	0.11 (max. 0.25)	0.11 (max. 0.70)	Pass
Roof	0.10 (max. 0.20)	0.10 (max. 0.35)	Pass
Openings	1.19 (max. 2.00)	1.20 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.43 (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 2.34

Pass

Primary pipework insulated

Yes

Pass

6 Controls

Space heating controls

Time and temperature zone control

Pass

Hot water controls

Cylinderstat

Pass

Independent timer for DHW

Pass

Boiler interlock

Yes

Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings

100 %

Minimum

75 %

Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)

Slight

Pass

Based on:

Overshading

Average

Windows facing North East

3.84 m², No overhang

Windows facing South East

11.56 m², Overhang twice as wide as window, ratio 0.54

Windows facing South West

1.33 m², No overhang

Windows facing North West

21.39 m², No overhang

Air change rate

4.00 ach

Blinds/curtains

None

Criterion 4 – Building performance consistent with DER and DFEE rate

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals

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

Maximum

10.0 m³/(h.m²) @ 50 Pa

Pass

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BUILDING REGULATION COMPLIANCE

Calculation Type: New Build (As Built)

10 Key features

Roof U-value	0.10	W/m ² K
Floor U-value	0.11	W/m ² K
Door U-value	1.10	W/m ² K
Thermal bridging ψ -value	0.037	W/m ² K
Photovoltaic array	1.32	kW

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THERMAL BRIDGING

Calculation Type: New Build (As Built)

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SAP Rating	89 B	DER	11.98
Environmental	89 B	TER	15.63
CO ₂ Emissions (t/year)	1.53	% DER<TER	23.36
General Requirements Compliance	Pass	DFEE	47.96
		TFEE	58.14
		% DFEE<TFEE	17.51
Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 07798936079, toby@abacusenergyuk.com		Assessor ID
			E477-0001
Client	Foreman Homes, FORE		

	Junction detail	Source Type	Psi (W/mK)	Length (m)	Result	Reference
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.274	27.62	7.57	Knauf P3
External wall	E3 Sill	Independently assessed	0.021	17.68	0.37	Knauf P5
External wall	E4 Jamb	Independently assessed	0.016	58.20	0.93	Knauf P6
External wall	E5 Ground floor (normal)	Independently assessed	0.062	40.03	2.48	BE-E5-23902
External wall	E6 Intermediate floor within a dwelling	Independently assessed	0.000	40.03	0.00	CD0029
External wall	E10 Eaves (insulation at ceiling level)	Table K1 - Approved	0.060	23.42	1.41	
External wall	E12 Gable (insulation at ceiling level)	Independently assessed	0.044	16.61	0.73	Knauf P21
External wall	E16 Corner (normal)	Independently assessed	0.039	30.30	1.18	Knauf P23
External wall	E17 Corner (inverted – internal area greater than external area)	Independently assessed	-0.091	10.10	-0.92	Knauf P24

Total: **13.75** W/mK:
Y-Value: **0.037** W/m²K:

FULL SAP CALCULATION PRINTOUT

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Environmental	89 B	% DER<TER	23.36		
CO ₂ Emissions (t/year)	1.53	DFEE	47.96	TFEE	58.14
General Requirements Compliance	Pass	% DFEE<TFEE	17.51		
Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 07798936079, toby@abacusenergyuk.com			Assessor ID	E477-0001
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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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DWELLING AS BUILT

Detached House, total floor area 166 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) 15.63 kgCO₂/m²

Dwelling Carbon Dioxide Emission Rate (DER) 11.98 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)58.1 kWh/m²/yr

Dwelling Fabric Energy Efficiency (DFEE)48.0 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.24 (max. 0.30)	0.24 (max. 0.70)	OK
Floor	0.11 (max. 0.25)	0.11 (max. 0.70)	OK
Roof	0.10 (max. 0.20)	0.10 (max. 0.35)	OK
Openings	1.19 (max. 2.00)	1.20 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals:	4.43 (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 2.34 OK

Primary pipework insulated: Yes OK

6 Controls

Space heating controls: Time and temperature zone control OK

Hot water controls:

Cylinderstat OK

Independent timer for DHW OK

Boiler interlock

Yes OK

7 Low energy lights

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

Minimum 75% OK

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Southern England): Slight OK

Based on:

Overshading:	Average
Windows facing North East:	3.84 m ² , No overhang
Windows facing South East:	11.56 m ² , Overhang twice as wide as window, ratio 0.54
Windows facing South West:	1.33 m ² , No overhang
Windows facing North West:	21.39 m ² , No overhang
Air change rate:	4.00 ach
Blinds/curtains:	None

10 Key features

Roof U-value	0.10 W/m ² K
Floor U-value	0.11 W/m ² K
Door U-value	1.10 W/m ² K
Thermal bridging y-value	0.037 W/m ² K
Photovoltaic array	1.32 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	82.9600 (1b)	x 2.3900 (2b)	= 198.2744 (1b) - (3b)
First floor	82.9600 (1c)	x 2.6700 (2c)	= 221.5032 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	165.9200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 419.7776 (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					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) = 0.1191 (8)
Pressure test					Yes
Measured/design AP50					4.4300
Infiltration rate					0.3406 (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) =	0.2895 (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	0.3691	0.3619	0.3547	0.3185	0.3112	0.2750	0.2750	0.2678	0.2895	0.3112	0.3257	0.3402 (22b)
Effective ac	0.5681	0.5655	0.5629	0.5507	0.5484	0.5378	0.5378	0.5359	0.5419	0.5484	0.5530	0.5579 (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)			38.1200	1.1450	43.6489		(27)
Ground Floor			82.9600	0.1100	9.1256	140.0000	11614.4000 (28a)
Brick and Block	181.6200	38.3200	143.3000	0.2400	34.3920	42.2200	6050.1260 (29a)
Clad	20.9300	1.9200	19.0100	0.2400	4.5624	42.2200	802.6022 (29a)
Pitched Roof	82.9600		82.9600	0.1000	8.2960	9.0000	746.6400 (30)
Total net area of external elements Aum(A, m ²)			368.4700				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	102.3569		(33)
Ground Floor Block			47.5100			75.0000	3563.2500 (32c)
Ground Floor Stud			61.8700			9.0000	556.8300 (32c)
First Floor Stud			197.8800			9.0000	1780.9200 (32c)
Internal Floor 1			82.9600			18.0000	1493.2800 (32d)
Internal Ceiling 1			82.9600			18.0000	1493.2800 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 28101.3282 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 169.3667 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 13.7509 (36)
Total fabric heat loss (33) + (36) = 116.1077 (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	78.7013	78.3348	77.9755	76.2882	75.9726	74.5030	74.5030	74.2308	75.0690	75.9726	76.6112	77.2789 (38)
Heat transfer coeff	194.8090	194.4425	194.0833	192.3960	192.0803	190.6107	190.6107	190.3386	191.1768	192.0803	192.7189	193.3866 (39)
Average = Sum(39)m / 12 =												192.3945 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1741	1.1719	1.1697	1.1596	1.1577	1.1488	1.1488	1.1472	1.1522	1.1577	1.1615	1.1655 (40)
HLP (average)												1.1596 (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 2.9571 (42)
Average daily hot water use (litres/day) 104.4305 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	114.8735	110.6963	106.5191	102.3419	98.1647	93.9874	93.9874	98.1647	102.3419	106.5191	110.6963	114.8735 (44)
Energy conte	170.3541	148.9928	153.7472	134.0406	128.6151	110.9851	102.8440	118.0150	119.4244	139.1777	151.9233	164.9789 (45)

FULL SAP CALCULATION PRINTOUT

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Energy content (annual)												Total = Sum(45)m = 1643.0981 (45)
Distribution loss (46)m = 0.15 x (45)m												
	25.5531	22.3489	23.0621	20.1061	19.2923	16.6478	15.4266	17.7022	17.9137	20.8767	22.7885	24.7468 (46)
Water storage loss:												
Store volume												216.0000 (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												
	226.0921	199.3368	209.4852	187.9806	184.3531	164.9251	158.5820	173.7530	173.3644	194.9157	205.8633	220.7169 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h												
	226.0921	199.3368	209.4852	187.9806	184.3531	164.9251	158.5820	173.7530	173.3644	194.9157	205.8633	220.7169 (64)
Heat gains from water heating, kWh/month												
	101.2331	89.8153	95.7114	87.7205	87.3549	80.0545	78.7860	83.8304	82.8606	90.8670	93.6665	99.4459 (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	147.8536	147.8536	147.8536	147.8536	147.8536	147.8536	147.8536	147.8536	147.8536	147.8536	147.8536	147.8536 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	30.0763	26.7135	21.7249	16.4472	12.2944	10.3795	11.2154	14.5782	19.5668	24.8446	28.9973	30.9123 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	337.3651	340.8659	332.0440	313.2632	289.5559	267.2743	252.3889	248.8881	257.7100	276.4907	300.1981	322.4796 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	37.7854	37.7854	37.7854	37.7854	37.7854	37.7854	37.7854	37.7854	37.7854	37.7854	37.7854	37.7854 (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)												
	-118.2829	-118.2829	-118.2829	-118.2829	-118.2829	-118.2829	-118.2829	-118.2829	-118.2829	-118.2829	-118.2829	-118.2829 (71)
Water heating gains (Table 5)												
	136.0661	133.6537	128.6443	121.8340	117.4125	111.1869	105.8952	112.6752	115.0842	122.1330	130.0924	133.6638 (72)
Total internal gains	573.8636	571.5892	552.7693	521.9005	489.6190	459.1968	439.8556	446.4976	462.7171	493.8245	529.6438	557.4118 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
Northeast					3.8400	11.2829	0.6300	0.7000	0.7700	13.2411 (75)		
Southeast					11.5600	36.7938	0.6300	0.7000	0.7700	129.9884 (77)		
Southwest					1.3300	36.7938	0.6300	0.7000	0.7700	14.9554 (79)		
Northwest					21.3900	11.2829	0.6300	0.7000	0.7700	73.7573 (81)		
Solar gains	231.9423	423.9808	656.8657	942.5441	1173.1590	1216.3293	1151.1752	971.2292	754.5511	489.2847	283.0759	195.0890 (83)
Total gains	805.8058	995.5700	1209.6349	1464.4446	1662.7779	1675.5260	1591.0308	1417.7268	1217.2683	983.1092	812.7197	752.5008 (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	40.0696	40.1452	40.2195	40.5722	40.6389	40.9522	40.9522	41.0107	40.8309	40.6389	40.5042	40.3644
alpha	3.6713	3.6763	3.6813	3.7048	3.7093	3.7301	3.7301	3.7340	3.7221	3.7093	3.7003	3.6910
util living area	0.9955	0.9898	0.9740	0.9249	0.8149	0.6501	0.5031	0.5741	0.8187	0.9620	0.9915	0.9965 (86)
MIT	19.1487	19.3790	19.7630	20.2621	20.6729	20.9007	20.9709	20.9531	20.7551	20.2024	19.5810	19.1086 (87)
Th 2	19.9408	19.9425	19.9443	19.9525	19.9540	19.9612	19.9612	19.9625	19.9584	19.9540	19.9509	19.9477 (88)
util rest of house	0.9944	0.9874	0.9675	0.9055	0.7685	0.5683	0.3945	0.4619	0.7542	0.9486	0.9891	0.9957 (89)
MIT 2	17.4565	17.7932	18.3507	19.0639	19.6124	19.8835	19.9467	19.9366	19.7339	18.9943	18.0947	17.4023 (90)
Living area fraction												
MIT	17.7133	18.0338	18.5650	19.2457	19.7733	20.0379	20.1021	20.0909	19.8889	19.1776	18.3203	17.6612 (92)
Temperature adjustment												0.0000
adjusted MIT	17.7133	18.0338	18.5650	19.2457	19.7733	20.0379	20.1021	20.0909	19.8889	19.1776	18.3203	17.6612 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9908	0.9806	0.9555	0.8890	0.7594	0.5748	0.4099	0.4767	0.7492	0.9349	0.9831	0.9927 (94)
Useful gains	798.3558	976.3028	1155.7909	1301.9467	1262.6391	963.0351	652.1065	675.8017	911.9630	919.0767	799.0093	747.0031 (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	2613.0370	2553.7733	2341.6151	1990.4723	1550.7288	1036.5196	667.5380	702.5185	1106.6958	1647.5877	2162.3609	2603.2189 (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	1350.1228	1060.0602	882.2532	495.7384	214.3387	0.0000	0.0000	0.0000	0.0000	542.0122	981.6131	1381.0246 (98)
Space heating												6907.1632 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Space heating per m2 (98) / (4) = 41.6295 (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													7607.0079 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1350.1228	1060.0602	882.2532	495.7384	214.3387	0.0000	0.0000	0.0000	0.0000	542.0122	981.6131	1381.0246	(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)	1486.9194	1167.4672	971.6445	545.9674	236.0559	0.0000	0.0000	0.0000	0.0000	596.9297	1081.0717	1520.9522	(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	226.0921	199.3368	209.4852	187.9806	184.3531	164.9251	158.5820	173.7530	173.3644	194.9157	205.8633	220.7169	(64)
Efficiency of water heater (217)m	89.0929	88.9199	88.5308	87.5833	85.5177	80.1000	80.1000	80.1000	80.1000	87.7013	88.7448	80.1000	(216)
Fuel for water heating, kWh/month	253.7713	224.1756	236.6242	214.6306	215.5730	205.8990	197.9800	216.9201	216.4350	222.2495	231.9722	247.5548	(219)
Water heating fuel used												2683.7851	(219)
Annual totals kWh/year													
Space heating fuel - main system												7607.0079	(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)												531.1576	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.32 * 1004 * 1.00) =										-1060.2200		-1060.2200	(233)
Total delivered energy for all uses												9836.7306	(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	7607.0079	0.2160	1643.1137 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2683.7851	0.2160	579.6976 (264)
Space and water heating			2222.8113 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	531.1576	0.5190	275.6708 (268)
Energy saving/generation technologies			
PV Unit	-1060.2200	0.5190	-550.2542 (269)
Total CO2, kg/year			1987.1529 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			11.9800 (273)

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

DER		11.9800	ZC1
Total Floor Area		165.9200	
Assumed number of occupants		2.9571	
CO2 emission factor in Table 12 for electricity displaced from grid		0.5190	
CO2 emissions from appliances, equation (L14)		12.0489	ZC2
CO2 emissions from cooking, equation (L16)		1.1449	ZC3
Total CO2 emissions		25.1739	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		25.1739	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	82.9600 (1b)	x 2.3900 (2b)	= 198.2744 (1b) - (3b)
First floor	82.9600 (1c)	x 2.6700 (2c)	= 221.5032 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	165.9200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 419.7776 (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) =	0.0953 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3453 (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) =		0.2935 (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	0.3742	0.3669	0.3595	0.3228	0.3155	0.2788	0.2788	0.2715	0.2935	0.3155	0.3302	0.3449 (22b)
Effective ac	0.5700	0.5673	0.5646	0.5521	0.5498	0.5389	0.5389	0.5369	0.5431	0.5498	0.5545	0.5595 (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 Semi-glazed door			2.1200	1.2000	2.5440		(26a)
TER Opening Type (Uw = 1.40)			38.1200	1.3258	50.5379		(27)
Ground Floor			82.9600	0.1300	10.7848		(28a)
Brick and Block	181.6200	38.3200	143.3000	0.1800	25.7940		(29a)
Clad	20.9300	1.9200	19.0100	0.1800	3.4218		(29a)
Pitched Roof	82.9600		82.9600	0.1300	10.7848		(30)
Total net area of external elements Aum(A, m ²)			368.4700				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	103.8673		(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)							15.7996 (36)
Total fabric heat loss						(33) + (36) =	119.6669 (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	78.9623	78.5857	78.2165	76.4825	76.1581	74.6479	74.6479	74.3682	75.2296	76.1581	76.8144	77.5005 (38)
Heat transfer coeff	198.6292	198.2525	197.8834	196.1494	195.8250	194.3148	194.3148	194.0351	194.8965	195.8250	196.4813	197.1674 (39)
Average = Sum(39)m / 12 =												196.1479 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1971	1.1949	1.1926	1.1822	1.1802	1.1711	1.1711	1.1694	1.1746	1.1802	1.1842	1.1883 (40)
HLP (average)												1.1822 (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												2.9571 (42)
Average daily hot water use (litres/day)												104.4305 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	114.8735	110.6963	106.5191	102.3419	98.1647	93.9874	93.9874	98.1647	102.3419	106.5191	110.6963	114.8735 (44)
Energy conte	170.3541	148.9928	153.7472	134.0406	128.6151	110.9851	102.8440	118.0150	119.4244	139.1777	151.9233	164.9789 (45)
Energy content (annual)										Total = Sum(45)m =		1643.0981 (45)
Distribution loss (46)m = 0.15 x (45)m	25.5531	22.3489	23.0621	20.1061	19.2923	16.6478	15.4266	17.7022	17.9137	20.8767	22.7885	24.7468 (46)
Water storage loss:												216.0000 (47)
Store volume												1.7306 (48)
a) If manufacturer declared loss factor is known (kWh/day):												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.9345 (55)
Total storage loss												
28.9702	26.1667	28.9702	28.0357	28.9702	28.0357	28.9702	28.9702	28.0357	28.9702	28.0357	28.9702	(56)
If cylinder contains dedicated solar storage												
28.9702	26.1667	28.9702	28.0357	28.9702	28.0357	28.9702	28.9702	28.0357	28.9702	28.0357	28.9702	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month												
222.5868	196.1707	205.9799	184.5883	180.8478	161.5328	155.0766	170.2476	169.9722	191.4103	202.4710	217.2115	(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	(63)
Solar input (sum of months) = Sum(63)m =												(63)
Output from w/h												
222.5868	196.1707	205.9799	184.5883	180.8478	161.5328	155.0766	170.2476	169.9722	191.4103	202.4710	217.2115	(64)
Heat gains from water heating, kWh/month												
98.4289	87.2824	92.9071	85.0067	84.5506	77.3407	75.9817	81.0261	80.1468	88.0627	90.9527	96.6416	(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	147.8536	147.8536	147.8536	147.8536	147.8536	147.8536	147.8536	147.8536	147.8536	147.8536	147.8536	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
30.0763	26.7135	21.7249	16.4472	12.2944	10.3795	11.2154	14.5782	19.5668	24.8446	28.9973	30.9123	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
337.3651	340.8659	332.0440	313.2632	289.5559	267.2743	252.3889	248.8881	257.7100	276.4907	300.1981	322.4796	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
37.7854	37.7854	37.7854	37.7854	37.7854	37.7854	37.7854	37.7854	37.7854	37.7854	37.7854	37.7854	(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)												
-118.2829	-118.2829	-118.2829	-118.2829	-118.2829	-118.2829	-118.2829	-118.2829	-118.2829	-118.2829	-118.2829	-118.2829	(71)
Water heating gains (Table 5)												
132.2969	129.8845	124.8751	118.0648	113.6433	107.4177	102.1260	108.9060	111.3150	118.3638	126.3232	129.8946	(72)
Total internal gains												
570.0944	567.8200	549.0001	518.1313	485.8498	455.4276	436.0864	442.7284	458.9479	490.0553	525.8746	553.6426	(73)

6. Solar gains

[Jan]												
	Area	Solar flux	g	Specific data	FF	Access	Gains					
	m2	Table 6a	W/m2	or Table 6b	or Table 6c	factor	W					
						Table 6d						
Northeast	3.8400	11.2829	0.6300	0.7000	0.7700	13.2411	(75)					
Southeast	11.5600	36.7938	0.6300	0.7000	0.7700	129.9884	(77)					
Southwest	1.3300	36.7938	0.6300	0.7000	0.7700	14.9554	(79)					
Northwest	21.3900	11.2829	0.6300	0.7000	0.7700	73.7573	(81)					
Solar gains	231.9423	423.9808	656.8657	942.5441	1173.1590	1216.3293	1151.1752	971.2292	754.5511	489.2847	283.0759	195.0890 (83)
Total gains	802.0366	991.8008	1205.8657	1460.6754	1659.0087	1671.7568	1587.2616	1413.9576	1213.4991	979.3400	808.9505	748.7316 (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	58.0087	58.1189	58.2273	58.7421	58.8394	59.2967	59.2967	59.3822	59.1197	58.8394	58.6428	58.4388
alpha	4.8672	4.8746	4.8818	4.9161	4.9226	4.9531	4.9531	4.9588	4.9413	4.9226	4.9095	4.8959
util living area												
	0.9992	0.9977	0.9915	0.9625	0.8674	0.6908	0.5268	0.6058	0.8714	0.9857	0.9982	0.9995 (86)
MIT	19.5882	19.7635	20.0600	20.4556	20.7849	20.9499	20.9893	20.9797	20.8381	20.3970	19.9179	19.5587 (87)
Th 2	19.9223	19.9241	19.9259	19.9343	19.9358	19.9432	19.9432	19.9445	19.9403	19.9358	19.9327	19.9293 (88)
util rest of house												
	0.9990	0.9969	0.9883	0.9479	0.8192	0.5974	0.4064	0.4793	0.8040	0.9780	0.9974	0.9993 (89)
MIT 2	18.0302	18.2878	18.7207	19.2915	19.7266	19.9105	19.9393	19.9362	19.8061	19.2182	18.5201	17.9920 (90)
Living area fraction												
									fLA = Living area / (4) =			0.1518 (91)
MIT	18.2667	18.5117	18.9240	19.4682	19.8872	20.0683	20.0987	20.0946	19.9627	19.3971	18.7322	18.2298 (92)
Temperature adjustment												0.0000
adjusted MIT	18.2667	18.5117	18.9240	19.4682	19.8872	20.0683	20.0987	20.0946	19.9627	19.3971	18.7322	18.2298 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9983	0.9952	0.9840	0.9395	0.8166	0.6093	0.4246	0.4982	0.8057	0.9723	0.9960	0.9988 (94)
Useful gains	800.6779	987.0183	1186.6000	1372.3666	1354.8176	1018.5770	673.9808	704.4868	977.7326	952.1677	805.7543	747.8223 (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												
	2774.1874	2698.5638	2458.5002	2072.9422	1603.2679	1062.5678	679.8482	716.8788	1142.6272	1722.6847	2285.5129	2766.2202 (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												
	1468.2911	1150.1585	946.2937	504.4145	184.8470	0.0000	0.0000	0.0000	0.0000	573.2647	1065.4262	1501.6880 (98)
Space heating												7394.3838 (98)
Space heating per m2												44.5660 (99)
										(98) / (4) =		

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													7908.4318 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1468.2911	1150.1585	946.2937	504.4145	184.8470	0.0000	0.0000	0.0000	0.0000	573.2647	1065.4262	1501.6880	(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)	1570.3648	1230.1161	1012.0789	539.4807	197.6974	0.0000	0.0000	0.0000	0.0000	613.1173	1139.4933	1606.0835	(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	222.5868	196.1707	205.9799	184.5883	180.8478	161.5328	155.0766	170.2476	169.9722	191.4103	202.4710	217.2115	(64)
Efficiency of water heater (217)m	88.9303	88.7658	88.3816	87.3618	84.8722	79.8000	79.8000	79.8000	79.8000	87.5611	88.6028	79.8000	(216)
Fuel for water heating, kWh/month	250.2935	220.9981	233.0575	211.2918	213.0825	202.4220	194.3316	213.3429	212.9977	218.6019	228.5153	244.0795	(219)
Water heating fuel used												2643.0144	(219)
Annual totals kWh/year													
Space heating fuel - main system												7908.4318	(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)												531.1576	(232)
Total delivered energy for all uses												11157.6038	(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	7908.4318	0.2160	1708.2213	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2643.0144	0.2160	570.8911	(264)
Space and water heating			2279.1124	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	531.1576	0.5190	275.6708	(268)
Total CO2, kg/m2/year			2593.7082	(272)
Emissions per m2 for space and water heating			13.7362	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			1.6615	(272b)
Emissions per m2 for pumps and fans			0.2346	(272c)
Target Carbon Dioxide Emission Rate (TER) = (13.7362 * 1.00) + 1.6615 + 0.2346, rounded to 2 d.p.			15.6300	(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	82.9600 (1b)	x 2.3900 (2b)	= 198.2744 (1b) - (3b)
First floor	82.9600 (1c)	x 2.6700 (2c)	= 221.5032 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	165.9200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 419.7776 (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) = 0.0953 (8)
Pressure test					Yes
Measured/design AP50					4.4300
Infiltration rate					0.3168 (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) =	0.2693 (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	0.3433	0.3366	0.3299	0.2962	0.2895	0.2558	0.2558	0.2491	0.2693	0.2895	0.3029	0.3164 (22b)
Effective ac	0.5589	0.5566	0.5544	0.5439	0.5419	0.5327	0.5327	0.5310	0.5363	0.5419	0.5459	0.5501 (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)			38.1200	1.1450	43.6489		(27)
Ground Floor			82.9600	0.1100	9.1256	140.0000	11614.4000 (28a)
Brick and Block	181.6200	38.3200	143.3000	0.2400	34.3920	42.2200	6050.1260 (29a)
Clad	20.9300	1.9200	19.0100	0.2400	4.5624	42.2200	802.6022 (29a)
Pitched Roof	82.9600		82.9600	0.1000	8.2960	9.0000	746.6400 (30)
Total net area of external elements Aum(A, m ²)			368.4700				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	102.3569		(33)
Ground Floor Block			47.5100			75.0000	3563.2500 (32c)
Ground Floor Stud			61.8700			9.0000	556.8300 (32c)
First Floor Stud			197.8800			9.0000	1780.9200 (32c)
Internal Floor 1			82.9600			18.0000	1493.2800 (32d)
Internal Ceiling 1			82.9600			9.0000	746.6400 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	27354.6882 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							164.8667 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							13.7509 (36)
Total fabric heat loss						(33) + (36) =	116.1077 (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	77.4273	77.1102	76.7995	75.3400	75.0669	73.7957	73.7957	73.5603	74.2853	75.0669	75.6193	76.1969 (38)
Heat transfer coeff	193.5350	193.2180	192.9072	191.4477	191.1746	189.9034	189.9034	189.6680	190.3931	191.1746	191.7270	192.3046 (39)
Average = Sum(39)m / 12 =												191.4464 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1664	1.1645	1.1627	1.1539	1.1522	1.1445	1.1445	1.1431	1.1475	1.1522	1.1555	1.1590 (40)
HLP (average)												1.1538 (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												2.9571 (42)
Average daily hot water use (litres/day)												104.4305 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	114.8735	110.6963	106.5191	102.3419	98.1647	93.9874	93.9874	98.1647	102.3419	106.5191	110.6963	114.8735 (44)
Energy conte	170.3541	148.9928	153.7472	134.0406	128.6151	110.9851	102.8440	118.0150	119.4244	139.1777	151.9233	164.9789 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Energy content (annual)	Total = Sum(45)m = 1643.0981 (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	36.2003	31.6610	32.6713	28.4836	27.3307	23.5843	21.8543	25.0782	25.3777	29.5753	32.2837	35.0580 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(66)
(66)m	147.8536	147.8536	147.8536	147.8536	147.8536	147.8536	147.8536	147.8536	147.8536	147.8536	147.8536	147.8536	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	30.0763	26.7135	21.7249	16.4472	12.2944	10.3795	11.2154	14.5782	19.5668	24.8446	28.9973	30.9123	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	337.3651	340.8659	332.0440	313.2632	289.5559	267.2743	252.3889	248.8881	257.7100	276.4907	300.1981	322.4796	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.7854	37.7854	37.7854	37.7854	37.7854	37.7854	37.7854	37.7854	37.7854	37.7854	37.7854	37.7854	(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)	-118.2829	-118.2829	-118.2829	-118.2829	-118.2829	-118.2829	-118.2829	-118.2829	-118.2829	-118.2829	-118.2829	-118.2829	(71)
Water heating gains (Table 5)	48.6563	47.1145	43.9130	39.5606	36.7348	32.7560	29.3741	33.7072	35.2468	39.7517	44.8385	47.1210	(72)
Total internal gains	483.4537	482.0500	465.0380	436.6270	405.9412	377.7659	360.3345	364.5296	379.8797	408.4431	441.3899	467.8690	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
Northeast					3.8400	11.2829	0.6300	0.7000	0.7700	13.2411 (75)			
Southeast					11.5600	36.7938	0.6300	0.7000	0.7700	129.9884 (77)			
Southwest					1.3300	36.7938	0.6300	0.7000	0.7700	14.9554 (79)			
Northwest					21.3900	11.2829	0.6300	0.7000	0.7700	73.7573 (81)			
Solar gains	231.9423	423.9808	656.8657	942.5441	1173.1590	1216.3293	1151.1752	971.2292	754.5511	489.2847	283.0759	195.0890	(83)
Total gains	715.3960	906.0308	1121.9037	1379.1712	1579.1002	1594.0952	1511.5097	1335.7588	1134.4309	897.7278	724.4658	662.9580	(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	39.2618	39.3262	39.3895	39.6898	39.7465	40.0126	40.0126	40.0622	39.9097	39.7465	39.6320	39.5130	
alpha	3.6175	3.6217	3.6260	3.6460	3.6498	3.6675	3.6675	3.6708	3.6606	3.6498	3.6421	3.6342	
util living area	0.9967	0.9918	0.9779	0.9329	0.8289	0.6691	0.5228	0.5982	0.8390	0.9691	0.9936	0.9975	(86)
MIT	19.0569	19.2928	19.6874	20.2031	20.6369	20.8847	20.9648	20.9430	20.7195	20.1344	19.4955	19.0143	(87)
Th 2	19.9469	19.9485	19.9500	19.9571	19.9584	19.9646	19.9646	19.9658	19.9622	19.9584	19.9557	19.9529	(88)
util rest of house	0.9959	0.9899	0.9723	0.9154	0.7849	0.5881	0.4122	0.4849	0.7790	0.9581	0.9918	0.9969	(89)
MIT 2	18.1606	18.3967	18.7889	19.2960	19.6957	19.9016	19.9522	19.9435	19.7821	19.2393	18.6050	18.1226	(90)
Living area fraction	18.2966	18.5327	18.9252	19.4336	19.8385	20.0508	20.1059	20.0952	19.9244	19.3751	18.7402	18.2579	(91)
Temperature adjustment	18.2966	18.5327	18.9252	19.4336	19.8385	20.0508	20.1059	20.0952	19.9244	19.3751	18.7402	18.2579	(92)
adjusted MIT	18.2966	18.5327	18.9252	19.4336	19.8385	20.0508	20.1059	20.0952	19.9244	19.3751	18.7402	18.2579	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9940	0.9862	0.9650	0.9046	0.7791	0.5954	0.4280	0.5001	0.7764	0.9498	0.9887	0.9954	(94)
Ext temp.	711.1247	893.4825	1082.6843	1247.5435	1230.2498	949.1753	646.9554	668.0312	880.7906	852.6650	716.2948	659.9273	(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	2708.8321	2634.0735	2396.9200	2016.6358	1555.8758	1035.1263	665.7830	700.8662	1108.9192	1677.5797	2231.7365	2703.3969	(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	(98)
Space heating per m2	1486.2943	1169.6772	977.7913	553.7465	242.2658	0.0000	0.0000	0.0000	0.0000	613.7365	1091.1180	1520.3414	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													

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Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	1785.0920	1405.2852	1441.4768	0.0000	0.0000	0.0000	0.0000 (100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.8270	0.8852	0.8439	0.0000	0.0000	0.0000	0.0000 (101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1476.2214	1243.9291	1216.4490	0.0000	0.0000	0.0000	0.0000 (102)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1994.1462	1894.4829	1691.6715	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	372.9058	484.0120	353.5655	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction									FC = cooled area / (4) =			1210.4834 (104)
Intermittency factor (Table 10b)												1.0000 (105)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	93.2265	121.0030	88.3914	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling per m2												302.6208 (107)
Energy for space heating												1.8239 (108)
Energy for space cooling												46.1365 (99)
Total												1.8239 (108)
Dwelling Fabric Energy Efficiency (DFEE)												47.9604 (109)
												48.0 (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	82.9600 (1b)	x 2.3900 (2b)	= 198.2744 (1b) - (3b)
First floor	82.9600 (1c)	x 2.6700 (2c)	= 221.5032 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	165.9200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 419.7776 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																4 * 10 =	40.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) =	0.0953 (8)	
Pressure test															Yes		
Measured/design AP50															5.0000		
Infiltration rate															0.3453 (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) =					0.2935 (21)		
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
	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																	
	0.3742	0.3669	0.3595	0.3228	0.3155	0.2788	0.2788	0.2715	0.2935	0.3155	0.3302	0.3449 (22b)					
Effective ac	0.5700	0.5673	0.5646	0.5521	0.5498	0.5389	0.5389	0.5369	0.5431	0.5498	0.5545	0.5595 (25)					

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K						
TER Semi-glazed door			2.1200	1.2000	2.5440			(26a)					
TER Opening Type (Uw = 1.40)			38.1200	1.3258	50.5379			(27)					
Ground Floor			82.9600	0.1300	10.7848			(28a)					
Brick and Block	181.6200	38.3200	143.3000	0.1800	25.7940			(29a)					
Clad	20.9300	1.9200	19.0100	0.1800	3.4218			(29a)					
Pitched Roof	82.9600		82.9600	0.1300	10.7848			(30)					
Total net area of external elements Aum(A, m2)			368.4700					(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	103.8673			(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)								15.7996 (36)					
Total fabric heat loss						(33) + (36) =		119.6669 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 78.9623	Feb 78.5857	Mar 78.2165	Apr 76.4825	May 76.1581	Jun 74.6479	Jul 74.6479	Aug 74.3682	Sep 75.2296	Oct 76.1581	Nov 76.8144	Dec 77.5005	(38)
Heat transfer coeff	198.6292	198.2525	197.8834	196.1494	195.8250	194.3148	194.3148	194.0351	194.8965	195.8250	196.4813	197.1674	(39)
Average = Sum(39)m / 12 =												196.1479	(39)
HLP	Jan 1.1971	Feb 1.1949	Mar 1.1926	Apr 1.1822	May 1.1802	Jun 1.1711	Jul 1.1711	Aug 1.1694	Sep 1.1746	Oct 1.1802	Nov 1.1842	Dec 1.1883	(40)
HLP (average)												1.1822	(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												2.9571 (42)
Average daily hot water use (litres/day)												104.4305 (43)
Daily hot water use	Jan 114.8735	Feb 110.6963	Mar 106.5191	Apr 102.3419	May 98.1647	Jun 93.9874	Jul 93.9874	Aug 98.1647	Sep 102.3419	Oct 106.5191	Nov 110.6963	Dec 114.8735 (44)
Energy conte	170.3541	148.9928	153.7472	134.0406	128.6151	110.9851	102.8440	118.0150	119.4244	139.1777	151.9233	164.9789 (45)
Energy content (annual)										Total = Sum(45)m =		1643.0981 (45)
Distribution loss (46)m = 0.15 x (45)m												
Water storage loss:	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (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	36.2003	31.6610	32.6713	28.4836	27.3307	23.5843	21.8543	25.0782	25.3777	29.5753	32.2837	35.0580 (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	147.8536	147.8536	147.8536	147.8536	147.8536	147.8536	147.8536	147.8536	147.8536	147.8536	147.8536	147.8536	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	30.0763	26.7135	21.7249	16.4472	12.2944	10.3795	11.2154	14.5782	19.5668	24.8446	28.9973	30.9123	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	337.3651	340.8659	332.0440	313.2632	289.5559	267.2743	252.3889	248.8881	257.7100	276.4907	300.1981	322.4796	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.7854	37.7854	37.7854	37.7854	37.7854	37.7854	37.7854	37.7854	37.7854	37.7854	37.7854	37.7854	(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)	-118.2829	-118.2829	-118.2829	-118.2829	-118.2829	-118.2829	-118.2829	-118.2829	-118.2829	-118.2829	-118.2829	-118.2829	(71)
Water heating gains (Table 5)	48.6563	47.1145	43.9130	39.5606	36.7348	32.7560	29.3741	33.7072	35.2468	39.7517	44.8385	47.1210	(72)
Total internal gains	483.4537	482.0500	465.0380	436.6270	405.9412	377.7659	360.3345	364.5296	379.8797	408.4431	441.3899	467.8690	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	3.8400	11.2829	0.6300	0.7000	0.7700	13.2411	(75)
Southeast	11.5600	36.7938	0.6300	0.7000	0.7700	129.9884	(77)
Southwest	1.3300	36.7938	0.6300	0.7000	0.7700	14.9554	(79)
Northwest	21.3900	11.2829	0.6300	0.7000	0.7700	73.7573	(81)

Solar gains	231.9423	423.9808	656.8657	942.5441	1173.1590	1216.3293	1151.1752	971.2292	754.5511	489.2847	283.0759	195.0890	(83)
Total gains	715.3960	906.0308	1121.9037	1379.1712	1579.1002	1594.0952	1511.5097	1335.7588	1134.4309	897.7278	724.4658	662.9580	(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	58.0087	58.1189	58.2273	58.7421	58.8394	59.2967	59.2967	59.3822	59.1197	58.8394	58.6428	58.4388	
alpha	4.8672	4.8746	4.8818	4.9161	4.9226	4.9531	4.9531	4.9588	4.9413	4.9226	4.9095	4.8959	
util living area	0.9996	0.9985	0.9938	0.9697	0.8845	0.7152	0.5505	0.6352	0.8939	0.9900	0.9989	0.9997	(86)
MIT	19.5397	19.7158	20.0146	20.4170	20.7611	20.9416	20.9871	20.9751	20.8136	20.3539	19.8708	19.5106	(87)
Th 2	19.9223	19.9241	19.9259	19.9343	19.9358	19.9432	19.9432	19.9445	19.9403	19.9358	19.9327	19.9293	(88)
util rest of house	0.9994	0.9979	0.9914	0.9575	0.8398	0.6219	0.4260	0.5054	0.8331	0.9844	0.9984	0.9996	(89)
MIT 2	18.5821	18.7594	19.0584	19.4594	19.7745	19.9167	19.9400	19.9374	19.8315	19.4042	18.9212	18.5586	(90)
Living area fraction									fLA = Living area / (4) =			0.1518	(91)
MIT	18.7274	18.9046	19.2035	19.6047	19.9242	20.0722	20.0989	20.0949	19.9805	19.5483	19.0653	18.7031	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7274	18.9046	19.2035	19.6047	19.9242	20.0722	20.0989	20.0949	19.9805	19.5483	19.0653	18.7031	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9991	0.9971	0.9891	0.9526	0.8392	0.6342	0.4450	0.5251	0.8359	0.9815	0.9979	0.9994	(94)
Ext temp.	714.7701	903.4279	1109.6984	1313.7940	1325.2331	1010.9832	672.6697	701.3752	948.2845	881.1400	722.9150	662.5607	(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	2865.7018	2776.4416	2513.8074	2099.7266	1610.5046	1063.3351	679.8822	716.9345	1146.0949	1752.3012	2350.9614	2859.5300	(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	1600.2932	1258.6652	1044.6571	565.8715	212.2420	0.0000	0.0000	0.0000	0.0000	648.1439	1172.1934	1634.5452	(98)
										(98) / (4) =		49.0394	(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	1826.5589	1437.9293	1474.6668	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8663	0.9237	0.8838	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1582.3935	1328.2605	1303.2691	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1994.1462	1894.4829	1691.6715	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													

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	296.4619	421.2694	288.9713	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction												1006.7027 (104)
Intermittency factor (Table 10b)									FC = cooled area / (4) =			1.0000 (105)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	74.1155	105.3174	72.2428	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling per m2												251.6757 (107)
Energy for space heating												1.5168 (108)
Energy for space cooling												49.0394 (99)
Total												1.5168 (108)
Target Fabric Energy Efficiency (TFEE)												50.5562 (109)
												58.1 (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	82.9600 (1b)	x 2.3900 (2b)	= 198.2744 (1b) - (3b)
First floor	82.9600 (1c)	x 2.6700 (2c)	= 221.5032 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	165.9200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 419.7776 (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					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) = 0.1191 (8)
Pressure test					Yes
Measured/design AP50					4.4300
Infiltration rate					0.3406 (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) =		0.2895 (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	0.3040	0.2823	0.2895	0.2750	0.2750	0.2678	0.2606	0.2533	0.2461	0.2678	0.2533	0.2678 (22b)
Effective ac	0.5462	0.5398	0.5419	0.5378	0.5378	0.5359	0.5339	0.5321	0.5303	0.5359	0.5321	0.5359 (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)			38.1200	1.1450	43.6489		(27)
Ground Floor			82.9600	0.1100	9.1256	140.0000	11614.4000 (28a)
Brick and Block	181.6200	38.3200	143.3000	0.2400	34.3920	42.2200	6050.1260 (29a)
Clad	20.9300	1.9200	19.0100	0.2400	4.5624	42.2200	802.6022 (29a)
Pitched Roof	82.9600		82.9600	0.1000	8.2960	9.0000	746.6400 (30)
Total net area of external elements Aum(A, m ²)			368.4700				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		102.3569		(33)
Ground Floor Block			47.5100			75.0000	3563.2500 (32c)
Ground Floor Stud			61.8700			9.0000	556.8300 (32c)
First Floor Stud			197.8800			9.0000	1780.9200 (32c)
Internal Floor 1			82.9600			18.0000	1493.2800 (32d)
Internal Ceiling 1			82.9600			18.0000	1493.2800 (32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss
(28)...(30) + (32) + (32a)...(32e) = 28101.3282 (34)
169.3667 (35)
13.7509 (36)
(33) + (36) = 116.1077 (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	75.6641	74.7824	75.0690	74.5030	74.5030	74.2308	73.9660	73.7083	73.4580	74.2308	73.7083	74.2308 (38)
Heat transfer coeff	191.7718	190.8901	191.1768	190.6107	190.6107	190.3386	190.0737	189.8160	189.5657	190.3386	189.8160	190.3386 (39)
Average = Sum(39)m / 12 =												190.4456 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1558	1.1505	1.1522	1.1488	1.1488	1.1472	1.1456	1.1440	1.1425	1.1472	1.1440	1.1472 (40)
HLP (average)												1.1478 (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
Average daily hot water use (litres/day)
2.9571 (42)
104.4305 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	114.8735	110.6963	106.5191	102.3419	98.1647	93.9874	93.9874	98.1647	102.3419	106.5191	110.6963	114.8735 (44)
Energy conte	170.3541	148.9928	153.7472	134.0406	128.6151	110.9851	102.8440	118.0150	119.4244	139.1777	151.9233	164.9789 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Energy content (annual)												Total = Sum(45)m = 1643.0981 (45)
Distribution loss (46)m = 0.15 x (45)m												
25.5531	22.3489	23.0621	20.1061	19.2923	16.6478	15.4266	17.7022	17.9137	20.8767	22.7885	24.7468	(46)
Water storage loss:												
Store volume												216.0000 (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	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month												
226.0921	199.3368	209.4852	187.9806	184.3531	164.9251	158.5820	173.7530	173.3644	194.9157	205.8633	220.7169	(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	(63)
Solar input (sum of months) = Sum(63)m =												0.0000 (63)
Output from w/h												
226.0921	199.3368	209.4852	187.9806	184.3531	164.9251	158.5820	173.7530	173.3644	194.9157	205.8633	220.7169	(64)
Total per year (kWh/year) = Sum(64)m =												2299.3681 (64)
RHI water heating demand												2299 (64)
Heat gains from water heating, kWh/month												
101.2331	89.8153	95.7114	87.7205	87.3549	80.0545	78.7860	83.8304	82.8606	90.8670	93.6665	99.4459	(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	177.4244	177.4244	177.4244	177.4244	177.4244	177.4244	177.4244	177.4244	177.4244	177.4244	177.4244	177.4244 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	75.1909	66.7838	54.3123	41.1179	30.7361	25.9487	28.0385	36.4455	48.9171	62.1115	72.4933	77.2806 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	503.5299	508.7550	495.5880	467.5570	432.1730	398.9169	376.6999	371.4748	384.6418	412.6728	448.0568	481.3129 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.6995	55.6995	55.6995	55.6995	55.6995	55.6995	55.6995	55.6995	55.6995	55.6995	55.6995	55.6995 (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)	-118.2829	-118.2829	-118.2829	-118.2829	-118.2829	-118.2829	-118.2829	-118.2829	-118.2829	-118.2829	-118.2829	-118.2829 (71)
Water heating gains (Table 5)	136.0661	133.6537	128.6443	121.8340	117.4125	111.1869	105.8952	112.6752	115.0842	122.1330	130.0924	133.6638 (72)
Total internal gains	832.6278	827.0336	796.3856	748.3499	698.1626	653.8935	628.4745	638.4365	666.4840	714.7582	768.4834	810.0983 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	

Northeast					3.8400	14.6176		0.6300	0.7000	0.7700		17.1546 (75)	
Southeast					11.5600	45.1778		0.6300	0.7000	0.7700		159.6081 (77)	
Southwest					1.3300	45.1778		0.6300	0.7000	0.7700		18.3632 (79)	
Northwest					21.3900	14.6176		0.6300	0.7000	0.7700		95.5565 (81)	

Solar gains	290.6824	454.5128	715.0546	1038.2077	1230.2330	1385.4157	1301.0599	1124.0612	869.8754	567.4803	354.1038	240.0302	(83)
Total gains	1123.3102	1281.5464	1511.4401	1786.5576	1928.3956	2039.3092	1929.5344	1762.4977	1536.3595	1282.2385	1122.5872	1050.1285	(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	40.7042	40.8922	40.8309	40.9522	40.9522	41.0107	41.0679	41.1236	41.1779	41.0107	41.1236	41.0107
alpha	3.7136	3.7261	3.7221	3.7301	3.7301	3.7340	3.7379	3.7416	3.7452	3.7340	3.7416	3.7340
util living area	0.9850	0.9754	0.9444	0.8609	0.7152	0.5072	0.3775	0.4104	0.6807	0.9023	0.9714	0.9876 (86)
MIT	19.4970	19.6729	20.0515	20.5030	20.8169	20.9615	20.9902	20.9871	20.8870	20.4904	19.9377	19.4732 (87)
Th 2	19.9555	19.9598	19.9584	19.9612	19.9612	19.9625	19.9638	19.9650	19.9663	19.9625	19.9650	19.9625 (88)
util rest of house	0.9814	0.9697	0.9314	0.8296	0.6560	0.4240	0.2803	0.3059	0.5978	0.8717	0.9634	0.9846 (89)
MIT 2	17.9723	18.2289	18.7688	19.3914	19.7863	19.9370	19.9599	19.9599	19.8772	19.3923	18.6181	17.9426 (90)
Living area fraction												
MIT	18.2037	18.4481	18.9635	19.5601	19.9427	20.0925	20.1163	20.1158	20.0304	19.5589	18.8184	18.1749 (92)
Temperature adjustment												0.0000
adjusted MIT	18.2037	18.4481	18.9635	19.5601	19.9427	20.0925	20.1163	20.1158	20.0304	19.5589	18.8184	18.1749 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9728	0.9583	0.9155	0.8156	0.6549	0.4348	0.2949	0.3215	0.6034	0.8570	0.9511	0.9771	(94)
Useful gains	1092.7862	1228.0659	1383.6775	1457.0308	1262.8621	886.6312	568.9854	566.6607	927.0306	1098.8811	1067.6922	1026.0785	(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	2551.2752	2509.8350	2287.1370	1917.5590	1418.6567	912.1969	573.3164	572.4403	1010.4700	1552.9613	2072.4812	2507.6903	(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	1085.1158	861.3488	672.1739	331.5803	115.9112	0.0000	0.0000	0.0000	0.0000	337.8356	723.4481	1102.3192	(98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF HEAT DEMAND 09 Jan 2014

Space heating	5229.7330 (98)
RHI space heating demand	5230 (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	82.9600 (1b)	x 2.3900 (2b)	= 198.2744 (1b) - (3b)
First floor	82.9600 (1c)	x 2.6700 (2c)	= 221.5032 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	165.9200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 419.7776 (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) = 0.1191 (8)
Pressure test					Yes
Measured/design AP50					4.4300
Infiltration rate					0.3406 (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)	=	0.2895 (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	0.3691	0.3619	0.3547	0.3185	0.3112	0.2750	0.2750	0.2678	0.2895	0.3112	0.3257	0.3402 (22b)
Effective ac	0.5681	0.5655	0.5629	0.5507	0.5484	0.5378	0.5378	0.5359	0.5419	0.5484	0.5530	0.5579 (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)			38.1200	1.1450	43.6489		(27)
Ground Floor			82.9600	0.1100	9.1256	140.0000	11614.4000 (28a)
Brick and Block	181.6200	38.3200	143.3000	0.2400	34.3920	42.2200	6050.1260 (29a)
Clad	20.9300	1.9200	19.0100	0.2400	4.5624	42.2200	802.6022 (29a)
Pitched Roof	82.9600		82.9600	0.1000	8.2960	9.0000	746.6400 (30)
Total net area of external elements Aum(A, m ²)			368.4700				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	102.3569		(33)
Ground Floor Block			47.5100			75.0000	3563.2500 (32c)
Ground Floor Stud			61.8700			9.0000	556.8300 (32c)
First Floor Stud			197.8800			9.0000	1780.9200 (32c)
Internal Floor 1			82.9600			18.0000	1493.2800 (32d)
Internal Ceiling 1			82.9600			18.0000	1493.2800 (32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss
(28)...(30) + (32) + (32a)...(32e) = 28101.3282 (34)
169.3667 (35)
13.7509 (36)
(33) + (36) = 116.1077 (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	78.7013	78.3348	77.9755	76.2882	75.9726	74.5030	74.5030	74.2308	75.0690	75.9726	76.6112	77.2789 (38)
Heat transfer coeff	194.8090	194.4425	194.0833	192.3960	192.0803	190.6107	190.6107	190.3386	191.1768	192.0803	192.7189	193.3866 (39)
Average = Sum(39)m / 12 =												192.3945 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1741	1.1719	1.1697	1.1596	1.1577	1.1488	1.1488	1.1472	1.1522	1.1577	1.1615	1.1655 (40)
HLP (average)												1.1596 (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
Average daily hot water use (litres/day)
2.9571 (42)
104.4305 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	114.8735	110.6963	106.5191	102.3419	98.1647	93.9874	93.9874	98.1647	102.3419	106.5191	110.6963	114.8735 (44)
Energy conte	170.3541	148.9928	153.7472	134.0406	128.6151	110.9851	102.8440	118.0150	119.4244	139.1777	151.9233	164.9789 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Energy content (annual)	Total = Sum(45)m = 1643.0981 (45)										
Distribution loss (46)m = 0.15 x (45)m											
25.5531	22.3489	23.0621	20.1061	19.2923	16.6478	15.4266	17.7022	17.9137	20.8767	22.7885	24.7468 (46)
Water storage loss:											
Store volume	216.0000 (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	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	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	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month											
Solar input	226.0921	199.3368	209.4852	187.9806	184.3531	164.9251	158.5820	173.7530	173.3644	194.9157	205.8633 (62)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	226.0921	199.3368	209.4852	187.9806	184.3531	164.9251	158.5820	173.7530	173.3644	194.9157	205.8633 (64)
Heat gains from water heating, kWh/month	101.2331	89.8153	95.7114	87.7205	87.3549	80.0545	78.7860	83.8304	82.8606	90.8670	93.6665 (65)
101.2331	89.8153	95.7114	87.7205	87.3549	80.0545	78.7860	83.8304	82.8606	90.8670	93.6665	99.4459 (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	177.4244	177.4244	177.4244	177.4244	177.4244	177.4244	177.4244	177.4244	177.4244	177.4244	177.4244	177.4244	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	75.1909	66.7838	54.3123	41.1179	30.7361	25.9487	28.0385	36.4455	48.9171	62.1115	72.4933	77.2806	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	503.5299	508.7550	495.5880	467.5570	432.1730	398.9169	376.6999	371.4748	384.6418	412.6728	448.0568	481.3129	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.6995	55.6995	55.6995	55.6995	55.6995	55.6995	55.6995	55.6995	55.6995	55.6995	55.6995	55.6995	(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)	-118.2829	-118.2829	-118.2829	-118.2829	-118.2829	-118.2829	-118.2829	-118.2829	-118.2829	-118.2829	-118.2829	-118.2829	(71)
Water heating gains (Table 5)	136.0661	133.6537	128.6443	121.8340	117.4125	111.1869	105.8952	112.6752	115.0842	122.1330	130.0924	133.6638	(72)
Total internal gains	832.6278	827.0336	796.3856	748.3499	698.1626	653.8935	628.4745	638.4365	666.4840	714.7582	768.4834	810.0983	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
Northeast					3.8400	11.2829	0.6300	0.7000	0.7700	13.2411 (75)			
Southeast					11.5600	36.7938	0.6300	0.7000	0.7700	129.9884 (77)			
Southwest					1.3300	36.7938	0.6300	0.7000	0.7700	14.9554 (79)			
Northwest					21.3900	11.2829	0.6300	0.7000	0.7700	73.7573 (81)			
Solar gains	231.9423	423.9808	656.8657	942.5441	1173.1590	1216.3293	1151.1752	971.2292	754.5511	489.2847	283.0759	195.0890	(83)
Total gains	1064.5701	1251.0144	1453.2512	1690.8940	1871.3215	1870.2227	1779.6497	1609.6657	1421.0352	1204.0429	1051.5593	1005.1873	(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	40.0696	40.1452	40.2195	40.5722	40.6389	40.9522	40.9522	41.0107	40.8309	40.6389	40.5042	40.3644
alpha	3.6713	3.6763	3.6813	3.7048	3.7093	3.7301	3.7301	3.7340	3.7221	3.7093	3.7003	3.6910
util living area	0.9888	0.9791	0.9555	0.8924	0.7690	0.5992	0.4558	0.5169	0.7580	0.9331	0.9807	0.9909 (86)
MIT	19.3379	19.5599	19.9221	20.3792	20.7366	20.9245	20.9790	20.9669	20.8162	20.3371	19.7518	19.2949 (87)
Th 2	19.9408	19.9425	19.9443	19.9525	19.9540	19.9612	19.9612	19.9625	19.9584	19.9540	19.9509	19.9477 (88)
util rest of house	0.9862	0.9743	0.9451	0.8672	0.7181	0.5188	0.3549	0.4114	0.6862	0.9119	0.9754	0.9887 (89)
MIT 2	17.7315	18.0542	18.5757	19.2197	19.6856	19.9037	19.9510	19.9449	19.7973	19.1779	18.3409	17.6734 (90)
Living area fraction	17.9753	18.2827	18.7800	19.3956	19.8451	20.0587	20.1070	20.1000	19.9519	19.3538	18.5550	17.9195 (92)
Temperature adjustment	17.9753	18.2827	18.7800	19.3956	19.8451	20.0587	20.1070	20.1000	19.9519	19.3538	18.5550	17.9195 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9790	0.9637	0.9299	0.8512	0.7122	0.5268	0.3695	0.4260	0.6857	0.8962	0.9653	0.9825	(94)
Useful gains	1042.2296	1205.5516	1351.4176	1439.2432	1332.7856	985.2238	657.5450	685.7977	974.3751	1079.0623	1015.0346	987.6392	(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	2664.0687	2602.1722	2383.3420	2019.3164	1564.5164	1040.4775	668.4729	704.2498	1118.7469	1681.4368	2207.5969	2653.1697	(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	1206.6483	938.5291	767.7518	417.6526	172.4077	0.0000	0.0000	0.0000	0.0000	448.1666	858.6449	1239.1547	(98)
Space heating												6048.9557	(98)

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Space heating per m2 (98) / (4) = 36.4571 (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													6661.8454 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1206.6483	938.5291	767.7518	417.6526	172.4077	0.0000	0.0000	0.0000	0.0000	448.1666	858.6449	1239.1547	(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)	1328.9078	1033.6224	845.5416	459.9699	189.8763	0.0000	0.0000	0.0000	0.0000	493.5755	945.6441	1364.7078	(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	226.0921	199.3368	209.4852	187.9806	184.3531	164.9251	158.5820	173.7530	173.3644	194.9157	205.8633	220.7169	(64)
Efficiency of water heater (217)m	88.9255	88.7237	88.2723	87.1851	84.9370	80.1000	80.1000	80.1000	80.1000	87.2667	88.5134	80.1000	(216)
Fuel for water heating, kWh/month	254.2490	224.6714	237.3171	215.6109	217.0469	205.8990	197.9800	216.9201	216.4350	223.3563	232.5787	247.9896	(219)
Water heating fuel used												2690.0540	(219)
Annual totals kWh/year													
Space heating fuel - main system												6661.8454	(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)												531.1576	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.32 * 1004 * 1.00) =									-1060.2200			-1060.2200	(233)
Total delivered energy for all uses												8897.8370	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	6661.8454	3.4800	231.8322 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2690.0540	3.4800	93.6139 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	531.1576	13.1900	70.0597 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-1060.2200	13.1900	-139.8430 (252)
Total energy cost			385.5553 (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] =	0.7677 (257)
SAP value		89.2899
SAP rating (Section 12)		89 (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	6661.8454	0.2160	1438.9586 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2690.0540	0.2160	581.0517 (264)
Space and water heating			2020.0103 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	531.1576	0.5190	275.6708 (268)
Energy saving/generation technologies			
PV Unit	-1060.2200	0.5190	-550.2542 (269)
Total kg/year			1784.3519 (272)
CO2 emissions per m2			10.7500 (273)
EI value			88.6638
EI rating			89 (274)
EI band			B

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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	$3.48 / 0.8527 = 4.081$, stars = 4
Water heating environmental impact	$0.216 / 0.8527 = 0.2533$, 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	82.9600 (1b)	x 2.3900 (2b)	= 198.2744 (1b) - (3b)
First floor	82.9600 (1c)	x 2.6700 (2c)	= 221.5032 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	165.9200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 419.7776 (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) = 0.1191 (8)
Pressure test					Yes
Measured/design AP50					4.4300
Infiltration rate					0.3406 (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) =	0.2895 (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	0.3040	0.2823	0.2895	0.2750	0.2750	0.2678	0.2606	0.2533	0.2461	0.2678	0.2533	0.2678 (22b)
Effective ac	0.5462	0.5398	0.5419	0.5378	0.5378	0.5359	0.5339	0.5321	0.5303	0.5359	0.5321	0.5359 (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)			38.1200	1.1450	43.6489		(27)
Ground Floor			82.9600	0.1100	9.1256	140.0000	11614.4000 (28a)
Brick and Block	181.6200	38.3200	143.3000	0.2400	34.3920	42.2200	6050.1260 (29a)
Clad	20.9300	1.9200	19.0100	0.2400	4.5624	42.2200	802.6022 (29a)
Pitched Roof	82.9600		82.9600	0.1000	8.2960	9.0000	746.6400 (30)
Total net area of external elements Aum(A, m ²)			368.4700				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	102.3569		(33)
Ground Floor Block			47.5100			75.0000	3563.2500 (32c)
Ground Floor Stud			61.8700			9.0000	556.8300 (32c)
First Floor Stud			197.8800			9.0000	1780.9200 (32c)
Internal Floor 1			82.9600			18.0000	1493.2800 (32d)
Internal Ceiling 1			82.9600			18.0000	1493.2800 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	28101.3282 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							169.3667 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							13.7509 (36)
Total fabric heat loss						(33) + (36) =	116.1077 (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	75.6641	74.7824	75.0690	74.5030	74.5030	74.2308	73.9660	73.7083	73.4580	74.2308	73.7083	74.2308 (38)
Heat transfer coeff	191.7718	190.8901	191.1768	190.6107	190.6107	190.3386	190.0737	189.8160	189.5657	190.3386	189.8160	190.3386 (39)
Average = Sum(39)m / 12 =												190.4456 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1558	1.1505	1.1522	1.1488	1.1488	1.1472	1.1456	1.1440	1.1425	1.1472	1.1440	1.1472 (40)
HLP (average)												1.1478 (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												2.9571 (42)
Average daily hot water use (litres/day)												104.4305 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	114.8735	110.6963	106.5191	102.3419	98.1647	93.9874	93.9874	98.1647	102.3419	106.5191	110.6963	114.8735 (44)
Energy conte	170.3541	148.9928	153.7472	134.0406	128.6151	110.9851	102.8440	118.0150	119.4244	139.1777	151.9233	164.9789 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Energy content (annual)												Total = Sum(45)m = 1643.0981 (45)
Distribution loss (46)m = 0.15 x (45)m												
	25.5531	22.3489	23.0621	20.1061	19.2923	16.6478	15.4266	17.7022	17.9137	20.8767	22.7885	24.7468 (46)
Water storage loss:												
Store volume												216.0000 (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												
	226.0921	199.3368	209.4852	187.9806	184.3531	164.9251	158.5820	173.7530	173.3644	194.9157	205.8633	220.7169 (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												
	226.0921	199.3368	209.4852	187.9806	184.3531	164.9251	158.5820	173.7530	173.3644	194.9157	205.8633	220.7169 (64)
												Total per year (kWh/year) = Sum(64)m = 2299.3681 (64)
Heat gains from water heating, kWh/month												
	101.2331	89.8153	95.7114	87.7205	87.3549	80.0545	78.7860	83.8304	82.8606	90.8670	93.6665	99.4459 (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	177.4244	177.4244	177.4244	177.4244	177.4244	177.4244	177.4244	177.4244	177.4244	177.4244	177.4244	177.4244 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	75.1909	66.7838	54.3123	41.1179	30.7361	25.9487	28.0385	36.4455	48.9171	62.1115	72.4933	77.2806 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	503.5299	508.7550	495.5880	467.5570	432.1730	398.9169	376.6999	371.4748	384.6418	412.6728	448.0568	481.3129 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	55.6995	55.6995	55.6995	55.6995	55.6995	55.6995	55.6995	55.6995	55.6995	55.6995	55.6995	55.6995 (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)												
	-118.2829	-118.2829	-118.2829	-118.2829	-118.2829	-118.2829	-118.2829	-118.2829	-118.2829	-118.2829	-118.2829	-118.2829 (71)
Water heating gains (Table 5)												
	136.0661	133.6537	128.6443	121.8340	117.4125	111.1869	105.8952	112.6752	115.0842	122.1330	130.0924	133.6638 (72)
Total internal gains												
	832.6278	827.0336	796.3856	748.3499	698.1626	653.8935	628.4745	638.4365	666.4840	714.7582	768.4834	810.0983 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
Northeast					3.8400	14.6176	0.6300	0.7000	0.7700		17.1546 (75)	
Southeast					11.5600	45.1778	0.6300	0.7000	0.7700		159.6081 (77)	
Southwest					1.3300	45.1778	0.6300	0.7000	0.7700		18.3632 (79)	
Northwest					21.3900	14.6176	0.6300	0.7000	0.7700		95.5565 (81)	

Solar gains	290.6824	454.5128	715.0546	1038.2077	1230.2330	1385.4157	1301.0599	1124.0612	869.8754	567.4803	354.1038	240.0302 (83)
Total gains	1123.3102	1281.5464	1511.4401	1786.5576	1928.3956	2039.3092	1929.5344	1762.4977	1536.3595	1282.2385	1122.5872	1050.1285 (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	40.7042	40.8922	40.8309	40.9522	40.9522	41.0107	41.0679	41.1236	41.1779	41.0107	41.1236	41.0107
alpha	3.7136	3.7261	3.7221	3.7301	3.7301	3.7340	3.7379	3.7416	3.7452	3.7340	3.7416	3.7340
util living area	0.9850	0.9754	0.9444	0.8609	0.7152	0.5072	0.3775	0.4104	0.6807	0.9023	0.9714	0.9876 (86)
MIT	19.4970	19.6729	20.0515	20.5030	20.8169	20.9615	20.9902	20.9871	20.8870	20.4904	19.9377	19.4732 (87)
Th 2	19.9555	19.9598	19.9584	19.9612	19.9612	19.9625	19.9638	19.9650	19.9663	19.9625	19.9650	19.9625 (88)
util rest of house	0.9814	0.9697	0.9314	0.8296	0.6560	0.4240	0.2803	0.3059	0.5978	0.8717	0.9634	0.9846 (89)
MIT 2	17.9723	18.2289	18.7688	19.3914	19.7863	19.9370	19.9599	19.9599	19.8772	19.3923	18.6181	17.9426 (90)
Living area fraction												
												fLA = Living area / (4) = 0.1518 (91)
MIT	18.2037	18.4481	18.9635	19.5601	19.9427	20.0925	20.1163	20.1158	20.0304	19.5589	18.8184	18.1749 (92)
Temperature adjustment												0.0000
adjusted MIT	18.2037	18.4481	18.9635	19.5601	19.9427	20.0925	20.1163	20.1158	20.0304	19.5589	18.8184	18.1749 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9728	0.9583	0.9155	0.8156	0.6549	0.4348	0.2949	0.3215	0.6034	0.8570	0.9511	0.9771 (94)
Useful gains	1092.7862	1228.0659	1383.6775	1457.0308	1262.8621	886.6312	568.9854	566.6607	927.0306	1098.8811	1067.6922	1026.0785 (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	2551.2752	2509.8350	2287.1370	1917.5590	1418.6567	912.1969	573.3164	572.4403	1010.4700	1552.9613	2072.4812	2507.6903 (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	1085.1158	861.3488	672.1739	331.5803	115.9112	0.0000	0.0000	0.0000	0.0000	337.8356	723.4481	1102.3192 (98)
Space heating												5229.7330 (98)

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Space heating per m2 (98) / (4) = 31.5196 (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													5759.6178 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1085.1158	861.3488	672.1739	331.5803	115.9112	0.0000	0.0000	0.0000	0.0000	337.8356	723.4481	1102.3192	(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)	1195.0615	948.6220	740.2796	365.1766	127.6555	0.0000	0.0000	0.0000	0.0000	372.0657	796.7490	1214.0079	(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	226.0921	199.3368	209.4852	187.9806	184.3531	164.9251	158.5820	173.7530	173.3644	194.9157	205.8633	220.7169	(64)
Efficiency of water heater (217)m	88.7556	88.5763	88.0067	86.6138	83.9174	80.1000	80.1000	80.1000	80.1000	86.5691	88.1903	88.1000	(216)
Fuel for water heating, kWh/month	254.7356	225.0452	238.0333	217.0329	219.6839	205.8990	197.9800	216.9201	216.4350	225.1563	233.4308	248.4973	(219)
Water heating fuel used												2698.8493	(219)
Annual totals kWh/year													
Space heating fuel - main system												5759.6178	(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)												531.1576	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.32 * 1122 * 1.00) =										-1184.7482		-1184.7482	(233)
Total delivered energy for all uses												7879.8765	(238)

10a. Fuel costs - using BEDF prices (514)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	5759.6178	9.7400	560.9868	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	2698.8493	9.7400	262.8679	(247)
Pumps and fans for heating	75.0000	36.8500	27.6375	(249)
Energy for lighting	531.1576	36.8500	195.7316	(250)
Additional standing charges			104.0000	(251)
Energy saving/generation technologies				
PV Unit	-1184.7482	36.8500	-436.5797	(252)
Total energy cost			714.6441	(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	5759.6178	0.2160	1244.0775	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2698.8493	0.2160	582.9514	(264)
Space and water heating			1827.0289	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	531.1576	0.5190	275.6708	(268)
Energy saving/generation technologies				
PV Unit	-1184.7482	0.5190	-614.8843	(269)
Total kg/year			1526.7404	(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	5759.6178	1.2200	7026.7338	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2698.8493	1.2200	3292.5961	(264)
Space and water heating			10319.3299	(265)
Pumps and fans	75.0000	3.0700	230.2500	(267)
Energy for lighting	531.1576	3.0700	1630.6538	(268)

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Energy saving/generation technologies			
PV Unit	-1184.7482	3.0700	-3637.1769 (269)
Primary energy kWh/year			8543.0568 (272)
Primary energy kWh/m2/year			51.4890 (273)

SAP 2012 EPC IMPROVEMENTS

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

(For testing purposes):

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

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.1	-£ 117	-274 kg (17.9%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£117 1.65 kg/m²	B 90	B 90
Total Savings	£117 1.65 kg/m²		
Potential energy efficiency rating:		B 90	
Potential environmental impact rating:			B 90

Fuel prices for cost data on this page from database revision number 514 TEST (30 Mar 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	£223	£242	-£18
Mains gas	£928	£793	£135
Space heating	£693	£697	-£5
Water heating	£263	£142	£121
Lighting	£196	£196	£0
Generated (PV)	-£437	-£437	£0
Total cost of fuels	£714	£598	£117
Total cost of uses	£715	£598	£116
Delivered energy	47 kWh/m²	39 kWh/m²	8 kWh/m²
Carbon dioxide emissions	1.5 tonnes	1.3 tonnes	0.3 tonnes
CO2 emissions per m²	9 kg/m²	8 kg/m²	2 kg/m²
Primary energy	51 kWh/m²	42 kWh/m²	9 kWh/m²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	82.9600 (1b)	x 2.3900 (2b)	= 198.2744 (1b) - (3b)
First floor	82.9600 (1c)	x 2.6700 (2c)	= 221.5032 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	165.9200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 419.7776 (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) = 0.1191 (8)
Pressure test					Yes
Measured/design AP50					4.4300
Infiltration rate					0.3406 (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) =	0.2895 (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	0.3691	0.3619	0.3547	0.3185	0.3112	0.2750	0.2750	0.2678	0.2895	0.3112	0.3257	0.3402 (22b)
Effective ac	0.5681	0.5655	0.5629	0.5507	0.5484	0.5378	0.5378	0.5359	0.5419	0.5484	0.5530	0.5579 (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)			38.1200	1.1450	43.6489		(27)
Ground Floor			82.9600	0.1100	9.1256	140.0000	11614.4000 (28a)
Brick and Block	181.6200	38.3200	143.3000	0.2400	34.3920	42.2200	6050.1260 (29a)
Clad	20.9300	1.9200	19.0100	0.2400	4.5624	42.2200	802.6022 (29a)
Pitched Roof	82.9600		82.9600	0.1000	8.2960	9.0000	746.6400 (30)
Total net area of external elements Aum(A, m ²)			368.4700				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	102.3569		(33)
Ground Floor Block			47.5100			75.0000	3563.2500 (32c)
Ground Floor Stud			61.8700			9.0000	556.8300 (32c)
First Floor Stud			197.8800			9.0000	1780.9200 (32c)
Internal Floor 1			82.9600			18.0000	1493.2800 (32d)
Internal Ceiling 1			82.9600			18.0000	1493.2800 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 28101.3282 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 169.3667 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 13.7509 (36)
Total fabric heat loss (33) + (36) = 116.1077 (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	78.7013	78.3348	77.9755	76.2882	75.9726	74.5030	74.5030	74.2308	75.0690	75.9726	76.6112	77.2789 (38)
Heat transfer coeff	194.8090	194.4425	194.0833	192.3960	192.0803	190.6107	190.6107	190.3386	191.1768	192.0803	192.7189	193.3866 (39)
Average = Sum(39)m / 12 =												192.3945 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1741	1.1719	1.1697	1.1596	1.1577	1.1488	1.1488	1.1472	1.1522	1.1577	1.1615	1.1655 (40)
HLP (average)												1.1596 (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 2.9571 (42)
Average daily hot water use (litres/day) 104.4305 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	114.8735	110.6963	106.5191	102.3419	98.1647	93.9874	93.9874	98.1647	102.3419	106.5191	110.6963	114.8735 (44)
Energy conte	170.3541	148.9928	153.7472	134.0406	128.6151	110.9851	102.8440	118.0150	119.4244	139.1777	151.9233	164.9789 (45)

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Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Energy content (annual)												Total = Sum(45)m =	1643.0981 (45)
Distribution loss (46)m = 0.15 x (45)m													
	25.5531	22.3489	23.0621	20.1061	19.2923	16.6478	15.4266	17.7022	17.9137	20.8767	22.7885	24.7468	(46)
Water storage loss:													
Store volume												216.0000	(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													
	21.1994	19.1478	21.1994	20.5155	21.1994	20.5155	21.1994	21.1994	20.5155	21.1994	20.5155	21.1994	(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													
	214.8159	189.1518	196.8132	170.3145	160.2825	141.4058	134.2788	150.3803	157.0491	182.2437	194.9508	209.4406	(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												1.1038	(H8)
Utilisation factor												0.5959	(H9)
Collector performance factor												0.8793	(H10)
Dedicated solar storage volume												75.0000	(H11)
Effective solar volume												117.3000	(H13)
Daily hot water demand												104.4305	(H14)
Volume ratio Veff/V												1.1232	(H15)
Solar storage volume factor												1.0000	(H16)
Solar input												-950.2058	(H17)
Solar input	-27.5541	-45.9798	-78.3089	-104.9494	-129.6561	-127.4726	-125.7880	-109.9016	-86.0750	-58.7791	-32.6831	-23.0581	(63)
												-950.2058	(63)
Solar input (sum of months) = Sum(63)m =													
Output from w/h													
	187.2618	143.1720	118.5043	65.3651	30.6264	13.9332	8.4908	40.4787	70.9741	123.4646	162.2677	186.3826	(64)
Total per year (kWh/year) = Sum(64)m =												1150.9212	(64)
Heat gains from water heating, kWh/month													
	92.2121	81.6673	85.5738	73.5876	68.0985	61.2392	59.3435	65.1322	69.8083	80.7294	84.9365	90.4249	(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	177.4244	177.4244	177.4244	177.4244	177.4244	177.4244	177.4244	177.4244	177.4244	177.4244	177.4244	177.4244	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	75.1909	66.7838	54.3123	41.1179	30.7361	25.9487	28.0385	36.4455	48.9171	62.1115	72.4933	77.2806	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	503.5299	508.7550	495.5880	467.5570	432.1730	398.9169	376.6999	371.4748	384.6418	412.6728	448.0568	481.3129	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.6995	55.6995	55.6995	55.6995	55.6995	55.6995	55.6995	55.6995	55.6995	55.6995	55.6995	55.6995	(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)	-118.2829	-118.2829	-118.2829	-118.2829	-118.2829	-118.2829	-118.2829	-118.2829	-118.2829	-118.2829	-118.2829	-118.2829	(71)
Water heating gains (Table 5)	123.9411	121.5287	115.0185	102.2050	91.5302	85.0544	79.7627	87.5433	96.9560	108.5072	117.9674	121.5388	(72)
Total internal gains	820.5028	814.9086	782.7598	728.7209	672.2802	627.7610	602.3420	613.3046	648.3558	701.1324	756.3584	797.9733	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d	Gains W	
Northeast				3.8400	11.2829	0.6300		0.7000		0.7700	13.2411 (75)	
Southeast				11.5600	36.7938	0.6300		0.7000		0.7700	129.9884 (77)	
Southwest				1.3300	36.7938	0.6300		0.7000		0.7700	14.9554 (79)	
Northwest				21.3900	11.2829	0.6300		0.7000		0.7700	73.7573 (81)	
Solar gains	231.9423	423.9808	656.8657	942.5441	1173.1590	1216.3293	1151.1752	971.2292	754.5511	489.2847	283.0759	195.0890 (83)
Total gains	1052.4451	1238.8894	1439.6254	1671.2650	1845.4392	1844.0903	1753.5172	1584.5338	1402.9070	1190.4171	1039.4343	993.0623 (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	40.0696	40.1452	40.2195	40.5722	40.6389	40.9522	40.9522	41.0107	40.8309	40.6389	40.5042	40.3644	
alpha	3.6713	3.6763	3.6813	3.7048	3.7093	3.7301	3.7301	3.7340	3.7221	3.7093	3.7003	3.6910	
util living area	0.9892	0.9797	0.9567	0.8954	0.7747	0.6057	0.4619	0.5238	0.7633	0.9351	0.9814	0.9912	(86)
MIT	19.3291	19.5515	19.9136	20.3697	20.7294	20.9217	20.9781	20.9654	20.8115	20.3293	19.7433	19.2860	(87)
Th 2	19.9408	19.9425	19.9443	19.9525	19.9540	19.9612	19.9612	19.9625	19.9584	19.9540	19.9509	19.9477	(88)
util rest of house	0.9867	0.9751	0.9465	0.8707	0.7242	0.5250	0.3599	0.4175	0.6920	0.9144	0.9762	0.9892	(89)
MIT 2	17.7189	18.0422	18.5636	19.2072	19.6775	19.9014	19.9505	19.9440	19.7925	19.1674	18.3288	17.6606	(90)
Living area fraction	17.9632	18.2712	18.7685	19.3836	19.8372	20.0563	20.1064	20.0990	19.9471	19.3437	18.5434	17.9073	(92)
MIT													

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Temperature adjustment
adjusted MIT 17.9632 18.2712 18.7685 19.3836 19.8372 20.0563 20.1064 20.0990 19.9471 19.3437 18.5434 0.0000
17.9073 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9797	0.9646	0.9315	0.8545	0.7179	0.5329	0.3746	0.4321	0.6911	0.8987	0.9663	0.9831	(94)
Useful gains	1031.0656	1195.0166	1340.9784	1428.1548	1324.9304	982.6581	656.9210	684.7279	969.5980	1069.8816	1004.4387	976.3265	(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	2661.7194	2599.9366	2381.1110	2017.0010	1562.9897	1040.0234	668.3658	704.0653	1117.8388	1679.4987	2205.3654	2650.8087	(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	1213.2064	944.1062	773.8587	423.9692	177.1161	0.0000	0.0000	0.0000	0.0000	453.5551	864.6672	1245.8148	(98)
Space heating												6096.2938	(98)
Space heating per m2												36.7424	(99)

(98) / (4) =

8c. Space cooling requirement

Not applicable

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.8000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													6713.9799 (211)
Space heating requirement	1213.2064	944.1062	773.8587	423.9692	177.1161	0.0000	0.0000	0.0000	0.0000	453.5551	864.6672	1245.8148	(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)	1336.1304	1039.7646	852.2673	466.9265	195.0618	0.0000	0.0000	0.0000	0.0000	499.5100	952.2766	1372.0427	(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	187.2618	143.1720	118.5043	65.3651	30.6264	13.9332	8.4908	40.4787	70.9741	123.4646	162.2677	186.3826	(64)
Efficiency of water heater (217)m	89.2066	89.2304	89.2173	89.2082	89.0464	80.1000	80.1000	80.1000	80.1000	88.2768	88.9230	89.2485	(216)
Fuel for water heating, kWh/month	209.9192	160.4520	132.8266	73.2725	34.3938	17.3948	10.6002	50.5351	88.6068	139.8607	182.4811	208.8355	(219)
Water heating fuel used												1309.1784	(219)
Annual totals kWh/year													
Space heating fuel - main system												6713.9799	(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)												531.1576	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.32 * 1004 * 1.00) =									-1060.2200			-1060.2200	(233)
Total delivered energy for all uses												7619.0959	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	6713.9799	3.4800	233.6465	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1309.1784	3.4800	45.5594	(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	531.1576	13.1900	70.0597	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-1060.2200	13.1900	-139.8430	(252)
Total energy cost			345.9101	(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] =	0.6888 (257)
SAP value			90.3912
SAP rating (Section 12)			90 (258)
SAP band			B

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	6713.9799	0.2160	1450.2197 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1309.1784	0.2160	282.7825 (264)
Space and water heating			1733.0022 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	531.1576	0.5190	275.6708 (268)
Energy saving/generation technologies			
PV Unit	-1060.2200	0.5190	-550.2542 (269)
Total kg/year			1523.2938 (272)
CO2 emissions per m2			9.1800 (273)
EI value			90.3223
EI rating			90 (274)
EI band			B

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	82.9600 (1b)	x 2.3900 (2b)	= 198.2744 (1b) - (3b)
First floor	82.9600 (1c)	x 2.6700 (2c)	= 221.5032 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	165.9200		(3a) + (3b) + (3c) + (3d) + (3e) ... (3n) = 419.7776 (5)
Dwelling volume			

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) = 0.1191 (8)
Pressure test					Yes
Measured/design AP50					4.4300
Infiltration rate					0.3406 (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) =	0.2895 (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	0.3040	0.2823	0.2895	0.2750	0.2750	0.2678	0.2606	0.2533	0.2461	0.2678	0.2533	0.2678 (22b)
Effective ac	0.5462	0.5398	0.5419	0.5378	0.5378	0.5359	0.5339	0.5321	0.5303	0.5359	0.5321	0.5359 (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)			38.1200	1.1450	43.6489		(27)
Ground Floor			82.9600	0.1100	9.1256	140.0000	11614.4000 (28a)
Brick and Block	181.6200	38.3200	143.3000	0.2400	34.3920	42.2200	6050.1260 (29a)
Clad	20.9300	1.9200	19.0100	0.2400	4.5624	42.2200	802.6022 (29a)
Pitched Roof	82.9600		82.9600	0.1000	8.2960	9.0000	746.6400 (30)
Total net area of external elements Aum(A, m ²)			368.4700				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	102.3569		(33)
Ground Floor Block			47.5100			75.0000	3563.2500 (32c)
Ground Floor Stud			61.8700			9.0000	556.8300 (32c)
First Floor Stud			197.8800			9.0000	1780.9200 (32c)
Internal Floor 1			82.9600			18.0000	1493.2800 (32d)
Internal Ceiling 1			82.9600			18.0000	1493.2800 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	28101.3282 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							169.3667 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							13.7509 (36)
Total fabric heat loss						(33) + (36) =	116.1077 (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	75.6641	74.7824	75.0690	74.5030	74.5030	74.2308	73.9660	73.7083	73.4580	74.2308	73.7083	74.2308 (38)
Heat transfer coeff	191.7718	190.8901	191.1768	190.6107	190.6107	190.3386	190.0737	189.8160	189.5657	190.3386	189.8160	190.3386 (39)
Average = Sum(39)m / 12 =												190.4456 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1558	1.1505	1.1522	1.1488	1.1488	1.1472	1.1456	1.1440	1.1425	1.1472	1.1440	1.1472 (40)
HLP (average)												1.1478 (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												2.9571 (42)
Average daily hot water use (litres/day)												104.4305 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	114.8735	110.6963	106.5191	102.3419	98.1647	93.9874	93.9874	98.1647	102.3419	106.5191	110.6963	114.8735 (44)
Energy conte	170.3541	148.9928	153.7472	134.0406	128.6151	110.9851	102.8440	118.0150	119.4244	139.1777	151.9233	164.9789 (45)

FULL SAP CALCULATION PRINTOUT

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

Energy content (annual)												Total = Sum (45)m =	1643.0981 (45)
Distribution loss (46)m = 0.15 x (45)m													
	25.5531	22.3489	23.0621	20.1061	19.2923	16.6478	15.4266	17.7022	17.9137	20.8767	22.7885	24.7468	(46)
Water storage loss:													
Store volume												216.0000	(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													
	21.1994	19.1478	21.1994	20.5155	21.1994	20.5155	21.1994	21.1994	20.5155	21.1994	20.5155	21.1994	(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													
	214.8159	189.1518	196.8132	170.3145	160.2825	141.4058	134.2788	150.3803	157.0491	182.2437	194.9508	209.4406	(62)
Aperture area of solar collector												3.0000	(H1)
Zero-loss collector efficiency												0.7000	(H2)
Collector heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0050	(H3a)
Collector effective heat loss coefficient												1.8063	(H3b)
Collector performance ratio												2.5804	(H4)
Annual solar radiation per m2												1208.1510	(H5)
Overshading factor												0.8000	(H6)
Solar energy available												2029.6937	(H7)
Adjustment factor for showers												1.0000	(H7a)
Solar-to-load ratio												1.2353	(H8)
Utilisation factor												0.5549	(H9)
Collector performance factor												0.8793	(H10)
Dedicated solar storage volume												75.0000	(H11)
Effective solar volume												117.3000	(H13)
Daily hot water demand												104.4305	(H14)
Volume ratio Veff/V												1.1232	(H15)
Solar storage volume factor												1.0000	(H16)
Solar input												-990.3866	(H17)
Solar input	-32.3088	-45.9411	-78.9617	-106.5376	-125.1348	-133.6637	-130.8527	-117.1172	-91.6946	-63.3945	-38.2128	-26.5672	(63)
												-990.3866	(63)
Solar input (sum of months) = Sum (63)m =													
Output from w/h													
	182.5071	143.2107	117.8516	63.7769	35.1478	7.7422	3.4261	33.2631	65.3544	118.8491	156.7380	182.8734	(64)
Total per year (kWh/year) = Sum (64)m =												1110.7404	(64)
Heat gains from water heating, kWh/month													
	92.2121	81.6673	85.5738	73.5876	68.0985	61.2392	59.3435	65.1322	69.8083	80.7294	84.9365	90.4249	(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	177.4244	177.4244	177.4244	177.4244	177.4244	177.4244	177.4244	177.4244	177.4244	177.4244	177.4244	177.4244	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	75.1909	66.7838	54.3123	41.1179	30.7361	25.9487	28.0385	36.4455	48.9171	62.1115	72.4933	77.2806	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	503.5299	508.7550	495.5880	467.5570	432.1730	398.9169	376.6999	371.4748	384.6418	412.6728	448.0568	481.3129	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	55.6995	55.6995	55.6995	55.6995	55.6995	55.6995	55.6995	55.6995	55.6995	55.6995	55.6995	55.6995	(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)													
	-118.2829	-118.2829	-118.2829	-118.2829	-118.2829	-118.2829	-118.2829	-118.2829	-118.2829	-118.2829	-118.2829	-118.2829	(71)
Water heating gains (Table 5)													
	123.9411	121.5287	115.0185	102.2050	91.5302	85.0544	79.7627	87.5433	96.9560	108.5072	117.9674	121.5388	(72)
Total internal gains	820.5028	814.9086	782.7598	728.7209	672.2802	627.7610	602.3420	613.3046	648.3558	701.1324	756.3584	797.9733	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d			Gains W
Northeast					3.8400	14.6176		0.6300	0.7000	0.7700			17.1546 (75)
Southeast					11.5600	45.1778		0.6300	0.7000	0.7700			159.6081 (77)
Southwest					1.3300	45.1778		0.6300	0.7000	0.7700			18.3632 (79)
Northwest					21.3900	14.6176		0.6300	0.7000	0.7700			95.5565 (81)

Solar gains	290.6824	454.5128	715.0546	1038.2077	1230.2330	1385.4157	1301.0599	1124.0612	869.8754	567.4803	354.1038	240.0302	(83)
Total gains	1111.1852	1269.4214	1497.8143	1766.9286	1902.5133	2013.1767	1903.4019	1737.3657	1518.2313	1268.6127	1110.4622	1038.0035	(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	40.7042	40.8922	40.8309	40.9522	40.9522	41.0107	41.0679	41.1236	41.1779	41.0107	41.1236	41.0107	
alpha	3.7136	3.7261	3.7221	3.7301	3.7301	3.7340	3.7379	3.7416	3.7452	3.7340	3.7416	3.7340	
util living area	0.9855	0.9761	0.9457	0.8643	0.7212	0.5128	0.3824	0.4159	0.6861	0.9048	0.9723	0.9881	(86)
MIT	19.4884	19.6646	20.0433	20.4947	20.8114	20.9600	20.9897	20.9865	20.8839	20.4835	19.9295	19.4644	(87)
Th 2	19.9555	19.9598	19.9584	19.9612	19.9612	19.9625	19.9638	19.9650	19.9663	19.9625	19.9650	19.9625	(88)
util rest of house	0.9821	0.9706	0.9330	0.8334	0.6622	0.4290	0.2841	0.3102	0.6033	0.8748	0.9645	0.9852	(89)
MIT 2	17.9599	18.2170	18.7574	19.3808	19.7806	19.9360	19.9598	19.9596	19.8744	19.3835	18.6065	17.9300	(90)
Living area fraction												0.1518	(91)
MIT	18.1918	18.4367	18.9526	19.5499	19.9370	20.0914	20.1161	20.1155	20.0276	19.5504	18.8073	18.1628	(92)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Temperature adjustment													0.0000
adjusted MIT	18.1918	18.4367	18.9526	19.5499	19.9370	20.0914	20.1161	20.1155	20.0276	19.5504	18.8073	18.1628	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9736	0.9593	0.9172	0.8192	0.6608	0.4398	0.2988	0.3260	0.6087	0.8600	0.9524	0.9778	(94)
Useful gains	1081.8889	1217.7553	1373.8132	1447.4958	1257.0987	885.4313	568.7443	566.3272	924.0742	1091.0300	1057.6572	1015.0057	(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	2548.9978	2507.6713	2285.0532	1915.6135	1417.5766	911.9903	573.2749	572.3829	1009.9335	1551.3357	2070.3802	2505.3957	(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	1091.5290	866.8235	677.9625	337.0447	119.3956	0.0000	0.0000	0.0000	0.0000	342.4674	729.1605	1108.8502	(98)
Space heating												5273.2335	(98)
Space heating per m2											(98) / (4) =	31.7818	(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													5807.5259	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	1091.5290	866.8235	677.9625	337.0447	119.3956	0.0000	0.0000	0.0000	0.0000	342.4674	729.1605	1108.8502	(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)	1202.1245	954.6515	746.6548	371.1946	131.4929	0.0000	0.0000	0.0000	0.0000	377.1668	803.0402	1221.2006	(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	182.5071	143.2107	117.8516	63.7769	35.1478	7.7422	3.4261	33.2631	65.3544	118.8491	156.7380	182.8734	(64)	
Efficiency of water heater (217)m	89.0951	89.1122	89.0386	88.9102	88.1228	80.1000	80.1000	80.1000	80.1000	87.7791	88.7036	89.1147	(217)	
Fuel for water heating, kWh/month	204.8453	160.7084	132.3601	71.7318	39.8850	9.6656	4.2772	41.5270	81.5910	135.3957	176.6987	205.2113	(219)	
Water heating fuel used												1263.8971	(219)	
Annual totals kWh/year														
Space heating fuel - main system												5807.5259	(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)												531.1576	(232)	
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 1.32 * 1122 * 1.00) =										-1184.7482		-1184.7482	(233)	
Total delivered energy for all uses												6542.8324	(238)	

10a. Fuel costs - using BEDF prices (514)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	5807.5259	9.7400	565.6530	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1263.8971	9.7400	123.1036	(247)
Pumps and fans for heating	75.0000	36.8500	27.6375	(249)
Pump for solar water heating	50.0000	36.8500	18.4250	(249)
Energy for lighting	531.1576	36.8500	195.7316	(250)
Additional standing charges			104.0000	(251)
Energy saving/generation technologies				
PV Unit	-1184.7482	36.8500	-436.5797	(252)
Total energy cost			597.9710	(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	5807.5259	0.2160	1254.4256	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1263.8971	0.2160	273.0018	(264)
Space and water heating			1527.4274	(265)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	531.1576	0.5190	275.6708 (268)
Energy saving/generation technologies			
PV Unit	-1184.7482	0.5190	-614.8843 (269)
Total kg/year			1253.0889 (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	5807.5259	1.2200	7085.1816 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1263.8971	1.2200	1541.9545 (264)
Space and water heating			8627.1361 (265)
Pumps and fans	125.0000	3.0700	383.7500 (267)
Energy for lighting	531.1576	3.0700	1630.6538 (268)
Energy saving/generation technologies			
PV Unit	-1184.7482	3.0700	-3637.1769 (269)
Primary energy kWh/year			7004.3630 (272)
Primary energy kWh/m2/year			42.2153 (273)

U-VALUE CALCULATOR REPORT

Property Reference	SAP 0645 Plot 36	Issued on Date	05/05/2023
Assessment Reference	As Built	Prop Type Ref	ZI
Project	10, Fieldfare Crescent, Botley, Southampton, SO32 2TW		
Calculation Type	New Build (As Built)		

SAP Rating	89 B	DER	11.98	TER	15.63
Environmental	89 B	% DER<TER	23.36		
CO ₂ Emissions (t/year)	1.53	DFEE	47.96	TFEE	58.14
General Requirements Compliance	Pass	% DFEE<TFEE	17.51		

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 000004 - 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 36	Issued on Date	05/05/2023
Assessment Reference	As Built	Prop Type Ref	ZI
Project	10, Fieldfare Crescent, Botley, Southampton, SO32 2TW		
Calculation Type	New Build (As Built)		

SAP Rating	89 B	DER	11.98	TER	15.63
Environmental	89 B	% DER<TER	23.36		
CO ₂ Emissions (t/year)	1.53	DFEE	47.96	TFEE	58.14
General Requirements Compliance	Pass	% DFEE<TFEE	17.51		

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 36	Issued on Date	05/05/2023
Assessment Reference	As Built	Prop Type Ref	ZI
Project	10, Fieldfare Crescent, Botley, Southampton, SO32 2TW		
Calculation Type	New Build (As Built)		

SAP Rating	89 B	DER	11.98	TER	15.63
Environmental	89 B	% DER<TER	23.36		
CO ₂ Emissions (t/year)	1.53	DFEE	47.96	TFEE	58.14
General Requirements Compliance	Pass	% DFEE<TFEE	17.51		

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 000009

Wall Type: Standard Wall

Layer	Description	Thickness (mm)	Conductivity (W/m ² K)	Resistance (m ² K/W)	Fraction (%)	Density (kg/m ³)	Heat Cap. (J/kgK)
Ext surface				0.1300			
Layer 1	Tiling, clay						
	Main construction	30	1.0000	0.0000	100.00		
Layer 2	Standard cavity						
	Main construction	25	0.0000	0.0000	90.50		
	Main construction	25	0.1300	0.0000	9.50		
	Corrections - Cavity Ventilated, Emissivity: Normal						
Layer 3	Blockwork, dense						
	Main construction	100	1.5900	0.0629	93.18		
	Main construction	100	0.8800	0.1136	6.82		
Layer 4	Supafil 34						
	Main construction	100	0.0340	2.9412	100.00		
Layer 5	Supabloc						
	Main construction	100	0.1100	0.9091	94.04	460	1000
	Main construction	100	0.8803	0.1136	5.96	460	1000
	Corrections - Air Gap: Level 1, Fasteners: None or plastic						
Layer 6	airspace/plaster dabs						
	Main construction	15	0.0882	0.1700	80.00		
	Main construction	15	0.0882	0.1700	20.00		
	Corrections - Cavity Unventilated, Emissivity: Normal						
Layer 7	Plasterboard, standard						
	Main construction	12.5	0.2100	0.0595	100.00	700	1000
Int surface				0.1300			

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

Unheated space: None		
Total thickness: 383 mm	U-value: 0.24 W/m² K	Kappa: 42.22 kJ/m² K

U-VALUE CALCULATOR REPORT

Property Reference	SAP 0645 Plot 36	Issued on Date	05/05/2023
Assessment Reference	As Built	Prop Type Ref	ZI
Project	10, Fieldfare Crescent, Botley, Southampton, SO32 2TW		
Calculation Type	New Build (As Built)		

SAP Rating	89 B	DER	11.98	TER	15.63
Environmental	89 B	% DER<TER	23.36		
CO ₂ Emissions (t/year)	1.53	DFEE	47.96	TFEE	58.14
General Requirements Compliance	Pass	% DFEE<TFEE	17.51		

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

Building Elements

Floor 000008 - Floor - suspended beam-and-block floor

Floor Type: Suspended Floor

Area = 82.96 m², Perimeter = 40.03 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) = 0.11 W/m² K

Unheated space: None

Total thickness: 450 mm

U-value: 0.11 W/m² K

Kappa: 140.00 kJ/m² K

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

Property Reference	SAP 0645 Plot 36	Issued on Date	05/05/2023
Assessment Reference	As Built	Prop Type Ref	ZI
Property	10, Fieldfare Crescent, Botley, Southampton, SO32 2TW		
SAP Rating	89 B	DER	11.98
Environmental	89 B	TER	15.63
CO ₂ Emissions (t/year)	1.53	% DER<TER	23.36
General Requirements Compliance	Pass	DFEE	47.96
		TFEE	58.14
		% DFEE<TFEE	17.51
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	South East						
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							
			Heat Loss Perimeter		Internal Floor Area	Average Storey Height	
		Ground Floor:	40.03 m		82.96 m²	2.39 m	
		1st Storey:	40.03 m		82.96 m²	2.67 m	
7.0 Living Area	25.18			m²			
8.0 Thermal Mass Parameter	Precise calculation						
Thermal Mass	169.37			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	181.62	143.30
Clad	Cavity Wall	Other		0.24	42.22	20.93	19.01
9.2 Internal Walls							
Description	Construction					Kappa (kJ/m²K)	Area (m²)
Ground Floor Block	Dense block, plasterboard on dabs					75.00	47.51
Ground Floor Stud	Plasterboard on timber frame					9.00	61.87
First Floor Stud	Plasterboard on timber frame					9.00	197.88
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	82.96	82.96
10.2 Internal Ceilings							
Description	Construction					Kappa (kJ/m²K)	Area (m²)
Internal Ceiling 1	Plasterboard ceiling, carpeted chipboard floor					9.00	82.96

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Area (m²)
Ground Floor	Ground Floor - Solid	Other	0.11	140.00	82.96

11.2 Internal Floors

Description	Construction	Kappa (kJ/m²K)	Area (m²)
Internal Floor 1	Plasterboard ceiling, carpeted chipboard floor	18.00	82.96

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

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	South East							2.12	
Front Elevation	Window	[1] Brick and Block	South East	None	0.54	Yes				1.68	
Front Elevation	Window	[1] Brick and Block	South East	None	0.00					7.96	
Side Elevation	Window	[1] Brick and Block	South West	None	0.00					1.33	
Rear Elevation	Window	[1] Brick and Block	North West	None	0.00					21.39	
Side Elevation	Window	[1] Brick and Block	North East	None	0.00					3.84	
Front Clad	Window	[2] Clad	South East	None	0.00					1.92	

14.0 Conservatory

None

15.0 Draught Proofing

100

%

16.0 Draught Lobby

No

17.0 Thermal Bridging

Calculate Bridges

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported	Reference:
Independently assessed	E2 Other lintels (including other steel lintels)	27.62	0.274	No	Knauf P3
Independently assessed	E3 Sill	17.68	0.021	No	Knauf P5
Independently assessed	E4 Jamb	58.20	0.016	No	Knauf P6
Independently assessed	E5 Ground floor (normal)	40.03	0.062	No	BE-E5-23902
Independently assessed	E6 Intermediate floor within a dwelling	40.03	0.000	No	CD0029
Table K1 - Approved	E10 Eaves (insulation at ceiling level)	23.42	0.060	No	
Independently assessed	E12 Gable (insulation at ceiling level)	16.61	0.044	No	Knauf P21
Independently assessed	E16 Corner (normal)	30.30	0.039	No	Knauf P23
Independently assessed	E17 Corner (inverted – internal area greater than external area)	10.10	-0.091	No	Knauf P24

Y-value	0.037	W/m²K
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18.0 Pressure Testing

Designed AP ₅₀	5.00	m³/(h.m²) @ 50 Pa
Property Tested ?	Yes	
As Built AP ₅₀	4.43	m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows half open
Cross ventilation possible	Yes
Night Ventilation	Yes

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

Air change rate 4.00

Mechanical Ventilation

Mechanical Ventilation System Present

No

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

22.0 Lighting

Internal

Total number of light fittings	31	
Total number of L.E.L. fittings	31	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	Yes
Light and motion sensor	Yes

23.0 Electricity Tariff

Standard

24.0 Main Heating 1

Description	Database	
Percentage of Heat	System Boiler	%
Database Ref. No.	100	
Fuel Type	18913	
Main Heating	Mains gas	
SAP Code	BGB	
In Winter	102	
In Summer	90.8	
Controls	80.1	
PCDF Controls	CBI Time and temperature zone control	
Delayed Start Stat	0	
Sap Code	No	
Flue Type	2110	
Fan Assisted Flue	Balanced	
Is MHS Pumped	Yes	
Heat Emitter	Pump in heated space	
Flow Temperature	Radiators	
	Normal (> 45°C)	

25.0 Main Heating 2

None

Community Heating

None

28.0 Water Heating

Water Heating	HWP From main heating 1
Flue Gas Heat Recovery System	Main Heating 1
Waste Water Heat Recovery	No
	No

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

Instantaneous System 1	
Waste Water Heat Recovery	No
Instantaneous System 2	
Waste Water Heat Recovery	No
Storage System	
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	216.00	L
Loss	1.94	kWh/day
Pipes insulation	Fully insulated primary pipework	

31.0 Thermal Store	None
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32.0 Photovoltaic Unit	One Dwelling			
PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
1.32	South East	45°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£117	B 90	