



SAP Report Submission for Building Regulations Compliance

Client: RGOM

Project: Clarence Elizabeth Charles, The Lillies
Horton Heath, Eastleigh, SO50 7QH

Contact: Tobias Whiting
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Report Issue Date: 25/04/2023

EXCELLENCE
IN ENERGY
ASSESSMENT

BUILDING REGULATION COMPLIANCE

Calculation Type: New Build (As Built)

Property Reference	SAP 0865	Issued on Date	25/04/2023
Assessment Reference	As Built	Prop Type Ref	
Property	Clarence Elizabeth Charles, The Lillies, Horton Heath, Eastleigh, SO50 7QH		
SAP Rating	89 B	DER	12.63
Environmental	89 B	TER	16.05
CO ₂ Emissions (t/year)	1.26	% DER<TER	21.31
General Requirements Compliance	Pass	DfEE	47.42
		TfEE	56.29
		% DfEE<TfEE	15.76
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)	16.05	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	12.63	kgCO ₂ /m ²	Pass
	-3.42 (-21.3%)	kgCO ₂ /m ²	

1b TfEE and DfEE

Target Fabric Energy Efficiency (TfEE)	56.29	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DfEE)	47.42	kWh/m ² /yr	
	-8.9 (-15.8%)	kWh/m ² /yr	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.23 (max. 0.30)	0.23 (max. 0.70)	Pass
Floor	0.12 (max. 0.25)	0.12 (max. 0.70)	Pass
Roof	0.10 (max. 0.20)	0.10 (max. 0.35)	Pass
Openings	1.38 (max. 2.00)	1.40 (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	3.32 (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 21 S NG

Efficiency: 89.6% SEDBUK2009
Minimum: 88.0%

Pass

Secondary heating system

None

5 Cylinder insulation

Hot water storage

Measured cylinder loss: 1.73 kWh/day
Permitted by DBSCG 2.33

Pass

Primary pipework insulated

Yes

Pass

6 Controls

Space heating controls

Programmer, room thermostat and TRVs

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

0.96 m², No overhang

Windows facing East

15.73 m², No overhang

Windows facing West

8.86 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

3.32 (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	0.12	W/m ² K
Door U-value	1.10	W/m ² K
Thermal bridging ψ -value	0.031	W/m ² K
Air permeability	3.3	m ³ /m ² h
Photovoltaic array	1.48	kW

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THERMAL BRIDGING

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CO ₂ Emissions (t/year)	1.26	% DER<TER	21.31
General Requirements Compliance	Pass	DFEE	47.42
		TFEE	56.29
		% DFEE<TFEE	15.76
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	0.077	0.69	0.05	Birtley Supatherm
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.071	1.93	0.14	Birtley Supatherm
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.061	10.86	0.66	Birtley Supatherm
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.056	5.42	0.30	Birtley Supatherm
External wall	E3 Sill	Independently assessed	0.021	12.46	0.26	Knauf P5
External wall	E4 Jamb	Independently assessed	0.016	30.60	0.49	Knauf P6
External wall	E5 Ground floor (normal)	Table K1 - Approved	0.160	37.35	5.98	
External wall	E6 Intermediate floor within a dwelling	Independently assessed	0.000	37.35	0.00	CD0029
External wall	E10 Eaves (insulation at ceiling level)	Table K1 - Approved	0.060	14.87	0.89	
External wall	E12 Gable (insulation at ceiling level)	Independently assessed	0.044	22.48	0.99	Knauf P21
External wall	E16 Corner (normal)	Independently assessed	0.039	29.99	1.17	Knauf P23
External wall	E17 Corner (inverted – internal area greater than external area)	Independently assessed	-0.091	10.00	-0.91	Knauf P24

Total: **10.02** W/mK:
Y-Value: **0.031** W/m²K:

FULL SAP CALCULATION PRINTOUT

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General Requirements Compliance	Pass	% DFEE<TFEE	15.76		
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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 141 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) 16.05 kgCO₂/m²

Dwelling Carbon Dioxide Emission Rate (DER) 12.63 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)56.3 kWh/m²/yr

Dwelling Fabric Energy Efficiency (DFEE)47.4 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.23 (max. 0.30)	0.23 (max. 0.70)	OK
Floor	0.12 (max. 0.25)	0.12 (max. 0.70)	OK
Roof	0.10 (max. 0.20)	0.10 (max. 0.35)	OK
Openings	1.38 (max. 2.00)	1.40 (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:	3.32 (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 21 S NG

Efficiency: 89.6% SEDBUK2009

Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation

Hot water storage Measured cylinder loss: 1.73 kWh/day

Permitted by DBSCG 2.33 OK

Primary pipework insulated: Yes OK

6 Controls

Space heating controls: Programmer, room thermostat and TRVs 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: 0.96 m², No overhang

Windows facing East: 15.73 m², No overhang

Windows facing West: 8.86 m², No overhang

Air change rate: 4.00 ach

Blinds/curtains: None

10 Key features

Roof U-value 0.10 W/m²K

Floor U-value 0.12 W/m²K

Door U-value 1.10 W/m²K

Thermal bridging y-value 0.031 W/m²K

Air permeability 3.3 m³/m²h

Photovoltaic array 1.48 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	70.3700 (1b)	x 2.3900 (2b)	= 168.1843 (1b) - (3b)
First floor	70.3700 (1c)	x 2.6100 (2c)	= 183.6657 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	140.7400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 351.8500 (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) = 0.1421 (8)
Pressure test					Yes
Measured/design AP50					3.3200
Infiltration rate					0.3081 (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) =	0.2619 (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	0.3339	0.3274	0.3208	0.2881	0.2815	0.2488	0.2488	0.2422	0.2619	0.2815	0.2946	0.3077 (22b)
Effective ac	0.5557	0.5536	0.5515	0.5415	0.5396	0.5309	0.5309	0.5293	0.5343	0.5396	0.5434	0.5473 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			2.1500	1.1000	2.3650		(26)
Windows (Uw = 1.40)			25.5500	1.3258	33.8731		(27)
Ground Floor			70.3700	0.1200	8.4444	90.0000	6333.3000 (28a)
Brick and Block	186.7500	27.7000	159.0500	0.2300	36.5815	42.2200	6715.0910 (29a)
Pitched Roof	70.3700		70.3700	0.1000	7.0370	9.1000	640.3670 (30)
Total net area of external elements Aum(A, m ²)			327.4900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	88.3010		(33)
Ground Floor Block			59.3900			75.0000	4454.2500 (32c)
Ground Floor Stud			45.5500			9.0000	409.9500 (32c)
First Floor Stud			173.6700			9.0000	1563.0300 (32c)
Internal Floor 1			70.3700			18.0000	1266.6600 (32d)
Internal Ceiling 1			70.3700			18.0000	1266.6600 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 22649.3080 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 160.9301 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 10.0243 (36)
Total fabric heat loss (33) + (36) = 98.3253 (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	64.5282	64.2768	64.0304	62.8732	62.6567	61.6488	61.6488	61.4622	62.0371	62.6567	63.0947	63.5526 (38)
Heat transfer coeff	162.8535	162.6022	162.3558	161.1986	160.9821	159.9742	159.9742	159.7875	160.3624	160.9821	161.4201	161.8780 (39)
Average = Sum(39)m / 12 =												161.1975 (39)
HLP	1.1571	1.1553	1.1536	1.1454	1.1438	1.1367	1.1367	1.1353	1.1394	1.1438	1.1469	1.1502 (40)
HLP (average)												1.1454 (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												2.9185 (42)
Average daily hot water use (litres/day)												103.5139 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.8653	109.7247	105.5842	101.4436	97.3031	93.1625	93.1625	97.3031	101.4436	105.5842	109.7247	113.8653 (44)
Energy conte	168.8589	147.6851	152.3978	132.8641	127.4863	110.0109	101.9413	116.9791	118.3762	137.9561	150.5899	163.5309 (45)
Energy content (annual)										Total = Sum(45)m =		1628.6766 (45)

FULL SAP CALCULATION PRINTOUT

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	25.3288	22.1528	22.8597	19.9296	19.1229	16.5016	15.2912	17.5469	17.7564	20.6934	22.5885	24.5296 (46)
Water storage loss:												
Store volume												215.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.7300 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.9342 (55)
Total storage loss												
28.9602 26.1576 28.9602 28.0260 28.9602 28.0260 28.9602 28.9602 28.0260 28.9602 28.0260 28.9602 28.9602 (56)												
If cylinder contains dedicated solar storage												
28.9602 26.1576 28.9602 28.0260 28.9602 28.0260 28.9602 28.9602 28.0260 28.9602 28.0260 28.9602 28.9602 (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												
221.0815 194.8539 204.6204 183.4021 179.7089 160.5489 154.1639 169.2017 168.9142 190.1787 201.1279 215.7535 (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	221.0815	194.8539	204.6204	183.4021	179.7089	160.5489	154.1639	169.2017	168.9142	190.1787	201.1279	215.7535 (64)
Total per year (kWh/year) = Sum(64)m =												2243.5556 (64)
Heat gains from water heating, kWh/month												
97.9237 86.8403 92.4503 84.6077 84.1673 77.0090 75.6736 80.6736 79.7905 87.6485 90.5015 96.1521 (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	145.9240	145.9240	145.9240	145.9240	145.9240	145.9240	145.9240	145.9240	145.9240	145.9240	145.9240	145.9240	145.9240 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
28.2119 25.0576 20.3782 15.4276 11.5323 9.7361 10.5202 13.6745 18.3539 23.3045 27.1997 28.9960 (67)													
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
310.2518 313.4713 305.3584 288.0870 266.2850 245.7941 232.1050 228.8856 236.9985 254.2698 276.0719 296.5627 (68)													
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
37.5924 37.5924 37.5924 37.5924 37.5924 37.5924 37.5924 37.5924 37.5924 37.5924 37.5924 37.5924 37.5924 (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	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)													
-116.7392 -116.7392 -116.7392 -116.7392 -116.7392 -116.7392 -116.7392 -116.7392 -116.7392 -116.7392 -116.7392 -116.7392 (71)													
Water heating gains (Table 5)													
131.6178 129.2267 124.2612 117.5107 113.1280 106.9570 101.7118 108.4323 110.8201 117.8071 125.6966 129.2367 (72)													
Total internal gains	539.8588	537.5327	519.7750	490.8025	460.7225	432.2644	414.1141	420.7696	435.9497	465.1586	498.7454	524.5726	524.5726 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d			Gains W
North				0.9600	10.6334	0.6300	0.7000			0.7700			3.1197 (74)
East				15.7300	19.6403	0.6300	0.7000			0.7700			94.4165 (76)
West				8.8600	19.6403	0.6300	0.7000			0.7700			53.1806 (80)

Solar gains	150.7168	294.6931	485.6298	709.7597	871.8151	893.4849	850.2020	728.8734	565.2056	349.7007	187.8847	123.9774	(83)
Total gains	690.5755	832.2258	1005.4048	1200.5621	1332.5376	1325.7493	1264.3161	1149.6430	1001.1552	814.8593	686.6301	648.5499	(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	38.6327	38.6924	38.7512	39.0293	39.0818	39.3281	39.3281	39.3740	39.2329	39.0818	38.9758	38.8655	38.8655
alpha	3.5755	3.5795	3.5834	3.6020	3.6055	3.6219	3.6219	3.6249	3.6155	3.6055	3.5984	3.5910	3.5910
util living area	0.9944	0.9887	0.9723	0.9250	0.8260	0.6733	0.5250	0.5872	0.8207	0.9603	0.9902	0.9956	0.9956 (86)
MIT	19.1149	19.3347	19.7224	20.2188	20.6311	20.8777	20.9626	20.9441	20.7347	20.1704	19.5461	19.0736	19.0736 (87)
Th 2	19.9545	19.9559	19.9573	19.9640	19.9652	19.9710	19.9710	19.9721	19.9688	19.9652	19.9627	19.9601	19.9601 (88)
util rest of house													
0.9931 0.9860 0.9656 0.9063 0.7823 0.5933 0.4151 0.4759 0.7585 0.9469 0.9874 0.9945 (89)													
MIT 2	18.2265	18.4461	18.8305	19.3172	19.6971	19.9033	19.9576	19.9500	19.7995	19.2804	18.6627	18.1894	18.1894 (90)
Living area fraction													
fLA = Living area / (4) =													
MIT	18.3590	18.5787	18.9636	19.4517	19.8365	20.0487	20.1075	20.0984	19.9390	19.4132	18.7946	18.3213	18.3213 (92)
Temperature adjustment													0.0000
adjusted MIT	18.3590	18.5787	18.9636	19.4517	19.8365	20.0487	20.1075	20.0984	19.9390	19.4132	18.7946	18.3213	18.3213 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
0.9903 0.9812 0.9572 0.8950 0.7761 0.5999 0.4305 0.4906 0.7564 0.9375 0.9831 0.9922 (94)													
Useful gains	683.9089	816.6177	962.4051	1074.4966	1034.1669	795.2790	544.2598	563.9754	757.2794	763.9245	675.0409	643.4959	643.4959 (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	4.2000 (96)
Heat loss rate W													
2289.5626 2224.1797 2023.5370 1700.9180 1309.8287 871.6502 561.1159 590.9527 936.3591 1418.7636 1887.7364 2285.9316 (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	1.0000 (97a)
Space heating kWh													
1194.6064 945.8817 789.4822 451.0234 205.0923 0.0000 0.0000 0.0000 0.0000 487.2003 873.1408 1221.9722 (98)													
Space heating													
Space heating per m2													43.8283 (99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.6000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													6808.3877 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1194.6064	945.8817	789.4822	451.0234	205.0923	0.0000	0.0000	0.0000	0.0000	487.2003	873.1408	1221.9722	(98)
Space heating efficiency (main heating system 1)	90.6000	90.6000	90.6000	90.6000	90.6000	0.0000	0.0000	0.0000	0.0000	90.6000	90.6000	90.6000	(210)
Space heating fuel (main heating system)	1318.5501	1044.0195	871.3931	497.8184	226.3712	0.0000	0.0000	0.0000	0.0000	537.7487	963.7315	1348.7552	(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	221.0815	194.8539	204.6204	183.4021	179.7089	160.5489	154.1639	169.2017	168.9142	190.1787	201.1279	215.7535	(64)
Efficiency of water heater	88.7441	88.5739	88.1696	87.2233	85.2672	79.9000	79.9000	79.9000	79.9000	87.3170	88.3840	79.9000	(216)
Fuel for water heating, kWh/month	249.1226	219.9903	232.0758	210.2673	210.7596	200.9373	192.9461	211.7669	211.4071	217.8025	227.5614	242.9242	(219)
Water heating fuel used												2627.5610	(219)
Annual totals kWh/year													
Space heating fuel - main system												6808.3877	(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)												498.2308	(232)
Energy saving/generation technologies (Appendices M, N and Q)													
PV Unit 0 (0.80 * 1.48 * 908 * 1.00) =										-1074.8994		-1074.8994	(233)
Total delivered energy for all uses												8934.2801	(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	6808.3877	0.2160	1470.6117 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2627.5610	0.2160	567.5532 (264)
Space and water heating			2038.1649 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	498.2308	0.5190	258.5818 (268)
Energy saving/generation technologies			
PV Unit	-1074.8994	0.5190	-557.8728 (269)
Total CO2, kg/year			1777.7989 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			12.6300 (273)

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

DER			12.6300 ZC1
Total Floor Area		TFA	140.7400
Assumed number of occupants		N	2.9185
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190
CO2 emissions from appliances, equation (L14)			13.0630 ZC2
CO2 emissions from cooking, equation (L16)			1.3432 ZC3
Total CO2 emissions			27.0362 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			27.0362 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	70.3700 (1b)	x 2.3900 (2b)	= 168.1843 (1b) - (3b)
First floor	70.3700 (1c)	x 2.6100 (2c)	= 183.6657 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	140.7400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 351.8500 (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) =	0.1137 (8)
Pressure test										Yes							
Measured/design AP50										5.0000							
Infiltration rate										0.3637 (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) =							0.3091 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
Wind factor	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)				
Adj infilt rate	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)				
	0.3941	0.3864	0.3787	0.3400	0.3323	0.2937	0.2937	0.2859	0.3091	0.3323	0.3478	0.3632	(22b)				
Effective ac	0.5777	0.5747	0.5717	0.5578	0.5552	0.5431	0.5431	0.5409	0.5478	0.5552	0.5605	0.5660	(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 Opaque door			2.1500	1.0000	2.1500		(26)					
TER Opening Type (Uw = 1.40)			25.5500	1.3258	33.8731		(27)					
Ground Floor			70.3700	0.1300	9.1481		(28a)					
Brick and Block	186.7500	27.7000	159.0500	0.1800	28.6290		(29a)					
Pitched Roof	70.3700		70.3700	0.1300	9.1481		(30)					
Total net area of external elements Aum(A, m2)			327.4900				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	82.9483		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							13.1141 (36)					
Total fabric heat loss						(33) + (36) =	96.0624 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 67.0741	Feb 66.7239	Mar 66.3806	Apr 64.7682	May 64.4666	Jun 63.0622	Jul 63.0622	Aug 62.8022	Sep 63.6032	Oct 64.4666	Nov 65.0768	Dec 65.7148 (38)
Heat transfer coeff	163.1365	162.7863	162.4430	160.8306	160.5290	159.1246	159.1246	158.8646	159.6656	160.5290	161.1392	161.7772 (39)
Average = Sum(39)m / 12 =												160.8292 (39)
HLP	Jan 1.1591	Feb 1.1566	Mar 1.1542	Apr 1.1427	May 1.1406	Jun 1.1306	Jul 1.1306	Aug 1.1288	Sep 1.1345	Oct 1.1406	Nov 1.1449	Dec 1.1495 (40)
HLP (average)												1.1427 (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												2.9185 (42)
Average daily hot water use (litres/day)												103.5139 (43)
Daily hot water use	Jan 113.8653	Feb 109.7247	Mar 105.5842	Apr 101.4436	May 97.3031	Jun 93.1625	Jul 93.1625	Aug 97.3031	Sep 101.4436	Oct 105.5842	Nov 109.7247	Dec 113.8653 (44)
Energy conte	168.8589	147.6851	152.3978	132.8641	127.4863	110.0109	101.9413	116.9791	118.3762	137.9561	150.5899	163.5309 (45)
Energy content (annual)										Total = Sum(45)m =		1628.6766 (45)
Distribution loss (46)m = 0.15 x (45)m												
	25.3288	22.1528	22.8597	19.9296	19.1229	16.5016	15.2912	17.5469	17.7564	20.6934	22.5885	24.5296 (46)
Water storage loss:												
Store volume												215.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.7258 (48)
Temperature factor from Table 2b												0.5400 (49)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Enter (49) or (54) in (55)													0.9319 (55)
Total storage loss	28.8896	26.0938	28.8896	27.9576	28.8896	27.9576	28.8896	28.8896	27.9576	28.8896	27.9576	28.8896	(56)
If cylinder contains dedicated solar storage	28.8896	26.0938	28.8896	27.9576	28.8896	27.9576	28.8896	28.8896	27.9576	28.8896	27.9576	28.8896	(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	221.0109	194.7901	204.5497	183.3337	179.6382	160.4806	154.0933	169.1311	168.8459	190.1081	201.0595	215.6828	(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	221.0109	194.7901	204.5497	183.3337	179.6382	160.4806	154.0933	169.1311	168.8459	190.1081	201.0595	215.6828	(64)
Heat gains from water heating, kWh/month	97.8672	86.7893	92.3938	84.5530	84.1107	76.9543	75.6170	80.6171	79.7358	87.5920	90.4468	96.0956	(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	145.9240	145.9240	145.9240	145.9240	145.9240	145.9240	145.9240	145.9240	145.9240	145.9240	145.9240	145.9240	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	28.2119	25.0576	20.3782	15.4276	11.5323	9.7361	10.5202	13.6745	18.3539	23.3045	27.1997	28.9960	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	310.2518	313.4713	305.3584	288.0870	266.2850	245.7941	232.1050	228.8856	236.9985	254.2698	276.0719	296.5627	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.5924	37.5924	37.5924	37.5924	37.5924	37.5924	37.5924	37.5924	37.5924	37.5924	37.5924	37.5924	(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)	-116.7392	-116.7392	-116.7392	-116.7392	-116.7392	-116.7392	-116.7392	-116.7392	-116.7392	-116.7392	-116.7392	-116.7392	(71)
Water heating gains (Table 5)	131.5419	129.1507	124.1852	117.4347	113.0521	106.8810	101.6358	108.3564	110.7442	117.7311	125.6206	129.1607	(72)
Total internal gains	539.7828	537.4567	519.6990	490.7265	460.6465	432.1884	414.0382	420.6936	435.8737	465.0826	498.6694	524.4966	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
North					0.9600	10.6334		0.6300	0.7000	0.7700		3.1197 (74)	
East					15.7300	19.6403		0.6300	0.7000	0.7700		94.4165 (76)	
West					8.8600	19.6403		0.6300	0.7000	0.7700		53.1806 (80)	

Solar gains	150.7168	294.6931	485.6298	709.7597	871.8151	893.4849	850.2020	728.8734	565.2056	349.7007	187.8847	123.9774	(83)
Total gains	690.4996	832.1498	1005.3288	1200.4862	1332.4616	1325.6733	1264.2401	1149.5670	1001.0793	814.7834	686.5541	648.4740	(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	59.9106	60.0395	60.1664	60.7696	60.8838	61.4211	61.4211	61.5216	61.2130	60.8838	60.6532	60.4140	
alpha	4.9940	5.0026	5.0111	5.0513	5.0589	5.0947	5.0947	5.1014	5.0809	5.0589	5.0435	5.0276	
util living area	0.9992	0.9978	0.9919	0.9647	0.8786	0.7101	0.5413	0.6112	0.8728	0.9862	0.9982	0.9994	(86)
MIT	19.6447	19.8066	20.0943	20.4735	20.7846	20.9484	20.9894	20.9811	20.8475	20.4212	19.9617	19.6187	(87)
Th 2	19.9528	19.9548	19.9568	19.9661	19.9678	19.9759	19.9759	19.9774	19.9728	19.9678	19.9643	19.9606	(88)
util rest of house	0.9989	0.9970	0.9889	0.9509	0.8333	0.6189	0.4218	0.4874	0.8071	0.9788	0.9975	0.9992	(89)
MIT 2	18.1343	18.3724	18.7929	19.3415	19.7555	19.9416	19.9720	19.9695	19.8456	19.2764	18.6063	18.1018	(90)
Living area fraction	0.9989	0.9970	0.9889	0.9509	0.8333	0.6189	0.4218	0.4874	0.8071	0.9788	0.9975	0.9992	(91)
MIT	18.3596	18.5864	18.9871	19.5104	19.9090	20.0918	20.1238	20.1205	19.9951	19.4472	18.8086	18.3281	(92)
Temperature adjustment	18.3596	18.5864	18.9871	19.5104	19.9090	20.0918	20.1238	20.1205	19.9951	19.4472	18.8086	18.3281	(93)
adjusted MIT	18.3596	18.5864	18.9871	19.5104	19.9090	20.0918	20.1238	20.1205	19.9951	19.4472	18.8086	18.3281	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	689.2966	828.3598	990.0583	1132.1127	1106.3383	835.1944	555.7321	581.2386	809.6398	793.1457	683.8817	647.6488	(94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	2293.6402	2227.9590	2028.4358	1706.4812	1317.7875	873.8819	560.7257	591.0525	941.2434	1420.2284	1886.7111	2285.6084	(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	1193.6316	940.5307	772.5529	413.5453	157.3182	0.0000	0.0000	0.0000	0.0000	466.5495	866.0371	1218.6419	(98)
Space heating													(98)
Space heating per m2													(98) / (4) =

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													6447.9222 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1193.6316	940.5307	772.5529	413.5453	157.3182	0.0000	0.0000	0.0000	0.0000	466.5495	866.0371	1218.6419	(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)	1276.6113	1005.9152	826.2598	442.2945	168.2547	0.0000	0.0000	0.0000	0.0000	498.9834	926.2429	1303.3604	(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	221.0109	194.7901	204.5497	183.3337	179.6382	160.4806	154.0933	169.1311	168.8459	190.1081	201.0595	215.6828	(64)
Efficiency of water heater (217)m	88.6431	88.4648	88.0290	86.9202	84.4623	79.8000	79.8000	79.8000	79.8000	87.1182	88.2699	79.8000	(216)
Fuel for water heating, kWh/month	249.3267	220.1893	232.3662	210.9218	212.6844	201.1035	193.0993	211.9437	211.5863	218.2186	227.7780	243.1288	(219)
Water heating fuel used												2632.3466	(219)
Annual totals kWh/year													
Space heating fuel - main system												6447.9222	(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)												498.2308	(232)
Total delivered energy for all uses												9653.4996	(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	6447.9222	0.2160	1392.7512	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2632.3466	0.2160	568.5869	(264)
Space and water heating			1961.3381	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	498.2308	0.5190	258.5818	(268)
Total CO2, kg/m2/year			2258.8449	(272)
Emissions per m2 for space and water heating			13.9359	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			1.8373	(272b)
Emissions per m2 for pumps and fans			0.2766	(272c)
Target Carbon Dioxide Emission Rate (TER) = (13.9359 * 1.00) + 1.8373 + 0.2766, rounded to 2 d.p.			16.0500	(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	70.3700 (1b)	x 2.3900 (2b)	= 168.1843 (1b) - (3b)
First floor	70.3700 (1c)	x 2.6100 (2c)	= 183.6657 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	140.7400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 351.8500 (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) = 0.1137 (8)
Pressure test					Yes
Measured/design AP50					3.3200
Infiltration rate					0.2797 (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) =	0.2377 (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	0.3031	0.2972	0.2912	0.2615	0.2556	0.2258	0.2258	0.2199	0.2377	0.2556	0.2674	0.2793 (22b)
Effective ac	0.5459	0.5442	0.5424	0.5342	0.5327	0.5255	0.5255	0.5242	0.5283	0.5327	0.5358	0.5390 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			2.1500	1.1000	2.3650		(26)
Windows (Uw = 1.40)			25.5500	1.3258	33.8731		(27)
Ground Floor			70.3700	0.1200	8.4444	90.0000	6333.3000 (28a)
Brick and Block	186.7500	27.7000	159.0500	0.2300	36.5815	42.2200	6715.0910 (29a)
Pitched Roof	70.3700		70.3700	0.1000	7.0370	9.1000	640.3670 (30)
Total net area of external elements Aum(A, m ²)			327.4900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	88.3010		(33)
Ground Floor Block			59.3900			75.0000	4454.2500 (32c)
Ground Floor Stud			45.5500			9.0000	409.9500 (32c)
First Floor Stud			173.6700			9.0000	1563.0300 (32c)
Internal Floor 1			70.3700			18.0000	1266.6600 (32d)
Internal Ceiling 1			70.3700			9.0000	633.3300 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 22015.9780 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 156.4301 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 10.0243 (36)
Total fabric heat loss (33) + (36) = 98.3253 (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	63.3891	63.1819	62.9789	62.0254	61.8470	61.0164	61.0164	60.8626	61.3363	61.8470	62.2079	62.5852 (38)
Heat transfer coeff	161.7144	161.5073	161.3043	160.3507	160.1723	159.3418	159.3418	159.1880	159.6617	160.1723	160.5332	160.9105 (39)
Average = Sum(39)m / 12 =												160.3498 (39)
HLP	1.1490	1.1476	1.1461	1.1393	1.1381	1.1322	1.1322	1.1311	1.1344	1.1381	1.1406	1.1433 (40)
HLP (average)												1.1393 (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												2.9185 (42)
Average daily hot water use (litres/day)												103.5139 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.8653	109.7247	105.5842	101.4436	97.3031	93.1625	93.1625	97.3031	101.4436	105.5842	109.7247	113.8653 (44)
Energy conte	168.8589	147.6851	152.3978	132.8641	127.4863	110.0109	101.9413	116.9791	118.3762	137.9561	150.5899	163.5309 (45)
Energy content (annual)										Total = Sum(45)m =		1628.6766 (45)

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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	35.8825	31.3831	32.3845	28.2336	27.0908	23.3773	21.6625	24.8581	25.1550	29.3157	32.0003	34.7503 (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	145.9240	145.9240	145.9240	145.9240	145.9240	145.9240	145.9240	145.9240	145.9240	145.9240	145.9240	145.9240	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	28.2119	25.0576	20.3782	15.4276	11.5323	9.7361	10.5202	13.6745	18.3539	23.3045	27.1997	28.9960	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	310.2518	313.4713	305.3584	288.0870	266.2850	245.7941	232.1050	228.8856	236.9985	254.2698	276.0719	296.5627	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.5924	37.5924	37.5924	37.5924	37.5924	37.5924	37.5924	37.5924	37.5924	37.5924	37.5924	37.5924	(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)	-116.7392	-116.7392	-116.7392	-116.7392	-116.7392	-116.7392	-116.7392	-116.7392	-116.7392	-116.7392	-116.7392	-116.7392	(71)
Water heating gains (Table 5)	48.2292	46.7010	43.5276	39.2134	36.4124	32.4685	29.1163	33.4114	34.9374	39.4028	44.4449	46.7074	(72)
Total internal gains	453.4701	452.0070	436.0413	409.5051	381.0069	354.7759	338.5187	342.7486	357.0670	383.7543	414.4937	439.0433	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
North					0.9600	10.6334	0.6300	0.7000	0.7700		3.1197 (74)	
East					15.7300	19.6403	0.6300	0.7000	0.7700		94.4165 (76)	
West					8.8600	19.6403	0.6300	0.7000	0.7700		53.1806 (80)	
Solar gains	150.7168	294.6931	485.6298	709.7597	871.8151	893.4849	850.2020	728.8734	565.2056	349.7007	187.8847	123.9774 (83)
Total gains	604.1869	746.7001	921.6712	1119.2648	1252.8220	1248.2608	1188.7206	1071.6220	922.2725	733.4550	602.3785	563.0207 (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	37.8170	37.8655	37.9131	38.1386	38.1811	38.3801	38.3801	38.4172	38.3032	38.1811	38.0952	38.0059
alpha	3.5211	3.5244	3.5275	3.5426	3.5454	3.5587	3.5587	3.5611	3.5535	3.5454	3.5397	3.5337
util living area	0.9960	0.9912	0.9770	0.9343	0.8420	0.6960	0.5492	0.6156	0.8439	0.9687	0.9929	0.9969 (86)
MIT	19.0104	19.2360	19.6354	20.1500	20.5868	20.8562	20.9540	20.9309	20.6923	20.0919	19.4483	18.9665 (87)
Th 2	19.9610	19.9622	19.9633	19.9688	19.9699	19.9746	19.9746	19.9755	19.9728	19.9699	19.9678	19.9656 (88)
util rest of house	0.9951	0.9892	0.9714	0.9177	0.8012	0.6174	0.4372	0.5034	0.7868	0.9580	0.9909	0.9962 (89)
MIT 2	18.1301	18.3557	18.7525	19.2583	19.6648	19.8930	19.9575	19.9473	19.7711	19.2111	18.5724	18.0897 (90)
Living area fraction									fLA = Living area /	(4) =		0.1492 (91)
MIT	18.2615	18.4870	18.8842	19.3913	19.8024	20.0367	20.1062	20.0940	19.9085	19.3425	18.7031	18.2205 (92)
Temperature adjustment												0.0000
adjusted MIT	18.2615	18.4870	18.8842	19.3913	19.8024	20.0367	20.1062	20.0940	19.9085	19.3425	18.7031	18.2205 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9929	0.9851	0.9637	0.9063	0.7935	0.6226	0.4525	0.5175	0.7825	0.9492	0.9875	0.9944 (94)
Useful gains	599.9097	735.5873	888.2436	1014.3470	994.1611	777.1941	537.8585	554.5669	721.7232	696.2113	594.8380	559.8843 (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	2257.7720	2194.4073	1997.6299	1682.2902	1297.7814	866.3007	558.6865	588.0450	927.3992	1400.3100	1862.6844	2256.0511 (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	1233.4496	980.3270	825.3834	480.9191	225.8935	0.0000	0.0000	0.0000	0.0000	523.8494	912.8494	1261.9481 (98)
Space heating												6444.6195 (98)
Space heating per m2												45.7910 (99)
										(98) / (4) =		

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	1497.8126	1179.1290	1209.8285	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8014	0.8655	0.8278	0.0000	0.0000	0.0000	0.0000 (101)

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Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1200.3751	1020.5224	1001.4421	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1581.7975	1509.3836	1374.9468	0.0000	0.0000	0.0000	0.0000 (103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	274.6242	363.7127	277.8875	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												916.2244 (104)
Cooled fraction									FC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	68.6560	90.9282	69.4719	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												229.0561 (107)
Space cooling per m2												1.6275 (108)
Energy for space heating												45.7910 (99)
Energy for space cooling												1.6275 (108)
Total												47.4185 (109)
Dwelling Fabric Energy Efficiency (DFEE)												47.4 (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	70.3700 (1b)	x 2.3900 (2b)	= 168.1843 (1b) - (3b)
First floor	70.3700 (1c)	x 2.6100 (2c)	= 183.6657 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	140.7400		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 351.8500 (5)
Dwelling volume			

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) =	0.1137 (8)
Pressure test										Yes							
Measured/design AP50										5.0000							
Infiltration rate										0.3637 (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) =					0.3091	(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	0.3941	0.3864	0.3787	0.3400	0.3323	0.2937	0.2937	0.2859	0.3091	0.3323	0.3478	0.3632	(22b)				
Effective ac	0.5777	0.5747	0.5717	0.5578	0.5552	0.5431	0.5431	0.5409	0.5478	0.5552	0.5605	0.5660	(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 Opaque door			2.1500	1.0000	2.1500		(26)					
TER Opening Type (Uw = 1.40)			25.5500	1.3258	33.8731		(27)					
Ground Floor			70.3700	0.1300	9.1481		(28a)					
Brick and Block	186.7500	27.7000	159.0500	0.1800	28.6290		(29a)					
Pitched Roof	70.3700		70.3700	0.1300	9.1481		(30)					
Total net area of external elements Aum(A, m2)			327.4900				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	82.9483		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							13.1141 (36)					
Total fabric heat loss						(33) + (36) =	96.0624 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 67.0741	Feb 66.7239	Mar 66.3806	Apr 64.7682	May 64.4666	Jun 63.0622	Jul 63.0622	Aug 62.8022	Sep 63.6032	Oct 64.4666	Nov 65.0768	Dec 65.7148 (38)
Heat transfer coeff	163.1365	162.7863	162.4430	160.8306	160.5290	159.1246	159.1246	158.8646	159.6656	160.5290	161.1392	161.7772 (39)
Average = Sum(39)m / 12 =												160.8292 (39)
HLP	Jan 1.1591	Feb 1.1566	Mar 1.1542	Apr 1.1427	May 1.1406	Jun 1.1306	Jul 1.1306	Aug 1.1288	Sep 1.1345	Oct 1.1406	Nov 1.1449	Dec 1.1495 (40)
HLP (average)												1.1427 (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												2.9185 (42)
Average daily hot water use (litres/day)												103.5139 (43)
Daily hot water use	Jan 113.8653	Feb 109.7247	Mar 105.5842	Apr 101.4436	May 97.3031	Jun 93.1625	Jul 93.1625	Aug 97.3031	Sep 101.4436	Oct 105.5842	Nov 109.7247	Dec 113.8653 (44)
Energy conte	168.8589	147.6851	152.3978	132.8641	127.4863	110.0109	101.9413	116.9791	118.3762	137.9561	150.5899	163.5309 (45)
Energy content (annual)										Total = Sum(45)m =		1628.6766 (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												

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Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Heat gains from water heating, kWh/month	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
	35.8825	31.3831	32.3845	28.2336	27.0908	23.3773	21.6625	24.8581	25.1550	29.3157	32.0003	34.7503 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	Jan 145.9240	Feb 145.9240	Mar 145.9240	Apr 145.9240	May 145.9240	Jun 145.9240	Jul 145.9240	Aug 145.9240	Sep 145.9240	Oct 145.9240	Nov 145.9240	Dec 145.9240 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	28.2119	25.0576	20.3782	15.4276	11.5323	9.7361	10.5202	13.6745	18.3539	23.3045	27.1997	28.9960 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	310.2518	313.4713	305.3584	288.0870	266.2850	245.7941	232.1050	228.8856	236.9985	254.2698	276.0719	296.5627 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.5924	37.5924	37.5924	37.5924	37.5924	37.5924	37.5924	37.5924	37.5924	37.5924	37.5924	37.5924 (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)	-116.7392	-116.7392	-116.7392	-116.7392	-116.7392	-116.7392	-116.7392	-116.7392	-116.7392	-116.7392	-116.7392	-116.7392 (71)
Water heating gains (Table 5)	48.2292	46.7010	43.5276	39.2134	36.4124	32.4685	29.1163	33.4114	34.9374	39.4028	44.4449	46.7074 (72)
Total internal gains	453.4701	452.0070	436.0413	409.5051	381.0069	354.7759	338.5187	342.7486	357.0670	383.7543	414.4937	439.0433 (73)

6. Solar gains												

[Jan]			Area m2		Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d	Gains W
North			0.9600		10.6334		0.6300		0.7000		0.7700	3.1197 (74)
East			15.7300		19.6403		0.6300		0.7000		0.7700	94.4165 (76)
West			8.8600		19.6403		0.6300		0.7000		0.7700	53.1806 (80)

Solar gains	150.7168	294.6931	485.6298	709.7597	871.8151	893.4849	850.2020	728.8734	565.2056	349.7007	187.8847	123.9774 (83)
Total gains	604.1869	746.7001	921.6712	1119.2648	1252.8220	1248.2608	1188.7206	1071.6220	922.2725	733.4550	602.3785	563.0207 (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 tau 59.9106 alpha 4.9940 util living area 0.9996	Feb 60.0395 5.0026 0.9987	Mar 60.1664 5.0111 0.9945	Apr 60.7696 5.0513 0.9731	May 60.8838 5.0589 0.8988	Jun 61.4211 5.0947 0.7409	Jul 61.4211 5.0947 0.5720	Aug 61.5216 5.1014 0.6479	Sep 61.2130 5.0809 0.9001	Oct 60.8838 5.0589 0.9912	Nov 60.6532 5.0435 0.9990	Dec 60.4140 5.0276 0.9997 (86)
MIT	19.5874	19.7502	20.0406	20.4274	20.7547	20.9374	20.9865	20.9755	20.8183	20.3700	19.9059	19.5618 (87)
Th 2	19.9528	19.9548	19.9568	19.9661	19.9678	19.9759	19.9759	19.9774	19.9728	19.9678	19.9643	19.9606 (88)
util rest of house	0.9994	0.9982	0.9923	0.9621	0.8581	0.6504	0.4475	0.5203	0.8424	0.9863	0.9986	0.9996 (89)
MIT 2	18.6540	18.8182	19.1091	19.4964	19.7992	19.9467	19.9724	19.9702	19.8652	19.4461	18.9815	18.6346 (90)
Living area fraction	fLA = Living area / (4) =											0.1492 (91)
MIT	18.7932	18.9573	19.2481	19.6353	19.9418	20.0945	20.1237	20.1202	20.0074	19.5840	19.1195	18.7730 (92)
Temperature adjustment												0.0000
adjusted MIT	18.7932	18.9573	19.2481	19.6353	19.9418	20.0945	20.1237	20.1202	20.0074	19.5840	19.1195	18.7730 (93)

8. Space heating requirement												

Utilisation	Jan 0.9992	Feb 0.9975	Mar 0.9903	Apr 0.9575	May 0.8569	Jun 0.6618	Jul 0.4662	Aug 0.5393	Sep 0.8448	Oct 0.9837	Nov 0.9981	Dec 0.9994 (94)
Useful gains	603.6926	744.8424	912.7500	1071.7344	1073.4881	826.1197	554.2039	577.9328	779.1200	721.4719	601.2296	562.7006 (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	2364.3743	2288.3319	2070.8338	1726.5630	1323.0459	874.3114	560.7125	591.0114	943.2097	1442.1905	1936.8056	2357.5771 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	1309.9471	1037.2250	861.6144	471.4766	185.6710	0.0000	0.0000	0.0000	0.0000	536.2146	961.6147	1335.3881 (98)
Space heating												6699.1516 (98)
Space heating per m2	(98) / (4) =											47.5995 (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	1495.7717	1177.5224	1207.3709	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8584	0.9204	0.8853	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1283.9344	1083.8158	1068.8812	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1581.7975	1509.3836	1374.9468	0.0000	0.0000	0.0000	0.0000 (103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	214.4615	316.6224	227.7128	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												758.7967 (104)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Cooled fraction											FC = cooled area / (4) =	1.0000 (105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	53.6154	79.1556	56.9282	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												189.6992 (107)
Space cooling per m2												1.3479 (108)
Energy for space heating												47.5995 (99)
Energy for space cooling												1.3479 (108)
Total												48.9474 (109)
Target Fabric Energy Efficiency (TFEE)												56.3 (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	70.3700 (1b)	x 2.3900 (2b)	= 168.1843 (1b) - (3b)
First floor	70.3700 (1c)	x 2.6100 (2c)	= 183.6657 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	140.7400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 351.8500 (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) = 0.1421 (8)
Pressure test					Yes
Measured/design AP50					3.3200
Infiltration rate					0.3081 (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)	=	0.2619 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.4000	4.1000	4.1000	3.9000	3.9000	3.7000	3.7000	3.5000	3.5000	3.8000	3.7000	3.9000 (22)
Wind factor	1.1000	1.0250	1.0250	0.9750	0.9750	0.9250	0.9250	0.8750	0.8750	0.9500	0.9250	0.9750 (22a)
Adj infilt rate	0.2881	0.2684	0.2684	0.2553	0.2553	0.2422	0.2422	0.2292	0.2292	0.2488	0.2422	0.2553 (22b)
Effective ac	0.5415	0.5360	0.5360	0.5326	0.5326	0.5293	0.5293	0.5263	0.5263	0.5309	0.5293	0.5326 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			2.1500	1.1000	2.3650		(26)
Windows (Uw = 1.40)			25.5500	1.3258	33.8731		(27)
Ground Floor			70.3700	0.1200	8.4444	90.0000	6333.3000 (28a)
Brick and Block	186.7500	27.7000	159.0500	0.2300	36.5815	42.2200	6715.0910 (29a)
Pitched Roof	70.3700		70.3700	0.1000	7.0370	9.1000	640.3670 (30)
Total net area of external elements Aum(A, m ²)			327.4900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	88.3010		(33)
Ground Floor Block			59.3900			75.0000	4454.2500 (32c)
Ground Floor Stud			45.5500			9.0000	409.9500 (32c)
First Floor Stud			173.6700			9.0000	1563.0300 (32c)
Internal Floor 1			70.3700			18.0000	1266.6600 (32d)
Internal Ceiling 1			70.3700			18.0000	1266.6600 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 22649.3080 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 160.9301 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 10.0243 (36)
Total fabric heat loss (33) + (36) = 98.3253 (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	62.8732	62.2386	62.2386	61.8405	61.8405	61.4622	61.4622	61.1038	61.1038	61.6488	61.4622	61.8405 (38)
Heat transfer coeff	161.1986	160.5640	160.5640	160.1658	160.1658	159.7875	159.7875	159.4292	159.4292	159.9742	159.7875	160.1658 (39)
Average = Sum(39)m / 12 =												160.0849 (39)
HLP	1.1454	1.1409	1.1409	1.1380	1.1380	1.1353	1.1353	1.1328	1.1328	1.1367	1.1353	1.1380 (40)
HLP (average)												1.1375 (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												2.9185 (42)
Average daily hot water use (litres/day)												103.5139 (43)
Daily hot water use	113.8653	109.7247	105.5842	101.4436	97.3031	93.1625	93.1625	97.3031	101.4436	105.5842	109.7247	113.8653 (44)
Energy conte	168.8589	147.6851	152.3978	132.8641	127.4863	110.0109	101.9413	116.9791	118.3762	137.9561	150.5899	163.5309 (45)
Energy content (annual)										Total = Sum(45)m =		1628.6766 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	25.3288	22.1528	22.8597	19.9296	19.1229	16.5016	15.2912	17.5469	17.7564	20.6934	22.5885	24.5296 (46)
Water storage loss:												
Store volume												215.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.7300 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.9342 (55)
Total storage loss												
28.9602 26.1576 28.9602 28.0260 28.9602 28.0260 28.9602 28.9602 28.0260 28.9602 28.0260 28.9602 28.9602 (56)												
If cylinder contains dedicated solar storage												
28.9602 26.1576 28.9602 28.0260 28.9602 28.0260 28.9602 28.9602 28.0260 28.9602 28.0260 28.9602 28.9602 (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	23.2624 (59)
Total heat required for water heating calculated for each month												
221.0815 194.8539 204.6204 183.4021 179.7089 160.5489 154.1639 169.2017 168.9142 190.1787 201.1279 215.7535 (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	221.0815	194.8539	204.6204	183.4021	179.7089	160.5489	154.1639	169.2017	168.9142	190.1787	201.1279	215.7535 (64)
Total per year (kWh/year) = Sum(64)m =												2244 (64)
RHI water heating demand												
Heat gains from water heating, kWh/month	97.9237	86.8403	92.4503	84.6077	84.1673	77.0090	75.6736	80.6736	79.7905	87.6485	90.5015	96.1521 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	175.1088	175.1088	175.1088	175.1088	175.1088	175.1088	175.1088	175.1088	175.1088	175.1088	175.1088	175.1088 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	70.5297	62.6439	50.9454	38.5690	28.8308	24.3401	26.3004	34.1862	45.8847	58.2611	67.9994	72.4900 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	463.0624	467.8676	455.7588	429.9806	397.4403	366.8569	346.4254	341.6202	353.7290	379.5072	412.0476	442.6309 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.4294	55.4294	55.4294	55.4294	55.4294	55.4294	55.4294	55.4294	55.4294	55.4294	55.4294	55.4294 (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)	-116.7392	-116.7392	-116.7392	-116.7392	-116.7392	-116.7392	-116.7392	-116.7392	-116.7392	-116.7392	-116.7392	-116.7392 (71)
Water heating gains (Table 5)	131.6178	129.2267	124.2612	117.5107	113.1280	106.9570	101.7118	108.4323	110.8201	117.8071	125.6966	129.2367 (72)
Total internal gains	782.0090	776.5371	747.7644	702.8592	656.1980	614.9530	591.2365	601.0377	627.2328	672.3744	722.5424	761.1565 (73)

6. Solar gains

[Jan]		Area	Solar flux	g	FF	Access	Gains
		m2	Table 6a	W/m2	Specific data	factor	W
					or Table 6b	Table 6d	
North		0.9600	13.4839	0.6300	0.7000	0.7700	3.9560 (74)
East		15.7300	25.1925	0.6300	0.7000	0.7700	121.1079 (76)
West		8.8600	25.1925	0.6300	0.7000	0.7700	68.2146 (80)

Solar gains	193.2786	321.5413	532.8805	780.4542	903.8443	1014.4446	931.7391	835.4778	649.1885	406.1946	240.1682	150.4795 (83)
Total gains	975.2875	1098.0784	1280.6449	1483.3135	1560.0423	1629.3976	1522.9756	1436.5156	1276.4213	1078.5690	962.7107	911.6359 (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	39.0293	39.1836	39.1836	39.2810	39.2810	39.3740	39.4625	39.4625	39.3281	39.3740	39.2810	
alpha	3.6020	3.6122	3.6122	3.6187	3.6187	3.6249	3.6249	3.6308	3.6219	3.6249	3.6187	
util living area	0.9795	0.9679	0.9316	0.8453	0.6952	0.4790	0.3414	0.3601	0.6366	0.8804	0.9628	0.9830 (86)
MIT	19.5497	19.7321	20.1076	20.5267	20.8316	20.9679	20.9931	20.9918	20.9103	20.5431	19.9870	19.5218 (87)
Th 2	19.9640	19.9676	19.9676	19.9699	19.9699	19.9721	19.9721	19.9741	19.9741	19.9710	19.9721	19.9699 (88)
util rest of house	0.9749	0.9606	0.9161	0.8114	0.6319	0.3906	0.2374	0.2511	0.5463	0.8440	0.9527	0.9790 (89)
MIT 2	18.6648	18.8466	19.2110	19.6035	19.8632	19.9588	19.9707	19.9724	19.9294	19.6309	19.1032	18.6420 (90)
Living area fraction									fLA = Living area / (4) =			0.1492 (91)
MIT	18.7968	18.9788	19.3448	19.7412	20.0077	20.1094	20.1232	20.1245	20.0758	19.7670	19.2350	18.7733 (92)
Temperature adjustment												0.0000
adjusted MIT	18.7968	18.9788	19.3448	19.7412	20.0077	20.1094	20.1232	20.1245	20.0758	19.7670	19.2350	18.7733 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9679	0.9517	0.9047	0.8028	0.6344	0.4028	0.2529	0.2674	0.5559	0.8354	0.9434	0.9728 (94)
Useful gains	943.9507	1045.0509	1158.6084	1190.8616	989.7402	656.3531	385.1783	384.1315	709.5943	900.9919	908.1757	886.8233 (95)
Ext temp.	5.4000	5.9000	7.6000	10.0000	13.1000	15.9000	17.7000	17.7000	15.3000	12.0000	8.4000	5.5000 (96)
Heat loss rate W	2159.5487	2099.9787	1885.7874	1560.2107	1106.3774	672.6058	387.1983	386.5418	761.4001	1242.5209	1731.3049	2125.9292 (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	904.4049	708.9115	541.0212	265.9313	86.7781	0.0000	0.0000	0.0000	0.0000	254.0975	592.6530	921.8948 (98)
Space heating												4275.6923 (98)
RHI space heating demand												4276 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

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	70.3700 (1b)	x 2.3900 (2b)	= 168.1843 (1b) - (3b)
First floor	70.3700 (1c)	x 2.6100 (2c)	= 183.6657 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	140.7400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 351.8500 (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) = 0.1421 (8)
Pressure test					Yes
Measured/design AP50					3.3200
Infiltration rate					0.3081 (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) =	0.2619 (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	0.3339	0.3274	0.3208	0.2881	0.2815	0.2488	0.2488	0.2422	0.2619	0.2815	0.2946	0.3077 (22b)
Effective ac	0.5557	0.5536	0.5515	0.5415	0.5396	0.5309	0.5309	0.5293	0.5343	0.5396	0.5434	0.5473 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			2.1500	1.1000	2.3650		(26)
Windows (Uw = 1.40)			25.5500	1.3258	33.8731		(27)
Ground Floor			70.3700	0.1200	8.4444	90.0000	6333.3000 (28a)
Brick and Block	186.7500	27.7000	159.0500	0.2300	36.5815	42.2200	6715.0910 (29a)
Pitched Roof	70.3700		70.3700	0.1000	7.0370	9.1000	640.3670 (30)
Total net area of external elements Aum(A, m ²)			327.4900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	88.3010		(33)
Ground Floor Block			59.3900			75.0000	4454.2500 (32c)
Ground Floor Stud			45.5500			9.0000	409.9500 (32c)
First Floor Stud			173.6700			9.0000	1563.0300 (32c)
Internal Floor 1			70.3700			18.0000	1266.6600 (32d)
Internal Ceiling 1			70.3700			18.0000	1266.6600 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 22649.3080 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 160.9301 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 10.0243 (36)
Total fabric heat loss (33) + (36) = 98.3253 (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	64.5282	64.2768	64.0304	62.8732	62.6567	61.6488	61.6488	61.4622	62.0371	62.6567	63.0947	63.5526 (38)
Heat transfer coeff	162.8535	162.6022	162.3558	161.1986	160.9821	159.9742	159.9742	159.7875	160.3624	160.9821	161.4201	161.8780 (39)
Average = Sum(39)m / 12 =												161.1975 (39)
HLP	1.1571	1.1553	1.1536	1.1454	1.1438	1.1367	1.1367	1.1353	1.1394	1.1438	1.1469	1.1502 (40)
HLP (average)												1.1454 (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												2.9185 (42)
Average daily hot water use (litres/day)												103.5139 (43)
Daily hot water use	113.8653	109.7247	105.5842	101.4436	97.3031	93.1625	93.1625	97.3031	101.4436	105.5842	109.7247	113.8653 (44)
Energy conte	168.8589	147.6851	152.3978	132.8641	127.4863	110.0109	101.9413	116.9791	118.3762	137.9561	150.5899	163.5309 (45)
Energy content (annual)										Total = Sum(45)m =		1628.6766 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	25.3288	22.1528	22.8597	19.9296	19.1229	16.5016	15.2912	17.5469	17.7564	20.6934	22.5885	24.5296 (46)
Water storage loss:												
Store volume												215.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.7300 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.9342 (55)
Total storage loss												
28.9602 26.1576 28.9602 28.0260 28.9602 28.0260 28.9602 28.9602 28.0260 28.9602 28.0260 28.9602 28.9602 (56)												
If cylinder contains dedicated solar storage												
28.9602 26.1576 28.9602 28.0260 28.9602 28.0260 28.9602 28.9602 28.0260 28.9602 28.0260 28.9602 28.9602 (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												
221.0815 194.8539 204.6204 183.4021 179.7089 160.5489 154.1639 169.2017 168.9142 190.1787 201.1279 215.7535 (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	221.0815	194.8539	204.6204	183.4021	179.7089	160.5489	154.1639	169.2017	168.9142	190.1787	201.1279	215.7535 (64)
Total per year (kWh/year) = Sum(64)m =												2243.5556 (64)
Heat gains from water heating, kWh/month												
97.9237 86.8403 92.4503 84.6077 84.1673 77.0090 75.6736 80.6736 79.7905 87.6485 90.5015 96.1521 (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	175.1088	175.1088	175.1088	175.1088	175.1088	175.1088	175.1088	175.1088	175.1088	175.1088	175.1088	175.1088	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
70.5297 62.6439 50.9454 38.5690 28.8308 24.3401 26.3004 34.1862 45.8847 58.2611 67.9994 72.4900 (67)													
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
463.0624 467.8676 455.7588 429.9806 397.4403 366.8569 346.4254 341.6202 353.7290 379.5072 412.0476 442.6309 (68)													
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
55.4294 55.4294 55.4294 55.4294 55.4294 55.4294 55.4294 55.4294 55.4294 55.4294 55.4294 55.4294 (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)													
-116.7392 -116.7392 -116.7392 -116.7392 -116.7392 -116.7392 -116.7392 -116.7392 -116.7392 -116.7392 -116.7392 -116.7392 (71)													
Water heating gains (Table 5)													
131.6178 129.2267 124.2612 117.5107 113.1280 106.9570 101.7118 108.4323 110.8201 117.8071 125.6966 129.2367 (72)													
Total internal gains	782.0090	776.5371	747.7644	702.8592	656.1980	614.9530	591.2365	601.0377	627.2328	672.3744	722.5424	761.1565	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c				Access factor Table 6d			Gains W
North				0.9600	10.6334	0.6300	0.7000				0.7700			3.1197 (74)
East				15.7300	19.6403	0.6300	0.7000				0.7700			94.4165 (76)
West				8.8600	19.6403	0.6300	0.7000				0.7700			53.1806 (80)
Solar gains	150.7168	294.6931	485.6298	709.7597	871.8151	893.4849	850.2020	728.8734	565.2056	349.7007	187.8847	123.9774	(83)	
Total gains	932.7257	1071.2302	1233.3942	1412.6189	1528.0131	1508.4379	1441.4385	1329.9111	1192.4384	1022.0751	910.4272	885.1339	(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	38.6327	38.6924	38.7512	39.0293	39.0818	39.3281	39.3281	39.3740	39.2329	39.0818	38.9758	38.8655	
alpha	3.5755	3.5795	3.5834	3.6020	3.6055	3.6219	3.6219	3.6249	3.6155	3.6055	3.5984	3.5910	
util living area	0.9856	0.9755	0.9505	0.8885	0.7748	0.6144	0.4690	0.5219	0.7531	0.9267	0.9765	0.9880 (86)	
MIT	19.3306	19.5408	19.9031	20.3532	20.7086	20.9096	20.9740	20.9618	20.8059	20.3236	19.7406	19.2861 (87)	
Th 2	19.9545	19.9559	19.9573	19.9640	19.9652	19.9710	19.9710	19.9721	19.9688	19.9652	19.9627	19.9601 (88)	
util rest of house													
0.9824 0.9701 0.9395 0.8635 0.7258 0.5351 0.3674 0.4175 0.6829 0.9048 0.9704 0.9853 (89)													
MIT 2	18.4402	18.6489	19.0050	19.4397	19.7591	19.9225	19.9620	19.9576	19.8506	19.4229	18.8538	18.4004 (90)	
Living area fraction													
fLA = Living area / (4) =													
MIT	18.5730	18.7820	19.1390	19.5760	19.9008	20.0698	20.1130	20.1075	19.9932	19.5573	18.9861	18.5325 (92)	
Temperature adjustment												0.0000	
adjusted MIT	18.5730	18.7820	19.1390	19.5760	19.9008	20.0698	20.1130	20.1075	19.9932	19.5573	18.9861	18.5325 (93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
0.9768 0.9623 0.9287 0.8526 0.7224 0.5432 0.3819 0.4320 0.6847 0.8941 0.9629 0.9803 (94)													
Useful gains	911.0593	1030.8403	1145.4726	1204.3983	1103.8501	819.4192	550.5263	574.4633	816.5113	913.8456	876.6089	867.7267 (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													
2324.4130 2257.2397 2052.0120 1720.9609 1320.1755 875.0262 561.9857 592.4072 945.0410 1441.9655 1918.6563 2320.1198 (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													
1051.5352 824.1404 674.4653 371.9251 160.9461 0.0000 0.0000 0.0000 0.0000 392.9211 750.2741 1080.5805 (98)													
Space heating													
Space heating per m2													
(98) / (4) =													37.7063 (99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.6000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													5857.3816 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1051.5352	824.1404	674.4653	371.9251	160.9461	0.0000	0.0000	0.0000	0.0000	392.9211	750.2741	1080.5805	(98)
Space heating efficiency (main heating system 1)	90.6000	90.6000	90.6000	90.6000	90.6000	0.0000	0.0000	0.0000	0.0000	90.6000	90.6000	90.6000	(210)
Space heating fuel (main heating system)	1160.6349	909.6472	744.4429	410.5133	177.6447	0.0000	0.0000	0.0000	0.0000	433.6878	828.1171	1192.6937	(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	221.0815	194.8539	204.6204	183.4021	179.7089	160.5489	154.1639	169.2017	168.9142	190.1787	201.1279	215.7535	(64)
Efficiency of water heater (217)m	88.5402	88.3379	87.8613	86.7627	84.6218	79.9000	79.9000	79.9000	79.9000	86.8084	88.1057	79.9000	(216)
Fuel for water heating, kWh/month	249.6963	220.5780	232.8904	211.3836	212.3672	200.9373	192.9461	211.7669	211.4071	219.0786	228.2802	243.4462	(219)
Water heating fuel used												2634.7778	(219)
Annual totals kWh/year													
Space heating fuel - main system												5857.3816	(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)												498.2308	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.48 * 908 * 1.00) =										-1074.8994		-1074.8994	(233)
Total delivered energy for all uses												7990.4908	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	5857.3816	3.4800	203.8369 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2634.7778	3.4800	91.6903 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	498.2308	13.1900	65.7166 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-1074.8994	13.1900	-141.7792 (252)
Total energy cost			349.3571 (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] =	0.7900 (257)
SAP value		88.9798
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	5857.3816	0.2160	1265.1944 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2634.7778	0.2160	569.1120 (264)
Space and water heating			1834.3064 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	498.2308	0.5190	258.5818 (268)
Energy saving/generation technologies			
PV Unit	-1074.8994	0.5190	-557.8728 (269)
Total kg/year			1573.9404 (272)
CO2 emissions per m2			11.1800 (273)
EI value			88.6450
EI rating			89 (274)
EI band			B

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Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

Calculation of stars for heating and DHW

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9060 = 3.841$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9060 = 0.2384$, stars = 4
Water heating energy efficiency	$3.48 / 0.8494 = 4.097$, stars = 4
Water heating environmental impact	$0.216 / 0.8494 = 0.2543$, 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	70.3700 (1b)	x 2.3900 (2b)	= 168.1843 (1b) - (3b)
First floor	70.3700 (1c)	x 2.6100 (2c)	= 183.6657 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	140.7400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 351.8500 (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) = 0.1421 (8)
Pressure test					Yes
Measured/design AP50					3.3200
Infiltration rate					0.3081 (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) =		0.2619 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.4000	4.1000	4.1000	3.9000	3.9000	3.7000	3.7000	3.5000	3.5000	3.8000	3.7000	3.9000 (22)
Wind factor	1.1000	1.0250	1.0250	0.9750	0.9750	0.9250	0.9250	0.8750	0.8750	0.9500	0.9250	0.9750 (22a)
Adj infilt rate												
Effective ac	0.2881	0.2684	0.2684	0.2553	0.2553	0.2422	0.2422	0.2292	0.2292	0.2488	0.2422	0.2553 (22b)
	0.5415	0.5360	0.5360	0.5326	0.5326	0.5293	0.5293	0.5263	0.5263	0.5309	0.5293	0.5326 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			2.1500	1.1000	2.3650		(26)
Windows (Uw = 1.40)			25.5500	1.3258	33.8731		(27)
Ground Floor			70.3700	0.1200	8.4444	90.0000	6333.3000 (28a)
Brick and Block	186.7500	27.7000	159.0500	0.2300	36.5815	42.2200	6715.0910 (29a)
Pitched Roof	70.3700		70.3700	0.1000	7.0370	9.1000	640.3670 (30)
Total net area of external elements Aum(A, m ²)			327.4900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	88.3010		(33)
Ground Floor Block			59.3900			75.0000	4454.2500 (32c)
Ground Floor Stud			45.5500			9.0000	409.9500 (32c)
First Floor Stud			173.6700			9.0000	1563.0300 (32c)
Internal Floor 1			70.3700			18.0000	1266.6600 (32d)
Internal Ceiling 1			70.3700			18.0000	1266.6600 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 22649.3080 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 160.9301 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 10.0243 (36)
Total fabric heat loss (33) + (36) = 98.3253 (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	62.8732	62.2386	62.2386	61.8405	61.8405	61.4622	61.4622	61.1038	61.1038	61.6488	61.4622	61.8405 (38)
Heat transfer coeff	161.1986	160.5640	160.5640	160.1658	160.1658	159.7875	159.7875	159.4292	159.4292	159.9742	159.7875	160.1658 (39)
Average = Sum(39)m / 12 =												160.0849 (39)
HLP	1.1454	1.1409	1.1409	1.1380	1.1380	1.1353	1.1353	1.1328	1.1328	1.1367	1.1353	1.1380 (40)
HLP (average)												1.1375 (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												2.9185 (42)
Average daily hot water use (litres/day)												103.5139 (43)
Daily hot water use	113.8653	109.7247	105.5842	101.4436	97.3031	93.1625	93.1625	97.3031	101.4436	105.5842	109.7247	113.8653 (44)
Energy conte	168.8589	147.6851	152.3978	132.8641	127.4863	110.0109	101.9413	116.9791	118.3762	137.9561	150.5899	163.5309 (45)
Energy content (annual)										Total = Sum(45)m =		1628.6766 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Distribution loss (46)m = 0.15 x (45)m	25.3288	22.1528	22.8597	19.9296	19.1229	16.5016	15.2912	17.5469	17.7564	20.6934	22.5885	24.5296 (46)
Water storage loss:												
Store volume												215.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.7300 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.9342 (55)
Total storage loss												
28.9602 26.1576 28.9602 28.0260 28.9602 28.0260 28.9602 28.9602 28.0260 28.9602 28.0260 28.9602 28.9602 (56)												
If cylinder contains dedicated solar storage												
28.9602 26.1576 28.9602 28.0260 28.9602 28.0260 28.9602 28.9602 28.0260 28.9602 28.0260 28.9602 28.9602 (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												
221.0815 194.8539 204.6204 183.4021 179.7089 160.5489 154.1639 169.2017 168.9142 190.1787 201.1279 215.7535 (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	221.0815	194.8539	204.6204	183.4021	179.7089	160.5489	154.1639	169.2017	168.9142	190.1787	201.1279	215.7535 (64)
Total per year (kWh/year) = Sum(64)m =												2243.5556 (64)
Heat gains from water heating, kWh/month												
97.9237 86.8403 92.4503 84.6077 84.1673 77.0090 75.6736 80.6736 79.7905 87.6485 90.5015 96.1521 (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	175.1088	175.1088	175.1088	175.1088	175.1088	175.1088	175.1088	175.1088	175.1088	175.1088	175.1088	175.1088	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
70.5297 62.6439 50.9454 38.5690 28.8308 24.3401 26.3004 34.1862 45.8847 58.2611 67.9994 72.4900 (67)													
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
463.0624 467.8676 455.7588 429.9806 397.4403 366.8569 346.4254 341.6202 353.7290 379.5072 412.0476 442.6309 (68)													
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
55.4294 55.4294 55.4294 55.4294 55.4294 55.4294 55.4294 55.4294 55.4294 55.4294 55.4294 55.4294 (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)													
-116.7392 -116.7392 -116.7392 -116.7392 -116.7392 -116.7392 -116.7392 -116.7392 -116.7392 -116.7392 -116.7392 -116.7392 (71)													
Water heating gains (Table 5)													
131.6178 129.2267 124.2612 117.5107 113.1280 106.9570 101.7118 108.4323 110.8201 117.8071 125.6966 129.2367 (72)													
Total internal gains	782.0090	776.5371	747.7644	702.8592	656.1980	614.9530	591.2365	601.0377	627.2328	672.3744	722.5424	761.1565	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	FF Specific data or Table 6c		Access factor Table 6d		Gains W
North				0.9600	13.4839		0.6300	0.7000		0.7700		3.9560 (74)
East				15.7300	25.1925		0.6300	0.7000		0.7700		121.1079 (76)
West				8.8600	25.1925		0.6300	0.7000		0.7700		68.2146 (80)

Solar gains	193.2786	321.5413	532.8805	780.4542	903.8443	1014.4446	931.7391	835.4778	649.1885	406.1946	240.1682	150.4795 (83)
Total gains	975.2875	1098.0784	1280.6449	1483.3135	1560.0423	1629.3976	1522.9756	1436.5156	1276.4213	1078.5690	962.7107	911.6359 (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	39.0293	39.1836	39.1836	39.2810	39.2810	39.3740	39.3740	39.4625	39.4625	39.3281	39.3740	39.2810	
alpha	3.6020	3.6122	3.6122	3.6187	3.6187	3.6249	3.6249	3.6308	3.6308	3.6219	3.6249	3.6187	
util living area	0.9795	0.9679	0.9316	0.8453	0.6952	0.4790	0.3414	0.3601	0.6366	0.8804	0.9628	0.9830 (86)	
MIT	19.5497	19.7321	20.1076	20.5267	20.8316	20.9679	20.9931	20.9918	20.9103	20.5431	19.9870	19.5218 (87)	
Th 2	19.9640	19.9676	19.9676	19.9699	19.9699	19.9721	19.9721	19.9741	19.9741	19.9710	19.9721	19.9699 (88)	
util rest of house													
0.9749 0.9606 0.9161 0.8114 0.6319 0.3906 0.2374 0.2511 0.5463 0.8440 0.9527 0.9790 (89)													
MIT 2	18.6648	18.8466	19.2110	19.6035	19.8632	19.9588	19.9707	19.9724	19.9294	19.6309	19.1032	18.6420 (90)	
Living area fraction									fLA = Living area / (4) =			0.1492 (91)	
MIT	18.7968	18.9788	19.3448	19.7412	20.0077	20.1094	20.1232	20.1245	20.0758	19.7670	19.2350	18.7733 (92)	
Temperature adjustment												0.0000	
adjusted MIT	18.7968	18.9788	19.3448	19.7412	20.0077	20.1094	20.1232	20.1245	20.0758	19.7670	19.2350	18.7733 (93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
0.9679 0.9517 0.9047 0.8028 0.6344 0.4028 0.2529 0.2674 0.5559 0.8354 0.9434 0.9728 (94)													
Useful gains	943.9507	1045.0509	1158.6084	1190.8616	989.7402	656.3531	385.1783	384.1315	709.5943	900.9919	908.1757	886.8233 (95)	
Ext temp.	5.4000	5.9000	7.6000	10.0000	13.1000	15.9000	17.7000	17.7000	15.3000	12.0000	8.4000	5.5000 (96)	
Heat loss rate W	2159.5487	2099.9787	1885.7874	1560.2107	1106.3774	672.6058	387.1983	386.5418	761.4001	1242.5209	1731.3049	2125.9292 (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	904.4049	708.9115	541.0212	265.9313	86.7781	0.0000	0.0000	0.0000	0.0000	254.0975	592.6530	921.8948 (98)	
Space heating												4275.6923 (98)	
Space heating per m2												(98) / (4) =	30.3801 (99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.6000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													4719.3072 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	904.4049	708.9115	541.0212	265.9313	86.7781	0.0000	0.0000	0.0000	0.0000	254.0975	592.6530	921.8948	(98)
Space heating efficiency (main heating system 1)	90.6000	90.6000	90.6000	90.6000	90.6000	0.0000	0.0000	0.0000	0.0000	90.6000	90.6000	90.6000	(210)
Space heating fuel (main heating system)	998.2394	782.4630	597.1536	293.5225	95.7815	0.0000	0.0000	0.0000	0.0000	280.4609	654.1424	1017.5439	(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	221.0815	194.8539	204.6204	183.4021	179.7089	160.5489	154.1639	169.2017	168.9142	190.1787	201.1279	215.7535	(64)
Efficiency of water heater (217)m	88.2778	88.0575	87.3885	85.9044	83.0957	79.9000	79.9000	79.9000	79.9000	85.6879	87.6267	79.9000	(216)
Fuel for water heating, kWh/month	250.4384	221.2802	234.1503	213.4955	216.2673	200.9373	192.9461	211.7669	211.4071	221.9434	229.5282	244.1865	(219)
Water heating fuel used												2648.3472	(219)
Annual totals kWh/year													
Space heating fuel - main system												4719.3072	(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)												498.2308	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.48 * 1025 * 1.00) =										-1213.1556		-1213.1556	(233)
Total delivered energy for all uses												6727.7297	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	4719.3072	9.7400	459.6605 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2648.3472	9.7400	257.9490 (247)
Pumps and fans for heating	75.0000	36.8500	27.6375 (249)
Energy for lighting	498.2308	36.8500	183.5981 (250)
Additional standing charges			104.0000 (251)
Energy saving/generation technologies			
PV Unit	-1213.1556	36.8500	-447.0478 (252)
Total energy cost			585.7973 (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	4719.3072	0.2160	1019.3704 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2648.3472	0.2160	572.0430 (264)
Space and water heating			1591.4134 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	498.2308	0.5190	258.5818 (268)
Energy saving/generation technologies			
PV Unit	-1213.1556	0.5190	-629.6277 (269)
Total kg/year			1259.2924 (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	4719.3072	1.2200	5757.5548 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2648.3472	1.2200	3230.9836 (264)
Space and water heating			8988.5384 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	498.2308	3.0700	1529.5686 (268)
Energy saving/generation technologies			
PV Unit	-1213.1556	3.0700	-3724.3876 (269)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Primary energy kWh/year
Primary energy kWh/m²/year

7023.9694 (272)
49.9074 (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
F	Already installed
G	Not considered
H	Not considered
I	Not considered
J	Not considered
K	Not considered
M	Not considered
N	Solar water heating
O	Recommended
P	Not considered
R	Not considered
S	Not considered
T	Not considered
U	Solar photovoltaic panels
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
L2	Not applicable
Q3	Not considered
O3	Not considered

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.2	-£ 115	-271 kg (21.5%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£115 1.92 kg/m ²	B 90	B 91
Total Savings	£115 1.92 kg/m ²		

Potential energy efficiency rating: B 90
Potential environmental impact rating: B 91

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	£211	£230	-£18
Mains gas	£822	£688	£134
Space heating	£591	£596	-£4
Water heating	£258	£138	£120
Lighting	£184	£184	£0
Generated (PV)	-£447	-£447	£0
Total cost of fuels	£586	£471	£116
Total cost of uses	£586	£471	£116
Delivered energy	48 kWh/m ²	38 kWh/m ²	9 kWh/m ²
Carbon dioxide emissions	1.3 tonnes	1.0 tonnes	0.3 tonnes
CO2 emissions per m ²	9 kg/m ²	7 kg/m ²	2 kg/m ²
Primary energy	50 kWh/m ²	39 kWh/m ²	11 kWh/m ²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	70.3700 (1b)	x 2.3900 (2b)	= 168.1843 (1b) - (3b)
First floor	70.3700 (1c)	x 2.6100 (2c)	= 183.6657 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	140.7400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 351.8500 (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) = 0.1421 (8)
Pressure test					Yes
Measured/design AP50					3.3200
Infiltration rate					0.3081 (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) =	0.2619 (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	0.3339	0.3274	0.3208	0.2881	0.2815	0.2488	0.2488	0.2422	0.2619	0.2815	0.2946	0.3077 (22b)
Effective ac	0.5557	0.5536	0.5515	0.5415	0.5396	0.5309	0.5309	0.5293	0.5343	0.5396	0.5434	0.5473 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			2.1500	1.1000	2.3650		(26)
Windows (Uw = 1.40)			25.5500	1.3258	33.8731		(27)
Ground Floor			70.3700	0.1200	8.4444	90.0000	6333.3000 (28a)
Brick and Block	186.7500	27.7000	159.0500	0.2300	36.5815	42.2200	6715.0910 (29a)
Pitched Roof	70.3700		70.3700	0.1000	7.0370	9.1000	640.3670 (30)
Total net area of external elements Aum(A, m ²)			327.4900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	88.3010		(33)
Ground Floor Block			59.3900			75.0000	4454.2500 (32c)
Ground Floor Stud			45.5500			9.0000	409.9500 (32c)
First Floor Stud			173.6700			9.0000	1563.0300 (32c)
Internal Floor 1			70.3700			18.0000	1266.6600 (32d)
Internal Ceiling 1			70.3700			18.0000	1266.6600 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 22649.3080 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 160.9301 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 10.0243 (36)
Total fabric heat loss (33) + (36) = 98.3253 (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	64.5282	64.2768	64.0304	62.8732	62.6567	61.6488	61.6488	61.4622	62.0371	62.6567	63.0947	63.5526 (38)
Heat transfer coeff	162.8535	162.6022	162.3558	161.1986	160.9821	159.9742	159.9742	159.7875	160.3624	160.9821	161.4201	161.8780 (39)
Average = Sum(39)m / 12 =												161.1975 (39)
HLP	1.1571	1.1553	1.1536	1.1454	1.1438	1.1367	1.1367	1.1353	1.1394	1.1438	1.1469	1.1502 (40)
HLP (average)												1.1454 (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												2.9185 (42)
Average daily hot water use (litres/day)												103.5139 (43)
Daily hot water use	113.8653	109.7247	105.5842	101.4436	97.3031	93.1625	93.1625	97.3031	101.4436	105.5842	109.7247	113.8653 (44)
Energy conte	168.8589	147.6851	152.3978	132.8641	127.4863	110.0109	101.9413	116.9791	118.3762	137.9561	150.5899	163.5309 (45)
Energy content (annual)										Total = Sum(45)m =		1628.6766 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	25.3288	22.1528	22.8597	19.9296	19.1229	16.5016	15.2912	17.5469	17.7564	20.6934	22.5885	24.5296 (46)
Water storage loss:												
Store volume												215.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.7300 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.9342 (55)
Total storage loss												
28.9602 26.1576 28.9602 28.0260 28.9602 28.0260 28.9602 28.9602 28.0260 28.9602 28.0260 28.9602 28.9602 (56)												
If cylinder contains dedicated solar storage												
18.8578 17.0329 18.8578 18.2495 18.8578 18.2495 18.8578 18.2495 18.8578 18.2495 18.8578 18.2495 18.8578 (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												
210.9791 185.7291 193.1222 166.8720 156.8121 138.1657 131.0346 147.0029 153.7349 178.6806 191.3514 205.6511 (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												1.1135 (H8)
Utilisation factor												0.5926 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												117.0000 (H13)
Daily hot water demand												103.5139 (H14)
Volume ratio Veff/V												1.1303 (H15)
Solar storage volume factor												1.0000 (H16)
Solar input												-945.0605 (H17)
Solar input	-27.4049	-45.7309	-77.8849	-104.3811	-128.9540	-126.7824	-125.1069	-109.3065	-85.6089	-58.4608	-32.5061	-22.9332 (63)
Solar input (sum of months) = Sum (63)m =												-945.0605 (63)
Output from w/h												
183.5743 139.9983 115.2374 62.4909 27.8581 11.3834 5.9277 37.6964 68.1259 120.2197 158.8452 182.7179 (64)												
Total per year (kWh/year) = Sum (64)m =												1114.0751 (64)
Heat gains from water heating, kWh/month												
89.8418 79.5405 83.2518 71.3836 65.8499 59.1025 57.1701 62.9146 67.6470 78.4500 82.6803 88.0702 (65)												

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

Metabolic gains (Table 5), Watts												
(66)m	175.1088	175.1088	175.1088	175.1088	175.1088	175.1088	175.1088	175.1088	175.1088	175.1088	175.1088	175.1088 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
70.5297 62.6439 50.9454 38.5690 28.8308 24.3401 26.3004 34.1862 45.8847 58.2611 67.9994 72.4900 (67)												
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
463.0624 467.8676 455.7588 429.9806 397.4403 366.8569 346.4254 341.6202 353.7290 379.5072 412.0476 442.6309 (68)												
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
55.4294 55.4294 55.4294 55.4294 55.4294 55.4294 55.4294 55.4294 55.4294 55.4294 55.4294 55.4294 (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)												
-116.7392 -116.7392 -116.7392 -116.7392 -116.7392 -116.7392 -116.7392 -116.7392 -116.7392 -116.7392 -116.7392 -116.7392 (71)												
Water heating gains (Table 5)												
120.7550 118.3639 111.8976 99.1439 88.5079 82.0867 76.8415 84.5626 93.9541 105.4435 114.8338 118.3739 (72)												
Total internal gains	771.1462	765.6743	735.4008	684.4924	631.5779	590.0828	566.3662	577.1680	610.3668	660.0108	711.6797	750.2937 (73)

6. Solar gains

[Jan]												
Area												
m2												
Solar flux												
Table 6a												
W/m2												
Specific data												
or Table 6b												
Specific data												
or Table 6c												
Access												
factor												
Table 6d												
Gains												
W												
North	0.9600	10.6334	0.6300	0.7000	0.7000	0.7000	0.7000	0.7000	0.7000	0.7000	0.7000	3.1197 (74)
East	15.7300	19.6403	0.6300	0.7000	0.7000	0.7000	0.7000	0.7000	0.7000	0.7000	0.7000	94.4165 (76)
West	8.8600	19.6403	0.6300	0.7000	0.7000	0.7000	0.7000	0.7000	0.7000	0.7000	0.7000	53.1806 (80)
Solar gains	150.7168	294.6931	485.6298	709.7597	871.8151	893.4849	850.2020	728.8734	565.2056	349.7007	187.8847	123.9774 (83)
Total gains	921.8629	1060.3674	1221.0306	1394.2521	1503.3930	1483.5677	1416.5682	1306.0414	1175.5724	1009.7116	899.5644	874.2711 (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	38.6327	38.6924	38.7512	39.0293	39.0818	39.3281	39.3281	39.3740	39.2329	39.0818	38.9758	38.8655
alpha	3.5755	3.5795	3.5834	3.6020	3.6055	3.6219	3.6219	3.6249	3.6155	3.6055	3.5984	3.5910
util living area	0.9861	0.9762	0.9518	0.8918	0.7812	0.6220	0.4762	0.5299	0.7590	0.9290	0.9773	0.9884 (86)
MIT	19.3211	19.5317	19.8938	20.3424	20.6998	20.9059	20.9727	20.9599	20.8005	20.3150	19.7314	19.2765 (87)
Th 2	19.9545	19.9559	19.9573	19.9640	19.9652	19.9710	19.9710	19.9721	19.9688	19.9652	19.9627	19.9601 (88)
util rest of house	0.9830	0.9710	0.9411	0.8674	0.7328	0.5425	0.3735	0.4245	0.6893	0.9076	0.9714	0.9858 (89)
MIT 2	18.4308	18.6400	18.9960	19.4300	19.7522	19.9203	19.9615	19.9568	19.8469	19.4151	18.8448	18.3909 (90)
Living area fraction												
fLA = Living area / (4) =												0.1492 (91)
MIT	18.5636	18.7730	19.1300	19.5661	19.8936	20.0674	20.1124	20.1065	19.9892	19.5494	18.9771	18.5230 (92)
Temperature adjustment												0.0000
adjusted MIT	18.5636	18.7730	19.1300	19.5661	19.8936	20.0674	20.1124	20.1065	19.9892	19.5494	18.9771	18.5230 (93)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9775	0.9633	0.9304	0.8564	0.7290	0.5505	0.3881	0.4390	0.6908	0.8969	0.9640	0.9810	(94)
Useful gains	901.1431	1021.4554	1136.0630	1194.0128	1096.0213	816.6346	549.8142	573.3523	812.0981	905.6096	867.2057	857.6764	(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	2322.8845	2255.7851	2050.5455	1719.3651	1319.0230	874.6393	561.8870	592.2535	944.4016	1440.6922	1917.2070	2318.5805	(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	1057.7756	829.4695	680.3750	378.2536	165.9133	0.0000	0.0000	0.0000	0.0000	398.1014	756.0009	1086.9127	(98)
Space heating												5352.8019	(98)
Space heating per m2												38.0333	(99)

(98) / (4) =

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.6000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													5908.1699 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1057.7756	829.4695	680.3750	378.2536	165.9133	0.0000	0.0000	0.0000	0.0000	398.1014	756.0009	1086.9127	(98)
Space heating efficiency (main heating system 1)	90.6000	90.6000	90.6000	90.6000	90.6000	0.0000	0.0000	0.0000	0.0000	90.6000	90.6000	90.6000	(210)
Space heating fuel (main heating system)	1167.5227	915.5293	750.9657	417.4985	183.1272	0.0000	0.0000	0.0000	0.0000	439.4055	834.4381	1199.6828	(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	183.5743	139.9983	115.2374	62.4909	27.8581	11.3834	5.9277	37.6964	68.1259	120.2197	158.8452	182.7179	(64)
Efficiency of water heater (217)m	88.8406	88.8812	88.8761	88.9118	88.8886	79.9000	79.9000	79.9000	79.9000	87.8707	88.5412	79.9000	(216)
Fuel for water heating, kWh/month	206.6333	157.5118	129.6607	70.2841	31.3405	14.2470	7.4189	47.1795	85.2640	136.8144	179.4026	205.5621	(219)
Water heating fuel used												1271.3189	(219)
Annual totals kWh/year													
Space heating fuel - main system												5908.1699	(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)												498.2308	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.48 * 908 * 1.00) =									-1074.8994			-1074.8994	(233)
Total delivered energy for all uses												6727.8202	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	5908.1699	3.4800	205.6043	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1271.3189	3.4800	44.2419	(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	498.2308	13.1900	65.7166	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-1074.8994	13.1900	-141.7792	(252)
Total energy cost			310.2711	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):			0.4200	(256)
Energy cost factor (ECF)			0.7016	(257)
SAP value		[(255) x (256)] / [(4) + 45.0] =	90.2128	
SAP rating (Section 12)			90	(258)
SAP band			B	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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	5908.1699	0.2160	1276.1647 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1271.3189	0.2160	274.6049 (264)
Space and water heating			1550.7696 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	498.2308	0.5190	258.5818 (268)
Energy saving/generation technologies			
PV Unit	-1074.8994	0.5190	-557.8728 (269)
Total kg/year			1316.3536 (272)
CO2 emissions per m2			9.3500 (273)
EI value			90.5033
EI rating			91 (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	70.3700 (1b)	x 2.3900 (2b)	= 168.1843 (1b) - (3b)
First floor	70.3700 (1c)	x 2.6100 (2c)	= 183.6657 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	140.7400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 351.8500 (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) = 0.1421 (8)
Pressure test					Yes
Measured/design AP50					3.3200
Infiltration rate					0.3081 (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) =		0.2619 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.4000	4.1000	4.1000	3.9000	3.9000	3.7000	3.7000	3.5000	3.5000	3.8000	3.7000	3.9000 (22)
Wind factor	1.1000	1.0250	1.0250	0.9750	0.9750	0.9250	0.9250	0.8750	0.8750	0.9500	0.9250	0.9750 (22a)
Adj infilt rate	0.2881	0.2684	0.2684	0.2553	0.2553	0.2422	0.2422	0.2292	0.2292	0.2488	0.2422	0.2553 (22b)
Effective ac	0.5415	0.5360	0.5360	0.5326	0.5326	0.5293	0.5293	0.5263	0.5263	0.5309	0.5293	0.5326 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			2.1500	1.1000	2.3650		(26)
Windows (Uw = 1.40)			25.5500	1.3258	33.8731		(27)
Ground Floor			70.3700	0.1200	8.4444	90.0000	6333.3000 (28a)
Brick and Block	186.7500	27.7000	159.0500	0.2300	36.5815	42.2200	6715.0910 (29a)
Pitched Roof	70.3700		70.3700	0.1000	7.0370	9.1000	640.3670 (30)
Total net area of external elements Aum(A, m ²)			327.4900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	88.3010		(33)
Ground Floor Block			59.3900			75.0000	4454.2500 (32c)
Ground Floor Stud			45.5500			9.0000	409.9500 (32c)
First Floor Stud			173.6700			9.0000	1563.0300 (32c)
Internal Floor 1			70.3700			18.0000	1266.6600 (32d)
Internal Ceiling 1			70.3700			18.0000	1266.6600 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 22649.3080 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 160.9301 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 10.0243 (36)
Total fabric heat loss (33) + (36) = 98.3253 (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	62.8732	62.2386	62.2386	61.8405	61.8405	61.4622	61.4622	61.1038	61.1038	61.6488	61.4622	61.8405 (38)
Heat transfer coeff	161.1986	160.5640	160.5640	160.1658	160.1658	159.7875	159.7875	159.4292	159.4292	159.9742	159.7875	160.1658 (39)
Average = Sum(39)m / 12 =												160.0849 (39)
HLP	1.1454	1.1409	1.1409	1.1380	1.1380	1.1353	1.1353	1.1328	1.1328	1.1367	1.1353	1.1380 (40)
HLP (average)												1.1375 (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												2.9185 (42)
Average daily hot water use (litres/day)												103.5139 (43)
Daily hot water use	113.8653	109.7247	105.5842	101.4436	97.3031	93.1625	93.1625	97.3031	101.4436	105.5842	109.7247	113.8653 (44)
Energy conte	168.8589	147.6851	152.3978	132.8641	127.4863	110.0109	101.9413	116.9791	118.3762	137.9561	150.5899	163.5309 (45)
Energy content (annual)										Total = Sum(45)m =		1628.6766 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Distribution loss (46)m = 0.15 x (45)m	25.3288	22.1528	22.8597	19.9296	19.1229	16.5016	15.2912	17.5469	17.7564	20.6934	22.5885	24.5296 (46)
Water storage loss:												
Store volume												215.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.7300 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.9342 (55)
Total storage loss												
28.9602 26.1576 28.9602 28.0260 28.9602 28.0260 28.9602 28.9602 28.0260 28.9602 28.0260 28.9602 28.9602 (56)												
If cylinder contains dedicated solar storage												
18.8578 17.0329 18.8578 18.2495 18.8578 18.2495 18.8578 18.2495 18.8578 18.2495 18.8578 18.2495 18.8578 (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	210.9791	185.7291	193.1222	166.8720	156.8121	138.1657	131.0346	147.0029	153.7349	178.6806	191.3514	205.6511 (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												1200.5924 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												2016.9953 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.2384 (H8)
Utilisation factor												0.5540 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												117.0000 (H13)
Daily hot water demand												103.5139 (H14)
Volume ratio Veff/V												1.1303 (H15)
Solar storage volume factor												1.0000 (H16)
Solar input												-982.5679 (H17)
Solar input	-32.2555	-45.8653	-78.8315	-106.3619	-124.3100	-134.0286	-127.5847	-116.2851	-90.8654	-62.4889	-38.1498	-25.5411 (63)
Solar input (sum of months) = Sum (63)m =												-982.5679 (63)
Output from w/h	178.7236	139.8638	114.2908	60.5101	32.5021	4.1371	3.4498	30.7178	62.8695	116.1917	153.2016	180.1100 (64)
Total per year (kWh/year) = Sum (64)m =												1076.5677 (64)
Heat gains from water heating, kWh/month	89.8418	79.5405	83.2518	71.3836	65.8499	59.1025	57.1701	62.9146	67.6470	78.4500	82.6803	88.0702 (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	175.1088	175.1088	175.1088	175.1088	175.1088	175.1088	175.1088	175.1088	175.1088	175.1088	175.1088	175.1088 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	70.5297	62.6439	50.9454	38.5690	28.8308	24.3401	26.3004	34.1862	45.8847	58.2611	67.9994	72.4900 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	463.0624	467.8676	455.7588	429.9806	397.4403	366.8569	346.4254	341.6202	353.7290	379.5072	412.0476	442.6309 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.4294	55.4294	55.4294	55.4294	55.4294	55.4294	55.4294	55.4294	55.4294	55.4294	55.4294	55.4294 (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)	-116.7392	-116.7392	-116.7392	-116.7392	-116.7392	-116.7392	-116.7392	-116.7392	-116.7392	-116.7392	-116.7392	-116.7392 (71)
Water heating gains (Table 5)	120.7550	118.3639	111.8976	99.1439	88.5079	82.0867	76.8415	84.5626	93.9541	105.4435	114.8338	118.3739 (72)
Total internal gains	771.1462	765.6743	735.4008	684.4924	631.5779	590.0828	566.3662	577.1680	610.3668	660.0108	711.6797	750.2937 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a		g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
North					0.9600	13.4839		0.6300	0.7000	0.7700		3.9560 (74)	
East					15.7300	25.1925		0.6300	0.7000	0.7700		121.1079 (76)	
West					8.8600	25.1925		0.6300	0.7000	0.7700		68.2146 (80)	

Solar gains	193.2786	321.5413	532.8805	780.4542	903.8443	1014.4446	931.7391	835.4778	649.1885	406.1946	240.1682	150.4795 (83)	
Total gains	964.4247	1087.2156	1268.2813	1464.9467	1535.4221	1604.5273	1498.1054	1412.6458	1259.5553	1066.2054	951.8479	900.7732 (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	39.0293	39.1836	39.1836	39.2810	39.2810	39.3740	39.3740	39.4625	39.4625	39.3281	39.3740	39.2810
alpha	3.6020	3.6122	3.6122	3.6187	3.6187	3.6249	3.6249	3.6308	3.6308	3.6219	3.6249	3.6187
util living area	0.9802	0.9688	0.9333	0.8493	0.7023	0.4855	0.3468	0.3659	0.6427	0.8835	0.9640	0.9836 (86)
MIT	19.5405	19.7232	20.0989	20.5177	20.8257	20.9665	20.9927	20.9914	20.9074	20.5361	19.9783	19.5124 (87)
Th 2	19.9640	19.9676	19.9676	19.9699	19.9699	19.9721	19.9721	19.9741	19.9741	19.9710	19.9721	19.9699 (88)
util rest of house	0.9757	0.9617	0.9181	0.8159	0.6392	0.3962	0.2413	0.2553	0.5522	0.8477	0.9542	0.9797 (89)
MIT 2	18.6557	18.8380	19.2028	19.5957	19.8591	19.9582	19.9706	19.9723	19.9278	19.6249	19.0948	18.6328 (90)
Living area fraction									fLA = Living area / (4) =			0.1492 (91)
MIT	18.7877	18.9701	19.3365	19.7333	20.0034	20.1086	20.1231	20.1244	20.0740	19.7608	19.2266	18.7640 (92)
Temperature adjustment												0.0000
adjusted MIT	18.7877	18.9701	19.3365	19.7333	20.0034	20.1086	20.1231	20.1244	20.0740	19.7608	19.2266	18.7640 (93)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9688	0.9529	0.9068	0.8072	0.6414	0.4085	0.2570	0.2718	0.5617	0.8390	0.9450	0.9737	(94)
Useful gains	934.3695	1036.0431	1150.0398	1182.4531	984.8448	655.4796	385.0468	383.9729	707.5520	894.4998	899.4494	877.0636	(95)
Ext temp.	5.4000	5.9000	7.6000	10.0000	13.1000	15.9000	17.7000	17.7000	15.3000	12.0000	8.4000	5.5000	(96)
Heat loss rate W	2158.0761	2098.5909	1884.4633	1558.9433	1105.6806	672.4862	387.1787	386.5183	761.1155	1241.5343	1729.9632	2124.4395	(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	910.4377	714.0321	546.4111	271.0729	89.9018	0.0000	0.0000	0.0000	0.0000	258.1937	597.9699	928.0476	(98)
Space heating												4316.0670	(98)
Space heating per m2											(98) / (4) =	30.6670	(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 %)													90.6000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													4763.8708 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	910.4377	714.0321	546.4111	271.0729	89.9018	0.0000	0.0000	0.0000	0.0000	258.1937	597.9699	928.0476	(98)
Space heating efficiency (main heating system 1)	90.6000	90.6000	90.6000	90.6000	90.6000	0.0000	0.0000	0.0000	0.0000	90.6000	90.6000	90.6000	(210)
Space heating fuel (main heating system)	1004.8982	788.1149	603.1027	299.1975	99.2294	0.0000	0.0000	0.0000	0.0000	284.9820	660.0110	1024.3351	(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	178.7236	139.8638	114.2908	60.5101	32.5021	4.1371	3.4498	30.7178	62.8695	116.1917	153.2016	180.1100	(64)
Efficiency of water heater (217)m	88.6519	88.6553	88.5487	88.4387	87.4890	79.9000	79.9000	79.9000	79.9000	86.9848	88.1913	79.9000	(216)
Fuel for water heating, kWh/month	201.6016	157.7613	129.0711	68.4203	37.1500	5.1778	4.3177	38.4453	78.6852	133.5770	173.7151	203.1238	(219)
Water heating fuel used												1231.0462	(219)
Annual totals kWh/year													
Space heating fuel - main system												4763.8708	(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)												498.2308	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.48 * 1025 * 1.00) =										-1213.1556		-1213.1556	(233)
Total delivered energy for all uses												5404.9922	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4763.8708	9.7400	464.0010	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1231.0462	9.7400	119.9039	(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	498.2308	36.8500	183.5981	(250)
Additional standing charges			104.0000	(251)
Energy saving/generation technologies				
PV Unit	-1213.1556	36.8500	-447.0478	(252)
Total energy cost			470.5176	(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	4763.8708	0.2160	1028.9961	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1231.0462	0.2160	265.9060	(264)
Space and water heating			1294.9021	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	498.2308	0.5190	258.5818	(268)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Energy saving/generation technologies			
PV Unit	-1213.1556	0.5190	-629.6277 (269)
Total kg/year			988.7311 (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	4763.8708	1.2200	5811.9224 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1231.0462	1.2200	1501.8763 (264)
Space and water heating			7313.7987 (265)
Pumps and fans	125.0000	3.0700	383.7500 (267)
Energy for lighting	498.2308	3.0700	1529.5686 (268)
Energy saving/generation technologies			
PV Unit	-1213.1556	3.0700	-3724.3876 (269)
Primary energy kWh/year			5502.7297 (272)
Primary energy kWh/m2/year			39.0985 (273)

U-VALUE CALCULATOR REPORT

Property Reference	SAP 0865	Issued on Date	25/04/2023
Assessment Reference	As Built	Prop Type Ref	
Project	Clarence Elizabeth Charles, The Lillies, Horton Heath, Eastleigh, SO50 7QH		
Calculation Type	New Build (As Built)		

SAP Rating	89 B	DER	12.63	TER	16.05
Environmental	89 B	% DER<TER	21.31		
CO ₂ Emissions (t/year)	1.26	DFEE	47.42	TFEE	56.29
General Requirements Compliance	Pass	% DFEE<TFEE	15.76		

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

Building Elements

Roof 000002 - Mineral Wool between and above

Roof Type: Pitched Roof, insulated flat ceiling

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

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

Unheated space: None

Total thickness: 463 mm

U-value: 0.10 W/m² K

Kappa: 9.10 kJ/m² K

U-VALUE CALCULATOR REPORT

Property Reference	SAP 0865	Issued on Date	25/04/2023
Assessment Reference	As Built	Prop Type Ref	
Project	Clarence Elizabeth Charles, The Lillies, Horton Heath, Eastleigh, SO50 7QH		
Calculation Type	New Build (As Built)		

SAP Rating	89 B	DER	12.63	TER	16.05
Environmental	89 B	% DER<TER	21.31		
CO ₂ Emissions (t/year)	1.26	DFEE	47.42	TFEE	56.29
General Requirements Compliance	Pass	% DFEE<TFEE	15.76		

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

Wall 000001

Wall Type: Standard Wall

Layer	Description	Thickness (mm)	Conductivity (W/m ² K)	Resistance (m ² K/W)	Fraction (%)	Density (kg/m ³)	Heat Cap. (J/kgK)
Ext surface				0.0400			
Layer 1	Brick, outer leaf						
	Main construction	102	0.7700	0.1325	82.81		
	Main construction	102	0.9407	0.1084	17.19		
Layer 2	Earthwool Dritherm 32 Ultimate						
	Main construction	100	0.0320	3.1250	100.00		
	Corrections - Air Gap: Level 1, 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 = 4.505 m ² K/W	Lower limit = 4.293 m ² K/W	Average = 4.399 m ² K/W
	Total correction = 0.0053 m ² K/W	U-value (unrounded) = 0.23 W/m ² K	

Unheated space: None		
Total thickness: 330 mm	U-value: 0.23 W/m ² K	Kappa: 42.22 kJ/m ² K

U-VALUE CALCULATOR REPORT

Property Reference	SAP 0865	Issued on Date	25/04/2023
Assessment Reference	As Built	Prop Type Ref	
Project	Clarence Elizabeth Charles, The Lillies, Horton Heath, Eastleigh, SO50 7QH		
Calculation Type	New Build (As Built)		

SAP Rating	89 B	DER	12.63	TER	16.05
Environmental	89 B	% DER<TER	21.31		
CO ₂ Emissions (t/year)	1.26	DFEE	47.42	TFEE	56.29
General Requirements Compliance	Pass	% DFEE<TFEE	15.76		

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

Building Elements

Floor 000003 - Block and Beam

Floor Type: Slab On Ground Floor

Area = 70.37 m², Perimeter = 37.35 m, Wall thickness = 275.00 mm, Soil: Unknown

Horizontal edge insulation: none

Vertical edge insulation: none

Layer	Description	Thickness (mm)	Conductivity (W/m ² K)	Resistance (m ² K/W)	Fraction (%)	Density (kg/m ³)	Heat Cap. (J/kgK)
Ext surface				0.0400			
Layer 1	Blockwork, dense						
	Main construction	100	1.5900	0.0629	84.09		
	Main construction	100	2.3000	0.0435	15.91		
Layer 2	Polythene, 1000 gauge						
	Main construction	1	0.0000	0.0000	100.00		
Layer 3	Xtratherm XT/UF Under Floor Board						
	Main construction	150	0.0220	6.8182	100.00		
	Corrections - Air Gap: Level 1, Fasteners: None or plastic						
Layer 4	Polythene, 500 gauge						
	Main construction	1	0.0000	0.0000	100.00		
Layer 5	Screed						
	Main construction	75	1.1500	0.0652	100.00	1200	1000
Int surface				0.1700			

Total resistance: Upper limit = 6.943 m² K/W Lower limit = 6.942 m² K/W Average = 6.943 m² K/W

Total correction = 0.0096 m² K/W

U-value (unrounded) = 0.12 W/m² K

Unheated space: None

Total thickness: 327 mm

U-value: 0.12 W/m² K

Kappa: 90.00 kJ/m² K

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

Property Reference	SAP 0865	Issued on Date	25/04/2023
Assessment Reference	As Built	Prop Type Ref	
Property	Clarence Elizabeth Charles, The Lillies, Horton Heath, Eastleigh, SO50 7QH		
SAP Rating	89 B	DER	12.63
Environmental	89 B	TER	16.05
CO ₂ Emissions (t/year)	1.26	% DER<TER	21.31
General Requirements Compliance	Pass	DFEE	47.42
		TFEE	56.29
		% DFEE<TFEE	15.76
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	West
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Suburban
1.0 Property Type	House, Detached
2.0 Number of Storeys	2
3.0 Date Built	2022
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements		Heat Loss Perimeter	Internal Floor Area	Average Storey Height
	Ground Floor:	37.35 m	70.37 m ²	2.39 m
	1st Storey:	37.35 m	70.37 m ²	2.61 m

7.0 Living Area	21.00	m ²
8.0 Thermal Mass Parameter	Precise calculation	
Thermal Mass	160.93	kJ/m ² K

9.0 External Walls				U-Value	Kappa	Gross Area	Nett Area
Description	Type	Construction		(W/m ² K)	(kJ/m ² K)	(m ²)	(m ²)
Brick and Block	Cavity Wall	Other		0.23	42.22	186.75	159.05

9.2 Internal Walls				Kappa	Area
Description	Construction			(kJ/m ² K)	(m ²)
Ground Floor Block	Dense block, plasterboard on dabs			75.00	59.39
Ground Floor Stud	Plasterboard on timber frame			9.00	45.55
First Floor Stud	Plasterboard on timber frame			9.00	173.67

10.0 External Roofs				U-Value	Kappa	Gross Area	Nett Area
Description	Type	Construction		(W/m ² K)	(kJ/m ² K)	(m ²)	(m ²)
Pitched Roof	External Plane Roof	Other		0.10	9.10	70.37	70.37

10.2 Internal Ceilings				Kappa	Area
Description	Construction			(kJ/m ² K)	(m ²)
Internal Ceiling 1	Plasterboard ceiling, carpeted chipboard floor			9.00	70.37

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	0.12	90.00	70.37

11.2 Internal Floors

Description	Construction	Kappa (kJ/m²K)	Area (m²)
Internal Floor 1	Plasterboard ceiling, carpeted chipboard floor	18.00	70.37

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	Manufacture	Solid Door							1.10
Windows	Manufacture	Window	Double Low-E Soft 0.1			0.63		0.70	1.40

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
Front Door	Solid Door	[1] Brick and Block	West							2.15	
Front Elevation	Window	[1] Brick and Block	West	None	0.00					6.96	
North	Window	[1] Brick and Block	North	None	0.00					0.96	
Rear Elevation	Window	[1] Brick and Block	East	None	0.00					15.73	
Front Shaded	Window	[1] Brick and Block	West	None	0.73	Yes				1.90	

14.0 Conservatory

None

15.0 Draught Proofing

100 %

16.0 Draught Lobby

No

17.0 Thermal Bridging

Calculate Bridges

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported	Reference:
Independently assessed	E2 Other lintels (including other steel lintels)	0.69	0.077	No	Birtley Supatherm
Independently assessed	E2 Other lintels (including other steel lintels)	1.93	0.071	No	Birtley Supatherm
Independently assessed	E2 Other lintels (including other steel lintels)	10.86	0.061	No	Birtley Supatherm
Independently assessed	E2 Other lintels (including other steel lintels)	5.42	0.056	No	Birtley Supatherm
Independently assessed	E3 Sill	12.46	0.021	No	Knauf P5
Independently assessed	E4 Jamb	30.60	0.016	No	Knauf P6
Table K1 - Approved	E5 Ground floor (normal)	37.35	0.160	No	
Independently assessed	E6 Intermediate floor within a dwelling	37.35	0.000	No	CD0029
Table K1 - Approved	E10 Eaves (insulation at ceiling level)	14.87	0.060	No	
Independently assessed	E12 Gable (insulation at ceiling level)	22.48	0.044	No	Knauf P21
Independently assessed	E16 Corner (normal)	29.99	0.039	No	Knauf P23
Independently assessed	E17 Corner (inverted – internal area greater than external area)	10.00	-0.091	No	Knauf P24

Y-value 0.031 W/m²K

18.0 Pressure Testing

Designed AP ₅₀	Yes	
Property Tested ?	5.00	m³/(h.m²) @ 50 Pa
As Built AP ₅₀	Yes	
	3.32	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	25	
Total number of L.E.L. fittings	25	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	Yes
Light and motion sensor	Yes

23.0 Electricity Tariff

Standard

24.0 Main Heating 1

	Database	
Description	Mains Gas Combi	
Percentage of Heat	100	%
Database Ref. No.	18910	
Fuel Type	Mains gas	
Main Heating	BGB	
SAP Code	102	
In Winter	90.6	
In Summer	79.9	
Controls	CBE Programmer, room thermostat and TRVs	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2106	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	

25.0 Main Heating 2

None

Community Heating None

28.0 Water Heating

	HWP From main heating 1
Water Heating	Main Heating 1
Flue Gas Heat Recovery System	No
Waste Water Heat Recovery	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	215.00	L
Loss	1.73	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
1.48	East	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£115	B 90	