



SAP Report Submission for Building Regulations Compliance

Client: Foreman Homes

Project: 5 Robert Place
West End, Southampton, SO30 3JY

Contact: Tobias Whiting
Abacus Energy (UK) Ltd
toby@abacusenergyuk.com

Report Issue Date: 22/08/2022

EXCELLENCE
IN ENERGY
ASSESSMENT

BUILDING REGULATION COMPLIANCE

Calculation Type: New Build (As Built)

Property Reference	SAP 0647 Plot 21				Issued on Date	22/08/2022
Assessment Reference	As Built	Prop Type Ref	Mh			
Property	5 Robert Place, West End, Southampton, SO30 3JY					
SAP Rating	89 B	DER	12.09	TER	16.15	
Environmental	89 B	% DER<TER	25.15			
CO ₂ Emissions (t/year)	1.24	DFEE	44.12	TFEE	55.46	
General Requirements Compliance	Pass	% DFEE<TFEE	20.44			
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)	16.15	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	12.09	kgCO ₂ /m ²	Pass
	-4.06 (-25.1%)	kgCO ₂ /m ²	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	55.46	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DFEE)	44.12	kWh/m ² /yr	
	-11.4 (-20.5%)	kWh/m ² /yr	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.24 (max. 0.30)	0.24 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.12 (max. 0.25)	0.12 (max. 0.70)	Pass
Roof	0.10 (max. 0.20)	0.10 (max. 0.35)	Pass
Openings	1.19 (max. 2.00)	1.20 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.22 (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 8000 Style GR8700iW 45 C NG
Combi boiler
Efficiency: 89.5% SEDBUK2009
Minimum: 88.0%

Pass

Secondary heating system

None

5 Cylinder insulation

Hot water storage

No cylinder

6 Controls

Space heating controls

Programmer, room thermostat and TRVs

Pass

Hot water controls

No cylinder

Boiler interlock

Yes

Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings

100 %

Minimum

75 %

Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)

Not significant

Pass

Based on:

Overshading

Average

Windows facing North

11.41 m², No overhang

Windows facing East

1.32 m², No overhang

Windows facing South

8.02 m², Overhang twice as wide as window, ratio 0.49

Air change rate

4.00 ach

Blinds/curtains

None

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type

U-value

W/m²K

Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals

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

Maximum

10.0 m³/(h.m²) @ 50 Pa

Pass

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)

10 Key features

Party wall U-value	0.00	W/m ² K
Roof U-value	0.10	W/m ² K
Floor U-value	0.12	W/m ² K
Door U-value	1.10	W/m ² K
Thermal bridging ψ -value	0.016	W/m ² K
Photovoltaic array	1.15	kW

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.

THERMAL BRIDGING

Calculation Type: New Build (As Built)

Property Reference	SAP 0647 Plot 21	Issued on Date	22/08/2022
Assessment Reference	As Built	Prop Type Ref	Mh
Property	5 Robert Place, West End, Southampton, SO30 3JY		
SAP Rating	89 B	DER	12.09
Environmental	89 B	TER	16.15
CO ₂ Emissions (t/year)	1.24	% DER<TER	25.15
General Requirements Compliance	Pass	DFEE	44.12
		TFEE	55.46
		% DFEE<TFEE	20.44
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	1.90	0.15	Birtley Supatherm
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.067	6.00	0.40	Birtley Supatherm
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.070	1.51	0.11	Birtley Supatherm
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.064	3.58	0.23	Birtley Supatherm
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.056	2.77	0.16	Birtley Supatherm
External wall	E3 Sill	Independently assessed	0.021	11.47	0.24	Knauf P5
External wall	E4 Jamb	Independently assessed	0.016	33.60	0.54	Knauf P6
External wall	E5 Ground floor (normal)	Independently assessed	0.022	37.76	0.83	Knauf P10
External wall	E6 Intermediate floor within a dwelling	Independently assessed	0.000	35.23	0.00	CD0029
External wall	E10 Eaves (insulation at ceiling level)	Table K1 - Approved	0.060	18.32	1.10	
External wall	E24 Eaves (insulation at ceiling level - inverted)	Independently assessed	0.151	3.27	0.49	Knauf P19
External wall	E12 Gable (insulation at ceiling level)	Independently assessed	0.044	22.65	1.00	Knauf P21
External wall	E16 Corner (normal)	Independently assessed	0.039	34.79	1.36	Knauf P23
External wall	E17 Corner (inverted – internal area greater than external area)	Independently assessed	-0.091	14.59	-1.33	Knauf P24

Total: **5.27** W/mK:
Y-Value: **0.016** W/m²K:

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

Property Reference	SAP 0647 Plot 21			Issued on Date	22/08/2022
Assessment Reference	As Built	Prop Type Ref	Mh		
Property	5 Robert Place, West End, Southampton, SO30 3JY				
SAP Rating	89 B	DER	12.09	TER	16.15
Environmental	89 B	% DER<TER	25.15		
CO ₂ Emissions (t/year)	1.24	DFEE	44.12	TFEE	55.46
General Requirements Compliance	Pass	% DFEE<TFEE	20.44		
Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 07798936079, toby@abacusenergyuk.com			Assessor ID	E477-0001
Client	Foreman Homes, FORE				

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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

DWELLING AS BUILT

Detached House, total floor area 149 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) 16.15 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 12.09 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)55.5 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)44.1 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.24 (max. 0.30)	0.24 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.12 (max. 0.25)	0.12 (max. 0.70)	OK
Roof	0.10 (max. 0.20)	0.10 (max. 0.35)	OK
Openings	1.19 (max. 2.00)	1.20 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals: 4.22 (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 8000 Style GR8700iW 45 C NG
Combi boiler
Efficiency: 89.5% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system:

None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls: Programmer, room thermostat and TRVs OK

Hot water controls:

No cylinder

Boiler interlock

Yes

OK

7 Low energy lights

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

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 11.41 m², No overhang
Windows facing East: 1.32 m², No overhang
Windows facing South: 8.02 m², Overhang twice as wide as window, ratio 0.49
Air change rate: 4.00 ach
Blinds/curtains: None

10 Key features

Party wall U-value 0.00 W/m²K
Roof U-value 0.10 W/m²K
Floor U-value 0.12 W/m²K
Door U-value 1.10 W/m²K
Thermal bridging y-value 0.016 W/m²K
Photovoltaic array 1.15 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	75.4100 (1b)	x 2.3900 (2b)	= 180.2299 (1b) - (3b)
First floor	73.1400 (1c)	x 2.6700 (2c)	= 195.2838 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	148.5500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 375.5137 (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) = 0.1332 (8)
Pressure test					Yes
Measured/design AP50					4.2200
Infiltration rate					0.3442 (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) =	0.2925 (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	0.3730	0.3657	0.3583	0.3218	0.3145	0.2779	0.2779	0.2706	0.2925	0.3145	0.3291	0.3437 (22b)
Effective ac	0.5696	0.5669	0.5642	0.5518	0.5494	0.5386	0.5386	0.5366	0.5428	0.5494	0.5542	0.5591 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			2.1200	1.1000	2.3320		(26)
Windows (Uw = 1.20)			20.7500	1.1450	23.7595		(27)
Ground Floor			75.4100	0.1200	9.0492	84.0000	6334.4400 (28a)
Brick and Block	184.2600	22.8700	161.3900	0.2400	38.7336	42.2200	6813.8858 (29a)
Pitched Roof	75.4100		75.4100	0.1000	7.5410	9.1000	686.2310 (30)
Total net area of external elements Aum(A, m ²)			335.0800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	81.4153		(33)
GF Block			84.1400			75.0000	6310.5000 (32c)
GF Stud			25.7100			9.0000	231.3900 (32c)
FF Stud			169.6200			9.0000	1526.5800 (32c)
Internal Floor 1			73.1400			18.0000	1316.5200 (32d)
Internal Ceiling 1			73.1400			18.0000	1316.5200 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 24536.0668 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 165.1704 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 5.2661 (36)
Total fabric heat loss (33) + (36) = 86.6815 (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	70.5789	70.2442	69.9162	68.3753	68.0870	66.7449	66.7449	66.4963	67.2618	68.0870	68.6702	69.2799 (38)
Heat transfer coeff	157.2604	156.9257	156.5976	155.0567	154.7684	153.4263	153.4263	153.1778	153.9433	154.7684	155.3517	155.9614 (39)
Average = Sum(39)m / 12 =												155.0553 (39)
HLP	1.0586	1.0564	1.0542	1.0438	1.0419	1.0328	1.0328	1.0312	1.0363	1.0419	1.0458	1.0499 (40)
HLP (average)												1.0438 (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												2.9319 (42)
Average daily hot water use (litres/day)												103.8326 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	114.2159	110.0626	105.9093	101.7560	97.6027	93.4494	93.4494	97.6027	101.7560	105.9093	110.0626	114.2159 (44)
Energy conte	169.3789	148.1399	152.8671	133.2732	127.8788	110.3497	102.2552	117.3394	118.7408	138.3809	151.0536	164.0344 (45)
Energy content (annual)										Total = Sum(45)m =		1633.6919 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	25.4068	22.2210	22.9301	19.9910	19.1818	16.5525	15.3383	17.6009	17.8111	20.7571	22.6580	24.6052 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	29.8600	26.9613	29.7962	28.7506	29.6207	28.5327	29.4013	29.5436	28.6425	29.6909	28.8326	29.8229 (61)
Total heat required for water heating calculated for each month	199.2389	175.1012	182.6633	162.0238	157.4995	138.8824	131.6565	146.8829	147.3832	168.0718	179.8862	193.8573 (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	199.2389	175.1012	182.6633	162.0238	157.4995	138.8824	131.6565	146.8829	147.3832	168.0718	179.8862	193.8573 (64)
Heat gains from water heating, kWh/month	63.7835	55.9968	58.2774	51.5010	49.9249	43.8245	41.3502	46.4012	46.6419	53.4344	57.4335	61.9972 (65)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)												
Total per year (kWh/year) = Sum(64)m = 1983.1470 (64)												

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	146.5951	146.5951	146.5951	146.5951	146.5951	146.5951	146.5951	146.5951	146.5951	146.5951	146.5951	146.5951 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	30.5193	27.1070	22.0449	16.6894	12.4755	10.5323	11.3806	14.7929	19.8550	25.2105	29.4244	31.3675 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	318.9411	322.2507	313.9106	296.1554	273.7428	252.6781	238.6056	235.2960	243.6361	261.3912	283.8038	304.8685 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.6595	37.6595	37.6595	37.6595	37.6595	37.6595	37.6595	37.6595	37.6595	37.6595	37.6595	37.6595 (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)	-117.2760	-117.2760	-117.2760	-117.2760	-117.2760	-117.2760	-117.2760	-117.2760	-117.2760	-117.2760	-117.2760	-117.2760 (71)
Water heating gains (Table 5)	85.7305	83.3286	78.3298	71.5291	67.1033	60.8673	55.5782	62.3672	64.7804	71.8204	79.7687	83.3295 (72)
Total internal gains	505.1693	502.6648	484.2637	454.3525	423.3002	394.0563	375.5429	382.4346	398.2500	428.4006	462.9754	489.5441 (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				11.4100	10.6334	0.6300	0.7000			0.7700			37.0791 (74)
East				1.3200	19.6403	0.6300	0.7000			0.7700			7.9231 (76)
South				8.0200	46.7521	0.6300	0.7000			0.7700			114.5901 (78)

Solar gains	159.5922	274.0283	384.9906	500.8200	587.7105	596.5699	569.6026	501.8859	424.1800	305.1594	191.4493	136.4429	(83)
Total gains	664.7616	776.6930	869.2543	955.1725	1011.0107	990.6262	945.1454	884.3205	822.4300	733.5600	654.4247	625.9870	(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	43.3394	43.4319	43.5228	43.9554	44.0372	44.4225	44.4225	44.4945	44.2733	44.0372	43.8719	43.7004
alpha	3.8893	3.8955	3.9015	3.9304	3.9358	3.9615	3.9615	3.9663	3.9516	3.9358	3.9248	3.9134
util living area	0.9964	0.9930	0.9853	0.9642	0.9102	0.7949	0.6480	0.6996	0.8856	0.9748	0.9936	0.9972 (86)
MIT	19.2638	19.4473	19.7483	20.1523	20.5391	20.8269	20.9442	20.9234	20.7032	20.2058	19.6614	19.2315 (87)
Th 2	20.0348	20.0366	20.0384	20.0470	20.0486	20.0561	20.0561	20.0575	20.0532	20.0486	20.0454	20.0420 (88)
util rest of house	0.9956	0.9913	0.9816	0.9540	0.8820	0.7264	0.5346	0.5912	0.8388	0.9659	0.9917	0.9965 (89)
MIT 2	18.4323	18.6165	18.9172	19.3218	19.6931	19.9514	20.0338	20.0241	19.8517	19.3793	18.8372	18.4055 (90)
Living area fraction									fLA = Living area / (4) =			0.1810 (91)
MIT	18.5828	18.7669	19.0676	19.4722	19.8462	20.1099	20.1986	20.1869	20.0058	19.5289	18.9864	18.5550 (92)
Temperature adjustment												0.0000
adjusted MIT	18.5828	18.7669	19.0676	19.4722	19.8462	20.1099	20.1986	20.1869	20.0058	19.5289	18.9864	18.5550 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	660.6419	767.6064	848.8652	903.8869	884.4475	723.9329	522.7904	537.3276	687.5159	703.7930	647.1752	622.9031 (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	2246.1146	2176.0741	1968.0580	1639.2846	1260.7811	845.3674	552.1232	580.0678	909.1634	1381.9133	1846.5736	2238.8285 (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	1179.5917	946.4903	832.6795	529.4864	279.9922	0.0000	0.0000	0.0000	0.0000	504.5215	863.5668	1202.2485 (98)
Space heating												6338.5769 (98)
Space heating per m2												(98) / (4) = 42.6697 (99)

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.4000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													7011.7001 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1179.5917	946.4903	832.6795	529.4864	279.9922	0.0000	0.0000	0.0000	0.0000	504.5215	863.5668	1202.2485	(98)
Space heating efficiency (main heating system 1)	90.4000	90.4000	90.4000	90.4000	90.4000	0.0000	0.0000	0.0000	0.0000	90.4000	90.4000	90.4000	(210)
Space heating fuel (main heating system)	1304.8581	1047.0025	921.1056	585.7150	309.7259	0.0000	0.0000	0.0000	0.0000	558.0990	955.2731	1329.9209	(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	199.2389	175.1012	182.6633	162.0238	157.4995	138.8824	131.6565	146.8829	147.3832	168.0718	179.8862	193.8573	(64)
Efficiency of water heater (217)m	90.0753	90.0493	89.9962	89.8747	89.5955	88.2000	88.2000	88.2000	88.2000	89.8400	90.0129	88.2000	(216)
Fuel for water heating, kWh/month	221.1914	194.4502	202.9679	180.2773	175.7896	157.4631	149.2704	166.5339	167.1012	187.0790	199.8448	215.1867	(219)
Water heating fuel used												2217.1555	(219)
Annual totals kWh/year													
Space heating fuel - main system												7011.7001	(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)												538.9802	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.15 * 1080 * 1.00) =										-993.1627		-993.1627	(233)
Total delivered energy for all uses												8849.6732	(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	7011.7001	0.2160	1514.5272 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2217.1555	0.2160	478.9056 (264)
Space and water heating			1993.4328 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	538.9802	0.5190	279.7307 (268)
Energy saving/generation technologies			
PV Unit	-993.1627	0.5190	-515.4514 (269)
Total CO2, kg/year			1796.6371 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			12.0900 (273)

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

DER		12.0900	ZC1
Total Floor Area	TFA	148.5500	
Assumed number of occupants	N	2.9319	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		12.7228	ZC2
CO2 emissions from cooking, equation (L16)		1.2748	ZC3
Total CO2 emissions		26.0876	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		26.0876	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	75.4100 (1b)	x 2.3900 (2b)	= 180.2299 (1b) - (3b)
First floor	73.1400 (1c)	x 2.6700 (2c)	= 195.2838 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	148.5500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 375.5137 (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) =	0.1065 (8)
Pressure test										Yes							
Measured/design AP50										5.0000							
Infiltration rate										0.3565 (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) =					0.3030 (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	0.3864	0.3788	0.3712	0.3333	0.3258	0.2879	0.2879	0.2803	0.3030	0.3258	0.3409	0.3561 (22b)					
Effective ac	0.5746	0.5717	0.5689	0.5556	0.5531	0.5414	0.5414	0.5393	0.5459	0.5531	0.5581	0.5634 (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			2.1200	1.0000	2.1200		(26)					
TER Opening Type (Uw = 1.40)			20.7500	1.3258	27.5095		(27)					
Ground Floor			75.4100	0.1300	9.8033		(28a)					
Brick and Block	184.2600	22.8700	161.3900	0.1800	29.0502		(29a)					
Pitched Roof	75.4100		75.4100	0.1300	9.8033		(30)					
Total net area of external elements Aum(A, m2)			335.0800				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26) ... (30) + (32) =	78.2863		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							14.1441 (36)					
Total fabric heat loss						(33) + (36) =	92.4304 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 71.2097	Feb 70.8505	Mar 70.4984	Apr 68.8447	May 68.5353	Jun 67.0950	Jul 67.0950	Aug 66.8283	Sep 67.6498	Oct 68.5353	Nov 69.1612	Dec 69.8156 (38)
Heat transfer coeff	163.6400	163.2809	162.9288	161.2751	160.9657	159.5254	159.5254	159.2587	160.0802	160.9657	161.5916	162.2460 (39)
Average = Sum(39)m / 12 =												161.2736 (39)
HLP	Jan 1.1016	Feb 1.0992	Mar 1.0968	Apr 1.0857	May 1.0836	Jun 1.0739	Jul 1.0739	Aug 1.0721	Sep 1.0776	Oct 1.0836	Nov 1.0878	Dec 1.0922 (40)
HLP (average)												1.0857 (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												2.9319 (42)
Average daily hot water use (litres/day)												103.8326 (43)
Daily hot water use	Jan 114.2159	Feb 110.0626	Mar 105.9093	Apr 101.7560	May 97.6027	Jun 93.4494	Jul 93.4494	Aug 97.6027	Sep 101.7560	Oct 105.9093	Nov 110.0626	Dec 114.2159 (44)
Energy conte	169.3789	148.1399	152.8671	133.2732	127.8788	110.3497	102.2552	117.3394	118.7408	138.3809	151.0536	164.0344 (45)
Energy content (annual)										Total = Sum(45)m =		1633.6919 (45)
Distribution loss (46)m = 0.15 x (45)m												
25.4068	22.2210	22.9301	19.9910	19.1818	16.5525	15.3383	17.6009	17.8111	20.7571	22.6580	24.6052 (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												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Combi 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)
Total heat required for water heating calculated for each month	50.9589	46.0274	50.9589	49.3151	49.7373	46.0846	47.6208	49.7373	49.3151	50.9589	49.3151	50.9589 (61)
Solar input	220.3378	194.1673	203.8260	182.5883	177.6161	156.4343	149.8760	167.0766	168.0558	189.3398	200.3687	214.9933 (62)
Output from w/h	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)
Heat gains from water heating, kWh/month	220.3378	194.1673	203.8260	182.5883	177.6161	156.4343	149.8760	167.0766	168.0558	189.3398	200.3687	214.9933 (64)
	69.0582	60.7634	63.5680	56.6421	54.9540	48.2124	45.9051	51.4497	51.8101	58.7514	62.5541	67.2812 (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	146.5951	146.5951	146.5951	146.5951	146.5951	146.5951	146.5951	146.5951	146.5951	146.5951	146.5951	146.5951	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	30.5193	27.1070	22.0449	16.6894	12.4755	10.5323	11.3806	14.7929	19.8550	25.2105	29.4244	31.3675	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	318.9411	322.2507	313.9106	296.1554	273.7428	252.6781	238.6056	235.2960	243.6361	261.3912	283.8038	304.8685	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.6595	37.6595	37.6595	37.6595	37.6595	37.6595	37.6595	37.6595	37.6595	37.6595	37.6595	37.6595	(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)	-117.2760	-117.2760	-117.2760	-117.2760	-117.2760	-117.2760	-117.2760	-117.2760	-117.2760	-117.2760	-117.2760	-117.2760	(71)
Water heating gains (Table 5)	92.8202	90.4217	85.4409	78.6696	73.8629	66.9617	61.7003	69.1528	71.9584	78.9669	86.8807	90.4317	(72)
Total internal gains	512.2590	509.7578	491.3748	461.4929	430.0598	400.1507	381.6650	389.2201	405.4280	435.5471	470.0874	496.6462	(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				11.4100	10.6334	0.6300	0.7000	0.7700	37.0791 (74)			
East				1.3200	19.6403	0.6300	0.7000	0.7700	7.9231 (76)			
South				8.0200	46.7521	0.6300	0.7000	0.7700	114.5901 (78)			
Solar gains	159.5922	274.0283	384.9906	500.8200	587.7105	596.5699	569.6026	501.8859	424.1800	305.1594	191.4493	136.4429 (83)
Total gains	671.8513	783.7861	876.3654	962.3130	1017.7703	996.7206	951.2676	891.1061	829.6080	740.7065	661.5367	633.0891 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	63.0406	63.1793	63.3158	63.9651	64.0880	64.6666	64.6666	64.7749	64.4425	64.0880	63.8398	63.5823	
alpha	5.2027	5.2120	5.2211	5.2643	5.2725	5.3111	5.3111	5.3183	5.2962	5.2725	5.2560	5.2388	
util living area	0.9995	0.9987	0.9964	0.9876	0.9541	0.8515	0.6928	0.7494	0.9345	0.9924	0.9989	0.9996	(86)
MIT	19.6852	19.8220	20.0493	20.3596	20.6634	20.8896	20.9725	20.9585	20.7891	20.3991	19.9862	19.6628	(87)
Th 2	19.9995	20.0015	20.0035	20.0126	20.0143	20.0222	20.0222	20.0237	20.0192	20.0143	20.0108	20.0072	(88)
util rest of house	0.9993	0.9983	0.9951	0.9821	0.9311	0.7765	0.5607	0.6234	0.8914	0.9881	0.9984	0.9995	(89)
MIT 2	18.2267	18.4282	18.7617	19.2189	19.6481	19.9367	20.0104	20.0034	19.8240	19.2799	18.6754	18.1993	(90)
Living area fraction	18.4907	18.6805	18.9947	19.4254	19.8319	20.1092	20.1846	20.1763	19.9987	19.4825	18.9127	18.4642	(91)
MIT	18.4907	18.6805	18.9947	19.4254	19.8319	20.1092	20.1846	20.1763	19.9987	19.4825	18.9127	18.4642	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.4907	18.6805	18.9947	19.4254	19.8319	20.1092	20.1846	20.1763	19.9987	19.4825	18.9127	18.4642	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	671.0989	781.6883	870.2083	940.6913	942.0689	781.6699	555.9079	575.0569	738.5590	729.3887	659.8868	632.5720	(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	2322.1691	2250.0908	2035.7531	1697.4794	1308.9512	878.8550	571.8304	601.4111	944.2587	1429.7790	1908.8312	2314.3112	(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	1228.3967	986.7665	867.1653	544.8874	272.9604	0.0000	0.0000	0.0000	0.0000	521.0904	899.2400	1251.2139	(98)
Space heating												6571.7206	(98)
Space heating per m2												44.2391	(99)

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 %)												93.4000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												7036.1035 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	1228.3967	986.7665	867.1653	544.8874	272.9604	0.0000	0.0000	0.0000	0.0000	521.0904	899.2400	1251.2139 (98)
Space heating efficiency (main heating system 1)	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000 (210)
Space heating fuel (main heating system)	1315.1999	1056.4952	928.4425	583.3912	292.2489	0.0000	0.0000	0.0000	0.0000	557.9126	962.7837	1339.6295 (211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating requirement	220.3378	194.1673	203.8260	182.5883	177.6161	156.4343	149.8760	167.0766	168.0558	189.3398	200.3687	214.9933 (64)
Efficiency of water heater (217)m	88.7031	88.5684	88.2866	87.6335	86.1296	80.3000	80.3000	80.3000	80.3000	87.4679	88.3745	80.3000 (216)
Fuel for water heating, kWh/month	248.3991	219.2286	230.8684	208.3544	206.2196	194.8124	186.6451	208.0655	209.2850	216.4677	226.7267	242.2107 (219)
Water heating fuel used												2597.2834 (219)
Annual totals kWh/year												
Space heating fuel - main system												7036.1035 (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)												538.9802 (232)
Total delivered energy for all uses												10247.3670 (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	7036.1035	0.2160	1519.7984 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2597.2834	0.2160	561.0132 (264)
Space and water heating			2080.8116 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	538.9802	0.5190	279.7307 (268)
Total CO2, kg/m2/year			2399.4673 (272)
Emissions per m2 for space and water heating			14.0075 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			1.8831 (272b)
Emissions per m2 for pumps and fans			0.2620 (272c)
Target Carbon Dioxide Emission Rate (TER) = (14.0075 * 1.00) + 1.8831 + 0.2620, rounded to 2 d.p.			16.1500 (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	75.4100 (1b)	x 2.3900 (2b)	= 180.2299 (1b) - (3b)
First floor	73.1400 (1c)	x 2.6700 (2c)	= 195.2838 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	148.5500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 375.5137 (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) = 0.1065 (8)
Pressure test					Yes
Measured/design AP50					4.2200
Infiltration rate					0.3175 (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) =	0.2699 (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	0.3441	0.3374	0.3306	0.2969	0.2901	0.2564	0.2564	0.2497	0.2699	0.2901	0.3036	0.3171 (22b)
Effective ac	0.5592	0.5569	0.5547	0.5441	0.5421	0.5329	0.5329	0.5312	0.5364	0.5421	0.5461	0.5503 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			2.1200	1.1000	2.3320		(26)
Windows (Uw = 1.20)			20.7500	1.1450	23.7595		(27)
Ground Floor			75.4100	0.1200	9.0492	84.0000	6334.4400 (28a)
Brick and Block	184.2600	22.8700	161.3900	0.2400	38.7336	42.2200	6813.8858 (29a)
Pitched Roof	75.4100		75.4100	0.1000	7.5410	9.1000	686.2310 (30)
Total net area of external elements Aum(A, m ²)			335.0800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	81.4153		(33)
GF Block			84.1400			75.0000	6310.5000 (32c)
GF Stud			25.7100			9.0000	231.3900 (32c)
FF Stud			169.6200			9.0000	1526.5800 (32c)
Internal Floor 1			73.1400			18.0000	1316.5200 (32d)
Internal Ceiling 1			73.1400			9.0000	658.2600 (32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss

(28)...(30) + (32) + (32a)...(32e) =	23877.8068 (34)
	160.7392 (35)
	5.2661 (36)
(33) + (36) =	86.6815 (37)
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)	
(38)m	Jan 69.2967 Feb 69.0118 Mar 68.7325 Apr 67.4208 May 67.1754 Jun 66.0330 Jul 66.0330 Aug 65.8214 Sep 66.4730 Oct 67.1754 Nov 67.6719 Dec 68.1909 (38)
Heat transfer coeff	155.9781 155.6932 155.4140 154.1023 153.8569 152.7145 152.7145 152.5029 153.1545 153.8569 154.3533 154.8724 (39)
Average = Sum(39)m / 12 =	154.1011 (39)
HLP	Jan 1.0500 Feb 1.0481 Mar 1.0462 Apr 1.0374 May 1.0357 Jun 1.0280 Jul 1.0280 Aug 1.0266 Sep 1.0310 Oct 1.0357 Nov 1.0391 Dec 1.0426 (40)
HLP (average)	1.0374 (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												2.9319 (42)
Average daily hot water use (litres/day)												103.8326 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	114.2159	110.0626	105.9093	101.7560	97.6027	93.4494	93.4494	97.6027	101.7560	105.9093	110.0626	114.2159 (44)
Energy conte	169.3789	148.1399	152.8671	133.2732	127.8788	110.3497	102.2552	117.3394	118.7408	138.3809	151.0536	164.0344 (45)
Energy content (annual)										Total = Sum(45)m =		1633.6919 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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	35.9930	31.4797	32.4843	28.3206	27.1743	23.4493	21.7292	24.9346	25.2324	29.4059	32.0989	34.8573 (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	146.5951	146.5951	146.5951	146.5951	146.5951	146.5951	146.5951	146.5951	146.5951	146.5951	146.5951	146.5951	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	30.5193	27.1070	22.0449	16.6894	12.4755	10.5323	11.3806	14.7929	19.8550	25.2105	29.4244	31.3675	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	318.9411	322.2507	313.9106	296.1554	273.7428	252.6781	238.6056	235.2960	243.6361	261.3912	283.8038	304.8685	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.6595	37.6595	37.6595	37.6595	37.6595	37.6595	37.6595	37.6595	37.6595	37.6595	37.6595	37.6595	(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)	-117.2760	-117.2760	-117.2760	-117.2760	-117.2760	-117.2760	-117.2760	-117.2760	-117.2760	-117.2760	-117.2760	-117.2760	(71)
Water heating gains (Table 5)	48.3777	46.8448	43.6616	39.3341	36.5245	32.5685	29.2060	33.5143	35.0450	39.5241	44.5818	46.8512	(72)
Total internal gains	464.8166	463.1810	446.5956	419.1575	389.7214	362.7574	346.1706	350.5816	365.5146	393.1043	424.7885	450.0658	(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				11.4100	10.6334		0.6300		0.7000		0.7700		37.0791 (74)
East				1.3200	19.6403		0.6300		0.7000		0.7700		7.9231 (76)
South				8.0200	46.7521		0.6300		0.7000		0.7700		114.5901 (78)
Solar gains	159.5922	274.0283	384.9906	500.8200	587.7105	596.5699	569.6026	501.8859	424.1800	305.1594	191.4493	136.4429	(83)
Total gains	624.4088	737.2092	831.5861	919.9775	977.4319	959.3274	915.7732	852.4676	789.6946	698.2637	616.2378	586.5087	(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	42.5234	42.6012	42.6778	43.0410	43.1097	43.4322	43.4322	43.4924	43.3074	43.1097	42.9710	42.8270	
alpha	3.8349	3.8401	3.8452	3.8694	3.8740	3.8955	3.8955	3.8995	3.8872	3.8740	3.8647	3.8551	
util living area	0.9968	0.9936	0.9862	0.9660	0.9142	0.8031	0.6588	0.7121	0.8927	0.9769	0.9942	0.9975	(86)
MIT	19.2083	19.3957	19.7033	20.1151	20.5126	20.8119	20.9376	20.9141	20.6805	20.1673	19.6107	19.1737	(87)
Th 2	20.0419	20.0435	20.0450	20.0523	20.0537	20.0600	20.0600	20.0612	20.0576	20.0537	20.0509	20.0480	(88)
util rest of house	0.9961	0.9921	0.9828	0.9565	0.8874	0.7366	0.5463	0.6053	0.8485	0.9688	0.9927	0.9969	(89)
MIT 2	18.3849	18.5728	18.8800	19.2919	19.6746	19.9444	20.0345	20.0227	19.8374	19.3479	18.7935	18.3549	(90)
Living area fraction	18.5339	18.7218	19.0290	19.4409	19.8263	20.1014	20.1979	20.1841	19.9900	19.4962	18.9414	18.5032	(91)
Temperature adjustment	18.5339	18.7218	19.0290	19.4409	19.8263	20.1014	20.1979	20.1841	19.9900	19.4962	18.9414	18.5032	(92)
adjusted MIT	18.5339	18.7218	19.0290	19.4409	19.8263	20.1014	20.1979	20.1841	19.9900	19.4962	18.9414	18.5032	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	620.9392	729.2421	813.2076	872.8073	859.8233	709.8123	516.7276	529.3035	667.0133	672.0603	610.0925	583.9355	(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	2220.1818	2151.9597	1947.1819	1624.3752	1250.2871	840.1476	549.4572	577.0853	902.0875	1368.7443	1827.7656	2215.1636	(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	(98)
Space heating kWh	1189.8365	956.0662	843.6769	541.1290	290.5051	0.0000	0.0000	0.0000	0.0000	518.3329	876.7246	1213.6337	(98)
Space heating												6429.9048	(98)
Space heating per m2												43.2844	(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	1435.5159	1130.0870	1159.0220	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7365	0.8169	0.7830	0.0000	0.0000	0.0000	0.0000	(101)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1057.2340	923.1988	907.4569	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1247.4817	1193.7157	1122.4658	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	136.9784	201.2645	159.9666	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												498.2095 (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	34.2446	50.3161	39.9917	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												124.5524 (107)
Space cooling per m2												0.8385 (108)
Energy for space heating												43.2844 (99)
Energy for space cooling												0.8385 (108)
Total												44.1229 (109)
Dwelling Fabric Energy Efficiency (DFEE)												44.1 (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	75.4100 (1b)	x 2.3900 (2b)	= 180.2299 (1b) - (3b)
First floor	73.1400 (1c)	x 2.6700 (2c)	= 195.2838 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	148.5500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 375.5137 (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) =	0.1065 (8)
Pressure test										Yes							
Measured/design AP50										5.0000							
Infiltration rate										0.3565 (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) =					0.3030	(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	0.3864	0.3788	0.3712	0.3333	0.3258	0.2879	0.2879	0.2803	0.3030	0.3258	0.3409	0.3561	(22b)				
Effective ac	0.5746	0.5717	0.5689	0.5556	0.5531	0.5414	0.5414	0.5393	0.5459	0.5531	0.5581	0.5634	(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			2.1200	1.0000	2.1200		(26)					
TER Opening Type (Uw = 1.40)			20.7500	1.3258	27.5095		(27)					
Ground Floor			75.4100	0.1300	9.8033		(28a)					
Brick and Block	184.2600	22.8700	161.3900	0.1800	29.0502		(29a)					
Pitched Roof	75.4100		75.4100	0.1300	9.8033		(30)					
Total net area of external elements Aum(A, m2)			335.0800				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	78.2863		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							14.1441 (36)					
Total fabric heat loss						(33) + (36) =	92.4304 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 71.2097	Feb 70.8505	Mar 70.4984	Apr 68.8447	May 68.5353	Jun 67.0950	Jul 67.0950	Aug 66.8283	Sep 67.6498	Oct 68.5353	Nov 69.1612	Dec 69.8156 (38)
Heat transfer coeff	163.6400	163.2809	162.9288	161.2751	160.9657	159.5254	159.5254	159.2587	160.0802	160.9657	161.5916	162.2460 (39)
Average = Sum(39)m / 12 =												161.2736 (39)
HLP	Jan 1.1016	Feb 1.0992	Mar 1.0968	Apr 1.0857	May 1.0836	Jun 1.0739	Jul 1.0739	Aug 1.0721	Sep 1.0776	Oct 1.0836	Nov 1.0878	Dec 1.0922 (40)
HLP (average)												1.0857 (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												2.9319 (42)
Average daily hot water use (litres/day)												103.8326 (43)
Daily hot water use	Jan 114.2159	Feb 110.0626	Mar 105.9093	Apr 101.7560	May 97.6027	Jun 93.4494	Jul 93.4494	Aug 97.6027	Sep 101.7560	Oct 105.9093	Nov 110.0626	Dec 114.2159 (44)
Energy conte	169.3789	148.1399	152.8671	133.2732	127.8788	110.3497	102.2552	117.3394	118.7408	138.3809	151.0536	164.0344 (45)
Energy content (annual)										Total = Sum(45)m =		1633.6919 (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	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												

FULL SAP CALCULATION PRINTOUT

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)
	35.9930	31.4797	32.4843	28.3206	27.1743	23.4493	21.7292	24.9346	25.2324	29.4059	32.0989	34.8573 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	146.5951	146.5951	146.5951	146.5951	146.5951	146.5951	146.5951	146.5951	146.5951	146.5951	146.5951	146.5951 (66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	30.5193	27.1070	22.0449	16.6894	12.4755	10.5323	11.3806	14.7929	19.8550	25.2105	29.4244	31.3675 (67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	318.9411	322.2507	313.9106	296.1554	273.7428	252.6781	238.6056	235.2960	243.6361	261.3912	283.8038	304.8685 (68)
Pumps, fans	37.6595	37.6595	37.6595	37.6595	37.6595	37.6595	37.6595	37.6595	37.6595	37.6595	37.6595	37.6595 (69)
Losses e.g. evaporation (negative values) (Table 5)	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)
Water heating gains (Table 5)	-117.2760	-117.2760	-117.2760	-117.2760	-117.2760	-117.2760	-117.2760	-117.2760	-117.2760	-117.2760	-117.2760	-117.2760 (71)
Total internal gains	48.3777	46.8448	43.6616	39.3341	36.5245	32.5685	29.2060	33.5143	35.0450	39.5241	44.5818	46.8512 (72)
	464.8166	463.1810	446.5956	419.1575	389.7214	362.7574	346.1706	350.5816	365.5146	393.1043	424.7885	450.0658 (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				11.4100	10.6334		0.6300		0.7000		0.7700	37.0791 (74)
East				1.3200	19.6403		0.6300		0.7000		0.7700	7.9231 (76)
South				8.0200	46.7521		0.6300		0.7000		0.7700	114.5901 (78)

Solar gains	159.5922	274.0283	384.9906	500.8200	587.7105	596.5699	569.6026	501.8859	424.1800	305.1594	191.4493	136.4429 (83)
Total gains	624.4088	737.2092	831.5861	919.9775	977.4319	959.3274	915.7732	852.4676	789.6946	698.2637	616.2378	586.5087 (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)												
tau	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
alpha	63.0406	63.1793	63.3158	63.9651	64.0880	64.6666	64.6666	64.7749	64.4425	64.0880	63.8398	63.5823
util living area	5.2027	5.2120	5.2211	5.2643	5.2725	5.3111	5.3111	5.3183	5.2962	5.2725	5.2560	5.2388
	0.9996	0.9990	0.9972	0.9898	0.9606	0.8665	0.7129	0.7718	0.9452	0.9942	0.9992	0.9997 (86)
MIT	19.6550	19.7925	20.0212	20.3342	20.6429	20.8784	20.9685	20.9521	20.7705	20.3729	19.9574	19.6331 (87)
Th 2	19.9995	20.0015	20.0035	20.0126	20.0143	20.0222	20.0222	20.0237	20.0192	20.0143	20.0108	20.0072 (88)
util rest of house	0.9995	0.9987	0.9961	0.9852	0.9402	0.7950	0.5801	0.6470	0.9070	0.9909	0.9988	0.9997 (89)
MIT 2	18.7590	18.8979	19.1277	19.4459	19.7459	19.9566	20.0128	20.0073	19.8710	19.4873	19.0703	18.7432 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	18.9212	19.0598	19.2895	19.6067	19.9083	20.1235	20.1858	20.1783	20.0338	19.6476	19.2309	18.9042 (92)
Temperature adjustment	0.0000											
adjusted MIT	18.9212	19.0598	19.2895	19.6067	19.9083	20.1235	20.1858	20.1783	20.0338	19.6476	19.2309	18.9042 (93)

8. Space heating requirement												

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9993	0.9982	0.9950	0.9827	0.9374	0.8037	0.6043	0.6693	0.9078	0.9891	0.9984	0.9995 (94)
Ext temp.	623.9833	735.9092	827.4437	904.0454	916.2894	771.0275	553.4357	570.5143	716.8514	690.6504	615.2724	586.2245 (95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Month fracti	2392.6079	2312.0230	2083.7711	1726.7239	1321.2543	881.1343	572.0266	601.7291	949.8870	1456.3510	1960.2519	2385.7042 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating	1315.8567	1059.1485	934.7076	592.3285	301.2939	0.0000	0.0000	0.0000	0.0000	569.6813	968.3852	1338.8129 (98)
Space heating per m2												7080.2146 (98)
												(98) / (4) = 47.6622 (99)

8c. Space cooling requirement												

Calculated for June, July and August. See Table 10b												
Ext. temp.	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	1499.5389	1180.4881	1210.3661	0.0000	0.0000	0.0000	0.0000 (100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.7553	0.8462	0.8084	0.0000	0.0000	0.0000	0.0000 (101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1132.6244	998.9291	978.4187	0.0000	0.0000	0.0000	0.0000 (102)
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	82.6973	144.9212	107.1710	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												334.7894 (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 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	20.6743	36.2303	26.7927	0.0000	0.0000	0.0000 (107)
Space cooling											83.6974 (107)
Space cooling per m2											0.5634 (108)
Energy for space heating											47.6622 (99)
Energy for space cooling											0.5634 (108)
Total											48.2256 (109)
Target Fabric Energy Efficiency (TFEE)											55.5 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	75.4100 (1b)	x 2.3900 (2b)	= 180.2299 (1b) - (3b)
First floor	73.1400 (1c)	x 2.6700 (2c)	= 195.2838 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	148.5500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 375.5137 (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) = 0.1332 (8)
Pressure test					Yes
Measured/design AP50					4.2200
Infiltration rate					0.3442 (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) =	0.2925 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.7000	4.4000	4.4000	4.0000	4.1000	3.9000	3.9000	3.8000	3.8000	4.1000	4.0000	4.1000 (22)
Wind factor	1.1750	1.1000	1.1000	1.0000	1.0250	0.9750	0.9750	0.9500	0.9500	1.0250	1.0000	1.0250 (22a)
Adj infilt rate	0.3437	0.3218	0.3218	0.2925	0.2998	0.2852	0.2852	0.2779	0.2779	0.2998	0.2925	0.2998 (22b)
Effective ac	0.5591	0.5518	0.5518	0.5428	0.5450	0.5407	0.5407	0.5386	0.5386	0.5450	0.5428	0.5450 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			2.1200	1.1000	2.3320		(26)
Windows (Uw = 1.20)			20.7500	1.1450	23.7595		(27)
Ground Floor			75.4100	0.1200	9.0492	84.0000	6334.4400 (28a)
Brick and Block	184.2600	22.8700	161.3900	0.2400	38.7336	42.2200	6813.8858 (29a)
Pitched Roof	75.4100		75.4100	0.1000	7.5410	9.1000	686.2310 (30)
Total net area of external elements Aum(A, m ²)			335.0800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	81.4153		(33)
GF Block			84.1400			75.0000	6310.5000 (32c)
GF Stud			25.7100			9.0000	231.3900 (32c)
FF Stud			169.6200			9.0000	1526.5800 (32c)
Internal Floor 1			73.1400			18.0000	1316.5200 (32d)
Internal Ceiling 1			73.1400			18.0000	1316.5200 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 24536.0668 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 165.1704 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 5.2661 (36)
Total fabric heat loss (33) + (36) = 86.6815 (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	69.2799	68.3753	68.3753	67.2618	67.5302	67.0000	67.0000	66.7449	66.7449	67.5302	67.2618	67.5302 (38)
Heat transfer coeff	155.9614	155.0567	155.0567	153.9433	154.2117	153.6815	153.6815	153.4263	153.4263	154.2117	153.9433	154.2117 (39)
Average = Sum(39)m / 12 =												154.2344 (39)
HLP	1.0499	1.0438	1.0438	1.0363	1.0381	1.0345	1.0345	1.0328	1.0328	1.0381	1.0363	1.0381 (40)
HLP (average)												1.0383 (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												2.9319 (42)
Average daily hot water use (litres/day)												103.8326 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	114.2159	110.0626	105.9093	101.7560	97.6027	93.4494	93.4494	97.6027	101.7560	105.9093	110.0626	114.2159 (44)
Energy conte	169.3789	148.1399	152.8671	133.2732	127.8788	110.3497	102.2552	117.3394	118.7408	138.3809	151.0536	164.0344 (45)
Energy content (annual)										Total = Sum(45)m =		1633.6919 (45)

Distribution loss	(46)m = 0.15 x (45)											
	25.4068	22.2210	22.9301	19.9910	19.1818	16.5525	15.3383	17.6009	17.8111	20.7571	22.6580	24.6052 (46)
Water storage loss:												
Total storage loss												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	29.8600	26.9613	29.7962	28.7506	29.6207	28.5327	29.4013	29.5436	28.6425	29.6909	28.8326	29.8229 (61)
Total heat required for water heating calculated for each month												
	199.2389	175.1012	182.6633	162.0238	157.4995	138.8824	131.6565	146.8829	147.3832	168.0718	179.8862	193.8573 (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												
	199.2389	175.1012	182.6633	162.0238	157.4995	138.8824	131.6565	146.8829	147.3832	168.0718	179.8862	193.8573 (64)
								Total per year (kWh/year) = Sum(64)m =				1983.1470 (64)
RHI water heating demand												1983 (64)
Heat gains from water heating, kWh/month												
	63.7835	55.9968	58.2774	51.5010	49.9249	43.8245	41.3502	46.4012	46.6419	53.4344	57.4335	61.9972 (65)

[illegible]

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	75.4100 (1b)	x 2.3900 (2b)	= 180.2299 (1b) - (3b)
First floor	73.1400 (1c)	x 2.6700 (2c)	= 195.2838 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	148.5500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 375.5137 (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) = 0.1332 (8)
Pressure test					Yes
Measured/design AP50					4.2200
Infiltration rate					0.3442 (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) =	0.2925 (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	0.3730	0.3657	0.3583	0.3218	0.3145	0.2779	0.2779	0.2706	0.2925	0.3145	0.3291	0.3437 (22b)
Effective ac	0.5696	0.5669	0.5642	0.5518	0.5494	0.5386	0.5386	0.5366	0.5428	0.5494	0.5542	0.5591 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			2.1200	1.1000	2.3320		(26)
Windows (Uw = 1.20)			20.7500	1.1450	23.7595		(27)
Ground Floor			75.4100	0.1200	9.0492	84.0000	6334.4400 (28a)
Brick and Block	184.2600	22.8700	161.3900	0.2400	38.7336	42.2200	6813.8858 (29a)
Pitched Roof	75.4100		75.4100	0.1000	7.5410	9.1000	686.2310 (30)
Total net area of external elements Aum(A, m ²)			335.0800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	81.4153		(33)
GF Block			84.1400			75.0000	6310.5000 (32c)
GF Stud			25.7100			9.0000	231.3900 (32c)
FF Stud			169.6200			9.0000	1526.5800 (32c)
Internal Floor 1			73.1400			18.0000	1316.5200 (32d)
Internal Ceiling 1			73.1400			18.0000	1316.5200 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 24536.0668 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 165.1704 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 5.2661 (36)
Total fabric heat loss (33) + (36) = 86.6815 (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	70.5789	70.2442	69.9162	68.3753	68.0870	66.7449	66.7449	66.4963	67.2618	68.0870	68.6702	69.2799 (38)
Heat transfer coeff	157.2604	156.9257	156.5976	155.0567	154.7684	153.4263	153.4263	153.1778	153.9433	154.7684	155.3517	155.9614 (39)
Average = Sum(39)m / 12 =												155.0553 (39)
HLP	1.0586	1.0564	1.0542	1.0438	1.0419	1.0328	1.0328	1.0312	1.0363	1.0419	1.0458	1.0499 (40)
HLP (average)												1.0438 (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												2.9319 (42)
Average daily hot water use (litres/day)												103.8326 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	114.2159	110.0626	105.9093	101.7560	97.6027	93.4494	93.4494	97.6027	101.7560	105.9093	110.0626	114.2159 (44)
Energy conte	169.3789	148.1399	152.8671	133.2732	127.8788	110.3497	102.2552	117.3394	118.7408	138.3809	151.0536	164.0344 (45)
Energy content (annual)										Total = Sum(45)m =		1633.6919 (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	25.4068	22.2210	22.9301	19.9910	19.1818	16.5525	15.3383	17.6009	17.8111	20.7571	22.6580	24.6052 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	29.8600	26.9613	29.7962	28.7506	29.6207	28.5327	29.4013	29.5436	28.6425	29.6909	28.8326	29.8229 (61)
Total heat required for water heating calculated for each month	199.2389	175.1012	182.6633	162.0238	157.4995	138.8824	131.6565	146.8829	147.3832	168.0718	179.8862	193.8573 (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	199.2389	175.1012	182.6633	162.0238	157.4995	138.8824	131.6565	146.8829	147.3832	168.0718	179.8862	193.8573 (64)
Heat gains from water heating, kWh/month	63.7835	55.9968	58.2774	51.5010	49.9249	43.8245	41.3502	46.4012	46.6419	53.4344	57.4335	61.9972 (65)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)												
Total per year (kWh/year) = Sum(64)m = 1983.1470 (64)												

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	175.9141	175.9141	175.9141	175.9141	175.9141	175.9141	175.9141	175.9141	175.9141	175.9141	175.9141	175.9141	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	76.2982	67.7674	55.1122	41.7234	31.1888	26.3309	28.4514	36.9823	49.6375	63.0262	73.5609	78.4188	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	476.0314	480.9711	468.5232	442.0231	408.5714	377.1315	356.1277	351.1880	363.6359	390.1361	423.5878	455.0277	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.5233	55.5233	55.5233	55.5233	55.5233	55.5233	55.5233	55.5233	55.5233	55.5233	55.5233	55.5233	(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)	-117.2760	-117.2760	-117.2760	-117.2760	-117.2760	-117.2760	-117.2760	-117.2760	-117.2760	-117.2760	-117.2760	-117.2760	(71)
Water heating gains (Table 5)	85.7305	83.3286	78.3298	71.5291	67.1033	60.8673	55.5782	62.3672	64.7804	71.8204	79.7687	83.3295	(72)
Total internal gains	755.2215	749.2285	719.1265	672.4370	624.0248	581.4910	557.3187	567.6988	595.2152	642.1440	694.0787	733.9373	(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				11.4100	10.6334	0.6300	0.7000	0.7700	37.0791 (74)			
East				1.3200	19.6403	0.6300	0.7000	0.7700	7.9231 (76)			
South				8.0200	46.7521	0.6300	0.7000	0.7700	114.5901 (78)			
Solar gains	159.5922	274.0283	384.9906	500.8200	587.7105	596.5699	569.6026	501.8859	424.1800	305.1594	191.4493	136.4429 (83)
Total gains	914.8137	1023.2568	1104.1170	1173.2570	1211.7353	1178.0609	1126.9212	1069.5847	1019.3952	947.3034	885.5280	870.3802 (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	43.3394	43.4319	43.5228	43.9554	44.0372	44.4225	44.4225	44.4945	44.2733	44.0372	43.8719	43.7004	
alpha	3.8893	3.8955	3.9015	3.9304	3.9358	3.9615	3.9615	3.9663	3.9516	3.9358	3.9248	3.9134	
util living area	0.9892	0.9822	0.9682	0.9343	0.8597	0.7201	0.5648	0.6097	0.8141	0.9449	0.9819	0.9910	(86)
MIT	19.4782	19.6541	19.9365	20.3078	20.6470	20.8811	20.9657	20.9532	20.7935	20.3656	19.8559	19.4427	(87)
Th 2	20.0348	20.0366	20.0384	20.0470	20.0486	20.0561	20.0561	20.0575	20.0532	20.0486	20.0454	20.0420	(88)
util rest of house	0.9868	0.9782	0.9608	0.9178	0.8222	0.6455	0.4577	0.5038	0.7535	0.9277	0.9772	0.9890	(89)
MIT 2	18.6452	18.8209	19.1009	19.4687	19.7859	19.9878	20.0432	20.0384	19.9213	19.5305	19.0291	18.6155	(90)
Living area fraction	18.7960	18.9717	19.2522	19.6206	19.9418	20.1495	20.2101	20.2040	fLA = Living area / (4) =	20.0792	19.6817	19.1788	0.1810 (91)
MIT	18.7960	18.9717	19.2522	19.6206	19.9418	20.1495	20.2101	20.2040	20.0792	19.6817	19.1788	18.7652	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7960	18.9717	19.2522	19.6206	19.9418	20.1495	20.2101	20.2040	20.0792	19.6817	19.1788	18.7652	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	898.9160	995.1690	1052.3787	1066.3019	990.3954	769.9462	536.4847	557.6146	770.0613	871.0719	860.3641	857.6921	(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	2279.6437	2208.2153	1996.9586	1662.3003	1275.5671	851.4466	553.8909	582.6898	920.4546	1405.5606	1876.4584	2271.6134	(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	1027.2614	815.1671	702.7674	429.1189	212.1677	0.0000	0.0000	0.0000	0.0000	397.6597	731.5879	1051.9574	(98)
Space heating												5367.6875	(98)
Space heating per m2												(98) / (4) =	36.1339 (99)

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.4000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													5937.7074 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1027.2614	815.1671	702.7674	429.1189	212.1677	0.0000	0.0000	0.0000	0.0000	397.6597	731.5879	1051.9574	(98)
Space heating efficiency (main heating system 1)	90.4000	90.4000	90.4000	90.4000	90.4000	0.0000	0.0000	0.0000	0.0000	90.4000	90.4000	90.4000	(210)
Space heating fuel (main heating system)	1136.3511	901.7335	777.3976	474.6890	234.6988	0.0000	0.0000	0.0000	0.0000	439.8890	809.2787	1163.6697	(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	199.2389	175.1012	182.6633	162.0238	157.4995	138.8824	131.6565	146.8829	147.3832	168.0718	179.8862	193.8573	(64)
Efficiency of water heater (217)m	90.0352	90.0030	89.9372	89.7862	89.4494	88.2000	88.2000	88.2000	88.2000	89.7350	89.9572	88.2000	(216)
Fuel for water heating, kWh/month	221.2900	194.5503	203.1009	180.4552	176.0767	157.4631	149.2704	166.5339	167.1012	187.2978	199.9687	215.2763	(219)
Water heating fuel used												2218.3845	(219)
Annual totals kWh/year													
Space heating fuel - main system												5937.7074	(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)												538.9802	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.15 * 1080 * 1.00) =										-993.1627		-993.1627	(233)
Total delivered energy for all uses												7776.9094	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	5937.7074	3.4800	206.6322 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2218.3845	3.4800	77.1998 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	538.9802	13.1900	71.0915 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-993.1627	13.1900	-130.9982 (252)
Total energy cost			353.8178 (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] =	0.7678 (257)
SAP value		89.2895
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	5937.7074	0.2160	1282.5448 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2218.3845	0.2160	479.1711 (264)
Space and water heating			1761.7158 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	538.9802	0.5190	279.7307 (268)
Energy saving/generation technologies			
PV Unit	-993.1627	0.5190	-515.4514 (269)
Total kg/year			1564.9201 (272)
CO2 emissions per m2			10.5300 (273)
EI value			89.1656
EI rating			89 (274)
EI band			B

Calculation of stars for heating and DHW

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9040 = 3.850$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9040 = 0.2389$, stars = 4
Water heating energy efficiency	$3.48 / 0.8931 = 3.896$, stars = 4
Water heating environmental impact	$0.216 / 0.8931 = 0.2418$, 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	75.4100 (1b)	x 2.3900 (2b)	= 180.2299 (1b) - (3b)
First floor	73.1400 (1c)	x 2.6700 (2c)	= 195.2838 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	148.5500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 375.5137 (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) = 0.1332 (8)
Pressure test					Yes
Measured/design AP50					4.2200
Infiltration rate					0.3442 (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) =	0.2925 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.7000	4.4000	4.4000	4.0000	4.1000	3.9000	3.9000	3.8000	3.8000	4.1000	4.0000	4.1000 (22)
Wind factor	1.1750	1.1000	1.1000	1.0000	1.0250	0.9750	0.9750	0.9500	0.9500	1.0250	1.0000	1.0250 (22a)
Adj infilt rate	0.3437	0.3218	0.3218	0.2925	0.2998	0.2852	0.2852	0.2779	0.2779	0.2998	0.2925	0.2998 (22b)
Effective ac	0.5591	0.5518	0.5518	0.5428	0.5450	0.5407	0.5407	0.5386	0.5386	0.5450	0.5428	0.5450 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			2.1200	1.1000	2.3320		(26)
Windows (Uw = 1.20)			20.7500	1.1450	23.7595		(27)
Ground Floor			75.4100	0.1200	9.0492	84.0000	6334.4400 (28a)
Brick and Block	184.2600	22.8700	161.3900	0.2400	38.7336	42.2200	6813.8858 (29a)
Pitched Roof	75.4100		75.4100	0.1000	7.5410	9.1000	686.2310 (30)
Total net area of external elements Aum(A, m ²)			335.0800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	81.4153		(33)
GF Block			84.1400			75.0000	6310.5000 (32c)
GF Stud			25.7100			9.0000	231.3900 (32c)
FF Stud			169.6200			9.0000	1526.5800 (32c)
Internal Floor 1			73.1400			18.0000	1316.5200 (32d)
Internal Ceiling 1			73.1400			18.0000	1316.5200 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 24536.0668 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 165.1704 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 5.2661 (36)
Total fabric heat loss (33) + (36) = 86.6815 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 69.2799	Feb 68.3753	Mar 68.3753	Apr 67.2618	May 67.5302	Jun 67.0000	Jul 67.0000	Aug 66.7449	Sep 66.7449	Oct 67.5302	Nov 67.2618	Dec 67.5302 (38)
Heat transfer coeff	155.9614	155.0567	155.0567	153.9433	154.2117	153.6815	153.6815	153.4263	153.4263	154.2117	153.9433	154.2117 (39)
Average = Sum(39)m / 12 =												154.2344 (39)

HLP	Jan 1.0499	Feb 1.0438	Mar 1.0438	Apr 1.0363	May 1.0381	Jun 1.0345	Jul 1.0345	Aug 1.0328	Sep 1.0328	Oct 1.0381	Nov 1.0363	Dec 1.0381 (40)
HLP (average)												1.0383 (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												2.9319 (42)
Average daily hot water use (litres/day)												103.8326 (43)
Daily hot water use	Jan 114.2159	Feb 110.0626	Mar 105.9093	Apr 101.7560	May 97.6027	Jun 93.4494	Jul 93.4494	Aug 97.6027	Sep 101.7560	Oct 105.9093	Nov 110.0626	Dec 114.2159 (44)
Energy conte	169.3789	148.1399	152.8671	133.2732	127.8788	110.3497	102.2552	117.3394	118.7408	138.3809	151.0536	164.0344 (45)
Energy content (annual)										Total = Sum(45)m =		1633.6919 (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	25.4068	22.2210	22.9301	19.9910	19.1818	16.5525	15.3383	17.6009	17.8111	20.7571	22.6580	24.6052 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	29.8600	26.9613	29.7962	28.7506	29.6207	28.5327	29.4013	29.5436	28.6425	29.6909	28.8326	29.8229 (61)
Total heat required for water heating calculated for each month	199.2389	175.1012	182.6633	162.0238	157.4995	138.8824	131.6565	146.8829	147.3832	168.0718	179.8862	193.8573 (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	199.2389	175.1012	182.6633	162.0238	157.4995	138.8824	131.6565	146.8829	147.3832	168.0718	179.8862	193.8573 (64)
Heat gains from water heating, kWh/month	63.7835	55.9968	58.2774	51.5010	49.9249	43.8245	41.3502	46.4012	46.6419	53.4344	57.4335	61.9972 (65)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)												
Total per year (kWh/year) = Sum(64)m = 1983.1470 (64)												

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	175.9141	175.9141	175.9141	175.9141	175.9141	175.9141	175.9141	175.9141	175.9141	175.9141	175.9141	175.9141	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	76.2982	67.7674	55.1122	41.7234	31.1888	26.3309	28.4514	36.9823	49.6375	63.0262	73.5609	78.4188	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	476.0314	480.9711	468.5232	442.0231	408.5714	377.1315	356.1277	351.1880	363.6359	390.1361	423.5878	455.0277	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.5233	55.5233	55.5233	55.5233	55.5233	55.5233	55.5233	55.5233	55.5233	55.5233	55.5233	55.5233	(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)	-117.2760	-117.2760	-117.2760	-117.2760	-117.2760	-117.2760	-117.2760	-117.2760	-117.2760	-117.2760	-117.2760	-117.2760	(71)
Water heating gains (Table 5)	85.7305	83.3286	78.3298	71.5291	67.1033	60.8673	55.5782	62.3672	64.7804	71.8204	79.7687	83.3295	(72)
Total internal gains	755.2215	749.2285	719.1265	672.4370	624.0248	581.4910	557.3187	567.6988	595.2152	642.1440	694.0787	733.9373	(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				11.4100	13.4684	0.6300	0.7000	0.7700	46.9650 (74)			
East				1.3200	25.1733	0.6300	0.7000	0.7700	10.1551 (76)			
South				8.0200	56.5862	0.6300	0.7000	0.7700	138.6937 (78)			
Solar gains	195.8138	286.8511	412.9155	544.3339	605.0620	681.1449	624.2819	571.1531	477.9936	345.3685	234.2544	158.4174 (83)
Total gains	951.0353	1036.0796	1132.0420	1216.7708	1229.0868	1262.6359	1181.6006	1138.8519	1073.2088	987.5125	928.3331	892.3547 (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	43.7004	43.9554	43.9554	44.2733	44.1962	44.3487	44.3487	44.4225	44.4225	44.1962	44.2733	44.1962	
alpha	3.9134	3.9304	3.9304	3.9516	3.9464	3.9566	3.9566	3.9615	3.9615	3.9464	3.9516	3.9464	
util living area	0.9837	0.9765	0.9560	0.9031	0.7943	0.5814	0.4204	0.4222	0.7016	0.9048	0.9694	0.9865	(86)
MIT	19.7008	19.8338	20.1165	20.4851	20.7849	20.9558	20.9908	20.9910	20.9055	20.5743	20.1029	19.6854	(87)
Th 2	20.0420	20.0470	20.0470	20.0532	20.0517	20.0546	20.0546	20.0561	20.0561	20.0517	20.0532	20.0517	(88)
util rest of house	0.9799	0.9710	0.9453	0.8784	0.7400	0.4883	0.3043	0.3020	0.6145	0.8740	0.9608	0.9833	(89)
MIT 2	18.8720	19.0069	19.2839	19.6411	19.9073	20.0351	20.0526	20.0541	20.0072	19.7289	19.2786	18.8645	(90)
Living area fraction	19.0220	19.1565	19.4346	19.7939	20.0661	20.2017	20.2224	20.2237	20.1698	19.8820	19.4278	19.0131	(91)
MIT	19.0220	19.1565	19.4346	19.7939	20.0661	20.2017	20.2224	20.2237	20.1698	19.8820	19.4278	19.0131	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0220	19.1565	19.4346	19.7939	20.0661	20.2017	20.2224	20.2237	20.1698	19.8820	19.4278	19.0131	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	926.8604	999.2106	1060.4671	1059.1044	910.6651	635.7250	384.4675	368.8804	671.7469	856.5390	885.2483	873.2163	(94)
Ext temp.	5.6000	6.0000	7.6000	10.1000	13.1000	15.9000	17.7000	17.8000	15.4000	12.1000	8.6000	5.7000	(96)
Heat loss rate W	2093.3160	2040.0114	1835.0337	1492.3064	1074.2607	661.0961	387.6472	371.8643	731.8122	1200.0688	1666.8678	2053.0424	(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	867.8430	699.4182	576.2776	311.9055	121.7151	0.0000	0.0000	0.0000	0.0000	255.5862	562.7660	877.7906	(98)
Space heating												4273.3022	(98)
Space heating per m2												(98) / (4) =	28.7668 (99)

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.4000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													4727.1042 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	867.8430	699.4182	576.2776	311.9055	121.7151	0.0000	0.0000	0.0000	0.0000	255.5862	562.7660	877.7906	(98)
Space heating efficiency (main heating system 1)	90.4000	90.4000	90.4000	90.4000	90.4000	0.0000	0.0000	0.0000	0.0000	90.4000	90.4000	90.4000	(210)
Space heating fuel (main heating system)	960.0033	773.6927	637.4752	345.0282	134.6406	0.0000	0.0000	0.0000	0.0000	282.7281	622.5288	971.0073	(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	199.2389	175.1012	182.6633	162.0238	157.4995	138.8824	131.6565	146.8829	147.3832	168.0718	179.8862	193.8573	(64)
Efficiency of water heater (217)m	89.9809	89.9508	89.8605	89.6356	89.1457	88.2000	88.2000	88.2000	88.2000	89.5142	89.8571	88.2000	(216)
Fuel for water heating, kWh/month	221.4235	194.6633	203.2742	180.7582	176.6765	157.4631	149.2704	166.5339	167.1012	187.7599	200.1914	215.4116	(219)
Water heating fuel used												2220.5271	(219)
Annual totals kWh/year													
Space heating fuel - main system												4727.1042	(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)												538.9802	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.15 * 1206 * 1.00) =										-1109.5294		-1109.5294	(233)
Total delivered energy for all uses												6452.0821	(238)

10a. Fuel costs - using BEDF prices (500)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	4727.1042	3.6300	171.5939 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2220.5271	3.6300	80.6051 (247)
Pumps and fans for heating	75.0000	19.4400	14.5800 (249)
Energy for lighting	538.9802	19.4400	104.7777 (250)
Additional standing charges			95.0000 (251)
Energy saving/generation technologies			
PV Unit	-1109.5294	19.4400	-215.6925 (252)
Total energy cost			250.8642 (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	4727.1042	0.2160	1021.0545 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2220.5271	0.2160	479.6339 (264)
Space and water heating			1500.6884 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	538.9802	0.5190	279.7307 (268)
Energy saving/generation technologies			
PV Unit	-1109.5294	0.5190	-575.8458 (269)
Total kg/year			1243.4983 (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	4727.1042	1.2200	5767.0671 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2220.5271	1.2200	2709.0431 (264)
Space and water heating			8476.1102 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	538.9802	3.0700	1654.6691 (268)
Energy saving/generation technologies			
PV Unit	-1109.5294	3.0700	-3406.2553 (269)
Primary energy kWh/year			6954.7741 (272)
Primary energy kWh/m2/year			46.8177 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

SAP 2012 EPC IMPROVEMENTS

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

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

Recommended measures: SAP change Cost change CO2 change
(none)

Measures omitted - SAP change or cost saving too small:
N Solar water heating + 0.8 -£ 28 -198 kg (15.9%)

Recommended measures Typical annual savings Energy Environmental
(none) efficiency impact
Total Savings £0 0.00 kg/m²

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

Fuel prices for cost data on this page from database revision number 500 TEST (30 Jun 2022)
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	£119	£119	£0
Mains gas	£347	£347	£0
Space heating	£281	£281	£0
Water heating	£81	£81	£0
Lighting	£105	£105	£0
Generated (PV)	-£216	-£216	£0
Total cost of fuels	£250	£250	£0
Total cost of uses	£251	£251	£0
Delivered energy	43 kWh/m²	43 kWh/m²	0 kWh/m²
Carbon dioxide emissions	1.2 tonnes	1.2 tonnes	0.0 tonnes
CO2 emissions per m²	8 kg/m²	8 kg/m²	0 kg/m²
Primary energy	47 kWh/m²	47 kWh/m²	0 kWh/m²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

No improvements selected / applicable

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

No improvements selected / applicable

U-VALUE CALCULATOR REPORT

Property Reference	SAP 0647 Plot 21	Issued on Date	22/08/2022
Assessment Reference	As Built	Prop Type Ref	Mh
Project	5 Robert Place, West End, Southampton, SO30 3JY		
Calculation Type	New Build (As Built)		

SAP Rating	89 B	DER	12.09	TER	16.15
Environmental	89 B	% DER<TER	25.15		
CO ₂ Emissions (t/year)	1.24	DFEE	44.12	TFEE	55.46
General Requirements Compliance	Pass	% DFEE<TFEE	20.44		

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

Building Elements

Roof 000002 - Mineral Wool between and above

Roof Type: Pitched Roof, insulated flat ceiling

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

Total resistance: Upper limit = 11.200 m² K/W Lower limit = 10.901 m² K/W Average = 11.050 m² K/W
Total correction = 0.0065 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 0647 Plot 21	Issued on Date	22/08/2022
Assessment Reference	As Built	Prop Type Ref	Mh
Project	5 Robert Place, West End, Southampton, SO30 3JY		
Calculation Type	New Build (As Built)		

SAP Rating	89 B	DER	12.09	TER	16.15
Environmental	89 B	% DER<TER	25.15		
CO ₂ Emissions (t/year)	1.24	DFEE	44.12	TFEE	55.46
General Requirements Compliance	Pass	% DFEE<TFEE	20.44		

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

Client	Foreman Homes, FORE
--------	---------------------

Building Elements

Wall 000001

Wall Type: Standard Wall

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

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

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

U-VALUE CALCULATOR REPORT

Property Reference	SAP 0647 Plot 21	Issued on Date	22/08/2022
Assessment Reference	As Built	Prop Type Ref	Mh
Project	5 Robert Place, West End, Southampton, SO30 3JY		
Calculation Type	New Build (As Built)		

SAP Rating	89 B	DER	12.09	TER	16.15
Environmental	89 B	% DER<TER	25.15		
CO ₂ Emissions (t/year)	1.24	DFEE	44.12	TFEE	55.46
General Requirements Compliance	Pass	% DFEE<TFEE	20.44		

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

Building Elements

Floor 000003 - Worst Case Slab

Floor Type: Slab On Ground Floor

Area = 35.11 m², Perimeter = 16.79 m, Wall thickness = 275.00 mm, Soil: Unknown

Horizontal edge insulation: none

Vertical edge insulation: none

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

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

Total correction = 0.0096 m² K/W

U-value (unrounded) = 0.12 W/m² K

Unheated space: None

Total thickness: 321 mm

U-value: 0.12 W/m² K

Kappa: 84.00 kJ/m² K

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

Property Reference	SAP 0647 Plot 21			Issued on Date	22/08/2022
Assessment Reference	As Built	Prop Type Ref	Mh		
Property	5 Robert Place, West End, Southampton, SO30 3JY				
SAP Rating	89 B	DER	12.09	TER	16.15
Environmental	89 B	% DER<TER	25.15		
CO ₂ Emissions (t/year)	1.24	DFEE	44.12	TFEE	55.46
General Requirements Compliance	Pass	% DFEE<TFEE	20.44		
Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 07798936079, toby@abacusenergyuk.com			Assessor ID	E477-0001
Client	Foreman Homes, FORE				

SUMMARY FOR INPUT DATA FOR: New Build (As Built)

Orientation	South
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	2020
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:	37.74 m	75.41 m ²	2.39 m
	1st Storey:	35.23 m	73.14 m ²	2.67 m

7.0 Living Area	26.89	m ²
8.0 Thermal Mass Parameter	Precise calculation	
Thermal Mass	165.17	kJ/m ² K

9.0 External Walls							
Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area (m ²)	Nett Area (m ²)	
Brick and Block	Cavity Wall	Other	0.24	42.22	184.26	161.39	

9.1 Party Walls							
Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Area (m ²)		
		Single plasterboard on dabs on both sides, dense blocks, cavity or cavity fill		70.00			

9.2 Internal Walls							
Description	Construction			Kappa (kJ/m ² K)	Area (m ²)		
GF Block	Dense block, plasterboard on dabs			75.00	84.14		
GF Stud	Plasterboard on timber frame			9.00	25.71		
FF Stud	Plasterboard on timber frame			9.00	169.62		

10.0 External Roofs							
Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area (m ²)	Nett Area (m ²)	
Pitched Roof	External Plane Roof	Other	0.10	9.10	75.41	75.41	

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

10.2 Internal Ceilings

Description	Construction	Kappa (kJ/m²K)	Area (m²)
Internal Ceiling 1	Plasterboard ceiling, carpeted chipboard floor	9.00	73.14

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Area (m²)
Ground Floor	Ground Floor - Solid	Other	0.12	84.00	75.41

11.2 Internal Floors

Description	Construction	Kappa (kJ/m²K)	Area (m²)
Internal Floor 1	Plasterboard ceiling, carpeted chipboard floor	18.00	73.14

12.0 Opening Types

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

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
Front Door	Solid Door	[1] Brick and Block	South							2.12	
Front Shaded	Window	[1] Brick and Block	South	None	0.49	Yes				1.68	
Front Elevation	Window	[1] Brick and Block	South	None	0.00					6.34	
Side Elevation	Window	[1] Brick and Block	East	None	0.00					1.32	
Rear Elevation	Window	[1] Brick and Block	North	None	0.00					11.41	

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)	1.90	0.077	No	Birtley Supatherm
Independently assessed	E2 Other lintels (including other steel lintels)	6.00	0.067	No	Birtley Supatherm
Independently assessed	E2 Other lintels (including other steel lintels)	1.51	0.070	No	Birtley Supatherm
Independently assessed	E2 Other lintels (including other steel lintels)	3.58	0.064	No	Birtley Supatherm
Independently assessed	E2 Other lintels (including other steel lintels)	2.77	0.056	No	Birtley Supatherm
Independently assessed	E3 Sill	11.47	0.021	No	Knauf P5
Independently assessed	E4 Jamb	33.60	0.016	No	Knauf P6
Independently assessed	E5 Ground floor (normal)	37.76	0.022	No	Knauf P10
Independently assessed	E6 Intermediate floor within a dwelling	35.23	0.000	No	CD0029
Table K1 - Approved	E10 Eaves (insulation at ceiling level)	18.32	0.060	No	
Independently assessed	E24 Eaves (insulation at ceiling level - inverted)	3.27	0.151	No	Knauf P19
Independently assessed	E12 Gable (insulation at ceiling level)	22.65	0.044	No	Knauf P21
Independently assessed	E16 Corner (normal)	34.79	0.039	No	Knauf P23
Independently assessed	E17 Corner (inverted – internal area greater than external area)	14.59	-0.091	No	Knauf P24

Y-value 0.016 W/m²K

18.0 Pressure Testing

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

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

19.0 Mechanical Ventilation

Summer Overheating

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

Mechanical Ventilation

Mechanical Ventilation System Present	No
---------------------------------------	----

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	28	
Total number of L.E.L. fittings	28	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	Yes
Light and motion sensor	Yes

23.0 Electricity Tariff

Standard

24.0 Main Heating 1

	Database	
Description	Gas Boiler	
Percentage of Heat	100	%
Database Ref. No.	18445	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.4	
In Summer	88.2	
Controls	CBE Programmer, room thermostat and TRVs	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2106	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	

25.0 Main Heating 2

None

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

Community Heating	None
28.0 Water Heating	HWP From main heating 1
Water Heating	Main Heating 1
Flue Gas Heat Recovery System	No
Waste Water Heat Recovery Instantaneous System 1	No
Waste Water Heat Recovery Instantaneous System 2	No
Waste Water Heat Recovery Storage System	No
Solar Panel	No
Water use <= 125 litres/person/day	Yes
SAP Code	901

29.0 Hot Water Cylinder	None
--------------------------------	------

32.0 Photovoltaic Unit	One Dwelling				
	PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
	1.15	South	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

None