



SAP Report Submission for Building Regulations Compliance

Client: Foreman Homes

Project: 3 Winifred Moody Road
West End, Southampton, SO30 3LB

Contact: Tobias Whiting
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Report Issue Date: 20/09/2022

EXCELLENCE
IN ENERGY
ASSESSMENT

BUILDING REGULATION COMPLIANCE

Calculation Type: New Build (As Built)

Property Reference	SAP 0647 Plot 26	Issued on Date	20/09/2022
Assessment Reference	As Built	Prop Type Ref	M
Property	3 Winifred Moody Road, West End, Southampton, SO30 3LB		
SAP Rating	89 B	DER	12.10
Environmental	89 B	TER	15.90
CO ₂ Emissions (t/year)	1.23	% DER<TER	23.88
General Requirements Compliance	Pass	DfEE	44.12
		TfEE	54.16
		% DfEE<TfEE	18.53
Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 07798936079, toby@abacusenergyuk.com		Assessor ID
			E477-0001
Client	Foreman Homes, FORE		

SUMMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TfEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	15.90	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	12.10	kgCO ₂ /m ²	Pass
	-3.80 (-23.9%)	kgCO ₂ /m ²	

1b TfEE and DfEE

Target Fabric Energy Efficiency (TfEE)	54.16	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DfEE)	44.12	kWh/m ² /yr	
	-10.1 (-18.6%)	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	4.08 (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

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

Windows facing East

1.32 m², No overhang

Windows facing South

11.41 m², No overhang

Air change rate

4.00 ach

Blinds/curtains

None

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type

U-value

W/m²K

Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals

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

Maximum

10.0 m³/(h.m²) @ 50 Pa

Pass

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BUILDING REGULATION COMPLIANCE

Calculation Type: New Build (As Built)

10 Key features

Party wall U-value	0.00	W/m ² K
Roof U-value	0.10	W/m ² K
Floor U-value	0.12	W/m ² K
Door U-value	1.10	W/m ² K
Thermal bridging ψ -value	0.025	W/m ² K
Photovoltaic array	1.15	kW

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THERMAL BRIDGING

Calculation Type: New Build (As Built)

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SAP Rating	89 B	DER	12.10
Environmental	89 B	TER	15.90
CO ₂ Emissions (t/year)	1.23	% DER<TER	23.88
General Requirements Compliance	Pass	DFEE	44.12
		TFEE	54.16
		% DFEE<TFEE	18.53
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			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	1.77	0.11	Birtley Supatherm
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.057	2.10	0.12	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	10.93	0.23	Knauf P5
External wall	E4 Jamb	Independently assessed	0.016	33.60	0.54	Knauf P6
External wall	E5 Ground floor (normal)	Independently assessed	0.105	37.60	3.95	LABC E5MCFF11
External wall	E6 Intermediate floor within a dwelling	Independently assessed	0.000	35.22	0.00	CD0029
External wall	E10 Eaves (insulation at ceiling level)	Table K1 - Approved	0.060	17.28	1.04	
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: **8.31** W/mK:
Y-Value: **0.025** W/m²K:

FULL SAP CALCULATION PRINTOUT

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Environmental	89 B	% DER<TER	23.88		
CO ₂ Emissions (t/year)	1.23	DFEE	44.12	TFEE	54.16
General Requirements Compliance	Pass	% DFEE<TFEE	18.53		
Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 07798936079, toby@abacusenergyuk.com			Assessor ID	E477-0001
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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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DWELLING AS BUILT

Detached House, total floor area 147 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating: Mains gas
Fuel factor: 1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 15.90 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 12.10 kgCO₂/m² OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 54.2 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE) 44.1 kWh/m²/yr OK

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: 4.08 (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: 8.02 m², Overhang twice as wide as window, ratio 0.49
Windows facing East: 1.32 m², No overhang
Windows facing South: 11.41 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

10 Key features

Party wall U-value 0.00 W/m²K
Roof U-value 0.10 W/m²K
Floor U-value 0.12 W/m²K
Door U-value 1.10 W/m²K
Thermal bridging y-value 0.025 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	74.6900 (1b)	x 2.3900 (2b)	= 178.5091 (1b) - (3b)
First floor	72.7700 (1c)	x 2.6700 (2c)	= 194.2959 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	147.4600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 372.8050 (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) = 0.1341 (8)
Pressure test					Yes
Measured/design AP50					4.0800
Infiltration rate					0.3381 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3128 (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	0.3988	0.3909	0.3831	0.3440	0.3362	0.2971	0.2971	0.2893	0.3128	0.3362	0.3519	0.3675 (22b)
Effective ac	0.5795	0.5764	0.5734	0.5592	0.5565	0.5441	0.5441	0.5418	0.5489	0.5565	0.5619	0.5675 (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			74.6900	0.1200	8.9628	84.0000	6273.9600 (28a)
Brick and Block	184.2800	22.8700	161.4100	0.2400	38.7384	42.2200	6814.7302 (29a)
Pitched Roof	74.6900		74.6900	0.1000	7.4690	9.1000	679.6790 (30)
Total net area of external elements Aum(A, m ²)			333.6600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	81.2617		(33)
GF Block			84.2400			75.0000	6318.0000 (32c)
GF Stud			30.1900			9.0000	271.7100 (32c)
FF Stud			171.9500			9.0000	1547.5500 (32c)
Internal Floor 1			72.7700			18.0000	1309.8600 (32d)
Internal Ceiling 1			72.7700			18.0000	1309.8600 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	24525.3492 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							166.3187 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.3135 (36)
Total fabric heat loss						(33) + (36) =	89.5753 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	71.2944	70.9145	70.5422	68.7935	68.4663	66.9433	66.9433	66.6612	67.5299	68.4663	69.1282	69.8202 (38)
Heat transfer coeff	160.8696	160.4898	160.1175	158.3688	158.0416	156.5185	156.5185	156.2365	157.1052	158.0416	158.7035	159.3954 (39)
Average = Sum(39)m / 12 =												158.3672 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0909	1.0884	1.0858	1.0740	1.0718	1.0614	1.0614	1.0595	1.0654	1.0718	1.0762	1.0809 (40)
HLP (average)												1.0740 (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												2.9301 (42)
Average daily hot water use (litres/day)												103.7910 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	114.1701	110.0184	105.8668	101.7152	97.5635	93.4119	93.4119	97.5635	101.7152	105.8668	110.0184	114.1701 (44)
Energy conte	169.3109	148.0804	152.8057	133.2197	127.8275	110.3054	102.2142	117.2923	118.6931	138.3254	150.9930	163.9686 (45)
Energy content (annual)										Total = Sum(45)m =		1633.0362 (45)

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	25.3966	22.2121	22.9209	19.9830	19.1741	16.5458	15.3321	17.5938	17.8040	20.7488	22.6489	24.5953 (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	29.8598	26.9611	29.7960	28.7504	29.6200	28.5321	29.4007	29.5429	28.6423	29.6907	28.8324	29.8227 (61)
Total heat required for water heating calculated for each month	199.1708	175.0415	182.6017	161.9701	157.4475	138.8375	131.6149	146.8351	147.3354	168.0161	179.8254	193.7913 (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	199.1708	175.0415	182.6017	161.9701	157.4475	138.8375	131.6149	146.8351	147.3354	168.0161	179.8254	193.7913 (64)
Heat gains from water heating, kWh/month	63.7608	55.9770	58.2569	51.4832	49.9076	43.8096	41.3364	46.3854	46.6260	53.4159	57.4133	61.9752 (65)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)												
Total per year (kWh/year) = Sum(64)m = 1982.4874 (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	146.5073	146.5073	146.5073	146.5073	146.5073	146.5073	146.5073	146.5073	146.5073	146.5073	146.5073	146.5073 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	30.3563	26.9622	21.9271	16.6002	12.4089	10.4761	11.3198	14.7139	19.7490	25.0758	29.2672	31.2000 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	317.7460	321.0432	312.7344	295.0458	272.7171	251.7313	237.7115	234.4143	242.7232	260.4118	282.7404	303.7262 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.6507	37.6507	37.6507	37.6507	37.6507	37.6507	37.6507	37.6507	37.6507	37.6507	37.6507	37.6507 (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)	-117.2059	-117.2059	-117.2059	-117.2059	-117.2059	-117.2059	-117.2059	-117.2059	-117.2059	-117.2059	-117.2059	-117.2059 (71)
Water heating gains (Table 5)	85.7001	83.2991	78.3023	71.5044	67.0802	60.8466	55.5597	62.3460	64.7584	71.7955	79.7407	83.3001 (72)
Total internal gains	503.7546	501.2567	482.9160	453.1026	422.1584	393.0063	374.5432	381.4264	397.1827	427.2353	461.7005	488.1785 (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			8.0200	10.6334		0.6300		0.7000		0.7700		26.0626 (74)
East			1.3200	19.6403		0.6300		0.7000		0.7700		7.9231 (76)
South			11.4100	46.7521		0.6300		0.7000		0.7700		163.0265 (78)
Solar gains	197.0122	332.3016	450.2640	557.5632	629.3126	628.2334	604.1389	549.1787	486.7240	365.6594	235.2727	169.1125 (83)
Total gains	700.7668	833.5584	933.1800	1010.6658	1051.4710	1021.2397	978.6821	930.6051	883.9068	792.8948	696.9732	657.2910 (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	42.3486	42.4488	42.5475	43.0173	43.1064	43.5258	43.5258	43.6044	43.3633	43.1064	42.9266	42.7402
alpha	3.8232	3.8299	3.8365	3.8678	3.8738	3.9017	3.9017	3.9070	3.8909	3.8738	3.8618	3.8493
util living area	0.9957	0.9911	0.9817	0.9584	0.9033	0.7882	0.6393	0.6831	0.8679	0.9684	0.9920	0.9966 (86)
MIT	19.2520	19.4541	19.7630	20.1635	20.5408	20.8258	20.9442	20.9265	20.7197	20.2265	19.6639	19.2177 (87)
Th 2	20.0082	20.0103	20.0124	20.0221	20.0240	20.0325	20.0325	20.0340	20.0292	20.0240	20.0203	20.0164 (88)
util rest of house	0.9946	0.9990	0.9770	0.9467	0.8732	0.7175	0.5238	0.5722	0.8159	0.9574	0.9897	0.9958 (89)
MIT 2	18.3998	18.6025	18.9107	19.3119	19.6730	19.9284	20.0106	20.0028	19.8431	19.3790	18.8199	18.3718 (90)
Living area fraction									fLA = Living area / (4) =			0.1443 (91)
MIT	18.5228	18.7254	19.0337	19.4348	19.7982	20.0579	20.1454	20.1361	19.9696	19.5013	18.9417	18.4938 (92)
Temperature adjustment												0.0000
adjusted MIT	18.5228	18.7254	19.0337	19.4348	19.7982	20.0579	20.1454	20.1361	19.9696	19.5013	18.9417	18.4938 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	695.4763	821.2057	906.0583	947.8636	909.2992	734.9224	526.9206	544.5739	717.7588	752.9114	687.3819	653.3749 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	2288.0185	2218.8395	2006.8688	1668.3885	1279.8538	854.2622	554.9133	583.7168	922.1431	1406.7730	1879.3189	2278.3723 (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	1184.8514	939.2099	819.0030	518.7779	275.6926	0.0000	0.0000	0.0000	0.0000	486.4730	858.1946	1208.9980 (98)
Space heating												6291.2005 (98)
Space heating per m2												(98) / (4) = 42.6638 (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													6959.2926 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1184.8514	939.2099	819.0030	518.7779	275.6926	0.0000	0.0000	0.0000	0.0000	486.4730	858.1946	1208.9980	(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)	1310.6763	1038.9490	905.9768	573.8694	304.9697	0.0000	0.0000	0.0000	0.0000	538.1339	949.3303	1337.3872	(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	199.1708	175.0415	182.6017	161.9701	157.4475	138.8375	131.6149	146.8351	147.3354	168.0161	179.8254	193.7913	(64)
Efficiency of water heater (217)m	90.0767	90.0472	89.9908	89.8667	89.5877	88.2000	88.2000	88.2000	88.2000	89.8248	90.0110	88.2000	(216)
Fuel for water heating, kWh/month	221.1125	194.3887	202.9116	180.2338	175.7467	157.4121	149.2232	166.4797	167.0470	187.0486	199.7815	215.1096	(219)
Water heating fuel used												2216.4951	(219)
Annual totals kWh/year													
Space heating fuel - main system												6959.2926	(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)												536.1015	(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												8793.7266	(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	6959.2926	0.2160	1503.2072 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2216.4951	0.2160	478.7630 (264)
Space and water heating			1981.9702 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	536.1015	0.5190	278.2367 (268)
Energy saving/generation technologies			
PV Unit	-993.1627	0.5190	-515.4514 (269)
Total CO2, kg/year			1783.6804 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			12.1000 (273)

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

DER			12.1000 ZC1
Total Floor Area		TFA	147.4600
Assumed number of occupants		N	2.9301
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190
CO2 emissions from appliances, equation (L14)			12.7689 ZC2
CO2 emissions from cooking, equation (L16)			1.2839 ZC3
Total CO2 emissions			26.1528 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			26.1528 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	74.6900 (1b)	x 2.3900 (2b)	= 178.5091 (1b) - (3b)
First floor	72.7700 (1c)	x 2.6700 (2c)	= 194.2959 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	147.4600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	372.8050 (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) =	0.1073 (8)
Pressure test										Yes							
Measured/design AP50										5.0000							
Infiltration rate										0.3573 (18)							
Number of sides sheltered										1 (19)							
Shelter factor										(20) = 1 - [0.075 x (19)] =							0.9250 (20)
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =							0.3305 (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	0.4214	0.4131	0.4049	0.3635	0.3553	0.3140	0.3140	0.3057	0.3305	0.3553	0.3718	0.3883 (22b)					
Effective ac	0.5888	0.5853	0.5820	0.5661	0.5631	0.5493	0.5493	0.5467	0.5546	0.5631	0.5691	0.5754 (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			74.6900	0.1300	9.7097		(28a)					
Brick and Block	184.2800	22.8700	161.4100	0.1800	29.0538		(29a)					
Pitched Roof	74.6900		74.6900	0.1300	9.7097		(30)					
Total net area of external elements Aum(A, m2)			333.6600				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		78.1027		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							14.0436 (36)					
Total fabric heat loss						(33) + (36) =	92.1463 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 72.4353	Feb 72.0112	Mar 71.5955	Apr 69.6428	May 69.2774	Jun 67.5767	Jul 67.5767	Aug 67.2617	Sep 68.2318	Oct 69.2774	Nov 70.0165	Dec 70.7892 (38)
Heat transfer coeff	164.5816	164.1575	163.7417	161.7890	161.4237	159.7230	159.7230	159.4080	160.3781	161.4237	162.1628	162.9355 (39)
Average = Sum(39)m / 12 =												161.7873 (39)
HLP	Jan 1.1161	Feb 1.1132	Mar 1.1104	Apr 1.0972	May 1.0947	Jun 1.0832	Jul 1.0832	Aug 1.0810	Sep 1.0876	Oct 1.0947	Nov 1.0997	Dec 1.1049 (40)
HLP (average)												1.0972 (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												2.9301 (42)
Average daily hot water use (litres/day)												103.7910 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												
Energy content (annual)	114.1701	110.0184	105.8668	101.7152	97.5635	93.4119	93.4119	97.5635	101.7152	105.8668	110.0184	114.1701 (44)
Energy content (annual)	169.3109	148.0804	152.8057	133.2197	127.8275	110.3054	102.2142	117.2923	118.6931	138.3254	150.9930	163.9686 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		1633.0362 (45)
	25.3966	22.2121	22.9209	19.9830	19.1741	16.5458	15.3321	17.5938	17.8040	20.7488	22.6489	24.5953 (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	49.7173	46.0661	47.6017	49.7173	49.3151	50.9589	49.3151	50.9589 (61)
Solar input	220.2698	194.1078	203.7646	182.5348	177.5448	156.3715	149.8159	167.0096	168.0082	189.2843	200.3080	214.9275 (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	220.2698	194.1078	203.7646	182.5348	177.5448	156.3715	149.8159	167.0096	168.0082	189.2843	200.3080	214.9275 (64)
	69.0356	60.7436	63.5476	56.6243	54.9320	48.1931	45.8866	51.4290	51.7942	58.7329	62.5339	67.2593 (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	146.5073	146.5073	146.5073	146.5073	146.5073	146.5073	146.5073	146.5073	146.5073	146.5073	146.5073	146.5073	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	30.3563	26.9622	21.9271	16.6002	12.4089	10.4761	11.3198	14.7139	19.7490	25.0758	29.2672	31.2000	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	317.7460	321.0432	312.7344	295.0458	272.7171	251.7313	237.7115	234.4143	242.7232	260.4118	282.7404	303.7262	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.6507	37.6507	37.6507	37.6507	37.6507	37.6507	37.6507	37.6507	37.6507	37.6507	37.6507	37.6507	(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)	-117.2059	-117.2059	-117.2059	-117.2059	-117.2059	-117.2059	-117.2059	-117.2059	-117.2059	-117.2059	-117.2059	-117.2059	(71)
Water heating gains (Table 5)	92.7898	90.3922	85.4135	78.6449	73.8333	66.9348	61.6756	69.1250	71.9364	78.9421	86.8527	90.4023	(72)
Total internal gains	510.8443	508.3499	490.0272	460.2431	428.9115	399.0945	380.6591	388.2054	404.3608	434.3819	468.8125	495.2807	(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			8.0200		10.6334		0.6300		0.7000		0.7700		26.0626 (74)
East			1.3200		19.6403		0.6300		0.7000		0.7700		7.9231 (76)
South			11.4100		46.7521		0.6300		0.7000		0.7700		163.0265 (78)
Solar gains	197.0122	332.3016	450.2640	557.5632	629.3126	628.2334	604.1389	549.1787	486.7240	365.6594	235.2727	169.1125	(83)
Total gains	707.8565	840.6515	940.2912	1017.8064	1058.2241	1027.3279	984.7980	937.3842	891.0848	800.0413	704.0853	664.3932	(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	62.2201	62.3808	62.5392	63.2940	63.4373	64.1127	64.1127	64.2394	63.8509	63.4373	63.1481	62.8487	
alpha	5.1480	5.1587	5.1693	5.2196	5.2292	5.2742	5.2742	5.2826	5.2567	5.2292	5.2099	5.1899	
util living area	0.9993	0.9981	0.9950	0.9839	0.9465	0.8385	0.6744	0.7231	0.9160	0.9890	0.9984	0.9995	(86)
MIT	19.6919	19.8434	20.0770	20.3851	20.6786	20.8963	20.9751	20.9642	20.8129	20.4290	20.0030	19.6686	(87)
Th 2	19.9877	19.9900	19.9923	20.0031	20.0052	20.0146	20.0146	20.0164	20.0110	20.0052	20.0011	19.9968	(88)
util rest of house	0.9991	0.9975	0.9930	0.9770	0.9207	0.7605	0.5426	0.5959	0.8650	0.9831	0.9977	0.9993	(89)
MIT 2	18.2281	18.4512	18.7939	19.2478	19.6599	19.9357	20.0042	19.9995	19.8438	19.3157	18.6928	18.2005	(90)
Living area fraction	18.4393	18.6521	18.9790	19.4119	19.8069	20.0744	20.1443	20.1387	19.9836	19.4763	18.8819	18.4123	(91)
MIT	18.4393	18.6521	18.9790	19.4119	19.8069	20.0744	20.1443	20.1387	19.9836	19.4763	18.8819	18.4123	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.4393	18.6521	18.9790	19.4119	19.8069	20.0744	20.1443	20.1387	19.9836	19.4763	18.8819	18.4123	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9985	0.9961	0.9902	0.9713	0.9141	0.7660	0.5612	0.6133	0.8632	0.9785	0.9965	0.9989	(94)
Ext temp.	706.7803	837.4145	931.0294	988.5778	967.3270	786.9550	552.7092	574.9144	769.2025	782.8061	701.6296	663.6663	(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	2327.0723	2257.5137	2043.3386	1700.7097	1308.6525	874.3808	566.1042	595.9796	943.6045	1432.8509	1910.5876	2315.6930	(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	1205.4973	954.3067	827.5581	512.7349	253.9462	0.0000	0.0000	0.0000	0.0000	483.6333	870.4497	1229.1079	(98)
Space heating per m2												6337.2342	(98)
												42.9760	(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												6785.0473 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	1205.4973	954.3067	827.5581	512.7349	253.9462	0.0000	0.0000	0.0000	0.0000	483.6333	870.4497	1229.1079 (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)	1290.6823	1021.7416	886.0365	548.9667	271.8910	0.0000	0.0000	0.0000	0.0000	517.8087	931.9590	1315.9613 (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	220.2698	194.1078	203.7646	182.5348	177.5448	156.3715	149.8159	167.0096	168.0082	189.2843	200.3080	214.9275 (64)
Efficiency of water heater (217)m	88.6769	88.5182	88.2080	87.5103	85.9517	80.3000	80.3000	80.3000	80.3000	87.3109	88.3218	80.3000 (216)
Fuel for water heating, kWh/month	248.3961	219.2859	231.0048	208.5867	206.5635	194.7342	186.5702	207.9820	209.2256	216.7933	226.7933	242.2025 (219)
Water heating fuel used												2598.1382 (219)
Annual totals kWh/year												
Space heating fuel - main system												6785.0473 (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)												536.1015 (232)
Total delivered energy for all uses												9994.2870 (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	6785.0473	0.2160	1465.5702 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2598.1382	0.2160	561.1978 (264)
Space and water heating			2026.7681 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	536.1015	0.5190	278.2367 (268)
Total CO2, kg/m2/year			2343.9297 (272)
Emissions per m2 for space and water heating			13.7445 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			1.8869 (272b)
Emissions per m2 for pumps and fans			0.2640 (272c)
Target Carbon Dioxide Emission Rate (TER) = (13.7445 * 1.00) + 1.8869 + 0.2640, rounded to 2 d.p.			15.9000 (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	74.6900 (1b)	x 2.3900 (2b)	= 178.5091 (1b) - (3b)
First floor	72.7700 (1c)	x 2.6700 (2c)	= 194.2959 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	147.4600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 372.8050 (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) = 0.1073 (8)
Pressure test					Yes
Measured/design AP50					4.0800
Infiltration rate					0.3113 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.2879 (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	0.3671	0.3599	0.3527	0.3167	0.3095	0.2736	0.2736	0.2664	0.2879	0.3095	0.3239	0.3383 (22b)
Effective ac	0.5674	0.5648	0.5622	0.5502	0.5479	0.5374	0.5374	0.5355	0.5415	0.5479	0.5525	0.5572 (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			74.6900	0.1200	8.9628	84.0000	6273.9600 (28a)
Brick and Block	184.2800	22.8700	161.4100	0.2400	38.7384	42.2200	6814.7302 (29a)
Pitched Roof	74.6900		74.6900	0.1000	7.4690	9.1000	679.6790 (30)
Total net area of external elements Aum(A, m ²)			333.6600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	81.2617		(33)
GF Block			84.2400			75.0000	6318.0000 (32c)
GF Stud			30.1900			9.0000	271.7100 (32c)
FF Stud			171.9500			9.0000	1547.5500 (32c)
Internal Floor 1			72.7700			18.0000	1309.8600 (32d)
Internal Ceiling 1			72.7700			9.0000	654.9300 (32e)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		23870.4192 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							161.8772 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.3135 (36)
Total fabric heat loss					(33) + (36) =		89.5753 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 69.8039	Feb 69.4820	Mar 69.1664	Apr 67.6841	May 67.4068	Jun 66.1158	Jul 66.1158	Aug 65.8767	Sep 66.6131	Oct 67.4068	Nov 67.9678	Dec 68.5544 (38)
Heat transfer coeff	159.3792	159.0572	158.7417	157.2594	156.9821	155.6911	155.6911	155.4520	156.1884	156.9821	157.5431	158.1296 (39)
Average = Sum(39)m / 12 =												157.2581 (39)

HLP	Jan 1.0808	Feb 1.0786	Mar 1.0765	Apr 1.0665	May 1.0646	Jun 1.0558	Jul 1.0558	Aug 1.0542	Sep 1.0592	Oct 1.0646	Nov 1.0684	Dec 1.0724 (40)
HLP (average)												1.0664 (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												2.9301 (42)
Average daily hot water use (litres/day)												103.7910 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	114.1701	110.0184	105.8668	101.7152	97.5635	93.4119	93.4119	97.5635	101.7152	105.8668	110.0184	114.1701 (44)
Energy conte	169.3109	148.0804	152.8057	133.2197	127.8275	110.3054	102.2142	117.2923	118.6931	138.3254	150.9930	163.9686 (45)
Energy content (annual)										Total = Sum(45)m =		1633.0362 (45)

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Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	35.9786	31.4671	32.4712	28.3092	27.1633	23.4399	21.7205	24.9246	25.2223	29.3941	32.0860	34.8433 (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	146.5073	146.5073	146.5073	146.5073	146.5073	146.5073	146.5073	146.5073	146.5073	146.5073	146.5073	146.5073	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	30.3563	26.9622	21.9271	16.6002	12.4089	10.4761	11.3198	14.7139	19.7490	25.0758	29.2672	31.2000	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	317.7460	321.0432	312.7344	295.0458	272.7171	251.7313	237.7115	234.4143	242.7232	260.4118	282.7404	303.7262	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.6507	37.6507	37.6507	37.6507	37.6507	37.6507	37.6507	37.6507	37.6507	37.6507	37.6507	37.6507	(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)	-117.2059	-117.2059	-117.2059	-117.2059	-117.2059	-117.2059	-117.2059	-117.2059	-117.2059	-117.2059	-117.2059	-117.2059	(71)
Water heating gains (Table 5)	48.3583	46.8260	43.6441	39.3183	36.5099	32.5554	29.1942	33.5008	35.0310	39.5083	44.5639	46.8324	(72)
Total internal gains	463.4128	461.7836	445.2578	417.9165	388.5881	361.7150	345.1778	349.5812	364.4553	391.9481	423.5237	448.7108	(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	8.0200	10.6334	0.6300	0.7000	0.7700	26.0626 (74)
East	1.3200	19.6403	0.6300	0.7000	0.7700	7.9231 (76)
South	11.4100	46.7521	0.6300	0.7000	0.7700	163.0265 (78)

Solar gains	197.0122	332.3016	450.2640	557.5632	629.3126	628.2334	604.1389	549.1787	486.7240	365.6594	235.2727	169.1125	(83)
Total gains	660.4250	794.0853	895.5218	975.4798	1017.9007	989.9485	949.3167	898.7600	851.1793	757.6075	658.7965	617.8234	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	41.6031	41.6873	41.7702	42.1639	42.2384	42.5886	42.5886	42.6541	42.4531	42.2384	42.0880	41.9319	
alpha	3.7735	3.7792	3.7847	3.8109	3.8159	3.8392	3.8392	3.8436	3.8302	3.8159	3.8059	3.7955	
util living area	0.9961	0.9917	0.9827	0.9602	0.9072	0.7959	0.6493	0.6948	0.8748	0.9706	0.9927	0.9970	(86)
MIT	19.1994	19.4056	19.7210	20.1286	20.5159	20.8114	20.9379	20.9180	20.6990	20.1903	19.6154	19.1623	(87)
Th 2	20.0165	20.0183	20.0201	20.0283	20.0299	20.0371	20.0371	20.0384	20.0343	20.0299	20.0267	20.0235	(88)
util rest of house	0.9952	0.9898	0.9783	0.9492	0.8784	0.7272	0.5347	0.5853	0.8253	0.9605	0.9907	0.9963	(89)
MIT 2	18.3562	18.5629	18.8775	19.2850	19.6567	19.9226	20.0121	20.0026	19.8315	19.3507	18.7792	18.3244	(90)
Living area fraction									fLA = Living area / (4) =			0.1443	(91)
MIT	18.4779	18.6845	18.9992	19.4068	19.7807	20.0508	20.1457	20.1347	19.9567	19.4719	18.8999	18.4453	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.4779	18.6845	18.9992	19.4068	19.7807	20.0508	20.1457	20.1347	19.9567	19.4719	18.8999	18.4453	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9932	0.9862	0.9724	0.9403	0.8695	0.7283	0.5488	0.5975	0.8205	0.9528	0.9875	0.9946	(94)
Ext temp.	655.9062	783.0935	870.7735	917.2355	885.0483	721.0096	520.9624	537.0037	698.4045	721.8632	650.5349	614.5109	(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	2259.6568	2192.5237	1984.1453	1652.2885	1268.5269	848.6474	552.0401	580.5701	914.7528	1392.7276	1858.9915	2252.6055	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000	(98)
Space heating per m2	1193.1905	947.1371	828.3486	529.2382	285.3080	0.0000	0.0000	0.0000	0.0000	499.1231	870.0887	1218.7424	(99)
										(98) / (4) =		43.2061	(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	1463.4961	1152.1140	1181.4352	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7382	0.8192	0.7918	0.0000	0.0000	0.0000	0.0000	(101)

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Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1080.3053	943.8478	935.4203	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1282.8768	1232.5374	1176.1689	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	145.8515	214.7851	179.1169	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												539.7535 (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	36.4629	53.6963	44.7792	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												134.9384 (107)
Space cooling per m2												0.9151 (108)
Energy for space heating												43.2061 (99)
Energy for space cooling												0.9151 (108)
Total												44.1212 (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	74.6900 (1b)	x 2.3900 (2b)	= 178.5091 (1b) - (3b)
First floor	72.7700 (1c)	x 2.6700 (2c)	= 194.2959 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	147.4600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 372.8050 (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) =	0.1073 (8)		
Pressure test															Yes			
Measured/design AP50															5.0000			
Infiltration rate															0.3573 (18)			
Number of sides sheltered															1 (19)			
Shelter factor										(20) = 1 - [0.075 x (19)] =					0.9250 (20)			
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =					0.3305 (21)			
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec						
	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)						
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)						
Adj infilt rate	0.4214	0.4131	0.4049	0.3635	0.3553	0.3140	0.3140	0.3057	0.3305	0.3553	0.3718	0.3883 (22b)						
Effective ac	0.5888	0.5853	0.5820	0.5661	0.5631	0.5493	0.5493	0.5467	0.5546	0.5631	0.5691	0.5754 (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			74.6900	0.1300	9.7097		(28a)					
Brick and Block	184.2800	22.8700	161.4100	0.1800	29.0538		(29a)					
Pitched Roof	74.6900		74.6900	0.1300	9.7097		(30)					
Total net area of external elements Aum(A, m2)			333.6600				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	78.1027		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							14.0436 (36)					
Total fabric heat loss						(33) + (36) =	92.1463 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 72.4353	Feb 72.0112	Mar 71.5955	Apr 69.6428	May 69.2774	Jun 67.5767	Jul 67.5767	Aug 67.2617	Sep 68.2318	Oct 69.2774	Nov 70.0165	Dec 70.7892 (38)
Heat transfer coeff	164.5816	164.1575	163.7417	161.7890	161.4237	159.7230	159.7230	159.4080	160.3781	161.4237	162.1628	162.9355 (39)
Average = Sum(39)m / 12 =												161.7873 (39)
HLP	Jan 1.1161	Feb 1.1132	Mar 1.1104	Apr 1.0972	May 1.0947	Jun 1.0832	Jul 1.0832	Aug 1.0810	Sep 1.0876	Oct 1.0947	Nov 1.0997	Dec 1.1049 (40)
HLP (average)												1.0972 (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													2.9301 (42)
Average daily hot water use (litres/day)													103.7910 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	114.1701	110.0184	105.8668	101.7152	97.5635	93.4119	93.4119	97.5635	101.7152	105.8668	110.0184	114.1701 (44)	
Energy conte	169.3109	148.0804	152.8057	133.2197	127.8275	110.3054	102.2142	117.2923	118.6931	138.3254	150.9930	163.9686 (45)	
Energy content (annual)												Total = Sum(45)m = 1633.0362 (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													

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Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	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	0.0000 (59)
	35.9786	31.4671	32.4712	28.3092	27.1633	23.4399	21.7205	24.9246	25.2223	29.3941	32.0860	34.8433	(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	146.5073	146.5073	146.5073	146.5073	146.5073	146.5073	146.5073	146.5073	146.5073	146.5073	146.5073	146.5073	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	30.3563	26.9622	21.9271	16.6002	12.4089	10.4761	11.3198	14.7139	19.7490	25.0758	29.2672	31.2000	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	317.7460	321.0432	312.7344	295.0458	272.7171	251.7313	237.7115	234.4143	242.7232	260.4118	282.7404	303.7262	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.6507	37.6507	37.6507	37.6507	37.6507	37.6507	37.6507	37.6507	37.6507	37.6507	37.6507	37.6507	(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)	-117.2059	-117.2059	-117.2059	-117.2059	-117.2059	-117.2059	-117.2059	-117.2059	-117.2059	-117.2059	-117.2059	-117.2059	(71)
Water heating gains (Table 5)	48.3583	46.8260	43.6441	39.3183	36.5099	32.5554	29.1942	33.5008	35.0310	39.5083	44.5639	46.8324	(72)
Total internal gains	463.4128	461.7836	445.2578	417.9165	388.5881	361.7150	345.1778	349.5812	364.4553	391.9481	423.5237	448.7108	(73)

6. Solar gains													

[Jan]			Area	Solar flux		g		FF		Access		Gains	
			m2	Table 6a		Specific data		Specific data		factor		W	
				W/m2		or Table 6b		or Table 6c		Table 6d			
North			8.0200	10.6334		0.6300		0.7000		0.7700		26.0626	(74)
East			1.3200	19.6403		0.6300		0.7000		0.7700		7.9231	(76)
South			11.4100	46.7521		0.6300		0.7000		0.7700		163.0265	(78)

Solar gains	197.0122	332.3016	450.2640	557.5632	629.3126	628.2334	604.1389	549.1787	486.7240	365.6594	235.2727	169.1125	(83)
Total gains	660.4250	794.0853	895.5218	975.4798	1017.9007	989.9485	949.3167	898.7600	851.1793	757.6075	658.7965	617.8234	(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	62.2201	62.3808	62.5392	63.2940	63.4373	64.1127	64.1127	64.2394	63.8509	63.4373	63.1481	62.8487	
alpha	5.1480	5.1587	5.1693	5.2196	5.2292	5.2742	5.2742	5.2826	5.2567	5.2292	5.2099	5.1899	
util living area	0.9995	0.9986	0.9960	0.9866	0.9537	0.8538	0.6939	0.7448	0.9280	0.9914	0.9988	0.9997	(86)
MIT	19.6616	19.8138	20.0490	20.3600	20.6587	20.8859	20.9716	20.9588	20.7959	20.4031	19.9741	19.6388	(87)
Th 2	19.9877	19.9900	19.9923	20.0031	20.0052	20.0146	20.0146	20.0164	20.0110	20.0052	20.0011	19.9968	(88)
util rest of house	0.9993	0.9981	0.9944	0.9807	0.9305	0.7789	0.5609	0.6179	0.8818	0.9866	0.9983	0.9995	(89)
MIT 2	18.7560	18.9099	19.1463	19.4631	19.7520	19.9542	20.0063	20.0028	19.8838	19.5093	19.0791	18.7405	(90)
Living area fraction									fLA = Living area / (4) =				0.1443 (91)
MIT	18.8867	19.0404	19.2766	19.5926	19.8828	20.0886	20.1456	20.1407	20.0154	19.6383	19.2082	18.8702	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8867	19.0404	19.2766	19.5926	19.8828	20.0886	20.1456	20.1407	20.0154	19.6383	19.2082	18.8702	(93)

8. Space heating requirement													

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	659.8017	792.0179	889.1116	953.4703	943.4352	777.6024	550.7234	571.4386	750.7721	745.5717	657.3147	617.4145	(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	(95)
Heat loss rate W	2400.7073	2321.2448	2092.0632	1729.9394	1320.9027	876.6571	566.3153	596.3014	948.7021	1458.9917	1963.5068	2390.2885	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	1295.2338	1027.6405	894.9960	559.0577	280.8358	0.0000	0.0000	0.0000	0.0000	530.7845	940.4583	1319.0182	(98)
Space heating												6848.0248	(98)
Space heating per m2										(98) / (4) =		46.4399	(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	1501.3958	1181.9499	1211.5009	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7680	0.8577	0.8281	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1153.0237	1013.7501	1003.2800	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1282.8768	1232.5374	1176.1689	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	93.4942	162.7777	128.6293	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												384.9013	(104)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Cooled fraction											FC = cooled area / (4) =	1.0000 (105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	23.3736	40.6944	32.1573	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												96.2253 (107)
Space cooling per m2												0.6526 (108)
Energy for space heating												46.4399 (99)
Energy for space cooling												0.6526 (108)
Total												47.0924 (109)
Target Fabric Energy Efficiency (TFEE)												54.2 (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	74.6900 (1b)	x 2.3900 (2b)	= 178.5091 (1b) - (3b)
First floor	72.7700 (1c)	x 2.6700 (2c)	= 194.2959 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	147.4600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 372.8050 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																5 * 10 =	50.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =					50.0000	/ (5) =	0.1341 (8)
Pressure test																Yes	
Measured/design AP50																	4.0800
Infiltration rate																	0.3381 (18)
Number of sides sheltered																	1 (19)
Shelter factor															(20) = 1 - [0.075 x (19)] =		0.9250 (20)
Infiltration rate adjusted to include shelter factor															(21) = (18) x (20) =		0.3128 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
	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	0.3675	0.3440	0.3440	0.3128	0.3206	0.3049	0.3049	0.2971	0.2971	0.3206	0.3128	0.3206	(22b)				
Effective ac	0.5675	0.5592	0.5592	0.5489	0.5514	0.5465	0.5465	0.5441	0.5441	0.5514	0.5489	0.5514	(25)				

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K						
Front Door			2.1200	1.1000	2.3320			(26)					
Windows (Uw = 1.20)			20.7500	1.1450	23.7595			(27)					
Ground Floor			74.6900	0.1200	8.9628	84.0000	6273.9600	(28a)					
Brick and Block	184.2800	22.8700	161.4100	0.2400	38.7384	42.2200	6814.7302	(29a)					
Pitched Roof	74.6900		74.6900	0.1000	7.4690	9.1000	679.6790	(30)					
Total net area of external elements Aum(A, m2)			333.6600					(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	81.2617			(33)					
GF Block			84.2400			75.0000	6318.0000	(32c)					
GF Stud			30.1900			9.0000	271.7100	(32c)					
FF Stud			171.9500			9.0000	1547.5500	(32c)					
Internal Floor 1			72.7700			18.0000	1309.8600	(32d)					
Internal Ceiling 1			72.7700			18.0000	1309.8600	(32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	24525.3492	(34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							166.3187	(35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.3135	(36)					
Total fabric heat loss						(33) + (36) =	89.5753	(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 69.8202	Feb 68.7935	Mar 68.7935	Apr 67.5299	May 67.8345	Jun 67.2328	Jul 67.2328	Aug 66.9433	Sep 66.9433	Oct 67.8345	Nov 67.5299	Dec 67.8345	(38)
Heat transfer coeff	159.3954	158.3688	158.3688	157.1052	157.4098	156.8081	156.8081	156.5185	156.5185	157.4098	157.1052	157.4098	(39)
Average = Sum(39)m / 12 =												157.4355	(39)
HLP	Jan 1.0809	Feb 1.0740	Mar 1.0740	Apr 1.0654	May 1.0675	Jun 1.0634	Jul 1.0634	Aug 1.0614	Sep 1.0614	Oct 1.0675	Nov 1.0654	Dec 1.0675	(40)
HLP (average)												1.0676	(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												2.9301 (42)
Average daily hot water use (litres/day)												103.7910 (43)
Daily hot water use	Jan 114.1701	Feb 110.0184	Mar 105.8668	Apr 101.7152	May 97.5635	Jun 93.4119	Jul 93.4119	Aug 97.5635	Sep 101.7152	Oct 105.8668	Nov 110.0184	Dec 114.1701 (44)
Energy conte	169.3109	148.0804	152.8057	133.2197	127.8275	110.3054	102.2142	117.2923	118.6931	138.3254	150.9930	163.9686 (45)
Energy content (annual)										Total = Sum(45)m =		1633.0362 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	25.3966	22.2121	22.9209	19.9830	19.1741	16.5458	15.3321	17.5938	17.8040	20.7488	22.6489	24.5953 (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	29.8598	26.9611	29.7960	28.7504	29.6200	28.5321	29.4007	29.5429	28.6423	29.6907	28.8324	29.8227 (61)
Total heat required for water heating calculated for each month	199.1708	175.0415	182.6017	161.9701	157.4475	138.8375	131.6149	146.8351	147.3354	168.0161	179.8254	193.7913 (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	199.1708	175.0415	182.6017	161.9701	157.4475	138.8375	131.6149	146.8351	147.3354	168.0161	179.8254	193.7913 (64)
RHI water heating demand												1982.4874 (64)
Heat gains from water heating, kWh/month	63.7608	55.9770	58.2569	51.4832	49.9076	43.8096	41.3364	46.3854	46.6260	53.4159	57.4133	61.9752 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	175.8088	175.8088	175.8088	175.8088	175.8088	175.8088	175.8088	175.8088	175.8088	175.8088	175.8088	175.8088	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	75.8907	67.4055	54.8178	41.5006	31.0222	26.1902	28.2995	36.7847	49.3724	62.6896	73.1680	78.0000	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	474.2478	479.1690	466.7677	440.3669	407.0405	375.7184	354.7933	349.8721	362.2734	388.6743	422.0007	453.3227	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.5110	55.5110	55.5110	55.5110	55.5110	55.5110	55.5110	55.5110	55.5110	55.5110	55.5110	55.5110	(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)	-117.2059	-117.2059	-117.2059	-117.2059	-117.2059	-117.2059	-117.2059	-117.2059	-117.2059	-117.2059	-117.2059	-117.2059	(71)
Water heating gains (Table 5)	85.7001	83.2991	78.3023	71.5044	67.0802	60.8466	55.5597	62.3460	64.7584	71.7955	79.7407	83.3001	(72)
Total internal gains	752.9525	746.9876	717.0018	670.4858	622.2568	579.8692	555.7664	566.1168	593.5181	640.2734	692.0233	731.7367	(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				8.0200	13.4684	0.6300	0.7000	0.7700	33.0113 (74)			
East				1.3200	25.1733	0.6300	0.7000	0.7700	10.1551 (76)			
South				11.4100	56.5862	0.6300	0.7000	0.7700	197.3186 (78)			
Solar gains	240.4851	345.3025	477.9558	599.0458	641.2544	710.7664	655.7500	617.9889	542.3710	410.3178	286.2225	195.4524 (83)
Total gains	993.4376	1092.2900	1194.9576	1269.5315	1263.5112	1290.6356	1211.5165	1184.1057	1135.8892	1050.5912	978.2458	927.1891 (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	42.7402	43.0173	43.0173	43.3633	43.2794	43.4454	43.4454	43.5258	43.5258	43.2794	43.3633	43.2794	
alpha	3.8493	3.8678	3.8678	3.8909	3.8853	3.8964	3.8964	3.9017	3.9017	3.8853	3.8909	3.8853	
util living area	0.9815	0.9726	0.9495	0.8950	0.7889	0.5792	0.4181	0.4144	0.6826	0.8917	0.9647	0.9848	(86)
MIT	19.6962	19.8409	20.1284	20.4903	20.7819	20.9539	20.9903	20.9910	20.9104	20.5896	20.1115	19.6780	(87)
Th 2	20.0164	20.0221	20.0221	20.0292	20.0275	20.0308	20.0308	20.0325	20.0325	20.0275	20.0292	20.0275	(88)
util rest of house	0.9771	0.9663	0.9374	0.8684	0.7330	0.4842	0.2997	0.2933	0.5933	0.8575	0.9548	0.9811	(89)
MIT 2	18.8470	18.9936	19.2744	19.6246	19.8823	20.0107	20.0287	20.0306	19.9871	19.7207	19.2671	18.8378	(90)
Living area fraction									fLA = Living area / (4) =			0.1443	(91)
MIT	18.9695	19.1159	19.3976	19.7495	20.0121	20.1468	20.1675	20.1692	20.1204	19.8461	19.3889	18.9590	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9695	19.1159	19.3976	19.7495	20.0121	20.1468	20.1675	20.1692	20.1204	19.8461	19.3889	18.9590	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	964.6285	1047.2018	1108.7156	1091.1351	924.9541	640.4678	383.8261	368.0650	683.9383	892.9201	925.9592	904.7350	(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	2131.0414	2077.1469	1868.3748	1515.9840	1088.0300	665.9327	386.9214	370.8201	738.8270	1219.3151	1694.9982	2087.1027	(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	867.8112	692.1231	565.1865	305.8913	121.3285	0.0000	0.0000	0.0000	0.0000	242.8379	553.7080	879.6815	(98)
Space heating												4228.5679	(98)
RHI space heating demand												4229	(98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	74.6900 (1b)	x 2.3900 (2b)	= 178.5091 (1b) - (3b)
First floor	72.7700 (1c)	x 2.6700 (2c)	= 194.2959 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	147.4600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 372.8050 (5)

2. Ventilation rate

										main heating	secondary heating	other	total	m3 per hour			
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																5 * 10 =	50.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =					50.0000	/ (5) =	0.1341 (8)
Pressure test										Yes							
Measured/design AP50										4.0800							
Infiltration rate										0.3381 (18)							
Number of sides sheltered										1 (19)							
Shelter factor										(20) = 1 - [0.075 x (19)] =					0.9250 (20)		
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =					0.3128 (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	0.3988	0.3909	0.3831	0.3440	0.3362	0.2971	0.2971	0.2893	0.3128	0.3362	0.3519	0.3675	(22b)				
Effective ac	0.5795	0.5764	0.5734	0.5592	0.5565	0.5441	0.5441	0.5418	0.5489	0.5565	0.5619	0.5675	(25)				

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K						
Front Door			2.1200	1.1000	2.3320			(26)					
Windows (Uw = 1.20)			20.7500	1.1450	23.7595			(27)					
Ground Floor			74.6900	0.1200	8.9628	84.0000	6273.9600	(28a)					
Brick and Block	184.2800	22.8700	161.4100	0.2400	38.7384	42.2200	6814.7302	(29a)					
Pitched Roof	74.6900		74.6900	0.1000	7.4690	9.1000	679.6790	(30)					
Total net area of external elements Aum(A, m2)			333.6600					(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	81.2617			(33)					
GF Block			84.2400			75.0000	6318.0000	(32c)					
GF Stud			30.1900			9.0000	271.7100	(32c)					
FF Stud			171.9500			9.0000	1547.5500	(32c)					
Internal Floor 1			72.7700			18.0000	1309.8600	(32d)					
Internal Ceiling 1			72.7700			18.0000	1309.8600	(32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	24525.3492	(34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							166.3187	(35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.3135	(36)					
Total fabric heat loss						(33) + (36) =	89.5753	(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 71.2944	Feb 70.9145	Mar 70.5422	Apr 68.7935	May 68.4663	Jun 66.9433	Jul 66.9433	Aug 66.6612	Sep 67.5299	Oct 68.4663	Nov 69.1282	Dec 69.8202	(38)
Heat transfer coeff	160.8696	160.4898	160.1175	158.3688	158.0416	156.5185	156.5185	156.2365	157.1052	158.0416	158.7035	159.3954	(39)
Average = Sum(39)m / 12 =												158.3672	(39)
HLP	Jan 1.0909	Feb 1.0884	Mar 1.0858	Apr 1.0740	May 1.0718	Jun 1.0614	Jul 1.0614	Aug 1.0595	Sep 1.0654	Oct 1.0718	Nov 1.0762	Dec 1.0809	(40)
HLP (average)												1.0740	(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												2.9301 (42)
Average daily hot water use (litres/day)												103.7910 (43)
Daily hot water use	Jan 114.1701	Feb 110.0184	Mar 105.8668	Apr 101.7152	May 97.5635	Jun 93.4119	Jul 93.4119	Aug 97.5635	Sep 101.7152	Oct 105.8668	Nov 110.0184	Dec 114.1701 (44)
Energy conte	169.3109	148.0804	152.8057	133.2197	127.8275	110.3054	102.2142	117.2923	118.6931	138.3254	150.9930	163.9686 (45)
Energy content (annual)										Total = Sum(45)m =		1633.0362 (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	25.3966	22.2121	22.9209	19.9830	19.1741	16.5458	15.3321	17.5938	17.8040	20.7488	22.6489	24.5953 (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	29.8598	26.9611	29.7960	28.7504	29.6200	28.5321	29.4007	29.5429	28.6423	29.6907	28.8324	29.8227 (61)
Total heat required for water heating calculated for each month	199.1708	175.0415	182.6017	161.9701	157.4475	138.8375	131.6149	146.8351	147.3354	168.0161	179.8254	193.7913 (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	199.1708	175.0415	182.6017	161.9701	157.4475	138.8375	131.6149	146.8351	147.3354	168.0161	179.8254	193.7913 (64)
Heat gains from water heating, kWh/month	63.7608	55.9770	58.2569	51.4832	49.9076	43.8096	41.3364	46.3854	46.6260	53.4159	57.4133	61.9752 (65)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)												
Total per year (kWh/year) = Sum(64)m = 1982.4874 (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	175.8088	175.8088	175.8088	175.8088	175.8088	175.8088	175.8088	175.8088	175.8088	175.8088	175.8088	175.8088 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	75.8907	67.4055	54.8178	41.5006	31.0222	26.1902	28.2995	36.7847	49.3724	62.6896	73.1680	78.0000 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	474.2478	479.1690	466.7677	440.3669	407.0405	375.7184	354.7933	349.8721	362.2734	388.6743	422.0007	453.3227 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.5110	55.5110	55.5110	55.5110	55.5110	55.5110	55.5110	55.5110	55.5110	55.5110	55.5110	55.5110 (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)	-117.2059	-117.2059	-117.2059	-117.2059	-117.2059	-117.2059	-117.2059	-117.2059	-117.2059	-117.2059	-117.2059	-117.2059 (71)
Water heating gains (Table 5)	85.7001	83.2991	78.3023	71.5044	67.0802	60.8466	55.5597	62.3460	64.7584	71.7955	79.7407	83.3001 (72)
Total internal gains	752.9525	746.9876	717.0018	670.4858	622.2568	579.8692	555.7664	566.1168	593.5181	640.2734	692.0233	731.7367 (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			8.0200	10.6334		0.6300	0.7000		0.7700	26.0626 (74)		
East			1.3200	19.6403		0.6300	0.7000		0.7700	7.9231 (76)		
South			11.4100	46.7521		0.6300	0.7000		0.7700	163.0265 (78)		
Solar gains	197.0122	332.3016	450.2640	557.5632	629.3126	628.2334	604.1389	549.1787	486.7240	365.6594	235.2727	169.1125 (83)
Total gains	949.9647	1079.2892	1167.2658	1228.0490	1251.5694	1208.1026	1159.9053	1115.2955	1080.2422	1005.9328	927.2960	900.8492 (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	42.3486	42.4488	42.5475	43.0173	43.1064	43.5258	43.5258	43.6044	43.3633	43.1064	42.9266	42.7402
alpha	3.8232	3.8299	3.8365	3.8678	3.8738	3.9017	3.9017	3.9070	3.8909	3.8738	3.8618	3.8493
util living area	0.9878	0.9791	0.9631	0.9274	0.8533	0.7157	0.5595	0.5978	0.7969	0.9363	0.9793	0.9899 (86)
MIT	19.4635	19.6569	19.9462	20.3139	20.6451	20.8786	20.9649	20.9540	20.8026	20.3802	19.8550	19.4262 (87)
Th 2	20.0082	20.0103	20.0124	20.0221	20.0240	20.0325	20.0325	20.0340	20.0292	20.0240	20.0203	20.0164 (88)
util rest of house	0.9850	0.9745	0.9545	0.9093	0.8141	0.6393	0.4505	0.4905	0.7329	0.9167	0.9739	0.9877 (89)
MIT 2	18.6097	18.8026	19.0889	19.4530	19.7620	19.9635	20.0195	20.0157	19.9055	19.5230	19.0081	18.5790 (90)
Living area fraction									fLA = Living area / (4) =			0.1443 (91)
MIT	18.7329	18.9258	19.2126	19.5773	19.8895	20.0955	20.1559	20.1511	20.0350	19.6467	19.1303	18.7013 (92)
Temperature adjustment												0.0000
adjusted MIT	18.7329	18.9258	19.2126	19.5773	19.8895	20.0955	20.1559	20.1511	20.0350	19.6467	19.1303	18.7013 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	931.2931	1044.6491	1104.0024	1104.4347	1011.1870	778.9741	539.6061	562.5483	792.1510	912.7575	897.0692	886.0777 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	2321.8154	2251.0056	2035.5147	1690.9441	1294.2772	860.1538	556.5656	586.0602	932.4126	1429.7563	1909.2473	2311.4383 (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	1034.5486	810.6715	693.0451	422.2868	210.6191	0.0000	0.0000	0.0000	0.0000	384.6471	728.7682	1060.4683 (98)
Space heating												5345.0548 (98)
Space heating per m2												(98) / (4) = 36.2475 (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													5912.6712 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1034.5486	810.6715	693.0451	422.2868	210.6191	0.0000	0.0000	0.0000	0.0000	384.6471	728.7682	1060.4683	(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)	1144.4121	896.7606	766.6428	467.1314	232.9858	0.0000	0.0000	0.0000	0.0000	425.4945	806.1596	1173.0844	(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	199.1708	175.0415	182.6017	161.9701	157.4475	138.8375	131.6149	146.8351	147.3354	168.0161	179.8254	193.7913	(64)
Efficiency of water heater (217)m	90.0374	90.0013	89.9322	89.7792	89.4456	88.2000	88.2000	88.2000	88.2000	89.7197	89.9559	88.2000	(216)
Fuel for water heating, kWh/month	221.2088	194.4877	203.0437	180.4094	176.0259	157.4121	149.2232	166.4797	167.0470	187.2679	199.9039	215.1971	(219)
Water heating fuel used												2217.7066	(219)
Annual totals kWh/year													
Space heating fuel - main system												5912.6712	(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)												536.1015	(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												7748.3166	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	5912.6712	3.4800	205.7610 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2217.7066	3.4800	77.1762 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	536.1015	13.1900	70.7118 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-993.1627	13.1900	-130.9982 (252)
Total energy cost			352.5433 (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] =	0.7693 (257)
SAP value		89.2676
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	5912.6712	0.2160	1277.1370 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2217.7066	0.2160	479.0246 (264)
Space and water heating			1756.1616 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	536.1015	0.5190	278.2367 (268)
Energy saving/generation technologies			
PV Unit	-993.1627	0.5190	-515.4514 (269)
Total kg/year			1557.8719 (272)
CO2 emissions per m2			10.5600 (273)
EI value			89.1533
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	$3.48 / 0.8931 = 3.897$, stars = 4
Water heating environmental impact	$0.216 / 0.8931 = 0.2419$, 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	74.6900 (1b)	x 2.3900 (2b)	= 178.5091 (1b) - (3b)
First floor	72.7700 (1c)	x 2.6700 (2c)	= 194.2959 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	147.4600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 372.8050 (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) = 0.1341 (8)
Pressure test					Yes
Measured/design AP50					4.0800
Infiltration rate					0.3381 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3128 (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	0.3675	0.3440	0.3440	0.3128	0.3206	0.3049	0.3049	0.2971	0.2971	0.3206	0.3128	0.3206 (22b)
Effective ac	0.5675	0.5592	0.5592	0.5489	0.5514	0.5465	0.5465	0.5441	0.5441	0.5514	0.5489	0.5514 (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			74.6900	0.1200	8.9628	84.0000	6273.9600 (28a)
Brick and Block	184.2800	22.8700	161.4100	0.2400	38.7384	42.2200	6814.7302 (29a)
Pitched Roof	74.6900		74.6900	0.1000	7.4690	9.1000	679.6790 (30)
Total net area of external elements Aum(A, m ²)			333.6600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	81.2617		(33)
GF Block			84.2400			75.0000	6318.0000 (32c)
GF Stud			30.1900			9.0000	271.7100 (32c)
FF Stud			171.9500			9.0000	1547.5500 (32c)
Internal Floor 1			72.7700			18.0000	1309.8600 (32d)
Internal Ceiling 1			72.7700			18.0000	1309.8600 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 24525.3492 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 166.3187 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 8.3135 (36)
Total fabric heat loss (33) + (36) = 89.5753 (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	69.8202	68.7935	68.7935	67.5299	67.8345	67.2328	67.2328	66.9433	66.9433	67.8345	67.5299	67.8345 (38)
Heat transfer coeff	159.3954	158.3688	158.3688	157.1052	157.4098	156.8081	156.8081	156.5185	156.5185	157.4098	157.1052	157.4098 (39)
Average = Sum(39)m / 12 =												157.4355 (39)
HLP	1.0809	1.0740	1.0740	1.0654	1.0675	1.0634	1.0634	1.0614	1.0614	1.0675	1.0654	1.0675 (40)
HLP (average)												1.0676 (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 2.9301 (42)
Average daily hot water use (litres/day) 103.7910 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	114.1701	110.0184	105.8668	101.7152	97.5635	93.4119	93.4119	97.5635	101.7152	105.8668	110.0184	114.1701 (44)
Energy conte	169.3109	148.0804	152.8057	133.2197	127.8275	110.3054	102.2142	117.2923	118.6931	138.3254	150.9930	163.9686 (45)
Energy content (annual)										Total = Sum(45)m =		1633.0362 (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	25.3966	22.2121	22.9209	19.9830	19.1741	16.5458	15.3321	17.5938	17.8040	20.7488	22.6489	24.5953 (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	29.8598	26.9611	29.7960	28.7504	29.6200	28.5321	29.4007	29.5429	28.6423	29.6907	28.8324	29.8227 (61)
Total heat required for water heating calculated for each month	199.1708	175.0415	182.6017	161.9701	157.4475	138.8375	131.6149	146.8351	147.3354	168.0161	179.8254	193.7913 (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	199.1708	175.0415	182.6017	161.9701	157.4475	138.8375	131.6149	146.8351	147.3354	168.0161	179.8254	193.7913 (64)
Heat gains from water heating, kWh/month	63.7608	55.9770	58.2569	51.4832	49.9076	43.8096	41.3364	46.3854	46.6260	53.4159	57.4133	61.9752 (65)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)												
Total per year (kWh/year) = Sum(64)m = 1982.4874 (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	175.8088	175.8088	175.8088	175.8088	175.8088	175.8088	175.8088	175.8088	175.8088	175.8088	175.8088	175.8088 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	75.8907	67.4055	54.8178	41.5006	31.0222	26.1902	28.2995	36.7847	49.3724	62.6896	73.1680	78.0000 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	474.2478	479.1690	466.7677	440.3669	407.0405	375.7184	354.7933	349.8721	362.2734	388.6743	422.0007	453.3227 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.5110	55.5110	55.5110	55.5110	55.5110	55.5110	55.5110	55.5110	55.5110	55.5110	55.5110	55.5110 (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)	-117.2059	-117.2059	-117.2059	-117.2059	-117.2059	-117.2059	-117.2059	-117.2059	-117.2059	-117.2059	-117.2059	-117.2059 (71)
Water heating gains (Table 5)	85.7001	83.2991	78.3023	71.5044	67.0802	60.8466	55.5597	62.3460	64.7584	71.7955	79.7407	83.3001 (72)
Total internal gains	752.9525	746.9876	717.0018	670.4858	622.2568	579.8692	555.7664	566.1168	593.5181	640.2734	692.0233	731.7367 (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				8.0200	13.4684		0.6300	0.7000		0.7700	33.0113 (74)	
East				1.3200	25.1733		0.6300	0.7000		0.7700	10.1551 (76)	
South				11.4100	56.5862		0.6300	0.7000		0.7700	197.3186 (78)	

Solar gains	240.4851	345.3025	477.9558	599.0458	641.2544	710.7664	655.7500	617.9889	542.3710	410.3178	286.2225	195.4524 (83)
Total gains	993.4376	1092.2900	1194.9576	1269.5315	1263.5112	1290.6356	1211.5165	1184.1057	1135.8892	1050.5912	978.2458	927.1891 (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	42.7402	43.0173	43.0173	43.3633	43.2794	43.4454	43.4454	43.5258	43.5258	43.2794	43.3633	43.2794
alpha	3.8493	3.8678	3.8678	3.8909	3.8853	3.8964	3.8964	3.9017	3.9017	3.8853	3.8909	3.8853
util living area	0.9815	0.9726	0.9495	0.8950	0.7889	0.5792	0.4181	0.4144	0.6826	0.8917	0.9647	0.9848 (86)
MIT	19.6962	19.8409	20.1284	20.4903	20.7819	20.9539	20.9903	20.9910	20.9104	20.5896	20.1115	19.6780 (87)
Th 2	20.0164	20.0221	20.0221	20.0292	20.0275	20.0308	20.0308	20.0325	20.0325	20.0275	20.0292	20.0275 (88)
util rest of house	0.9771	0.9663	0.9374	0.8684	0.7330	0.4842	0.2997	0.2933	0.5933	0.8575	0.9548	0.9811 (89)
MIT 2	18.8470	18.9936	19.2744	19.6246	19.8823	20.0107	20.0287	20.0306	19.9871	19.7207	19.2671	18.8378 (90)
Living area fraction									fLA = Living area / (4) =			0.1443 (91)
MIT	18.9695	19.1159	19.3976	19.7495	20.0121	20.1468	20.1675	20.1692	20.1204	19.8461	19.3889	18.9590 (92)
Temperature adjustment												0.0000
adjusted MIT	18.9695	19.1159	19.3976	19.7495	20.0121	20.1468	20.1675	20.1692	20.1204	19.8461	19.3889	18.9590 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	964.6285	1047.2018	1108.7156	1091.1351	924.9541	640.4678	383.8261	368.0650	683.9383	892.9201	925.9592	904.7350 (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	2131.0414	2077.1469	1868.3748	1515.9840	1088.0300	665.9327	386.9214	370.8201	738.8270	1219.3151	1694.9982	2087.1027 (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	867.8112	692.1231	565.1865	305.8913	121.3285	0.0000	0.0000	0.0000	0.0000	242.8379	553.7080	879.6815 (98)
Space heating												4228.5679 (98)
Space heating per m2										(98) / (4) =		28.6760 (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													4677.6194 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	867.8112	692.1231	565.1865	305.8913	121.3285	0.0000	0.0000	0.0000	0.0000	242.8379	553.7080	879.6815	(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)	959.9681	765.6229	625.2063	338.3753	134.2129	0.0000	0.0000	0.0000	0.0000	268.6260	612.5089	973.0991	(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	199.1708	175.0415	182.6017	161.9701	157.4475	138.8375	131.6149	146.8351	147.3354	168.0161	179.8254	193.7913	(64)
Efficiency of water heater (217)m	89.9810	89.9471	89.8527	89.6261	89.1442	88.2000	88.2000	88.2000	88.2000	89.4872	89.8506	88.2000	(216)
Fuel for water heating, kWh/month	221.3475	194.6049	203.2234	180.7176	176.6211	157.4121	149.2232	166.4797	167.0470	187.7543	200.1383	215.3362	(219)
Water heating fuel used												2219.9055	(219)
Annual totals kWh/year													
Space heating fuel - main system												4677.6194	(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)												536.1015	(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												6399.0970	(238)

10a. Fuel costs - using BEDF prices (505)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	4677.6194	3.7400	174.9430 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2219.9055	3.7400	83.0245 (247)
Pumps and fans for heating	75.0000	20.4300	15.3225 (249)
Energy for lighting	536.1015	20.4300	109.5255 (250)
Additional standing charges			95.0000 (251)
Energy saving/generation technologies			
PV Unit	-1109.5294	20.4300	-226.6769 (252)
Total energy cost			251.1386 (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	4677.6194	0.2160	1010.3658 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2219.9055	0.2160	479.4996 (264)
Space and water heating			1489.8654 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	536.1015	0.5190	278.2367 (268)
Energy saving/generation technologies			
PV Unit	-1109.5294	0.5190	-575.8458 (269)
Total kg/year			1231.1813 (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	4677.6194	1.2200	5706.6957 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2219.9055	1.2200	2708.2847 (264)
Space and water heating			8414.9804 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	536.1015	3.0700	1645.8317 (268)
Energy saving/generation technologies			
PV Unit	-1109.5294	3.0700	-3406.2553 (269)
Primary energy kWh/year			6884.8068 (272)
Primary energy kWh/m2/year			46.6893 (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 + 0.9 -£ 29 -198 kg (16.1%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
(none)			
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 505 TEST (31 Aug 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	£125	£125	£0
Mains gas	£353	£353	£0
Space heating	£285	£285	£0
Water heating	£83	£83	£0
Lighting	£110	£110	£0
Generated (PV)	-£227	-£227	£0
Total cost of fuels	£251	£251	£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 26	Issued on Date	20/09/2022
Assessment Reference	As Built	Prop Type Ref	M
Project	3 Winifred Moody Road, West End, Southampton, SO30 3LB		
Calculation Type	New Build (As Built)		

SAP Rating	89 B	DER	12.10	TER	15.90
Environmental	89 B	% DER<TER	23.88		
CO ₂ Emissions (t/year)	1.23	DFEE	44.12	TREE	54.16
General Requirements Compliance	Pass	% DFEE<TFEE	18.53		

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 m ² K/W	Lower limit = 10.901 m ² K/W	Average = 11.050 m ² K/W
	Total correction = 0.0065 m ² K/W	U-value (unrounded) = 0.1 W/m ² 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 26	Issued on Date	20/09/2022
Assessment Reference	As Built	Prop Type Ref	M
Project	3 Winifred Moody Road, West End, Southampton, SO30 3LB		
Calculation Type	New Build (As Built)		

SAP Rating	89 B	DER	12.10	TER	15.90
Environmental	89 B	% DER<TER	23.88		
CO ₂ Emissions (t/year)	1.23	DFEE	44.12	TFEE	54.16
General Requirements Compliance	Pass	% DFEE<TFEE	18.53		

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

Wall 000001

Wall Type: Standard Wall

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

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

Unheated space: None

Total thickness: 330 mm

U-value: 0.24 W/m² K

Kappa: 42.22 kJ/m² K

U-VALUE CALCULATOR REPORT

Property Reference	SAP 0647 Plot 26	Issued on Date	20/09/2022
Assessment Reference	As Built	Prop Type Ref	M
Project	3 Winifred Moody Road, West End, Southampton, SO30 3LB		
Calculation Type	New Build (As Built)		

SAP Rating	89 B	DER	12.10	TER	15.90
Environmental	89 B	% DER<TER	23.88		
CO ₂ Emissions (t/year)	1.23	DFEE	44.12	TFEE	54.16
General Requirements Compliance	Pass	% DFEE<TFEE	18.53		

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 26	Issued on Date	20/09/2022
Assessment Reference	As Built	Prop Type Ref	M
Property	3 Winifred Moody Road, West End, Southampton, SO30 3LB		

SAP Rating	89 B	DER	12.10	TER	15.90
Environmental	89 B	% DER<TER	23.88		
CO ₂ Emissions (t/year)	1.23	DFEE	44.12	TFEE	54.16
General Requirements Compliance	Pass	% DFEE<TFEE	18.53		

Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 07798936079, toby@abacusenergyuk.com	Assessor ID	E477-0001
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Client	Foreman Homes, FORE
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SUMMARY FOR INPUT DATA FOR: New Build (As Built)

Orientation	North
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	1
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements		Heat Loss Perimeter	Internal Floor Area	Average Storey Height
	Ground Floor:	37.76 m	74.69 m ²	2.39 m
	1st Storey:	35.22 m	72.77 m ²	2.67 m

7.0 Living Area	21.28	m ²
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8.0 Thermal Mass Parameter	Precise calculation	
Thermal Mass	166.32	kJ/m ² K

9.0 External Walls			U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area (m ²)	Nett Area (m ²)
Description	Type	Construction				
Brick and Block	Cavity Wall	Other	0.24	42.22	184.28	161.41

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

9.2 Internal Walls			Kappa (kJ/m ² K)	Area (m ²)
Description	Construction			
GF Block	Dense block, plasterboard on dabs		75.00	84.24
GF Stud	Plasterboard on timber frame		9.00	30.19
FF Stud	Plasterboard on timber frame		9.00	171.95

10.0 External Roofs			U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area (m ²)	Nett Area (m ²)
Description	Type	Construction				
Pitched Roof	External Plane Roof	Other	0.10	9.10	74.69	74.69

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	72.77

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	74.69

11.2 Internal Floors

Description	Construction	Kappa (kJ/m²K)	Area (m²)
Internal Floor 1	Plasterboard ceiling, carpeted chipboard floor	18.00	72.77

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	North							2.12	
Front Shaded	Window	[1] Brick and Block	North	None	0.49	Yes				1.68	
Front Elevation	Window	[1] Brick and Block	North	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	South	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)	1.77	0.064	No	Birtley Supatherm
Independently assessed	E2 Other lintels (including other steel lintels)	2.10	0.057	No	Birtley Supatherm
Independently assessed	E2 Other lintels (including other steel lintels)	2.77	0.056	No	Birtley Supatherm
Independently assessed	E3 Sill	10.93	0.021	No	Knauf P5
Independently assessed	E4 Jamb	33.60	0.016	No	Knauf P6
Independently assessed	E5 Ground floor (normal)	37.60	0.105	No	LABC E5MCFF11
Independently assessed	E6 Intermediate floor within a dwelling	35.22	0.000	No	CD0029
Table K1 - Approved	E10 Eaves (insulation at ceiling level)	17.28	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	0.025	W/m²K
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18.0 Pressure Testing

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

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

As Built AP₅₀

4.08

m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather

Windows half open

Cross ventilation possible

Yes

Night Ventilation

Yes

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

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

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

25.0 Main Heating 2

Community Heating

28.0 Water Heating

Water Heating

Flue Gas Heat Recovery System

Waste Water Heat Recovery Instantaneous System 1

Waste Water Heat Recovery Instantaneous System 2

Waste Water Heat Recovery Storage System

Solar Panel

Water use <= 125 litres/person/day

SAP Code

29.0 Hot Water Cylinder

32.0 Photovoltaic Unit

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