



SAP Report Submission for Building Regulations Compliance

Client: Foreman Homes

Project: 16 Oram Way
West End, Southampton, SO30 3JW

Contact: Tobias Whiting
Abacus Energy (UK) Ltd
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Report Issue Date: 26/07/2022

EXCELLENCE
IN ENERGY
ASSESSMENT

BUILDING REGULATION COMPLIANCE

Calculation Type: New Build (As Built)

Property Reference	SAP 0647 Plot 15	Issued on Date	26/07/2022
Assessment Reference	As Built	Prop Type Ref	L
Property	16 Oram Way, West End, Southampton, SO30 3JW		
SAP Rating	88 B	DER	13.30
Environmental	89 B	TER	17.88
CO ₂ Emissions (t/year)	1.10	% DER<TER	25.63
General Requirements Compliance	Pass	DfEE	48.29
		TfEE	60.82
		% DfEE<TfEE	20.61
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)	17.88	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	13.30	kgCO ₂ /m ²	Pass
	-4.58 (-25.6%)	kgCO ₂ /m ²	

1b TfEE and DfEE

Target Fabric Energy Efficiency (TfEE)	60.82	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DfEE)	48.29	kWh/m ² /yr	
	-12.5 (-20.6%)	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	4.15 (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 36CDi Compact ErP
Combi boiler
Efficiency: 89.8% 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)

Slight

Pass

Based on:

Overshading

Average

Windows facing North

5.76 m², No overhang

Windows facing East

9.46 m², No overhang

Windows facing West

11.48 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

4.15 (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	0.019	W/m ² K
Photovoltaic array	0.97	kW

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THERMAL BRIDGING

Calculation Type: New Build (As Built)

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SAP Rating	88 B	DER	13.30	TER	17.88
Environmental	89 B	% DER<TER	25.63		
CO ₂ Emissions (t/year)	1.10	DFEE	48.29	TFEE	60.82
General Requirements Compliance	Pass	% DFEE<TFEE	20.61		

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Client	Foreman Homes, FORE
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	Junction detail	Source Type	Psi (W/mK)	Length (m)	Result	Reference
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.070	1.83	0.13	Birtley Supatherm
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.071	1.01	0.07	Birtley Supatherm
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.067	8.40	0.56	Birtley Supatherm
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.070	3.02	0.21	Birtley Supatherm
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.064	7.08	0.45	Birtley Supatherm
External wall	E3 Sill	Independently assessed	0.021	17.31	0.36	Knauf P5
External wall	E4 Jamb	Independently assessed	0.016	42.90	0.69	Knauf P6
External wall	E5 Ground floor (normal)	Independently assessed	0.022	33.58	0.74	Knauf P10
External wall	E6 Intermediate floor within a dwelling	Independently assessed	0.000	33.58	0.00	CD0029
External wall	E10 Eaves (insulation at ceiling level)	Table K1 - Approved	0.060	18.70	1.12	
External wall	E12 Gable (insulation at ceiling level)	Independently assessed	0.044	14.88	0.65	Knauf P21
External wall	E16 Corner (normal)	Independently assessed	0.039	25.30	0.99	Knauf P23
External wall	E17 Corner (inverted – internal area greater than external area)	Independently assessed	-0.091	5.06	-0.46	Knauf P24

Total: **5.52** W/mK:
Y-Value: **0.019** W/m²K:

FULL SAP CALCULATION PRINTOUT

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

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

DWELLING AS BUILT

Detached House, total floor area 117 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) 17.88 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 13.30 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 60.8 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE) 48.3 kWh/m²/yrOK

2 Fabric U-values

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

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals: 4.15 (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 36CDi Compact ErP
Combi boiler
Efficiency: 89.8% 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): Slight OK
Based on:
Overshading:
Average
Windows facing North: 5.76 m², No overhang
Windows facing East: 9.46 m², No overhang
Windows facing West: 11.48 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 0.019 W/m²K
Photovoltaic array 0.97 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	58.6500 (1b)	x 2.3900 (2b)	= 140.1735 (1b) - (3b)
First floor	58.6500 (1c)	x 2.6800 (2c)	= 157.1820 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	117.3000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 297.3555 (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) = 0.1345 (8)
Pressure test					Yes
Measured/design AP50					4.1500
Infiltration rate					0.3420 (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) =	0.3164 (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	0.4034	0.3955	0.3876	0.3480	0.3401	0.3005	0.3005	0.2926	0.3164	0.3401	0.3559	0.3717 (22b)
Effective ac	0.5814	0.5782	0.5751	0.5606	0.5578	0.5452	0.5452	0.5428	0.5500	0.5578	0.5633	0.5691 (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)			26.7000	1.1450	30.5725		(27)
Ground Floor			58.6500	0.1200	7.0380	84.0000	4926.6000 (28a)
Brick and Block	170.2500	28.8200	141.4300	0.2400	33.9432	42.2200	5971.1746 (29a)
Pitched Roof	58.6500		58.6500	0.1000	5.8650	9.1000	533.7150 (30)
Total net area of external elements Aum(A, m ²)			287.5500				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	79.7507		(33)
GF Block			58.5300			75.0000	4389.7500 (32c)
GF Stud			29.4800			9.0000	265.3200 (32c)
FF Stud			126.9700			9.0000	1142.7300 (32c)
Internal Floor 1			58.6500			18.0000	1055.7000 (32d)
Internal Ceiling 1			58.6500			18.0000	1055.7000 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 19340.6896 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 164.8823 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 5.5188 (36)
Total fabric heat loss (33) + (36) = 85.2695 (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	57.0466	56.7366	56.4328	55.0056	54.7386	53.4956	53.4956	53.2654	53.9744	54.7386	55.2788	55.8435 (38)
Heat transfer coeff	142.3161	142.0061	141.7023	140.2751	140.0081	138.7651	138.7651	138.5349	139.2438	140.0081	140.5483	141.1130 (39)
Average = Sum(39)m / 12 =												140.2738 (39)
HLP	1.2133	1.2106	1.2080	1.1959	1.1936	1.1830	1.1830	1.1810	1.1871	1.1936	1.1982	1.2030 (40)
HLP (average)												1.1959 (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												2.8522 (42)
Average daily hot water use (litres/day)												101.9409 (43)
Daily hot water use	112.1350	108.0574	103.9798	99.9021	95.8245	91.7468	91.7468	95.8245	99.9021	103.9798	108.0574	112.1350 (44)
Energy conte	166.2930	145.4409	150.0820	130.8451	125.5490	108.3393	100.3922	115.2016	116.5774	135.8598	148.3016	161.0459 (45)
Energy content (annual)										Total = Sum(45)m =		1603.9278 (45)

FULL SAP CALCULATION PRINTOUT

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	24.9440	21.8161	22.5123	19.6268	18.8324	16.2509	15.0588	17.2802	17.4866	20.3790	22.2452	24.1569 (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	27.5658	24.8965	27.5524	26.6444	27.5075	26.5912	27.4595	27.4906	26.6202	27.5288	26.6627	27.5575 (61)
Total heat required for water heating calculated for each month	193.8588	170.3375	177.6344	157.4895	153.0565	134.9304	127.8518	142.6922	143.1976	163.3885	174.9642	188.6034 (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	193.8588	170.3375	177.6344	157.4895	153.0565	134.9304	127.8518	142.6922	143.1976	163.3885	174.9642	188.6034 (64)
Heat gains from water heating, kWh/month	62.1839	54.5832	56.7904	50.1671	48.6219	42.6706	40.2453	45.1772	45.4170	52.0556	55.9759	60.4371 (65)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)												
Total per year (kWh/year) = Sum(64)m = 1928.0048 (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	142.6125	142.6125	142.6125	142.6125	142.6125	142.6125	142.6125	142.6125	142.6125	142.6125	142.6125	142.6125	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.1098	22.3023	18.1374	13.7312	10.2642	8.6655	9.3634	12.1709	16.3357	20.7420	24.2089	25.8077	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	281.6553	284.5780	277.2129	261.5335	241.7410	223.1388	210.7114	207.7887	215.1539	230.8333	250.6258	269.2279	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.2612	37.2612	37.2612	37.2612	37.2612	37.2612	37.2612	37.2612	37.2612	37.2612	37.2612	37.2612	(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)	-114.0900	-114.0900	-114.0900	-114.0900	-114.0900	-114.0900	-114.0900	-114.0900	-114.0900	-114.0900	-114.0900	-114.0900	(71)
Water heating gains (Table 5)	83.5805	81.2251	76.3311	69.6765	65.3520	59.2647	54.0931	60.7220	63.0792	69.9672	77.7444	81.2327	(72)
Total internal gains	459.1293	456.8891	440.4652	413.7250	386.1410	359.8528	342.9517	349.4654	363.3526	390.3262	421.3628	445.0521	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a		g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
North				5.7600	10.6334		0.6300	0.7000	0.7700		18.7183 (74)	
East				9.4600	19.6403		0.6300	0.7000	0.7700		56.7819 (76)	
West				11.4800	19.6403		0.6300	0.7000	0.7700		68.9066 (80)	

Solar gains	144.4069	281.6451	465.7034	688.1856	855.2653	881.6783	836.8012	710.1747	544.0201	334.3311	179.8103	118.9647 (83)
Total gains	603.5362	738.5342	906.1686	1101.9105	1241.4063	1241.5311	1179.7529	1059.6400	907.3726	724.6572	601.1731	564.0167 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	37.7499	37.8323	37.9134	38.2991	38.3722	38.7159	38.7159	38.7802	38.5828	38.3722	38.2247	38.0717	
alpha	3.5167	3.5222	3.5276	3.5533	3.5581	3.5811	3.5811	3.5853	3.5722	3.5581	3.5483	3.5381	
util living area	0.9940	0.9873	0.9681	0.9121	0.7988	0.6371	0.4927	0.5585	0.8031	0.9562	0.9894	0.9953	(86)
MIT	19.0837	19.3195	19.7285	20.2502	20.6636	20.8945	20.9682	20.9506	20.7481	20.1730	19.5291	19.0437	(87)
Th 2	19.9094	19.9115	19.9136	19.9233	19.9251	19.9336	19.9336	19.9352	19.9304	19.9251	19.9214	19.9176	(88)
util rest of house	0.9925	0.9842	0.9603	0.8903	0.7504	0.5545	0.3837	0.4461	0.7359	0.9412	0.9864	0.9941	(89)
MIT 2	18.1596	18.3954	18.8007	19.3111	19.6867	19.8774	19.9228	19.9167	19.7740	19.2494	18.6126	18.1257	(90)
Living area fraction									fLA = Living area / (4) =			0.1416	(91)
MIT	18.2904	18.5263	18.9320	19.4441	19.8250	20.0215	20.0708	20.0631	19.9119	19.3802	18.7424	18.2557	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.2904	18.5263	18.9320	19.4441	19.8250	20.0215	20.0708	20.0631	19.9119	19.3802	18.7424	18.2557	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	597.1848	722.9804	861.8064	968.1822	925.2585	697.4837	469.9129	487.9208	666.5417	674.8038	590.1659	559.2834	(94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1991.0664	1935.0131	1761.6488	1479.0709	1137.5691	752.3078	481.6285	507.4644	809.2702	1229.2930	1636.3180	1983.4428	(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	1037.0479	814.4860	669.4828	367.8399	157.9591	0.0000	0.0000	0.0000	0.0000	412.5399	753.2295	1059.5746	(98)
Space heating												5272.1598	(98)
Space heating per m2												(98) / (4) =	44.9459 (99)

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

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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 %)												90.7000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												5812.7451	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1037.0479	814.4860	669.4828	367.8399	157.9591	0.0000	0.0000	0.0000	0.0000	412.5399	753.2295	1059.5746	(98)
Space heating efficiency (main heating system 1)	90.7000	90.7000	90.7000	90.7000	90.7000	0.0000	0.0000	0.0000	0.0000	90.7000	90.7000	90.7000	(210)
Space heating fuel (main heating system)	1143.3825	898.0000	738.1288	405.5567	174.1556	0.0000	0.0000	0.0000	0.0000	454.8401	830.4626	1168.2190	(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	193.8588	170.3375	177.6344	157.4895	153.0565	134.9304	127.8518	142.6922	143.1976	163.3885	174.9642	188.6034	(64)
Efficiency of water heater (217)m	90.2472	90.2030	90.0982	89.8420	89.3001	87.9000	87.9000	87.9000	87.9000	89.8877	90.1586	87.9000	(216)
Fuel for water heating, kWh/month	214.8085	188.8379	197.1565	175.2961	171.3956	153.5045	145.4514	162.3347	162.9097	181.7696	194.0626	208.9429	(219)
Water heating fuel used												2156.4700	(219)
Annual totals kWh/year													
Space heating fuel - main system												5812.7451	(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)												443.4465	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.97 * 1068 * 1.00) =										-828.8227		-828.8227	(233)
Total delivered energy for all uses												7658.8388	(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	5812.7451	0.2160	1255.5529	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2156.4700	0.2160	465.7975	(264)
Space and water heating			1721.3504	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	443.4465	0.5190	230.1487	(268)
Energy saving/generation technologies				
PV Unit	-828.8227	0.5190	-430.1590	(269)
Total CO2, kg/year			1560.2652	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.3000	(273)

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

DER		13.3000	ZC1
Total Floor Area	TFA	117.3000	
Assumed number of occupants	N	2.8522	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		14.2287	ZC2
CO2 emissions from cooking, equation (L16)		1.5981	ZC3
Total CO2 emissions		29.1268	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		29.1268	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	58.6500 (1b)	x 2.3900 (2b)	= 140.1735 (1b) - (3b)
First floor	58.6500 (1c)	x 2.6800 (2c)	= 157.1820 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	117.3000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 297.3555 (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							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) =	0.1345 (8)				
Pressure test							Yes					
Measured/design AP50							5.0000					
Infiltration rate							0.3845 (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) =						0.3557 (21)					
Wind speed	Jan 5.1000	Feb 5.0000	Mar 4.9000	Apr 4.4000	May 4.3000	Jun 3.8000	Jul 3.8000	Aug 3.7000	Sep 4.0000	Oct 4.3000	Nov 4.5000	Dec 4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4535	0.4446	0.4357	0.3912	0.3824	0.3379	0.3379	0.3290	0.3557	0.3824	0.4001	0.4179 (22b)
Effective ac	0.6028	0.5988	0.5949	0.5765	0.5731	0.5571	0.5571	0.5541	0.5633	0.5731	0.5801	0.5873 (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)			26.7000	1.3258	35.3977		(27)					
Ground Floor			58.6500	0.1300	7.6245		(28a)					
Brick and Block	170.2500	28.8200	141.4300	0.1800	25.4574		(29a)					
Pitched Roof	58.6500		58.6500	0.1300	7.6245		(30)					
Total net area of external elements Aum(A, m2)			287.5500				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26) ... (30) + (32) =		78.2241		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							13.2867 (36)					
Total fabric heat loss						(33) + (36) =	91.5108 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 59.1539	Feb 58.7620	Mar 58.3780	Apr 56.5741	May 56.2366	Jun 54.6654	Jul 54.6654	Aug 54.3745	Sep 55.2706	Oct 56.2366	Nov 56.9193	Dec 57.6331 (38)
Heat transfer coeff	150.6647	150.2729	149.8888	148.0849	147.7474	146.1763	146.1763	145.8853	146.7814	147.7474	148.4302	149.1440 (39)
Average = Sum(39)m / 12 =												148.0833 (39)
HLP	Jan 1.2844	Feb 1.2811	Mar 1.2778	Apr 1.2624	May 1.2596	Jun 1.2462	Jul 1.2462	Aug 1.2437	Sep 1.2513	Oct 1.2596	Nov 1.2654	Dec 1.2715 (40)
HLP (average)												1.2624 (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												2.8522 (42)
Average daily hot water use (litres/day)												101.9409 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	112.1350	108.0574	103.9798	99.9021	95.8245	91.7468	91.7468	95.8245	99.9021	103.9798	108.0574	112.1350 (44)
Energy conte	166.2930	145.4409	150.0820	130.8451	125.5490	108.3393	100.3922	115.2016	116.5774	135.8598	148.3016	161.0459 (45)
Energy content (annual)											Total = Sum(45)m =	1603.9278 (45)
Distribution loss	(46)m = 0.15 x (45)m											
	24.9440	21.8161	22.5123	19.6268	18.8324	16.2509	15.0588	17.2802	17.4866	20.3790	22.2452	24.1569 (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)
	50.9589	46.0274	50.9589	49.2668	48.8311	45.2450	46.7532	48.8311	49.2668	50.9589	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month												
Solar input	217.2519	191.4683	201.0409	180.1119	174.3801	153.5843	147.1454	164.0327	165.8442	186.8187	197.6166	212.0048 (62)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h								Solar input (sum of months) = Sum (63)m =				0.0000 (63)
	217.2519	191.4683	201.0409	180.1119	174.3801	153.5843	147.1454	164.0327	165.8442	186.8187	197.6166	212.0048 (64)
Heat gains from water heating, kWh/month								Total per year (kWh/year) = Sum (64)m =				2191.2999 (64)
	68.0321	59.8660	62.6420	55.8227	53.9528	47.3341	45.0687	50.5123	51.0787	57.9131	61.6390	66.2875 (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	142.6125	142.6125	142.6125	142.6125	142.6125	142.6125	142.6125	142.6125	142.6125	142.6125	142.6125	142.6125 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	25.1098	22.3023	18.1374	13.7312	10.2642	8.6655	9.3634	12.1709	16.3357	20.7420	24.2089	25.8077 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	281.6553	284.5780	277.2129	261.5335	241.7410	223.1388	210.7114	207.7887	215.1539	230.8333	250.6258	269.2279 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	37.2612	37.2612	37.2612	37.2612	37.2612	37.2612	37.2612	37.2612	37.2612	37.2612	37.2612	37.2612 (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)												
	-114.0900	-114.0900	-114.0900	-114.0900	-114.0900	-114.0900	-114.0900	-114.0900	-114.0900	-114.0900	-114.0900	-114.0900 (71)
Water heating gains (Table 5)												
	91.4411	89.0862	84.1962	77.5315	72.5172	65.7417	60.5762	67.8929	70.9426	77.8402	85.6098	89.0961 (72)
Total internal gains												
	466.9899	464.7503	448.3303	421.5799	393.3062	366.3298	349.4348	356.6362	371.2160	398.1992	429.2282	452.9154 (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					5.7600	10.6334	0.6300	0.7000	0.7700			18.7183 (74)
East					9.4600	19.6403	0.6300	0.7000	0.7700			56.7819 (76)
West					11.4800	19.6403	0.6300	0.7000	0.7700			68.9066 (80)
Solar gains	144.4069	281.6451	465.7034	688.1856	855.2653	881.6783	836.8012	710.1747	544.0201	334.3311	179.8103	118.9647 (83)
Total gains	611.3968	746.3954	914.0337	1109.7655	1248.5715	1248.0081	1186.2360	1066.8109	915.2360	732.5303	609.0385	571.8801 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	54.0660	54.2069	54.3458	55.0079	55.1335	55.7261	55.7261	55.8372	55.4963	55.1335	54.8799	54.6172	
alpha	4.6044	4.6138	4.6231	4.6672	4.6756	4.7151	4.7151	4.7225	4.6998	4.6756	4.6587	4.6411	
util living area													
	0.9989	0.9970	0.9894	0.9564	0.8608	0.6899	0.5279	0.6009	0.8636	0.9834	0.9976	0.9992 (86)	
MIT	19.5109	19.6900	20.0070	20.4269	20.7651	20.9413	20.9867	20.9764	20.8251	20.3593	19.8586	19.4849 (87)	
Th 2	19.8530	19.8557	19.8582	19.8704	19.8726	19.8832	19.8832	19.8852	19.8792	19.8726	19.8680	19.8632 (88)	
util rest of house													
	0.9985	0.9959	0.9853	0.9395	0.8097	0.5926	0.4012	0.4690	0.7918	0.9744	0.9966	0.9989 (89)	
MIT 2	17.8696	18.1330	18.5958	19.2017	19.6468	19.8455	19.8786	19.8758	19.7369	19.1181	18.3885	17.8385 (90)	
Living area fraction													
									fLA = Living area / (4) =			0.1416 (91)	
MIT	18.1020	18.3534	18.7956	19.3752	19.8051	20.0007	20.0355	20.0316	19.8910	19.2939	18.5967	18.0716 (92)	
Temperature adjustment												0.0000	
adjusted MIT	18.1020	18.3534	18.7956	19.3752	19.8051	20.0007	20.0355	20.0316	19.8910	19.2939	18.5967	18.0716 (93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9975	0.9936	0.9799	0.9299	0.8062	0.6036	0.4191	0.4873	0.7928	0.9676	0.9947	0.9981 (94)	
Useful gains	609.8560	741.6324	895.6707	1031.9327	1006.5729	753.3416	497.1205	519.8386	725.5569	708.7670	605.8049	570.8200 (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													
	2079.4740	2021.6877	1842.9790	1551.2152	1197.5112	789.4519	502.1884	529.8039	850.0099	1284.4964	1706.4513	2068.8696 (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													
	1093.3957	860.1972	704.7974	373.8834	142.0581	0.0000	0.0000	0.0000	0.0000	428.3427	792.4654	1114.5489 (98)	
Space heating												5509.6887 (98)	
Space heating per m2												(98) / (4) =	46.9709 (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													5899.0243 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1093.3957	860.1972	704.7974	373.8834	142.0581	0.0000	0.0000	0.0000	0.0000	428.3427	792.4654	1114.5489	(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)	1170.6593	920.9820	754.6010	400.3034	152.0965	0.0000	0.0000	0.0000	0.0000	458.6110	848.4640	1193.3072	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	217.2519	191.4683	201.0409	180.1119	174.3801	153.5843	147.1454	164.0327	165.8442	186.8187	197.6166	212.0048	(64)
Efficiency of water heater (217)m	88.5538	88.3762	87.9450	86.8486	84.5403	80.3000	80.3000	80.3000	80.3000	87.0740	88.1861	80.3000	(216)
Fuel for water heating, kWh/month	245.3334	216.6514	228.5984	207.3862	206.2687	191.2631	183.2446	204.2748	206.5308	214.5517	224.0905	239.2327	(219)
Water heating fuel used												2567.4263	(219)
Annual totals kWh/year													
Space heating fuel - main system												5899.0243	(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)												443.4465	(232)
Total delivered energy for all uses												8984.8971	(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	5899.0243	0.2160	1274.1893 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2567.4263	0.2160	554.5641 (264)
Space and water heating			1828.7533 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	443.4465	0.5190	230.1487 (268)
Total CO2, kg/m2/year			2097.8271 (272)
Emissions per m2 for space and water heating			15.5904 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			1.9621 (272b)
Emissions per m2 for pumps and fans			0.3318 (272c)
Target Carbon Dioxide Emission Rate (TER) = (15.5904 * 1.00) + 1.9621 + 0.3318, rounded to 2 d.p.			17.8800 (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	58.6500 (1b)	x 2.3900 (2b)	= 140.1735 (1b) - (3b)
First floor	58.6500 (1c)	x 2.6800 (2c)	= 157.1820 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	117.3000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 297.3555 (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) = 0.1345 (8)
Pressure test					Yes
Measured/design AP50					4.1500
Infiltration rate					0.3420 (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) =	0.3164 (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	0.4034	0.3955	0.3876	0.3480	0.3401	0.3005	0.3005	0.2926	0.3164	0.3401	0.3559	0.3717 (22b)
Effective ac	0.5814	0.5782	0.5751	0.5606	0.5578	0.5452	0.5452	0.5428	0.5500	0.5578	0.5633	0.5691 (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)			26.7000	1.1450	30.5725		(27)
Ground Floor			58.6500	0.1200	7.0380	84.0000	4926.6000 (28a)
Brick and Block	170.2500	28.8200	141.4300	0.2400	33.9432	42.2200	5971.1746 (29a)
Pitched Roof	58.6500		58.6500	0.1000	5.8650	9.1000	533.7150 (30)
Total net area of external elements Aum(A, m ²)			287.5500				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	79.7507		(33)
GF Block			58.5300			75.0000	4389.7500 (32c)
GF Stud			29.4800			9.0000	265.3200 (32c)
FF Stud			126.9700			9.0000	1142.7300 (32c)
Internal Floor 1			58.6500			18.0000	1055.7000 (32d)
Internal Ceiling 1			58.6500			9.0000	527.8500 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 18812.8396 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 160.3823 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 5.5188 (36)
Total fabric heat loss (33) + (36) = 85.2695 (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	57.0466	56.7366	56.4328	55.0056	54.7386	53.4956	53.4956	53.2654	53.9744	54.7386	55.2788	55.8435 (38)
Heat transfer coeff	142.3161	142.0061	141.7023	140.2751	140.0081	138.7651	138.7651	138.5349	139.2438	140.0081	140.5483	141.1130 (39)
Average = Sum(39)m / 12 =												140.2738 (39)
HLP	1.2133	1.2106	1.2080	1.1959	1.1936	1.1830	1.1830	1.1810	1.1871	1.1936	1.1982	1.2030 (40)
HLP (average)												1.1959 (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												2.8522 (42)
Average daily hot water use (litres/day)												101.9409 (43)
Daily hot water use	112.1350	108.0574	103.9798	99.9021	95.8245	91.7468	91.7468	95.8245	99.9021	103.9798	108.0574	112.1350 (44)
Energy conte	166.2930	145.4409	150.0820	130.8451	125.5490	108.3393	100.3922	115.2016	116.5774	135.8598	148.3016	161.0459 (45)
Energy content (annual)										Total = Sum(45)m =		1603.9278 (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	35.3373	30.9062	31.8924	27.8046	26.6792	23.0221	21.3334	24.4803	24.7727	28.8702	31.5141	34.2223 (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	142.6125	142.6125	142.6125	142.6125	142.6125	142.6125	142.6125	142.6125	142.6125	142.6125	142.6125	142.6125	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.1098	22.3023	18.1374	13.7312	10.2642	8.6655	9.3634	12.1709	16.3357	20.7420	24.2089	25.8077	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	281.6553	284.5780	277.2129	261.5335	241.7410	223.1388	210.7114	207.7887	215.1539	230.8333	250.6258	269.2279	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.2612	37.2612	37.2612	37.2612	37.2612	37.2612	37.2612	37.2612	37.2612	37.2612	37.2612	37.2612	(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)	-114.0900	-114.0900	-114.0900	-114.0900	-114.0900	-114.0900	-114.0900	-114.0900	-114.0900	-114.0900	-114.0900	-114.0900	(71)
Water heating gains (Table 5)	47.4963	45.9914	42.8662	38.6175	35.8591	31.9751	28.6739	32.9037	34.4065	38.8040	43.7696	45.9977	(72)
Total internal gains	420.0452	418.6554	404.0003	379.6659	353.6480	329.5632	314.5324	318.6470	331.6799	356.1630	384.3880	406.8170	(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					5.7600	10.6334	0.6300		0.7000			0.7700			18.7183 (74)
East					9.4600	19.6403	0.6300		0.7000			0.7700			56.7819 (76)
West					11.4800	19.6403	0.6300		0.7000			0.7700			68.9066 (80)

Solar gains	144.4069	281.6451	465.7034	688.1856	855.2653	881.6783	836.8012	710.1747	544.0201	334.3311	179.8103	118.9647			(83)
Total gains	564.4520	700.3005	869.7036	1067.8515	1208.9133	1211.2415	1151.3336	1028.8217	875.6999	690.4941	564.1983	525.7817			(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	36.7196	36.7997	36.8787	37.2539	37.3249	37.6593	37.6593	37.7218	37.5298	37.3249	37.1815	37.0327	
alpha	3.4480	3.4533	3.4586	3.4836	3.4883	3.5106	3.5106	3.5148	3.5020	3.4883	3.4788	3.4688	
util living area	0.9946	0.9883	0.9699	0.9156	0.8051	0.6459	0.5018	0.5699	0.8125	0.9596	0.9905	0.9958	(86)
MIT	19.0040	19.2459	19.6664	20.2053	20.6367	20.8828	20.9636	20.9436	20.7241	20.1232	19.4605	18.9637	(87)
Th 2	19.9094	19.9115	19.9136	19.9233	19.9251	19.9336	19.9336	19.9352	19.9304	19.9251	19.9214	19.9176	(88)
util rest of house	0.9934	0.9855	0.9625	0.8948	0.7580	0.5638	0.3918	0.4570	0.7475	0.9458	0.9878	0.9948	(89)
MIT 2	18.0833	18.3253	18.7425	19.2708	19.6651	19.8702	19.9209	19.9135	19.7563	19.2041	18.5476	18.0491	(90)
Living area fraction									fLA = Living area / (4) =			0.1416	(91)
MIT	18.2136	18.4557	18.8734	19.4032	19.8027	20.0136	20.0686	20.0594	19.8934	19.3343	18.6769	18.1786	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.2136	18.4557	18.8734	19.4032	19.8027	20.0136	20.0686	20.0594	19.8934	19.3343	18.6769	18.1786	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9905	0.9804	0.9534	0.8826	0.7519	0.5704	0.4064	0.4711	0.7449	0.9358	0.9835	0.9925	(94)
Ext temp.	559.1044	686.5850	829.1380	942.4747	908.9485	690.8880	467.9470	484.6660	652.3305	646.1457	554.8630	521.8420	(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	1980.1337	1924.9917	1753.3325	1473.3330	1134.4455	751.2117	481.3188	506.9499	806.6919	1222.8656	1627.1119	1972.5656	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating per m2	1057.2457	832.2093	687.6007	382.2180	167.7698	0.0000	0.0000	0.0000	0.0000	429.0796	772.0192	1079.3383	(98)
												5407.4807	(98)
												46.0996	(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	1304.3915	1026.8614	1052.8649	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8357	0.8910	0.8561	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	1090.0380	914.9604	901.3397	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1529.2258	1456.6670	1315.5483	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	316.2152	403.0297	308.1712	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												1027.4161 (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	79.0538	100.7574	77.0428	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												256.8540 (107)
Space cooling per m2												2.1897 (108)
Energy for space heating												46.0996 (99)
Energy for space cooling												2.1897 (108)
Total												48.2893 (109)
Dwelling Fabric Energy Efficiency (DFEE)												48.3 (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	58.6500 (1b)	x 2.3900 (2b)	= 140.1735 (1b) - (3b)
First floor	58.6500 (1c)	x 2.6800 (2c)	= 157.1820 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	117.3000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 297.3555 (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) =	0.1345 (8)	
Pressure test															Yes		
Measured/design AP50															5.0000		
Infiltration rate															0.3845 (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) =	0.3557 (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	0.4535	0.4446	0.4357	0.3912	0.3824	0.3379	0.3379	0.3290	0.3557	0.3824	0.4001	0.4179 (22b)					
Effective ac	0.6028	0.5988	0.5949	0.5765	0.5731	0.5571	0.5571	0.5541	0.5633	0.5731	0.5801	0.5873 (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)			26.7000	1.3258	35.3977		(27)					
Ground Floor			58.6500	0.1300	7.6245		(28a)					
Brick and Block	170.2500	28.8200	141.4300	0.1800	25.4574		(29a)					
Pitched Roof	58.6500		58.6500	0.1300	7.6245		(30)					
Total net area of external elements Aum(A, m2)			287.5500				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26) ... (30) + (32) =		78.2241		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							13.2867 (36)					
Total fabric heat loss						(33) + (36) =	91.5108 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 59.1539	Feb 58.7620	Mar 58.3780	Apr 56.5741	May 56.2366	Jun 54.6654	Jul 54.6654	Aug 54.3745	Sep 55.2706	Oct 56.2366	Nov 56.9193	Dec 57.6331 (38)
Heat transfer coeff	150.6647	150.2729	149.8888	148.0849	147.7474	146.1763	146.1763	145.8853	146.7814	147.7474	148.4302	149.1440 (39)
Average = Sum(39)m / 12 =												148.0833 (39)
HLP	Jan 1.2844	Feb 1.2811	Mar 1.2778	Apr 1.2624	May 1.2596	Jun 1.2462	Jul 1.2462	Aug 1.2437	Sep 1.2513	Oct 1.2596	Nov 1.2654	Dec 1.2715 (40)
HLP (average)												1.2624 (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												2.8522 (42)
Average daily hot water use (litres/day)												101.9409 (43)
Daily hot water use	Jan 112.1350	Feb 108.0574	Mar 103.9798	Apr 99.9021	May 95.8245	Jun 91.7468	Jul 91.7468	Aug 95.8245	Sep 99.9021	Oct 103.9798	Nov 108.0574	Dec 112.1350 (44)
Energy conte	166.2930	145.4409	150.0820	130.8451	125.5490	108.3393	100.3922	115.2016	116.5774	135.8598	148.3016	161.0459 (45)
Energy content (annual)										Total = Sum(45)m =		1603.9278 (45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												

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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)
	35.3373	30.9062	31.8924	27.8046	26.6792	23.0221	21.3334	24.4803	24.7727	28.8702	31.5141	34.2223	(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	142.6125	142.6125	142.6125	142.6125	142.6125	142.6125	142.6125	142.6125	142.6125	142.6125	142.6125	142.6125	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.1098	22.3023	18.1374	13.7312	10.2642	8.6655	9.3634	12.1709	16.3357	20.7420	24.2089	25.8077	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	281.6553	284.5780	277.2129	261.5335	241.7410	223.1388	210.7114	207.7887	215.1539	230.8333	250.6258	269.2279	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.2612	37.2612	37.2612	37.2612	37.2612	37.2612	37.2612	37.2612	37.2612	37.2612	37.2612	37.2612	(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)	-114.0900	-114.0900	-114.0900	-114.0900	-114.0900	-114.0900	-114.0900	-114.0900	-114.0900	-114.0900	-114.0900	-114.0900	(71)
Water heating gains (Table 5)	47.4963	45.9914	42.8662	38.6175	35.8591	31.9751	28.6739	32.9037	34.4065	38.8040	43.7696	45.9977	(72)
Total internal gains	420.0452	418.6554	404.0003	379.6659	353.6480	329.5632	314.5324	318.6470	331.6799	356.1630	384.3880	406.8170	(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				5.7600	10.6334	0.6300	0.7000		0.7700			18.7183	(74)
East				9.4600	19.6403	0.6300	0.7000		0.7700			56.7819	(76)
West				11.4800	19.6403	0.6300	0.7000		0.7700			68.9066	(80)

Solar gains	144.4069	281.6451	465.7034	688.1856	855.2653	881.6783	836.8012	710.1747	544.0201	334.3311	179.8103	118.9647	(83)
Total gains	564.4520	700.3005	869.7036	1067.8515	1208.9133	1211.2415	1151.3336	1028.8217	875.6999	690.4941	564.1983	525.7817	(84)

7. Mean internal temperature (heating season)													

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil/m (see Table 9a)													
tau	54.0660	54.2069	54.3458	55.0079	55.1335	55.7261	55.7261	55.8372	55.4963	55.1335	54.8799	54.6172	
alpha	4.6044	4.6138	4.6231	4.6672	4.6756	4.7151	4.7151	4.7225	4.6998	4.6756	4.6587	4.6411	
util living area	0.9992	0.9977	0.9913	0.9619	0.8721	0.7049	0.5422	0.6193	0.8787	0.9868	0.9983	0.9994	(86)
MIT	19.4744	19.6544	19.9740	20.4001	20.7490	20.9357	20.9851	20.9733	20.8087	20.3287	19.8238	19.4489	(87)
Th 2	19.8530	19.8557	19.8582	19.8704	19.8726	19.8832	19.8832	19.8852	19.8792	19.8726	19.8680	19.8632	(88)
util rest of house	0.9989	0.9968	0.9879	0.9467	0.8233	0.6076	0.4129	0.4851	0.8112	0.9794	0.9975	0.9992	(89)
MIT 2	18.4624	18.6441	18.9639	19.3889	19.7061	19.8547	19.8797	19.8778	19.7707	19.3281	18.8232	18.4449	(90)
Living area fraction									fLA = Living area / (4) =			0.1416	(91)
MIT	18.6057	18.7872	19.1069	19.5321	19.8538	20.0078	20.0362	20.0329	19.9177	19.4698	18.9649	18.5871	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6057	18.7872	19.1069	19.5321	19.8538	20.0078	20.0362	20.0329	19.9177	19.4698	18.9649	18.5871	(93)

8. Space heating requirement													

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9985	0.9957	0.9849	0.9409	0.8224	0.6194	0.4313	0.5040	0.8140	0.9757	0.9966	0.9989	(94)
Ext temp.	563.5796	697.2752	856.5475	1004.7482	994.1678	750.2634	496.5720	518.5276	712.8355	673.7205	562.2869	525.2006	(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	2155.3618	2086.8656	1889.6356	1574.4566	1204.6994	790.4858	502.2900	529.9917	853.9326	1310.4859	1761.1128	2145.7446	(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	1184.2859	933.8047	768.6176	410.1901	156.6355	0.0000	0.0000	0.0000	0.0000	473.7534	863.1547	1205.6847	(98)
Space heating												5996.1267	(98)
Space heating per m2										(98) / (4) =		51.1179	(99)

8c. Space cooling requirement													

Calculated for June, July and August. See Table 10b													
Ext. temp.	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	1374.0569	1081.7044	1108.7284	0.0000	0.0000	0.0000	0.0000	(100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.8661	0.9226	0.8877	0.0000	0.0000	0.0000	0.0000	(101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1190.0231	997.9844	984.2271	0.0000	0.0000	0.0000	0.0000	(102)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1529.2258	1456.6670	1315.5483	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	244.2259	341.2599	246.5030	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												831.9888	(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	61.0565	85.3150	61.6257	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												207.9972 (107)
Space cooling per m2												1.7732 (108)
Energy for space heating												51.1179 (99)
Energy for space cooling												1.7732 (108)
Total												52.8911 (109)
Target Fabric Energy Efficiency (TFEE)												60.8 (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	58.6500 (1b)	x 2.3900 (2b)	= 140.1735 (1b) - (3b)
First floor	58.6500 (1c)	x 2.6800 (2c)	= 157.1820 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	117.3000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 297.3555 (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) =	0.1345 (8)			
Pressure test																	Yes				
Measured/design AP50																		4.1500			
Infiltration rate																		0.3420 (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) =	0.3164 (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										0.3717	0.3480	0.3480	0.3164	0.3243	0.3085	0.3085	0.3005	0.3005	0.3243	0.3164	0.3243 (22b)
Effective ac										0.5691	0.5606	0.5606	0.5500	0.5526	0.5476	0.5476	0.5452	0.5452	0.5526	0.5500	0.5526 (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)			26.7000	1.1450	30.5725			(27)					
Ground Floor			58.6500	0.1200	7.0380	84.0000	4926.6000	(28a)					
Brick and Block	170.2500	28.8200	141.4300	0.2400	33.9432	42.2200	5971.1746	(29a)					
Pitched Roof	58.6500		58.6500	0.1000	5.8650	9.1000	533.7150	(30)					
Total net area of external elements Aum(A, m2)			287.5500					(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	79.7507			(33)					
GF Block			58.5300			75.0000	4389.7500	(32c)					
GF Stud			29.4800			9.0000	265.3200	(32c)					
FF Stud			126.9700			9.0000	1142.7300	(32c)					
Internal Floor 1			58.6500			18.0000	1055.7000	(32d)					
Internal Ceiling 1			58.6500			18.0000	1055.7000	(32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	19340.6896	(34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							164.8823	(35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.5188	(36)					
Total fabric heat loss						(33) + (36) =	85.2695	(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 55.8435	Feb 55.0056	Mar 55.0056	Apr 53.9744	May 54.2230	Jun 53.7319	Jul 53.7319	Aug 53.4956	Sep 53.4956	Oct 54.2230	Nov 53.9744	Dec 54.2230	(38)
Heat transfer coeff	141.1130	140.2751	140.2751	139.2438	139.4924	139.0014	139.0014	138.7651	138.7651	139.4924	139.2438	139.4924	(39)
Average = Sum(39)m / 12 =												139.5134	(39)
HLP	Jan 1.2030	Feb 1.1959	Mar 1.1959	Apr 1.1871	May 1.1892	Jun 1.1850	Jul 1.1850	Aug 1.1830	Sep 1.1830	Oct 1.1892	Nov 1.1871	Dec 1.1892	(40)
HLP (average)												1.1894	(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												2.8522 (42)
Average daily hot water use (litres/day)												101.9409 (43)
Daily hot water use	Jan 112.1350	Feb 108.0574	Mar 103.9798	Apr 99.9021	May 95.8245	Jun 91.7468	Jul 91.7468	Aug 95.8245	Sep 99.9021	Oct 103.9798	Nov 108.0574	Dec 112.1350 (44)
Energy conte	166.2930	145.4409	150.0820	130.8451	125.5490	108.3393	100.3922	115.2016	116.5774	135.8598	148.3016	161.0459 (45)
Energy content (annual)										Total = Sum(45)m =		1603.9278 (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	24.9440	21.8161	22.5123	19.6268	18.8324	16.2509	15.0588	17.2802	17.4866	20.3790	22.2452	24.1569 (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	27.5658	24.8965	27.5524	26.6444	27.5075	26.5912	27.4595	27.4906	26.6202	27.5288	26.6627	27.5575 (61)
Total heat required for water heating calculated for each month	193.8588	170.3375	177.6344	157.4895	153.0565	134.9304	127.8518	142.6922	143.1976	163.3885	174.9642	188.6034 (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	193.8588	170.3375	177.6344	157.4895	153.0565	134.9304	127.8518	142.6922	143.1976	163.3885	174.9642	188.6034 (64)
RHI water heating demand												1928 (64)
Heat gains from water heating, kWh/month	62.1839	54.5832	56.7904	50.1671	48.6219	42.6706	40.2453	45.1772	45.4170	52.0556	55.9759	60.4371 (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	171.1350	171.1350	171.1350	171.1350	171.1350	171.1350	171.1350	171.1350	171.1350	171.1350	171.1350	171.1350	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	62.7744	55.7557	45.3436	34.3280	25.6606	21.6638	23.4084	30.4272	40.8393	51.8549	60.5223	64.5191	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	420.3811	424.7433	413.7506	390.3485	360.8074	333.0430	314.4947	310.1324	321.1252	344.5273	374.0684	401.8328	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.9657	54.9657	54.9657	54.9657	54.9657	54.9657	54.9657	54.9657	54.9657	54.9657	54.9657	54.9657	(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)	-114.0900	-114.0900	-114.0900	-114.0900	-114.0900	-114.0900	-114.0900	-114.0900	-114.0900	-114.0900	-114.0900	-114.0900	(71)
Water heating gains (Table 5)	83.5805	81.2251	76.3311	69.6765	65.3520	59.2647	54.0931	60.7220	63.0792	69.9672	77.7444	81.2327	(72)
Total internal gains	681.7467	676.7348	650.4361	609.3637	566.8308	528.9822	507.0070	516.2924	540.0544	581.3601	627.3457	662.5953	(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					5.7600	13.4684	0.6300	0.7000			0.7700			23.7089 (74)
East					9.4600	25.1733	0.6300	0.7000			0.7700			72.7784 (76)
West					11.4800	25.1733	0.6300	0.7000			0.7700			88.3188 (80)
Solar gains	184.8060	307.1108	516.4537	763.3420	889.5085	1012.9778	924.3814	820.9785	630.7583	393.3655	229.4677	144.0415 (83)		
Total gains	866.5528	983.8456	1166.8898	1372.7057	1456.3393	1541.9601	1431.3885	1337.2709	1170.8127	974.7256	856.8134	806.6368 (84)		

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	38.0717	38.2991	38.2991	38.5828	38.5140	38.6501	38.6501	38.7159	38.7159	38.5140	38.5828	38.5140	
alpha	3.5381	3.5533	3.5533	3.5722	3.5676	3.5767	3.5767	3.5811	3.5811	3.5676	3.5722	3.5676	
util living area	0.9764	0.9631	0.9213	0.8187	0.6621	0.4439	0.3167	0.3277	0.6030	0.8645	0.9570	0.9804	(86)
MIT	19.5652	19.7473	20.1285	20.5724	20.8506	20.9734	20.9942	20.9937	20.9228	20.5672	20.0159	19.5426	(87)
Th 2	19.9176	19.9233	19.9233	19.9304	19.9287	19.9320	19.9320	19.9336	19.9336	19.9287	19.9304	19.9287	(88)
util rest of house	0.9708	0.9546	0.9034	0.7802	0.5960	0.3572	0.2160	0.2206	0.5088	0.8231	0.9450	0.9757	(89)
MIT 2	18.6427	18.8251	19.1928	19.6070	19.8368	19.9215	19.9309	19.9325	19.8973	19.6143	19.0967	18.6292	(90)
Living area fraction	18.7733	18.9557	19.3253	19.7437	19.9804	20.0705	20.0815	20.0828	20.0425	19.7493	19.2269	18.7585	(91)
MIT	18.7733	18.9557	19.3253	19.7437	19.9804	20.0705	20.0815	20.0828	20.0425	19.7493	19.2269	18.7585	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7733	18.9557	19.3253	19.7437	19.9804	20.0705	20.0815	20.0828	20.0425	19.7493	19.2269	18.7585	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	834.4709	929.5441	1040.2280	1060.5671	872.9054	568.6423	329.6722	315.3756	607.7457	794.3519	801.0003	781.4475	(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	1858.9229	1817.3594	1644.7695	1342.8307	959.7623	579.7028	331.0267	316.7690	644.2203	1067.0170	1479.7278	1821.5662	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	762.1923	596.6119	449.7789	203.2298	64.6215	0.0000	0.0000	0.0000	0.0000	202.8629	488.6838	773.8483	(98)
Space heating												3541.8293	(98)
RHI space heating demand												3542	(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	58.6500 (1b)	x 2.3900 (2b)	= 140.1735 (1b) - (3b)
First floor	58.6500 (1c)	x 2.6800 (2c)	= 157.1820 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	117.3000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 297.3555 (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) =							0.1345 (8)
Pressure test										Yes							
Measured/design AP50																	4.1500
Infiltration rate																	0.3420 (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) =							0.3164 (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	0.4034	0.3955	0.3876	0.3480	0.3401	0.3005	0.3005	0.2926	0.3164	0.3401	0.3559	0.3717	(22b)				
Effective ac	0.5814	0.5782	0.5751	0.5606	0.5578	0.5452	0.5452	0.5428	0.5500	0.5578	0.5633	0.5691	(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)			26.7000	1.1450	30.5725			(27)					
Ground Floor			58.6500	0.1200	7.0380	84.0000	4926.6000	(28a)					
Brick and Block	170.2500	28.8200	141.4300	0.2400	33.9432	42.2200	5971.1746	(29a)					
Pitched Roof	58.6500		58.6500	0.1000	5.8650	9.1000	533.7150	(30)					
Total net area of external elements Aum(A, m2)			287.5500					(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	79.7507			(33)					
GF Block			58.5300			75.0000	4389.7500	(32c)					
GF Stud			29.4800			9.0000	265.3200	(32c)					
FF Stud			126.9700			9.0000	1142.7300	(32c)					
Internal Floor 1			58.6500			18.0000	1055.7000	(32d)					
Internal Ceiling 1			58.6500			18.0000	1055.7000	(32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	19340.6896	(34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							164.8823	(35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.5188	(36)					
Total fabric heat loss						(33) + (36) =	85.2695	(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 57.0466	Feb 56.7366	Mar 56.4328	Apr 55.0056	May 54.7386	Jun 53.4956	Jul 53.4956	Aug 53.2654	Sep 53.9744	Oct 54.7386	Nov 55.2788	Dec 55.8435	(38)
Heat transfer coeff	142.3161	142.0061	141.7023	140.2751	140.0081	138.7651	138.7651	138.5349	139.2438	140.0081	140.5483	141.1130	(39)
Average = Sum(39)m / 12 =												140.2738	(39)
HLP	Jan 1.2133	Feb 1.2106	Mar 1.2080	Apr 1.1959	May 1.1936	Jun 1.1830	Jul 1.1830	Aug 1.1810	Sep 1.1871	Oct 1.1936	Nov 1.1982	Dec 1.2030	(40)
HLP (average)												1.1959	(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												2.8522 (42)
Average daily hot water use (litres/day)												101.9409 (43)
Daily hot water use	Jan 112.1350	Feb 108.0574	Mar 103.9798	Apr 99.9021	May 95.8245	Jun 91.7468	Jul 91.7468	Aug 95.8245	Sep 99.9021	Oct 103.9798	Nov 108.0574	Dec 112.1350 (44)
Energy conte	166.2930	145.4409	150.0820	130.8451	125.5490	108.3393	100.3922	115.2016	116.5774	135.8598	148.3016	161.0459 (45)
Energy content (annual)										Total = Sum(45)m =		1603.9278 (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	24.9440	21.8161	22.5123	19.6268	18.8324	16.2509	15.0588	17.2802	17.4866	20.3790	22.2452	24.1569 (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	27.5658	24.8965	27.5524	26.6444	27.5075	26.5912	27.4595	27.4906	26.6202	27.5288	26.6627	27.5575 (61)
Total heat required for water heating calculated for each month	193.8588	170.3375	177.6344	157.4895	153.0565	134.9304	127.8518	142.6922	143.1976	163.3885	174.9642	188.6034 (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	193.8588	170.3375	177.6344	157.4895	153.0565	134.9304	127.8518	142.6922	143.1976	163.3885	174.9642	188.6034 (64)
Heat gains from water heating, kWh/month	62.1839	54.5832	56.7904	50.1671	48.6219	42.6706	40.2453	45.1772	45.4170	52.0556	55.9759	60.4371 (65)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)												
Total per year (kWh/year) = Sum(64)m = 1928.0048 (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	171.1350	171.1350	171.1350	171.1350	171.1350	171.1350	171.1350	171.1350	171.1350	171.1350	171.1350	171.1350 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	62.7744	55.7557	45.3436	34.3280	25.6606	21.6638	23.4084	30.4272	40.8393	51.8549	60.5223	64.5191 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	420.3811	424.7433	413.7506	390.3485	360.8074	333.0430	314.4947	310.1324	321.1252	344.5273	374.0684	401.8328 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.9657	54.9657	54.9657	54.9657	54.9657	54.9657	54.9657	54.9657	54.9657	54.9657	54.9657	54.9657 (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)	-114.0900	-114.0900	-114.0900	-114.0900	-114.0900	-114.0900	-114.0900	-114.0900	-114.0900	-114.0900	-114.0900	-114.0900 (71)
Water heating gains (Table 5)	83.5805	81.2251	76.3311	69.6765	65.3520	59.2647	54.0931	60.7220	63.0792	69.9672	77.7444	81.2327 (72)
Total internal gains	681.7467	676.7348	650.4361	609.3637	566.8308	528.9822	507.0070	516.2924	540.0544	581.3601	627.3457	662.5953 (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				5.7600	10.6334		0.6300	0.7000		0.7700	18.7183 (74)	
East				9.4600	19.6403		0.6300	0.7000		0.7700	56.7819 (76)	
West				11.4800	19.6403		0.6300	0.7000		0.7700	68.9066 (80)	
Solar gains	144.4069	281.6451	465.7034	688.1856	855.2653	881.6783	836.8012	710.1747	544.0201	334.3311	179.8103	118.9647 (83)
Total gains	826.1536	958.3800	1116.1395	1297.5493	1422.0961	1410.6606	1343.8082	1226.4670	1084.0745	915.6912	807.1560	781.5600 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	37.7499	37.8323	37.9134	38.2991	38.3722	38.7159	38.7159	38.7802	38.5828	38.3722	38.2247	38.0717
alpha	3.5167	3.5222	3.5276	3.5533	3.5581	3.5811	3.5811	3.5853	3.5722	3.5581	3.5483	3.5381
util living area	0.9840	0.9723	0.9434	0.8715	0.7450	0.5790	0.4392	0.4945	0.7319	0.9190	0.9740	0.9867 (86)
MIT	19.3135	19.5382	19.9182	20.3863	20.7371	20.9225	20.9779	20.9665	20.8184	20.3339	19.7363	19.2705 (87)
Th 2	19.9094	19.9115	19.9136	19.9233	19.9251	19.9336	19.9336	19.9352	19.9304	19.9251	19.9214	19.9176 (88)
util rest of house	0.9804	0.9661	0.9307	0.8432	0.6921	0.4985	0.3392	0.3903	0.6576	0.8945	0.9672	0.9837 (89)
MIT 2	18.3871	18.6102	18.9827	19.4335	19.7437	19.8936	19.9263	19.9231	19.8230	19.3979	18.8158	18.3507 (90)
Living area fraction									fLA = Living area / (4) =			0.1416 (91)
MIT	18.5183	18.7416	19.1152	19.5684	19.8844	20.0393	20.0752	20.0709	19.9639	19.5305	18.9462	18.4810 (92)
Temperature adjustment												0.0000
adjusted MIT	18.5183	18.7416	19.1152	19.5684	19.8844	20.0393	20.0752	20.0709	19.9639	19.5305	18.9462	18.4810 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	804.8369	917.6782	1025.8372	1080.0358	981.0874	715.1478	474.2928	495.6405	715.7145	808.9921	774.0716	764.5647 (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	2023.4873	1965.5948	1787.6008	1496.5111	1145.8821	754.7837	482.2430	508.5441	816.5133	1250.3376	1664.9582	2015.2327 (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	906.6759	704.1999	566.7521	299.8622	122.6073	0.0000	0.0000	0.0000	0.0000	328.3611	641.4384	930.4970 (98)
Space heating												4500.3939 (98)
Space heating per m2												(98) / (4) = 38.3665 (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 %)													90.7000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													4961.8456 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	906.6759	704.1999	566.7521	299.8622	122.6073	0.0000	0.0000	0.0000	0.0000	328.3611	641.4384	930.4970	(98)
Space heating efficiency (main heating system 1)	90.7000	90.7000	90.7000	90.7000	90.7000	0.0000	0.0000	0.0000	0.0000	90.7000	90.7000	90.7000	(210)
Space heating fuel (main heating system)	999.6427	776.4057	624.8645	330.6088	135.1789	0.0000	0.0000	0.0000	0.0000	362.0299	707.2088	1025.9063	(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	193.8588	170.3375	177.6344	157.4895	153.0565	134.9304	127.8518	142.6922	143.1976	163.3885	174.9642	188.6034	(64)
Efficiency of water heater (217)m	90.1939	90.1407	90.0157	89.7159	89.1237	87.9000	87.9000	87.9000	87.9000	89.7501	90.0850	87.9000	(216)
Fuel for water heating, kWh/month	214.9356	188.9684	197.3370	175.5425	171.7348	153.5045	145.4514	162.3347	162.9097	182.0483	194.2212	209.0583	(219)
Water heating fuel used												2158.0464	(219)
Annual totals kWh/year													
Space heating fuel - main system												4961.8456	(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)												443.4465	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.97 * 1068 * 1.00) =										-828.8227		-828.8227	(233)
Total delivered energy for all uses												6809.5158	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	4961.8456	3.4800	172.6722 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2158.0464	3.4800	75.1000 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	443.4465	13.1900	58.4906 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-828.8227	13.1900	-109.3217 (252)
Total energy cost			326.8336 (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] =	0.8458 (257)
SAP value		88.2014
SAP rating (Section 12)		88 (258)
SAP band		B

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	4961.8456	0.2160	1071.7586 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2158.0464	0.2160	466.1380 (264)
Space and water heating			1537.8967 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	443.4465	0.5190	230.1487 (268)
Energy saving/generation technologies			
PV Unit	-828.8227	0.5190	-430.1590 (269)
Total kg/year			1376.8114 (272)
CO2 emissions per m2			11.7400 (273)
EI value			88.6326
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	$3.48 \times (1 + 0.29 \times 0.00) / 0.9070 = 3.837$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9070 = 0.2381$, stars = 4
Water heating energy efficiency	$3.48 / 0.8924 = 3.900$, stars = 4
Water heating environmental impact	$0.216 / 0.8924 = 0.2421$, 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	58.6500 (1b)	x 2.3900 (2b)	= 140.1735 (1b) - (3b)
First floor	58.6500 (1c)	x 2.6800 (2c)	= 157.1820 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	117.3000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 297.3555 (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) =	0.1345 (8)			
Pressure test																	Yes				
Measured/design AP50																		4.1500			
Infiltration rate																		0.3420 (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) =	0.3164 (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										0.3717	0.3480	0.3480	0.3164	0.3243	0.3085	0.3085	0.3005	0.3005	0.3243	0.3164	0.3243 (22b)
Effective ac										0.5691	0.5606	0.5606	0.5500	0.5526	0.5476	0.5476	0.5452	0.5452	0.5526	0.5500	0.5526 (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)			26.7000	1.1450	30.5725			(27)					
Ground Floor			58.6500	0.1200	7.0380	84.0000	4926.6000	(28a)					
Brick and Block	170.2500	28.8200	141.4300	0.2400	33.9432	42.2200	5971.1746	(29a)					
Pitched Roof	58.6500		58.6500	0.1000	5.8650	9.1000	533.7150	(30)					
Total net area of external elements Aum(A, m2)			287.5500					(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	79.7507			(33)					
GF Block			58.5300			75.0000	4389.7500	(32c)					
GF Stud			29.4800			9.0000	265.3200	(32c)					
FF Stud			126.9700			9.0000	1142.7300	(32c)					
Internal Floor 1			58.6500			18.0000	1055.7000	(32d)					
Internal Ceiling 1			58.6500			18.0000	1055.7000	(32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	19340.6896	(34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							164.8823	(35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.5188	(36)					
Total fabric heat loss						(33) + (36) =	85.2695	(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 55.8435	Feb 55.0056	Mar 55.0056	Apr 53.9744	May 54.2230	Jun 53.7319	Jul 53.7319	Aug 53.4956	Sep 53.4956	Oct 54.2230	Nov 53.9744	Dec 54.2230	(38)
Heat transfer coeff	141.1130	140.2751	140.2751	139.2438	139.4924	139.0014	139.0014	138.7651	138.7651	139.4924	139.2438	139.4924	(39)
Average = Sum(39)m / 12 =												139.5134	(39)
HLP	Jan 1.2030	Feb 1.1959	Mar 1.1959	Apr 1.1871	May 1.1892	Jun 1.1850	Jul 1.1850	Aug 1.1830	Sep 1.1830	Oct 1.1892	Nov 1.1871	Dec 1.1892	(40)
HLP (average)												1.1894	(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												2.8522 (42)
Average daily hot water use (litres/day)												101.9409 (43)
Daily hot water use	Jan 112.1350	Feb 108.0574	Mar 103.9798	Apr 99.9021	May 95.8245	Jun 91.7468	Jul 91.7468	Aug 95.8245	Sep 99.9021	Oct 103.9798	Nov 108.0574	Dec 112.1350 (44)
Energy conte	166.2930	145.4409	150.0820	130.8451	125.5490	108.3393	100.3922	115.2016	116.5774	135.8598	148.3016	161.0459 (45)
Energy content (annual)										Total = Sum(45)m =		1603.9278 (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	24.9440	21.8161	22.5123	19.6268	18.8324	16.2509	15.0588	17.2802	17.4866	20.3790	22.2452	24.1569 (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	27.5658	24.8965	27.5524	26.6444	27.5075	26.5912	27.4595	27.4906	26.6202	27.5288	26.6627	27.5575 (61)
Total heat required for water heating calculated for each month	193.8588	170.3375	177.6344	157.4895	153.0565	134.9304	127.8518	142.6922	143.1976	163.3885	174.9642	188.6034 (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	193.8588	170.3375	177.6344	157.4895	153.0565	134.9304	127.8518	142.6922	143.1976	163.3885	174.9642	188.6034 (64)
Heat gains from water heating, kWh/month	62.1839	54.5832	56.7904	50.1671	48.6219	42.6706	40.2453	45.1772	45.4170	52.0556	55.9759	60.4371 (65)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)												
Total per year (kWh/year) = Sum(64)m = 1928.0048 (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	171.1350	171.1350	171.1350	171.1350	171.1350	171.1350	171.1350	171.1350	171.1350	171.1350	171.1350	171.1350	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	62.7744	55.7557	45.3436	34.3280	25.6606	21.6638	23.4084	30.4272	40.8393	51.8549	60.5223	64.5191	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	420.3811	424.7433	413.7506	390.3485	360.8074	333.0430	314.4947	310.1324	321.1252	344.5273	374.0684	401.8328	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.9657	54.9657	54.9657	54.9657	54.9657	54.9657	54.9657	54.9657	54.9657	54.9657	54.9657	54.9657	(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)	-114.0900	-114.0900	-114.0900	-114.0900	-114.0900	-114.0900	-114.0900	-114.0900	-114.0900	-114.0900	-114.0900	-114.0900	(71)
Water heating gains (Table 5)	83.5805	81.2251	76.3311	69.6765	65.3520	59.2647	54.0931	60.7220	63.0792	69.9672	77.7444	81.2327	(72)
Total internal gains	681.7467	676.7348	650.4361	609.3637	566.8308	528.9822	507.0070	516.2924	540.0544	581.3601	627.3457	662.5953	(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				5.7600	13.4684		0.6300	0.7000		0.7700		23.7089 (74)	
East				9.4600	25.1733		0.6300	0.7000		0.7700		72.7784 (76)	
West				11.4800	25.1733		0.6300	0.7000		0.7700		88.3188 (80)	
Solar gains	184.8060	307.1108	516.4537	763.3420	889.5085	1012.9778	924.3814	820.9785	630.7583	393.3655	229.4677	144.0415	(83)
Total gains	866.5528	983.8456	1166.8898	1372.7057	1456.3393	1541.9601	1431.3885	1337.2709	1170.8127	974.7256	856.8134	806.6368	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	38.0717	38.2991	38.2991	38.5828	38.5140	38.6501	38.6501	38.7159	38.7159	38.5140	38.5828	38.5140	
alpha	3.5381	3.5533	3.5533	3.5722	3.5676	3.5767	3.5767	3.5811	3.5811	3.5676	3.5722	3.5676	
util living area	0.9764	0.9631	0.9213	0.8187	0.6621	0.4439	0.3167	0.3277	0.6030	0.8645	0.9570	0.9804	(86)
MIT	19.5652	19.7473	20.1285	20.5724	20.8506	20.9734	20.9942	20.9937	20.9228	20.5672	20.0159	19.5426	(87)
Th 2	19.9176	19.9233	19.9233	19.9304	19.9287	19.9320	19.9320	19.9336	19.9336	19.9287	19.9304	19.9287	(88)
util rest of house	0.9708	0.9546	0.9034	0.7802	0.5960	0.3572	0.2160	0.2206	0.5088	0.8231	0.9450	0.9757	(89)
MIT 2	18.6427	18.8251	19.1928	19.6070	19.8368	19.9215	19.9309	19.9325	19.8973	19.6143	19.0967	18.6292	(90)
Living area fraction	18.7733	18.9557	19.3253	19.7437	19.9804	20.0705	20.0815	20.0828	20.0425	19.7493	19.2269	18.7585	(91)
MIT	18.7733	18.9557	19.3253	19.7437	19.9804	20.0705	20.0815	20.0828	20.0425	19.7493	19.2269	18.7585	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7733	18.9557	19.3253	19.7437	19.9804	20.0705	20.0815	20.0828	20.0425	19.7493	19.2269	18.7585	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	834.4709	929.5441	1040.2280	1060.5671	872.9054	568.6423	329.6722	315.3756	607.7457	794.3519	801.0003	781.4475	(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	1858.9229	1817.3594	1644.7695	1342.8307	959.7623	579.7028	331.0267	316.7690	644.2203	1067.0170	1479.7278	1821.5662	(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	762.1923	596.6119	449.7789	203.2298	64.6215	0.0000	0.0000	0.0000	0.0000	202.8629	488.6838	773.8483	(98)
Space heating												3541.8293	(98)
Space heating per m2												30.1946	(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 %)													90.7000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3904.9938 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	762.1923	596.6119	449.7789	203.2298	64.6215	0.0000	0.0000	0.0000	0.0000	202.8629	488.6838	773.8483	(98)
Space heating efficiency (main heating system 1)	90.7000	90.7000	90.7000	90.7000	90.7000	0.0000	0.0000	0.0000	0.0000	90.7000	90.7000	90.7000	(210)
Space heating fuel (main heating system)	840.3443	657.7859	495.8974	224.0681	71.2475	0.0000	0.0000	0.0000	0.0000	223.6636	538.7914	853.1955	(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	193.8588	170.3375	177.6344	157.4895	153.0565	134.9304	127.8518	142.6922	143.1976	163.3885	174.9642	188.6034	(64)
Efficiency of water heater (217)m	90.1179	90.0628	89.8893	89.4559	88.7130	87.9000	87.9000	87.9000	87.9000	89.4292	89.9446	87.9000	(216)
Fuel for water heating, kWh/month	215.1168	189.1318	197.6146	176.0528	172.5299	153.5045	145.4514	162.3347	162.9097	182.7016	194.5244	209.2400	(219)
Water heating fuel used												2161.1121	(219)
Annual totals kWh/year													
Space heating fuel - main system												3904.9938	(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)												443.4465	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.97 * 1184 * 1.00) =										-918.7195		-918.7195	(233)
Total delivered energy for all uses												5665.8328	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3904.9938	3.6300	141.7513 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2161.1121	3.6300	78.4484 (247)
Pumps and fans for heating	75.0000	19.4400	14.5800 (249)
Energy for lighting	443.4465	19.4400	86.2060 (250)
Additional standing charges			95.0000 (251)
Energy saving/generation technologies			
PV Unit	-918.7195	19.4400	-178.5991 (252)
Total energy cost			237.3866 (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	3904.9938	0.2160	843.4787 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2161.1121	0.2160	466.8002 (264)
Space and water heating			1310.2789 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	443.4465	0.5190	230.1487 (268)
Energy saving/generation technologies			
PV Unit	-918.7195	0.5190	-476.8154 (269)
Total kg/year			1102.5372 (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	3904.9938	1.2200	4764.0924 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2161.1121	1.2200	2636.5568 (264)
Space and water heating			7400.6491 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	443.4465	3.0700	1361.3808 (268)
Energy saving/generation technologies			
PV Unit	-918.7195	3.0700	-2820.4690 (269)
Primary energy kWh/year			6171.8110 (272)
Primary energy kWh/m2/year			52.6156 (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 88
Current environmental impact rating: B 89

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

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.0	-£ 28	-197 kg (17.9%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£28 1.68 kg/m²	B 89	B 90
Total Savings	£28 1.68 kg/m²		

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

Fuel prices for cost data on this page from database revision number 500 TEST (30 Jun 2022)
Recommendation texts revision number 4.9c (22 Feb 2014)

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

	Current	Potential	Saving
Electricity	£101	£111	-£10
Mains gas	£315	£278	£37
Space heating	£251	£251	£0
Water heating	£78	£51	£28
Lighting	£86	£86	£0
Generated (PV)	-£179	-£179	£0
Total cost of fuels	£237	£210	£27
Total cost of uses	£236	£209	£28
Delivered energy	48 kWh/m²	40 kWh/m²	8 kWh/m²
Carbon dioxide emissions	1.1 tonnes	0.9 tonnes	0.2 tonnes
CO2 emissions per m²	9 kg/m²	8 kg/m²	2 kg/m²
Primary energy	53 kWh/m²	43 kWh/m²	9 kWh/m²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	58.6500 (1b)	x 2.3900 (2b)	= 140.1735 (1b) - (3b)
First floor	58.6500 (1c)	x 2.6800 (2c)	= 157.1820 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	117.3000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 297.3555 (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) = 0.1345 (8)
Pressure test					Yes
Measured/design AP50					4.1500
Infiltration rate					0.3420 (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) =	0.3164 (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	0.4034	0.3955	0.3876	0.3480	0.3401	0.3005	0.3005	0.2926	0.3164	0.3401	0.3559	0.3717 (22b)
Effective ac	0.5814	0.5782	0.5751	0.5606	0.5578	0.5452	0.5452	0.5428	0.5500	0.5578	0.5633	0.5691 (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)			26.7000	1.1450	30.5725		(27)
Ground Floor			58.6500	0.1200	7.0380	84.0000	4926.6000 (28a)
Brick and Block	170.2500	28.8200	141.4300	0.2400	33.9432	42.2200	5971.1746 (29a)
Pitched Roof	58.6500		58.6500	0.1000	5.8650	9.1000	533.7150 (30)
Total net area of external elements Aum(A, m ²)			287.5500				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	79.7507		(33)
GF Block			58.5300			75.0000	4389.7500 (32c)
GF Stud			29.4800			9.0000	265.3200 (32c)
FF Stud			126.9700			9.0000	1142.7300 (32c)
Internal Floor 1			58.6500			18.0000	1055.7000 (32d)
Internal Ceiling 1			58.6500			18.0000	1055.7000 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 19340.6896 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 164.8823 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 5.5188 (36)
Total fabric heat loss (33) + (36) = 85.2695 (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	57.0466	56.7366	56.4328	55.0056	54.7386	53.4956	53.4956	53.2654	53.9744	54.7386	55.2788	55.8435 (38)
Heat transfer coeff	142.3161	142.0061	141.7023	140.2751	140.0081	138.7651	138.7651	138.5349	139.2438	140.0081	140.5483	141.1130 (39)
Average = Sum(39)m / 12 =												140.2738 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2133	1.2106	1.2080	1.1959	1.1936	1.1830	1.1830	1.1810	1.1871	1.1936	1.1982	1.2030 (40)
HLP (average)												1.1959 (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												2.8522 (42)
Average daily hot water use (litres/day)												101.9409 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	112.1350	108.0574	103.9798	99.9021	95.8245	91.7468	91.7468	95.8245	99.9021	103.9798	108.0574	112.1350 (44)
Energy conte	166.2930	145.4409	150.0820	130.8451	125.5490	108.3393	100.3922	115.2016	116.5774	135.8598	148.3016	161.0459 (45)
Energy content (annual)										Total = Sum(45)m =		1603.9278 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	24.9440	21.8161	22.5123	19.6268	18.8324	16.2509	15.0588	17.2802	17.4866	20.3790	22.2452	24.1569 (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	27.5658	24.8965	27.5524	26.6444	27.5075	26.5912	27.4595	27.4906	26.6202	27.5288	26.6627	27.5575 (61)
Total heat required for water heating calculated for each month	193.8588	170.3375	177.6344	157.4895	153.0565	134.9304	127.8518	142.6922	143.1976	163.3885	174.9642	188.6034 (62)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.7000 (H2)
Collector heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0050 (H3a)
Collector effective heat loss coefficient												1.8063 (H3b)
Collector performance ratio												2.5804 (H4)
Annual solar radiation per m2												1079.5246 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												1813.6014 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.1307 (H8)
Utilisation factor												0.5870 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												101.9409 (H14)
Volume ratio Veff/V												0.7357 (H15)
Solar storage volume factor												0.9386 (H16)
Solar input	-25.4798	-42.5184	-72.4138	-97.0487	-119.8955	-117.8764	-116.3186	-101.6282	-79.5952	-54.3542	-30.2227	-878.6738 (H17)
Solar input (sum of months) = Sum (63)m =												-878.6738 (63)
Output from w/h	168.3790	127.8190	105.2206	60.4408	33.1609	17.0540	11.5331	41.0640	63.6024	109.0344	144.7415	167.2812 (64)
Total per year (kWh/year) = Sum (64)m =												1049.3310 (64)
Heat gains from water heating, kWh/month	62.1839	54.5832	56.7904	50.1671	48.6219	42.6706	40.2453	45.1772	45.4170	52.0556	55.9759	60.4371 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(66)
(66)m	171.1350	171.1350	171.1350	171.1350	171.1350	171.1350	171.1350	171.1350	171.1350	171.1350	171.1350	171.1350	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	62.7744	55.7557	45.3436	34.3280	25.6606	21.6638	23.4084	30.4272	40.8393	51.8549	60.5223	64.5191	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	420.3811	424.7433	413.7506	390.3485	360.8074	333.0430	314.4947	310.1324	321.1252	344.5273	374.0684	401.8328	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.9657	54.9657	54.9657	54.9657	54.9657	54.9657	54.9657	54.9657	54.9657	54.9657	54.9657	54.9657	(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)	-114.0900	-114.0900	-114.0900	-114.0900	-114.0900	-114.0900	-114.0900	-114.0900	-114.0900	-114.0900	-114.0900	-114.0900	(71)
Water heating gains (Table 5)	83.5805	81.2251	76.3311	69.6765	65.3520	59.2647	54.0931	60.7220	63.0792	69.9672	77.7444	81.2327	(72)
Total internal gains	681.7467	676.7348	650.4361	609.3637	566.8308	528.9822	507.0070	516.2924	540.0544	581.3601	627.3457	662.5953	(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					5.7600	10.6334		0.6300	0.7000	0.7700		18.7183 (74)
East					9.4600	19.6403		0.6300	0.7000	0.7700		56.7819 (76)
West					11.4800	19.6403		0.6300	0.7000	0.7700		68.9066 (80)

Solar gains	144.4069	281.6451	465.7034	688.1856	855.2653	881.6783	836.8012	710.1747	544.0201	334.3311	179.8103	118.9647 (83)
Total gains	826.1536	958.3800	1116.1395	1297.5493	1422.0961	1410.6606	1343.8082	1226.4670	1084.0745	915.6912	807.1560	781.5600 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	37.7499	37.8323	37.9134	38.2991	38.3722	38.7159	38.7159	38.7802	38.5828	38.3722	38.2247	38.0717
alpha	3.5167	3.5222	3.5276	3.5533	3.5581	3.5811	3.5811	3.5853	3.5722	3.5581	3.5483	3.5381
util living area												
	0.9840	0.9723	0.9434	0.8715	0.7450	0.5790	0.4392	0.4945	0.7319	0.9190	0.9740	0.9867 (86)
MIT	19.3135	19.5382	19.9182	20.3863	20.7371	20.9225	20.9779	20.9665	20.8184	20.3339	19.7363	19.2705 (87)
Th 2	19.9094	19.9115	19.9136	19.9233	19.9251	19.9336	19.9336	19.9352	19.9304	19.9251	19.9214	19.9176 (88)
util rest of house												
	0.9804	0.9661	0.9307	0.8432	0.6921	0.4985	0.3392	0.3903	0.6576	0.8945	0.9672	0.9837 (89)
MIT 2	18.3871	18.6102	18.9827	19.4335	19.7437	19.8936	19.9263	19.9231	19.8230	19.3979	18.8158	18.3507 (90)
Living area fraction									fLA = Living area / (4) =			0.1416 (91)
MIT	18.5183	18.7416	19.1152	19.5684	19.8844	20.0393	20.0752	20.0709	19.9639	19.5305	18.9462	18.4810 (92)
Temperature adjustment												0.0000
adjusted MIT	18.5183	18.7416	19.1152	19.5684	19.8844	20.0393	20.0752	20.0709	19.9639	19.5305	18.9462	18.4810 (93)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9742	0.9575	0.9191	0.8324	0.6899	0.5070	0.3529	0.4041	0.6602	0.8835	0.9590	0.9783	(94)
Useful gains	804.8369	917.6782	1025.8372	1080.0358	981.0874	715.1478	474.2928	495.6405	715.7145	808.9921	774.0716	764.5647	(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	2023.4873	1965.5948	1787.6008	1496.5111	1145.8821	754.7837	482.2430	508.5441	816.5133	1250.3376	1664.9582	2015.2327	(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	906.6759	704.1999	566.7521	299.8622	122.6073	0.0000	0.0000	0.0000	0.0000	328.3611	641.4384	930.4970	(98)
Space heating												4500.3939	(98)
Space heating per m2											(98) / (4) =	38.3665	(99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000	(201)
Fraction of space heat from main system(s)													1.0000	(202)
Efficiency of main space heating system 1 (in %)													90.7000	(206)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement													4961.8456	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	906.6759	704.1999	566.7521	299.8622	122.6073	0.0000	0.0000	0.0000	0.0000	328.3611	641.4384	930.4970	(98)	
Space heating efficiency (main heating system 1)	90.7000	90.7000	90.7000	90.7000	90.7000	0.0000	0.0000	0.0000	0.0000	90.7000	90.7000	90.7000	(210)	
Space heating fuel (main heating system)	999.6427	776.4057	624.8645	330.6088	135.1789	0.0000	0.0000	0.0000	0.0000	362.0299	707.2088	1025.9063	(211)	
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)	
Water heating														
Water heating requirement	168.3790	127.8190	105.2206	60.4408	33.1609	17.0540	11.5331	41.0640	63.6024	109.0344	144.7415	167.2812	(64)	
Efficiency of water heater	90.2497	90.2583	90.2498	90.2179	90.0891	87.9000	87.9000	87.9000	87.9000	89.9855	90.1712	90.2619	(217)	
Fuel for water heating, kWh/month	186.5701	141.6147	116.5882	66.9942	36.8091	19.4016	13.1208	46.7167	72.3577	121.1689	160.5186	185.3287	(219)	
Water heating fuel used												1167.1892	(219)	
Annual totals kWh/year												4961.8456	(211)	
Space heating fuel - main system												0.0000	(215)	
Space heating fuel - secondary														
Electricity for pumps and fans:														
central heating pump													30.0000	(230c)
main heating flue fan													45.0000	(230e)
pump for solar water heating													50.0000	(230g)
Total electricity for the above, kWh/year													125.0000	(231)
Electricity for lighting (calculated in Appendix L)													443.4465	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 0.97 * 1068 * 1.00) =										-828.8227			-828.8227	(233)
Total delivered energy for all uses													5868.6586	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4961.8456	3.4800	172.6722	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1167.1892	3.4800	40.6182	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Pump for solar water heating	50.0000	13.1900	6.5950	(249)
Energy for lighting	443.4465	13.1900	58.4906	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-828.8227	13.1900	-109.3217	(252)
Total energy cost			298.9468	(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] =	0.7736	(257)
SAP value			89.2081	
SAP rating (Section 12)			89	(258)
SAP band			B	

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

Energy	Emission factor	Emissions
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FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

	kWh/year	kg CO2/kWh	kg CO2/year
Space heating - main system 1	4961.8456	0.2160	1071.7586 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1167.1892	0.2160	252.1129 (264)
Space and water heating			1323.8715 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	443.4465	0.5190	230.1487 (268)
Energy saving/generation technologies			
PV Unit	-828.8227	0.5190	-430.1590 (269)
Total kg/year			1188.7363 (272)
CO2 emissions per m2			10.1300 (273)
EI value			90.1854
EI rating			90 (274)
EI band			B

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	58.6500 (1b)	x 2.3900 (2b)	= 140.1735 (1b) - (3b)
First floor	58.6500 (1c)	x 2.6800 (2c)	= 157.1820 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	117.3000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 297.3555 (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) =	0.1345 (8)			
Pressure test																	Yes				
Measured/design AP50																		4.1500			
Infiltration rate																		0.3420 (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) =	0.3164 (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										0.3717	0.3480	0.3480	0.3164	0.3243	0.3085	0.3085	0.3005	0.3005	0.3243	0.3164	0.3243 (22b)
Effective ac										0.5691	0.5606	0.5606	0.5500	0.5526	0.5476	0.5476	0.5452	0.5452	0.5526	0.5500	0.5526 (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)			26.7000	1.1450	30.5725			(27)					
Ground Floor			58.6500	0.1200	7.0380	84.0000	4926.6000	(28a)					
Brick and Block	170.2500	28.8200	141.4300	0.2400	33.9432	42.2200	5971.1746	(29a)					
Pitched Roof	58.6500		58.6500	0.1000	5.8650	9.1000	533.7150	(30)					
Total net area of external elements Aum(A, m2)			287.5500					(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	79.7507			(33)					
GF Block			58.5300			75.0000	4389.7500	(32c)					
GF Stud			29.4800			9.0000	265.3200	(32c)					
FF Stud			126.9700			9.0000	1142.7300	(32c)					
Internal Floor 1			58.6500			18.0000	1055.7000	(32d)					
Internal Ceiling 1			58.6500			18.0000	1055.7000	(32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	19340.6896	(34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							164.8823	(35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.5188	(36)					
Total fabric heat loss						(33) + (36) =	85.2695	(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 55.8435	Feb 55.0056	Mar 55.0056	Apr 53.9744	May 54.2230	Jun 53.7319	Jul 53.7319	Aug 53.4956	Sep 53.4956	Oct 54.2230	Nov 53.9744	Dec 54.2230	(38)
Heat transfer coeff	141.1130	140.2751	140.2751	139.2438	139.4924	139.0014	139.0014	138.7651	138.7651	139.4924	139.2438	139.4924	(39)
Average = Sum(39)m / 12 =												139.5134	(39)
HLP	Jan 1.2030	Feb 1.1959	Mar 1.1959	Apr 1.1871	May 1.1892	Jun 1.1850	Jul 1.1850	Aug 1.1830	Sep 1.1830	Oct 1.1892	Nov 1.1871	Dec 1.1892	(40)
HLP (average)												1.1894	(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												2.8522 (42)
Average daily hot water use (litres/day)												101.9409 (43)
Daily hot water use	Jan 112.1350	Feb 108.0574	Mar 103.9798	Apr 99.9021	May 95.8245	Jun 91.7468	Jul 91.7468	Aug 95.8245	Sep 99.9021	Oct 103.9798	Nov 108.0574	Dec 112.1350 (44)
Energy conte	166.2930	145.4409	150.0820	130.8451	125.5490	108.3393	100.3922	115.2016	116.5774	135.8598	148.3016	161.0459 (45)
Energy content (annual)										Total = Sum(45)m =		1603.9278 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Distribution loss (46)m = 0.15 x (45)m	24.9440	21.8161	22.5123	19.6268	18.8324	16.2509	15.0588	17.2802	17.4866	20.3790	22.2452	24.1569 (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	27.5658	24.8965	27.5524	26.6444	27.5075	26.5912	27.4595	27.4906	26.6202	27.5288	26.6627	27.5575 (61)
Total heat required for water heating calculated for each month	193.8588	170.3375	177.6344	157.4895	153.0565	134.9304	127.8518	142.6922	143.1976	163.3885	174.9642	188.6034 (62)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.7000 (H2)
Collector heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0050 (H3a)
Collector effective heat loss coefficient												1.8063 (H3b)
Collector performance ratio												2.5804 (H4)
Annual solar radiation per m2												1206.0102 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												2026.0972 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.2632 (H8)
Utilisation factor												0.5469 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												101.9409 (H14)
Volume ratio Veff/V												0.7357 (H15)
Solar storage volume factor												0.9386 (H16)
Solar input												-914.5098 (H17)
Solar input	-29.8416	-42.4381	-73.6411	-99.0597	-115.1141	-125.2107	-118.7188	-108.2601	-84.7349	-58.5657	-35.2959	-23.6291 (63)
Solar input (sum of months) = Sum (63)m =												-914.5098 (63)
Output from w/h	164.0172	127.8993	103.9933	58.4298	37.9424	9.7197	9.1329	34.4321	58.4627	104.8228	139.6684	164.9743 (64)
Total per year (kWh/year) = Sum (64)m =												1013.4950 (64)
Heat gains from water heating, kWh/month	62.1839	54.5832	56.7904	50.1671	48.6219	42.6706	40.2453	45.1772	45.4170	52.0556	55.9759	60.4371 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(66)
(66)m	171.1350	171.1350	171.1350	171.1350	171.1350	171.1350	171.1350	171.1350	171.1350	171.1350	171.1350	171.1350	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	62.7744	55.7557	45.3436	34.3280	25.6606	21.6638	23.4084	30.4272	40.8393	51.8549	60.5223	64.5191	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	420.3811	424.7433	413.7506	390.3485	360.8074	333.0430	314.4947	310.1324	321.1252	344.5273	374.0684	401.8328	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.9657	54.9657	54.9657	54.9657	54.9657	54.9657	54.9657	54.9657	54.9657	54.9657	54.9657	54.9657	(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)	-114.0900	-114.0900	-114.0900	-114.0900	-114.0900	-114.0900	-114.0900	-114.0900	-114.0900	-114.0900	-114.0900	-114.0900	(71)
Water heating gains (Table 5)	83.5805	81.2251	76.3311	69.6765	65.3520	59.2647	54.0931	60.7220	63.0792	69.9672	77.7444	81.2327	(72)
Total internal gains	681.7467	676.7348	650.4361	609.3637	566.8308	528.9822	507.0070	516.2924	540.0544	581.3601	627.3457	662.5953	(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				5.7600	13.4684		0.6300	0.7000		0.7700		23.7089 (74)	
East				9.4600	25.1733		0.6300	0.7000		0.7700		72.7784 (76)	
West				11.4800	25.1733		0.6300	0.7000		0.7700		88.3188 (80)	
Solar gains	184.8060	307.1108	516.4537	763.3420	889.5085	1012.9778	924.3814	820.9785	630.7583	393.3655	229.4677	144.0415	(83)
Total gains	866.5528	983.8456	1166.8898	1372.7057	1456.3393	1541.9601	1431.3885	1337.2709	1170.8127	974.7256	856.8134	806.6368	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	38.0717	38.2991	38.2991	38.5828	38.5140	38.6501	38.6501	38.7159	38.7159	38.5140	38.5828	38.5140
alpha	3.5381	3.5533	3.5533	3.5722	3.5676	3.5767	3.5767	3.5811	3.5811	3.5676	3.5722	3.5676
util living area	0.9764	0.9631	0.9213	0.8187	0.6621	0.4439	0.3167	0.3277	0.6030	0.8645	0.9570	0.9804 (86)
MIT	19.5652	19.7473	20.1285	20.5724	20.8506	20.9734	20.9942	20.9937	20.9228	20.5672	20.0159	19.5426 (87)
Th 2	19.9176	19.9233	19.9233	19.9304	19.9287	19.9320	19.9320	19.9336	19.9336	19.9287	19.9304	19.9287 (88)
util rest of house	0.9708	0.9546	0.9034	0.7802	0.5960	0.3572	0.2160	0.2206	0.5088	0.8231	0.9450	0.9757 (89)
MIT 2	18.6427	18.8251	19.1928	19.6070	19.8368	19.9215	19.9309	19.9325	19.8973	19.6143	19.0967	18.6292 (90)
Living area fraction									fLA = Living area / (4) =			0.1416 (91)
MIT	18.7733	18.9557	19.3253	19.7437	19.9804	20.0705	20.0815	20.0828	20.0425	19.7493	19.2269	18.7585 (92)
Temperature adjustment												0.0000
adjusted MIT	18.7733	18.9557	19.3253	19.7437	19.9804	20.0705	20.0815	20.0828	20.0425	19.7493	19.2269	18.7585 (93)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9630	0.9448	0.8915	0.7726	0.5994	0.3688	0.2303	0.2358	0.5191	0.8149	0.9349	0.9688	(94)
Useful gains	834.4709	929.5441	1040.2280	1060.5671	872.9054	568.6423	329.6722	315.3756	607.7457	794.3519	801.0003	781.4475	(95)
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	1858.9229	1817.3594	1644.7695	1342.8307	959.7623	579.7028	331.0267	316.7690	644.2203	1067.0170	1479.7278	1821.5662	(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	762.1923	596.6119	449.7789	203.2298	64.6215	0.0000	0.0000	0.0000	0.0000	202.8629	488.6838	773.8483	(98)
Space heating												3541.8293	(98)
Space heating per m2											(98) / (4) =	30.1946	(99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.7000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3904.9938 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	762.1923	596.6119	449.7789	203.2298	64.6215	0.0000	0.0000	0.0000	0.0000	202.8629	488.6838	773.8483	(98)
Space heating efficiency (main heating system 1)	90.7000	90.7000	90.7000	90.7000	90.7000	0.0000	0.0000	0.0000	0.0000	90.7000	90.7000	90.7000	(210)
Space heating fuel (main heating system)	840.3443	657.7859	495.8974	224.0681	71.2475	0.0000	0.0000	0.0000	0.0000	223.6636	538.7914	853.1955	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	164.0172	127.8993	103.9933	58.4298	37.9424	9.7197	9.1329	34.4321	58.4627	104.8228	139.6684	164.9743	(64)
Efficiency of water heater	90.1912	90.1928	90.1607	90.0594	89.6436	87.9000	87.9000	87.9000	87.9000	89.7263	90.0623	90.1951	(217)
Fuel for water heating, kWh/month	181.8549	141.8066	115.3422	64.8792	42.3258	11.0577	10.3901	39.1719	66.5105	116.8251	155.0797	182.9083	(219)
Water heating fuel used												1128.1520	(219)
Annual totals kWh/year													
Space heating fuel - main system												3904.9938	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
pump for solar water heating												50.0000	(230g)
Total electricity for the above, kWh/year												125.0000	(231)
Electricity for lighting (calculated in Appendix L)												443.4465	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.97 * 1184 * 1.00) =										-918.7195		-918.7195	(233)
Total delivered energy for all uses												4682.8727	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3904.9938	3.6300	141.7513	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1128.1520	3.6300	40.9519	(247)
Pumps and fans for heating	75.0000	19.4400	14.5800	(249)
Pump for solar water heating	50.0000	19.4400	9.7200	(249)
Energy for lighting	443.4465	19.4400	86.2060	(250)
Additional standing charges			95.0000	(251)
Energy saving/generation technologies				
PV Unit	-918.7195	19.4400	-178.5991	(252)
Total energy cost			209.6101	(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	3904.9938	0.2160	843.4787	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1128.1520	0.2160	243.6808	(264)
Space and water heating			1087.1595	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	443.4465	0.5190	230.1487	(268)
Energy saving/generation technologies				
PV Unit	-918.7195	0.5190	-476.8154	(269)
Total kg/year			905.3678	(272)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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	3904.9938	1.2200	4764.0924	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1128.1520	1.2200	1376.3455	(264)
Space and water heating			6140.4378	(265)
Pumps and fans	125.0000	3.0700	383.7500	(267)
Energy for lighting	443.4465	3.0700	1361.3808	(268)
Energy saving/generation technologies				
PV Unit	-918.7195	3.0700	-2820.4690	(269)
Primary energy kWh/year			5065.0996	(272)
Primary energy kWh/m2/year			43.1807	(273)

U-VALUE CALCULATOR REPORT

Property Reference	SAP 0647 Plot 15	Issued on Date	26/07/2022
Assessment Reference	As Built	Prop Type Ref	L
Project	16 Oram Way, West End, Southampton, SO30 3JW		
Calculation Type	New Build (As Built)		

SAP Rating	88 B	DER	13.30	TER	17.88
Environmental	89 B	% DER<TER	25.63		
CO ₂ Emissions (t/year)	1.10	DFEE	48.29	TREE	60.82
General Requirements Compliance	Pass	% DFEE<TFEE	20.61		

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 15	Issued on Date	26/07/2022
Assessment Reference	As Built	Prop Type Ref	L
Project	16 Oram Way, West End, Southampton, SO30 3JW		
Calculation Type	New Build (As Built)		

SAP Rating	88 B	DER	13.30	TER	17.88
Environmental	89 B	% DER<TER	25.63		
CO ₂ Emissions (t/year)	1.10	DFEE	48.29	TFEE	60.82
General Requirements Compliance	Pass	% DFEE<TFEE	20.61		

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 15	Issued on Date	26/07/2022
Assessment Reference	As Built	Prop Type Ref	L
Project	16 Oram Way, West End, Southampton, SO30 3JW		
Calculation Type	New Build (As Built)		

SAP Rating	88 B	DER	13.30	TER	17.88
Environmental	89 B	% DER<TER	25.63		
CO ₂ Emissions (t/year)	1.10	DFEE	48.29	TFEE	60.82
General Requirements Compliance	Pass	% DFEE<TFEE	20.61		

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

Floor 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 15	Issued on Date	26/07/2022
Assessment Reference	As Built	Prop Type Ref	L
Property	16 Oram Way, West End, Southampton, SO30 3JW		
SAP Rating	88 B	DER	13.30
Environmental	89 B	TER	17.88
CO ₂ Emissions (t/year)	1.10	% DER<TER	25.63
General Requirements Compliance	Pass	DFEE	48.29
		TFEE	60.82
		% DFEE<TFEE	20.61
Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 07798936079, toby@abacusenergyuk.com		Assessor ID
			E477-0001
Client	Foreman Homes, FORE		

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

Orientation	East
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Suburban
1.0 Property Type	House, Detached
2.0 Number of Storeys	2
3.0 Date Built	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:	33.58 m	58.65 m ²	2.39 m
	1st Storey:	33.58 m	58.65 m ²	2.68 m

7.0 Living Area	16.61	m ²
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8.0 Thermal Mass Parameter	Precise calculation	
Thermal Mass	164.88	kJ/m ² K

9.0 External Walls							
Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area (m ²)	Nett Area (m ²)	
Brick and Block	Cavity Wall	Other	0.24	42.22	170.25	141.43	

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

9.2 Internal Walls					
Description	Construction		Kappa (kJ/m ² K)	Area (m ²)	
GF Block	Dense block, plasterboard on dabs		75.00	58.53	
GF Stud	Plasterboard on timber frame		9.00	29.48	
FF Stud	Plasterboard on timber frame		9.00	126.97	

10.0 External Roofs						
Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area (m ²)	Nett Area (m ²)
Pitched Roof	External Plane Roof	Other	0.10	9.10	58.65	58.65

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	58.65

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	58.65

11.2 Internal Floors

Description	Construction	Kappa (kJ/m²K)	Area (m²)
Internal Floor 1	Plasterboard ceiling, carpeted chipboard floor	18.00	58.65

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	East							2.12	
Front Elevation	Window	[1] Brick and Block	East	None	0.00					9.46	
Rear Elevation	Window	[1] Brick and Block	West	None	0.00					11.48	
Side Elevation	Window	[1] Brick and Block	North	None	0.00					5.76	

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)	1.83	0.070	No	Birtley Supatherm
Independently assessed	E2 Other lintels (including other steel lintels)	1.01	0.071	No	Birtley Supatherm
Independently assessed	E2 Other lintels (including other steel lintels)	8.40	0.067	No	Birtley Supatherm
Independently assessed	E2 Other lintels (including other steel lintels)	3.02	0.070	No	Birtley Supatherm
Independently assessed	E2 Other lintels (including other steel lintels)	7.08	0.064	No	Birtley Supatherm
Independently assessed	E3 Sill	17.31	0.021	No	Knauf P5
Independently assessed	E4 Jamb	42.90	0.016	No	Knauf P6
Independently assessed	E5 Ground floor (normal)	33.58	0.022	No	Knauf P10
Independently assessed	E6 Intermediate floor within a dwelling	33.58	0.000	No	CD0029
Table K1 - Approved	E10 Eaves (insulation at ceiling level)	18.70	0.060	No	
Independently assessed	E12 Gable (insulation at ceiling level)	14.88	0.044	No	Knauf P21
Independently assessed	E16 Corner (normal)	25.30	0.039	No	Knauf P23
Independently assessed	E17 Corner (inverted – internal area greater than external area)	5.06	-0.091	No	Knauf P24

Y-value	0.019	W/m²K
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18.0 Pressure Testing

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

19.0 Mechanical Ventilation

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

Summer Overheating

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

Mechanical Ventilation

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

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				4
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	23	
Total number of L.E.L. fittings	23	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	Yes
Light and motion sensor	Yes

23.0 Electricity Tariff

Standard

24.0 Main Heating 1

	Database	
Description	Gas Combi	
Percentage of Heat	100	%
Database Ref. No.	17515	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.7	
In Summer	87.9	
Controls	CBE Programmer, room thermostat and TRVs	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2106	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	Gas/Oil, time clock	

25.0 Main Heating 2

None

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

Community Heating	None			
28.0 Water Heating	HWP From main heating 1			
Water Heating	Main Heating 1			
Flue Gas Heat Recovery System	No			
Waste Water Heat Recovery Instantaneous System 1	No			
Waste Water Heat Recovery Instantaneous System 2	No			
Waste Water Heat Recovery Storage System	No			
Solar Panel	No			
Water use <= 125 litres/person/day	Yes			
SAP Code	901			
29.0 Hot Water Cylinder	None			
32.0 Photovoltaic Unit	One Dwelling			
PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
0.97	South	45°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£28	B 89	