



SAP Report Submission for Building Regulations Compliance

Client: Foreman Homes

Project: 12 Oram Way
West End, Southampton, SO30 3JW

Contact: Tobias Whiting
Abacus Energy (UK) Ltd
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Report Issue Date: 27/06/2022

EXCELLENCE
IN ENERGY
ASSESSMENT

BUILDING REGULATION COMPLIANCE

Calculation Type: New Build (As Built)

Property Reference	SAP 0647 Plot 12	Issued on Date	27/06/2022
Assessment Reference	As Built	Prop Type Ref	Fh
Property	12 Oram Way, West End, Southampton, SO30 3JW		
SAP Rating	88 B	DER	13.03
Environmental	88 B	TER	16.17
CO ₂ Emissions (t/year)	1.52	% DER<TER	19.41
General Requirements Compliance	Pass	DfEE	48.27
		TfEE	58.89
		% DfEE<TfEE	18.03
Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 07798936079, toby@abacusenergyuk.com		Assessor ID
			E477-0001
Client	Foreman Homes, FORE		

SUMMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TfEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	16.17	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	13.03	kgCO ₂ /m ²	Pass
	-3.14 (-19.4%)	kgCO ₂ /m ²	

1b TfEE and DfEE

Target Fabric Energy Efficiency (TfEE)	58.89	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DfEE)	48.27	kWh/m ² /yr	
	-10.6 (-18.0%)	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	4.05 (measured in this dwelling)	m ³ /(h.m ²) @ 50 Pa	
Maximum	10.0	m ³ /(h.m ²) @ 50 Pa	Pass

Limiting System Efficiencies

4 Heating efficiency

This report has been produced by an accredited Elmhurst member whose work is subject to quality assurance audits. The data used to produce the report has been verified by the Elmhurst members' portal.

BUILDING REGULATION COMPLIANCE

Calculation Type: New Build (As Built)

Main heating system

Boiler system with radiators or underfloor - Mains gas
Data from database
Worcester Greenstar 4000 GR4700iW 18 S NG

Efficiency: 89.5% SEDBUK2009
Minimum: 88.0%

Pass

Secondary heating system

None

5 Cylinder insulation

Hot water storage

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

Pass

Primary pipework insulated

Yes

Pass

6 Controls

Space heating controls

Time and temperature zone control

Pass

Hot water controls

Cylinderstat

Pass

Independent timer for DHW

Pass

Boiler interlock

Yes

Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings

100 %

Minimum

75 %

Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)

Slight

Pass

Based on:

Overshading

Average

Windows facing North

16.84 m², No overhang

Windows facing East

0.96 m², No overhang

Windows facing South

9.54 m², Overhang twice as wide as window, ratio 1.15

Windows facing West

2.17 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

4.05 (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	0.032	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	13.03	TER	16.17
Environmental	88 B	% DER<TER	19.41		
CO ₂ Emissions (t/year)	1.52	DFEE	48.27	TFEE	58.89
General Requirements Compliance	Pass	% DFEE<TFEE	18.03		

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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	Junction detail	Source Type	Psi (W/mK)	Length (m)	Result	Reference
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.077	2.52	0.19	Birtley Supatherm
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.070	9.15	0.64	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	0.064	3.54	0.23	Birtley Supatherm
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.056	5.54	0.31	Birtley Supatherm
External wall	E3 Sill	Independently assessed	0.021	15.21	0.32	Knauf P5
External wall	E4 Jamb	Independently assessed	0.016	50.10	0.80	Knauf P6
External wall	E5 Ground floor (normal)	Table K1 - Approved	0.160	40.65	6.50	
External wall	E6 Intermediate floor within a dwelling	Independently assessed	0.000	40.65	0.00	CD0029
External wall	E10 Eaves (insulation at ceiling level)	Table K1 - Approved	0.060	25.64	1.54	
External wall	E12 Gable (insulation at ceiling level)	Independently assessed	0.044	15.01	0.66	Knauf P21
External wall	E16 Corner (normal)	Independently assessed	0.039	30.30	1.18	Knauf P23
External wall	E17 Corner (inverted – internal area greater than external area)	Independently assessed	-0.091	10.10	-0.92	Knauf P24

Total: **11.53** W/mK:
Y-Value: **0.032** W/m²K:

FULL SAP CALCULATION PRINTOUT

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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 157 m²

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

1a TER and DER

Fuel for main heating:Mains gas

Fuel factor:1.00 (mains gas)

Target Carbon Dioxide Emission Rate (TER) 16.17 kgCO₂/m²

Dwelling Carbon Dioxide Emission Rate (DER) 13.03 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)58.9 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: 4.05 (measured in this dwelling)
Maximum 10.0 OK

4 Heating efficiency

Main heating system: Boiler system with radiators or underfloor - Mains gas

Data from database

Worcester Greenstar 4000 GR4700iW 18 S NG

Efficiency: 89.5% SEDBUK2009

Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation

Hot water storage Measured cylinder loss: 1.73 kWh/day
Permitted by DBSCG 2.33 OK
Primary pipework insulated: Yes OK

6 Controls

Space heating controls: Time and temperature zone control OK

Hot water controls: Cylinderstat OK
Independent timer for DHW OK

Boiler interlock Yes OK

7 Low energy lights

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

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Southern England): Slight OK

Based on:

Overshading: Average
Windows facing North: 16.84 m², No overhang
Windows facing East: 0.96 m², No overhang
Windows facing South: 9.54 m², Overhang twice as wide as window, ratio 1.15
Windows facing West: 2.17 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 0.032 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	78.2900 (1b)	x 2.3900 (2b)	= 187.1131 (1b) - (3b)
First floor	78.2900 (1c)	x 2.6700 (2c)	= 209.0343 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	156.5800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 396.1474 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					5 * 10 = 50.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					50.0000 / (5) = 0.1262 (8)
Pressure test					Yes
Measured/design AP50					4.0500
Infiltration rate					0.3287 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3287 (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	0.4191	0.4109	0.4027	0.3616	0.3534	0.3123	0.3123	0.3041	0.3287	0.3534	0.3698	0.3862 (22b)
Effective ac	0.5878	0.5844	0.5811	0.5654	0.5624	0.5488	0.5488	0.5462	0.5540	0.5624	0.5684	0.5746 (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)			29.5100	1.1450	33.7901		(27)
Ground Floor			78.2900	0.1200	9.3948	84.0000	6576.3600 (28a)
Brick and Block	205.6900	31.6300	174.0600	0.2400	41.7744	42.2200	7348.8132 (29a)
Pitched Roof	78.2900		78.2900	0.1000	7.8290	9.1000	712.4390 (30)
Total net area of external elements Aum(A, m ²)			362.2700				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	95.1203		(33)
GF Block			75.9400			75.0000	5695.5000 (32c)
GF Stud			26.2700			9.0000	236.4300 (32c)
FF Stud			170.9000			9.0000	1538.1000 (32c)
Internal Floor 1			78.2900			18.0000	1409.2200 (32d)
Internal Ceiling 1			78.2900			18.0000	1409.2200 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 24926.0822 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 159.1907 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 11.5295 (36)
Total fabric heat loss (33) + (36) = 106.6498 (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	76.8459	76.4001	75.9630	73.9104	73.5264	71.7386	71.7386	71.4075	72.4272	73.5264	74.3033	75.1155 (38)
Heat transfer coeff	183.4957	183.0498	182.6128	180.5602	180.1761	178.3883	178.3883	178.0573	179.0770	180.1761	180.9530	181.7653 (39)
Average = Sum(39)m / 12 =												180.5583 (39)
HLP	1.1719	1.1690	1.1663	1.1531	1.1507	1.1393	1.1393	1.1372	1.1437	1.1507	1.1557	1.1608 (40)
HLP (average)												1.1531 (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												2.9440 (42)
Average daily hot water use (litres/day)												104.1209 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	114.5330	110.3682	106.2033	102.0385	97.8737	93.7088	93.7088	97.8737	102.0385	106.2033	110.3682	114.5330 (44)
Energy conte	169.8491	148.5512	153.2915	133.6432	128.2339	110.6561	102.5391	117.6651	119.0704	138.7651	151.4730	164.4898 (45)
Energy content (annual)										Total = Sum(45)m =		1638.2275 (45)

FULL SAP CALCULATION PRINTOUT

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	25.4774	22.2827	22.9937	20.0465	19.2351	16.5984	15.3809	17.6498	17.8606	20.8148	22.7209	24.6735 (46)
Water storage loss:												
Store volume												215.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.7300 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.9342 (55)
Total storage loss												
28.9602 26.1576 28.9602 28.0260 28.9602 28.0260 28.9602 28.9602 28.0260 28.9602 28.0260 28.9602 28.9602 (56)												
If cylinder contains dedicated solar storage												
28.9602 26.1576 28.9602 28.0260 28.9602 28.0260 28.9602 28.9602 28.0260 28.9602 28.0260 28.9602 28.9602 (57)												
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month												
222.0717 195.7200 205.5141 184.1812 180.4565 161.1941 154.7617 169.8877 169.6084 190.9877 202.0110 216.7124 (62)												
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Solar input (sum of months) = Sum(63)m =												0.0000 (63)
Output from w/h	222.0717	195.7200	205.5141	184.1812	180.4565	161.1941	154.7617	169.8877	169.6084	190.9877	202.0110	216.7124 (64)
Total per year (kWh/year) = Sum(64)m =												2253.1065 (64)
Heat gains from water heating, kWh/month												
98.2529 87.1283 92.7475 84.8668 84.4158 77.2235 75.8723 80.9017 80.0213 87.9175 90.7952 96.4709 (65)												

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	147.2019	147.2019	147.2019	147.2019	147.2019	147.2019	147.2019	147.2019	147.2019	147.2019	147.2019	147.2019	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
29.6248 26.3124 21.3987 16.2002 12.1098 10.2236 11.0470 14.3593 19.2730 24.4716 28.5619 30.4481 (67)													
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
327.5926 330.9920 322.4257 304.1889 281.1683 259.5322 245.0780 241.6786 250.2449 268.4817 291.5023 313.1384 (68)													
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
37.7202 37.7202 37.7202 37.7202 37.7202 37.7202 37.7202 37.7202 37.7202 37.7202 37.7202 37.7202 37.7202 (69)													
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)													
-117.7616 -117.7616 -117.7616 -117.7616 -117.7616 -117.7616 -117.7616 -117.7616 -117.7616 -117.7616 -117.7616 -117.7616 (71)													
Water heating gains (Table 5)													
132.0604 129.6552 124.6606 117.8705 113.4621 107.2549 101.9789 108.7389 111.1407 118.1687 126.1044 129.6653 (72)													
Total internal gains	559.4384	557.1203	538.6456	508.4203	476.9009	447.1714	428.2645	434.9374	450.8193	481.2825	516.3292	543.4123	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data FF or Table 6c	Access factor Table 6d	Gains W
North	16.8400	10.6334	0.6300	0.7000	0.7700	54.7250 (74)
East	0.9600	19.6403	0.6300	0.7000	0.7700	5.7622 (76)
South	9.5400	46.7521	0.6300	0.7000	0.7700	136.3079 (78)
West	2.1700	19.6403	0.6300	0.7000	0.7700	13.0250 (80)

Solar gains	209.8201	364.5713	522.6005	695.1151	827.6192	844.6965	804.6700	701.3017	581.1116	408.8830	252.5072	178.8538 (83)
Total gains	769.2585	921.6916	1061.2461	1203.5354	1304.5202	1291.8679	1232.9345	1136.2390	1031.9309	890.1654	768.8363	722.2661 (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	37.7334	37.8253	37.9158	38.3468	38.4286	38.8137	38.8137	38.8859	38.6644	38.4286	38.2636	38.0926	
alpha	3.5156	3.5217	3.5277	3.5565	3.5619	3.5876	3.5876	3.5924	3.5776	3.5619	3.5509	3.5395	
util living area	0.9942	0.9885	0.9758	0.9423	0.8667	0.7314	0.5842	0.6410	0.8459	0.9617	0.9896	0.9954 (86)	
MIT	19.0759	19.2952	19.6490	20.1167	20.5415	20.8339	20.9455	20.9234	20.6943	20.1438	19.5260	19.0410 (87)	
Th 2	19.9425	19.9448	19.9471	19.9577	19.9596	19.9689	19.9689	19.9706	19.9653	19.9596	19.9556	19.9515 (88)	
util rest of house	0.9928	0.9858	0.9699	0.9271	0.8291	0.6536	0.4677	0.5266	0.7884	0.9487	0.9868	0.9943 (89)	
MIT 2	17.3609	17.6817	18.1966	18.8731	19.4586	19.8288	19.9389	19.9244	19.6731	18.9223	18.0266	17.3154 (90)	
Living area fraction									fLA = Living area / (4) =				0.1796 (91)
MIT	17.6689	17.9715	18.4574	19.0964	19.6531	20.0093	20.1197	20.1038	19.8565	19.1417	18.2959	17.6253 (92)	
Temperature adjustment												0.0000	
adjusted MIT	17.6689	17.9715	18.4574	19.0964	19.6531	20.0093	20.1197	20.1038	19.8565	19.1417	18.2959	17.6253 (93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9883	0.9783	0.9581	0.9108	0.8159	0.6570	0.4860	0.5428	0.7811	0.9346	0.9799	0.9905	(94)
Useful gains	760.2559	901.7341	1016.7596	1096.1522	1064.3509	848.7490	599.1965	616.7768	806.0798	831.9894	753.3586	715.4026	(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													
	2453.1328	2392.7310	2183.5819	1841.0667	1432.9561	964.9519	627.8655	659.4881	1030.8521	1539.0109	2025.9235	2440.2534	(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													
	1259.5005	1001.9499	868.1158	536.3384	274.2423	0.0000	0.0000	0.0000	0.0000	526.0240	916.2467	1283.2890	(98)
Space heating													6665.7065 (98)
Space heating per m2													42.5706 (99)
										(98) / (4) =			

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												90.5000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												7365.4215 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	1259.5005	1001.9499	868.1158	536.3384	274.2423	0.0000	0.0000	0.0000	0.0000	526.0240	916.2467	1283.2890 (98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000 (210)
Space heating fuel (main heating system)	1391.7132	1107.1269	959.2440	592.6391	303.0301	0.0000	0.0000	0.0000	0.0000	581.2420	1012.4273	1417.9989 (211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating requirement	222.0717	195.7200	205.5141	184.1812	180.4565	161.1941	154.7617	169.8877	169.6084	190.9877	202.0110	216.7124 (64)
Efficiency of water heater (217)m	88.7170	88.5595	88.2353	87.5009	85.9274	79.8000	79.8000	79.8000	79.8000	87.3792	88.3597	88.7802 (216)
Fuel for water heating, kWh/month	250.3148	221.0039	232.9159	210.4907	210.0103	201.9976	193.9370	212.8919	212.5419	218.5735	228.6233	244.1001 (219)
Water heating fuel used												2637.4009 (219)
Annual totals kWh/year												
Space heating fuel - main system												7365.4215 (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)												523.1825 (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												9772.1823 (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	7365.4215	0.2160	1590.9311	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2637.4009	0.2160	569.6786	(264)
Space and water heating			2160.6097	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	523.1825	0.5190	271.5317	(268)
Energy saving/generation technologies				
PV Unit	-828.8227	0.5190	-430.1590	(269)
Total CO2, kg/year			2040.9074	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.0300	(273)

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

DER		13.0300	ZC1
Total Floor Area		156.5800	
Assumed number of occupants		2.9440	
CO2 emission factor in Table 12 for electricity displaced from grid		0.5190	
CO2 emissions from appliances, equation (L14)		12.3978	ZC2
CO2 emissions from cooking, equation (L16)		1.2112	ZC3
Total CO2 emissions		26.6390	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		26.6390	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	78.2900 (1b)	x 2.3900 (2b)	= 187.1131 (1b) - (3b)
First floor	78.2900 (1c)	x 2.6700 (2c)	= 209.0343 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	156.5800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 396.1474 (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) =	0.1010 (8)	
Pressure test										Yes							
Measured/design AP50										5.0000							
Infiltration rate										0.3510 (18)							
Number of sides sheltered										0 (19)							
Shelter factor										(20) = 1 - [0.075 x (19)] =				1.0000 (20)			
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =				0.3510 (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	0.4475	0.4387	0.4299	0.3861	0.3773	0.3334	0.3334	0.3246	0.3510	0.3773	0.3948	0.4124	(22b)				
Effective ac	0.6001	0.5962	0.5924	0.5745	0.5712	0.5556	0.5556	0.5527	0.5616	0.5712	0.5780	0.5850	(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)			29.5100	1.3258	39.1231		(27)					
Ground Floor			78.2900	0.1300	10.1777		(28a)					
Brick and Block	205.6900	31.6300	174.0600	0.1800	31.3308		(29a)					
Pitched Roof	78.2900		78.2900	0.1300	10.1777		(30)					
Total net area of external elements Aum(A, m2)			362.2700				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		92.9293		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							15.1145 (36)					
Total fabric heat loss						(33) + (36) =	108.0438 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 78.4533	Feb 77.9451	Mar 77.4469	Apr 75.1069	May 74.6691	Jun 72.6310	Jul 72.6310	Aug 72.2535	Sep 73.4160	Oct 74.6691	Nov 75.5547	Dec 76.4807 (38)
Heat transfer coeff	186.4972	185.9889	185.4907	183.1507	182.7129	180.6748	180.6748	180.2974	181.4598	182.7129	183.5985	184.5245 (39)
Average = Sum(39)m / 12 =												183.1486 (39)
HLP	Jan 1.1911	Feb 1.1878	Mar 1.1846	Apr 1.1697	May 1.1669	Jun 1.1539	Jul 1.1539	Aug 1.1515	Sep 1.1589	Oct 1.1669	Nov 1.1726	Dec 1.1785 (40)
HLP (average)												1.1697 (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												2.9440 (42)
Average daily hot water use (litres/day)												104.1209 (43)
Daily hot water use	Jan 114.5330	Feb 110.3682	Mar 106.2033	Apr 102.0385	May 97.8737	Jun 93.7088	Jul 93.7088	Aug 97.8737	Sep 102.0385	Oct 106.2033	Nov 110.3682	Dec 114.5330 (44)
Energy conte	169.8491	148.5512	153.2915	133.6432	128.2339	110.6561	102.5391	117.6651	119.0704	138.7651	151.4730	164.4898 (45)
Energy content (annual)										Total = Sum(45)m =		1638.2275 (45)
Distribution loss (46)m = 0.15 x (45)m												
25.4774	22.2827	22.9937	20.0465	19.2351	16.5984	15.3809	17.6498	17.8606	20.8148	22.7209	24.6735 (46)	
Water storage loss:												
Store volume												215.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.7258 (48)
Temperature factor from Table 2b												0.5400 (49)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Enter (49) or (54) in (55)												0.9319 (55)
Total storage loss	28.8896	26.0938	28.8896	27.9576	28.8896	27.9576	28.8896	28.8896	27.9576	28.8896	27.9576	28.8896 (56)
If cylinder contains dedicated solar storage	28.8896	26.0938	28.8896	27.9576	28.8896	27.9576	28.8896	28.8896	27.9576	28.8896	27.9576	28.8896 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	222.0011	195.6561	205.4434	184.1129	180.3858	161.1257	154.6911	169.8171	169.5401	190.9171	201.9426	216.6418 (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	222.0011	195.6561	205.4434	184.1129	180.3858	161.1257	154.6911	169.8171	169.5401	190.9171	201.9426	216.6418 (64)
Heat gains from water heating, kWh/month	98.1964	87.0772	92.6910	84.8121	84.3593	77.1688	75.8158	80.8452	79.9666	87.8610	90.7405	96.4144 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	147.2019	147.2019	147.2019	147.2019	147.2019	147.2019	147.2019	147.2019	147.2019	147.2019	147.2019	147.2019	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	29.6248	26.3124	21.3987	16.2002	12.1098	10.2236	11.0470	14.3593	19.2730	24.4716	28.5619	30.4481	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	327.5926	330.9920	322.4257	304.1889	281.1683	259.5322	245.0780	241.6786	250.2449	268.4817	291.5023	313.1384	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.7202	37.7202	37.7202	37.7202	37.7202	37.7202	37.7202	37.7202	37.7202	37.7202	37.7202	37.7202	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-117.7616	-117.7616	-117.7616	-117.7616	-117.7616	-117.7616	-117.7616	-117.7616	-117.7616	-117.7616	-117.7616	-117.7616	(71)
Water heating gains (Table 5)	131.9844	129.5792	124.5846	117.7946	113.3862	107.1790	101.9030	108.6629	111.0648	118.0927	126.0284	129.5893	(72)
Total internal gains	559.3624	557.0443	538.5696	508.3443	476.8250	447.0954	428.1885	434.8614	450.7433	481.2065	516.2532	543.3364	(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					16.8400	10.6334	0.6300	0.7000	0.7700		54.7250 (74)	
East					0.9600	19.6403	0.6300	0.7000	0.7700		5.7622 (76)	
South					9.5400	46.7521	0.6300	0.7000	0.7700		136.3079 (78)	
West					2.1700	19.6403	0.6300	0.7000	0.7700		13.0250 (80)	
Solar gains	209.8201	364.5713	522.6005	695.1151	827.6192	844.6965	804.6700	701.3017	581.1116	408.8830	252.5072	178.8538 (83)
Total gains	769.1825	921.6156	1061.1702	1203.4594	1304.4442	1291.7919	1232.8585	1136.1631	1031.8549	890.0895	768.7604	722.1901 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	58.3044	58.4638	58.6208	59.3698	59.5120	60.1833	60.1833	60.3093	59.9230	59.5120	59.2249	58.9277
alpha	4.8870	4.8976	4.9081	4.9580	4.9675	5.0122	5.0122	5.0206	4.9949	4.9675	4.9483	4.9285
util living area	0.9992	0.9978	0.9937	0.9773	0.9213	0.7843	0.6175	0.6822	0.9025	0.9876	0.9982	0.9994 (86)
MIT	19.6034	19.7641	20.0254	20.3784	20.7025	20.9142	20.9798	20.9675	20.8079	20.3894	19.9339	19.5809 (87)
Th 2	19.9272	19.9298	19.9323	19.9443	19.9466	19.9571	19.9571	19.9590	19.9530	19.9466	19.9420	19.9373 (88)
util rest of house	0.9989	0.9971	0.9912	0.9677	0.8863	0.6956	0.4847	0.5504	0.8450	0.9808	0.9974	0.9992 (89)
MIT 2	18.0558	18.2926	18.6755	19.1931	19.6395	19.8962	19.9492	19.9446	19.7862	19.2155	18.5500	18.0300 (90)
Living area fraction	18.3338	18.5569	18.9179	19.4060	19.8304	20.0790	20.1343	20.1283	fLA = Living area / (4) = 19.9697	19.4263	18.7986	0.1796 (91)
MIT	18.3338	18.5569	18.9179	19.4060	19.8304	20.0790	20.1343	20.1283	19.9697	19.4263	18.7986	18.3086 (92)
Temperature adjustment												0.0000
adjusted MIT	18.3338	18.5569	18.9179	19.4060	19.8304	20.0790	20.1343	20.1283	19.9697	19.4263	18.7986	18.3086 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9982	0.9955	0.9879	0.9611	0.8816	0.7072	0.5085	0.5736	0.8461	0.9759	0.9960	0.9987	(94)
Ext temp.	767.8140	917.5084	1048.2841	1156.5988	1149.9600	913.5788	626.9555	651.6478	873.0753	868.6458	765.6960	721.2501	(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	2617.2563	2540.0226	2303.4070	1924.1728	1485.5302	989.9232	638.5605	672.2056	1065.1143	1612.6830	2147.8387	2603.3736	(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 m ²	1375.9851	1090.3296	933.8114	552.6533	249.6643	0.0000	0.0000	0.0000	0.0000	553.5637	995.1428	1400.2999	(98)
Space heating												7151.4500	(98)
Space heating per m ²												45.6728	(99)

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													7648.6096 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1375.9851	1090.3296	933.8114	552.6533	249.6643	0.0000	0.0000	0.0000	0.0000	553.5637	995.1428	1400.2999	(98)
Space heating efficiency (main heating system 1)	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)
Space heating fuel (main heating system)	1471.6418	1166.1279	998.7288	591.0730	267.0206	0.0000	0.0000	0.0000	0.0000	592.0467	1064.3238	1497.6469	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	222.0011	195.6561	205.4434	184.1129	180.3858	161.1257	154.6911	169.8171	169.5401	190.9171	201.9426	216.6418	(64)
Efficiency of water heater (217)m	88.8450	88.6907	88.3634	87.5659	85.6811	79.8000	79.8000	79.8000	79.8000	87.4916	88.4982	88.9029	(216)
Fuel for water heating, kWh/month	249.8746	220.6051	232.4984	210.2563	210.5317	201.9119	193.8485	212.8034	212.4562	218.2119	228.1883	243.6837	(219)
Water heating fuel used												2634.8699	(219)
Annual totals kWh/year													
Space heating fuel - main system												7648.6096	(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)												523.1825	(232)
Total delivered energy for all uses												10881.6620	(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	7648.6096	0.2160	1652.0997 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2634.8699	0.2160	569.1319 (264)
Space and water heating			2221.2316 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	523.1825	0.5190	271.5317 (268)
Total CO2, kg/m2/year			2531.6883 (272)
Emissions per m2 for space and water heating			14.1859 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			1.7341 (272b)
Emissions per m2 for pumps and fans			0.2486 (272c)
Target Carbon Dioxide Emission Rate (TER) = (14.1859 * 1.00) + 1.7341 + 0.2486, rounded to 2 d.p.			16.1700 (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	78.2900 (1b)	x 2.3900 (2b)	= 187.1131 (1b) - (3b)
First floor	78.2900 (1c)	x 2.6700 (2c)	= 209.0343 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	156.5800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 396.1474 (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) = 0.1010 (8)
Pressure test					Yes
Measured/design AP50					4.0500
Infiltration rate					0.3035 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3035 (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	0.3869	0.3793	0.3718	0.3338	0.3262	0.2883	0.2883	0.2807	0.3035	0.3262	0.3414	0.3566 (22b)
Effective ac	0.5749	0.5719	0.5691	0.5557	0.5532	0.5416	0.5416	0.5394	0.5460	0.5532	0.5583	0.5636 (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)			29.5100	1.1450	33.7901		(27)
Ground Floor			78.2900	0.1200	9.3948	84.0000	6576.3600 (28a)
Brick and Block	205.6900	31.6300	174.0600	0.2400	41.7744	42.2200	7348.8132 (29a)
Pitched Roof	78.2900		78.2900	0.1000	7.8290	9.1000	712.4390 (30)
Total net area of external elements Aum(A, m ²)			362.2700				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	95.1203		(33)
GF Block			75.9400			75.0000	5695.5000 (32c)
GF Stud			26.2700			9.0000	236.4300 (32c)
FF Stud			170.9000			9.0000	1538.1000 (32c)
Internal Floor 1			78.2900			18.0000	1409.2200 (32d)
Internal Ceiling 1			78.2900			9.0000	704.6100 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	24221.4722 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							154.6907 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							11.5295 (36)
Total fabric heat loss						(33) + (36) =	106.6498 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	75.1502	74.7702	74.3977	72.6482	72.3209	70.7972	70.7972	70.5150	71.3841	72.3209	72.9831	73.6754 (38)
Average = Sum(39)m / 12 =	181.8000	181.4200	181.0475	179.2980	178.9707	177.4469	177.4469	177.1648	178.0339	178.9707	179.6329	180.3251 (39)
												179.2964 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1611	1.1586	1.1563	1.1451	1.1430	1.1333	1.1333	1.1315	1.1370	1.1430	1.1472	1.1516 (40)
HLP (average)												1.1451 (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												2.9440 (42)
Average daily hot water use (litres/day)												104.1209 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	114.5330	110.3682	106.2033	102.0385	97.8737	93.7088	93.7088	97.8737	102.0385	106.2033	110.3682	114.5330 (44)
Energy conte	169.8491	148.5512	153.2915	133.6432	128.2339	110.6561	102.5391	117.6651	119.0704	138.7651	151.4730	164.4898 (45)
Energy content (annual)										Total = Sum(45)m =		1638.2275 (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	36.0929	31.5671	32.5744	28.3992	27.2497	23.5144	21.7896	25.0038	25.3025	29.4876	32.1880	34.9541 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	147.2019	147.2019	147.2019	147.2019	147.2019	147.2019	147.2019	147.2019	147.2019	147.2019	147.2019	147.2019	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	29.6248	26.3124	21.3987	16.2002	12.1098	10.2236	11.0470	14.3593	19.2730	24.4716	28.5619	30.4481	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	327.5926	330.9920	322.4257	304.1889	281.1683	259.5322	245.0780	241.6786	250.2449	268.4817	291.5023	313.1384	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.7202	37.7202	37.7202	37.7202	37.7202	37.7202	37.7202	37.7202	37.7202	37.7202	37.7202	37.7202	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-117.7616	-117.7616	-117.7616	-117.7616	-117.7616	-117.7616	-117.7616	-117.7616	-117.7616	-117.7616	-117.7616	-117.7616	(71)
Water heating gains (Table 5)	48.5120	46.9749	43.7828	39.4433	36.6259	32.6589	29.2870	33.6073	35.1423	39.6339	44.7056	46.9813	(72)
Total internal gains	472.8900	471.4399	454.7678	426.9931	397.0647	369.5754	352.5726	356.8058	371.8209	399.7477	431.9303	457.7284	(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					16.8400	10.6334	0.6300	0.7000	0.7700		54.7250 (74)	
East					0.9600	19.6403	0.6300	0.7000	0.7700		5.7622 (76)	
South					9.5400	46.7521	0.6300	0.7000	0.7700		136.3079 (78)	
West					2.1700	19.6403	0.6300	0.7000	0.7700		13.0250 (80)	
Solar gains	209.8201	364.5713	522.6005	695.1151	827.6192	844.6965	804.6700	701.3017	581.1116	408.8830	252.5072	178.8538 (83)
Total gains	682.7101	836.0113	977.3684	1122.1082	1224.6840	1214.2718	1157.2426	1058.1075	952.9325	808.6306	684.4375	636.5821 (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	37.0087	37.0863	37.1625	37.5252	37.5938	37.9166	37.9166	37.9770	37.7916	37.5938	37.4552	37.3114	
alpha	3.4672	3.4724	3.4775	3.5017	3.5063	3.5278	3.5278	3.5318	3.5194	3.5063	3.4970	3.4874	
util living area	0.9956	0.9907	0.9795	0.9494	0.8797	0.7524	0.6088	0.6687	0.8656	0.9689	0.9921	0.9966	(86)
MIT	18.9828	19.2074	19.5704	20.0508	20.4951	20.8085	20.9343	20.9074	20.6523	20.0729	19.4382	18.9446	(87)
Th 2	19.9513	19.9532	19.9551	19.9642	19.9659	19.9738	19.9738	19.9752	19.9707	19.9659	19.9625	19.9589	(88)
util rest of house	0.9946	0.9886	0.9746	0.9360	0.8451	0.6773	0.4916	0.5551	0.8132	0.9583	0.9900	0.9958	(89)
MIT 2	18.0967	18.3218	18.6836	19.1617	19.5837	19.8606	19.9481	19.9355	19.7379	19.1906	18.5595	18.0642	(90)
Living area fraction									fLA = Living area / (4) =			0.1796	(91)
MIT	18.2558	18.4808	18.8428	19.3214	19.7474	20.0309	20.1252	20.1101	19.9021	19.3491	18.7173	18.2223	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.2558	18.4808	18.8428	19.3214	19.7474	20.0309	20.1252	20.1101	19.9021	19.3491	18.7173	18.2223	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	677.4304	822.9578	945.5865	1038.5263	1024.4088	828.0698	590.5716	604.9021	770.9405	768.0208	675.0508	632.6939	(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	2537.1679	2463.8366	2234.6399	1868.5345	1440.2430	963.6888	625.5371	657.2922	1032.9777	1565.8270	2086.8442	2528.5712	(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	1383.6447	1102.6705	959.0557	597.6059	309.3807	0.0000	0.0000	0.0000	0.0000	593.5679	1016.4913	1410.5326	(98)
Space heating												7372.9493	(98)
Space heating per m2												(98) / (4) =	47.0874 (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	1668.0012	1313.1073	1346.4522	0.0000	0.0000	0.0000	0.0000	(100)

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Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7490	0.8227	0.7845	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1249.3728	1080.2762	1056.2531	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1547.3762	1477.7050	1364.4122	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												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	214.5625	295.6870	229.2703	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												739.5198 (104)
Cooled fraction									FC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)												
Intermittency factor	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												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	53.6406	73.9218	57.3176	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												184.8800 (107)
Space cooling per m2												1.1807 (108)
Energy for space heating												47.0874 (99)
Energy for space cooling												1.1807 (108)
Total												48.2682 (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	78.2900 (1b)	x 2.3900 (2b)	= 187.1131 (1b) - (3b)
First floor	78.2900 (1c)	x 2.6700 (2c)	= 209.0343 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	156.5800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 396.1474 (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) =	0.1010 (8)	
Pressure test															Yes		
Measured/design AP50															5.0000		
Infiltration rate															0.3510 (18)		
Number of sides sheltered															0 (19)		
Shelter factor										(20) = 1 - [0.075 x (19)] =					1.0000 (20)		
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =					0.3510 (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	0.4475	0.4387	0.4299	0.3861	0.3773	0.3334	0.3334	0.3246	0.3510	0.3773	0.3948	0.4124 (22b)					
Effective ac	0.6001	0.5962	0.5924	0.5745	0.5712	0.5556	0.5556	0.5527	0.5616	0.5712	0.5780	0.5850 (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)			29.5100	1.3258	39.1231		(27)					
Ground Floor			78.2900	0.1300	10.1777		(28a)					
Brick and Block	205.6900	31.6300	174.0600	0.1800	31.3308		(29a)					
Pitched Roof	78.2900		78.2900	0.1300	10.1777		(30)					
Total net area of external elements Aum(A, m2)			362.2700				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	92.9293		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							15.1145 (36)					
Total fabric heat loss						(33) + (36) =	108.0438 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 78.4533	Feb 77.9451	Mar 77.4469	Apr 75.1069	May 74.6691	Jun 72.6310	Jul 72.6310	Aug 72.2535	Sep 73.4160	Oct 74.6691	Nov 75.5547	Dec 76.4807 (38)
Heat transfer coeff	186.4972	185.9889	185.4907	183.1507	182.7129	180.6748	180.6748	180.2974	181.4598	182.7129	183.5985	184.5245 (39)
Average = Sum(39)m / 12 =												183.1486 (39)
HLP	Jan 1.1911	Feb 1.1878	Mar 1.1846	Apr 1.1697	May 1.1669	Jun 1.1539	Jul 1.1539	Aug 1.1515	Sep 1.1589	Oct 1.1669	Nov 1.1726	Dec 1.1785 (40)
HLP (average)												1.1697 (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												2.9440 (42)
Average daily hot water use (litres/day)												104.1209 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	114.5330	110.3682	106.2033	102.0385	97.8737	93.7088	93.7088	97.8737	102.0385	106.2033	110.3682	114.5330 (44)
Energy content (annual)	169.8491	148.5512	153.2915	133.6432	128.2339	110.6561	102.5391	117.6651	119.0704	138.7651	151.4730	164.4898 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		1638.2275 (45)
Water storage loss:	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												

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CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Heat gains from water heating, kWh/month	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
	36.0929	31.5671	32.5744	28.3992	27.2497	23.5144	21.7896	25.0038	25.3025	29.4876	32.1880	34.9541 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	147.2019	147.2019	147.2019	147.2019	147.2019	147.2019	147.2019	147.2019	147.2019	147.2019	147.2019	147.2019	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	29.6248	26.3124	21.3987	16.2002	12.1098	10.2236	11.0470	14.3593	19.2730	24.4716	28.5619	30.4481	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	327.5926	330.9920	322.4257	304.1889	281.1683	259.5322	245.0780	241.6786	250.2449	268.4817	291.5023	313.1384	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.7202	37.7202	37.7202	37.7202	37.7202	37.7202	37.7202	37.7202	37.7202	37.7202	37.7202	37.7202	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-117.7616	-117.7616	-117.7616	-117.7616	-117.7616	-117.7616	-117.7616	-117.7616	-117.7616	-117.7616	-117.7616	-117.7616	(71)
Water heating gains (Table 5)	48.5120	46.9749	43.7828	39.4433	36.6259	32.6589	29.2870	33.6073	35.1423	39.6339	44.7056	46.9813	(72)
Total internal gains	472.8900	471.4399	454.7678	426.9931	397.0647	369.5754	352.5726	356.8058	371.8209	399.7477	431.9303	457.7284	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	FF	Access factor Table 6d	Gains W	
North	16.8400	10.6334	0.6300		0.7000	0.7700	54.7250	(74)
East	0.9600	19.6403	0.6300		0.7000	0.7700	5.7622	(76)
South	9.5400	46.7521	0.6300		0.7000	0.7700	136.3079	(78)
West	2.1700	19.6403	0.6300		0.7000	0.7700	13.0250	(80)

Solar gains	209.8201	364.5713	522.6005	695.1151	827.6192	844.6965	804.6700	701.3017	581.1116	408.8830	252.5072	178.8538	(83)
Total gains	682.7101	836.0113	977.3684	1122.1082	1224.6840	1214.2718	1157.2426	1058.1075	952.9325	808.6306	684.4375	636.5821	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
tau	58.3044	58.4638	58.6208	59.3698	59.5120	60.1833	60.1833	60.3093	59.9230	59.5120	59.2249	58.9277		
alpha	4.8870	4.8976	4.9081	4.9580	4.9675	5.0122	5.0122	5.0206	4.9949	4.9675	4.9483	4.9285		
util living area	0.9995	0.9986	0.9956	0.9828	0.9360	0.8126	0.6504	0.7190	0.9241	0.9917	0.9989	0.9997	(86)	
MIT	19.5521	19.7136	19.9769	20.3346	20.6694	20.8984	20.9746	20.9589	20.7776	20.3433	19.8840	19.5299	(87)	
Th 2	19.9272	19.9298	19.9323	19.9443	19.9466	19.9571	19.9571	19.9590	19.9530	19.9466	19.9420	19.9373	(88)	
util rest of house	0.9994	0.9981	0.9938	0.9753	0.9058	0.7274	0.5141	0.5861	0.8749	0.9870	0.9984	0.9996	(89)	
MIT 2	18.5983	18.7616	19.0262	19.3895	19.7089	19.9063	19.9501	19.9461	19.8163	19.4027	18.9418	18.5842	(90)	
Living area fraction									fLA = Living area / (4) =			0.1796	(91)	
MIT	18.7696	18.9326	19.1969	19.5592	19.8814	20.0845	20.1341	20.1280	19.9889	19.5716	19.1110	18.7540	(92)	
Temperature adjustment												0.0000		
adjusted MIT	18.7696	18.9326	19.1969	19.5592	19.8814	20.0845	20.1341	20.1280	19.9889	19.5716	19.1110	18.7540	(93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9991	0.9974	0.9921	0.9716	0.9035	0.7392	0.5388	0.6098	0.8771	0.9846	0.9979	0.9994	(94)
Ext temp.	682.0925	833.8554	969.6958	1090.2960	1106.4844	897.6253	623.5776	645.2709	835.7775	796.2000	682.9919	636.1792	(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	2698.5307	2609.9061	2355.1609	1952.2399	1494.8497	990.9076	638.5278	672.1433	1068.6026	1639.2244	2205.2067	2685.5744	(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	1500.2300	1193.5060	1030.7861	620.5996	288.9438	0.0000	0.0000	0.0000	0.0000	627.2102	1095.9946	1524.7500	(98)
Space heating per m2												7882.0201	(98)
										(98) / (4) =		50.3386	(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	1698.3429	1336.9933	1370.2599	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7926	0.8724	0.8321	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1346.1228	1166.4505	1140.2151	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1547.3762	1477.7050	1364.4122	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	144.9024	231.5733	166.8027	0.0000	0.0000	0.0000	0.0000	(104)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling												543.2784 (104)
Cooled fraction												1.0000 (105)
Intermittency factor (Table 10b)												
	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)	
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	36.2256	57.8933	41.7007	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												135.8196 (107)
Space cooling per m2												0.8674 (108)
Energy for space heating												50.3386 (99)
Energy for space cooling												0.8674 (108)
Total												51.2060 (109)
Target Fabric Energy Efficiency (TFEE)												58.9 (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	78.2900 (1b)	x 2.3900 (2b)	= 187.1131 (1b) - (3b)
First floor	78.2900 (1c)	x 2.6700 (2c)	= 209.0343 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	156.5800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 396.1474 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					5 * 10 = 50.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					50.0000 / (5) = 0.1262 (8)
Pressure test					Yes
Measured/design AP50					4.0500
Infiltration rate					0.3287 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3287 (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	0.3862	0.3616	0.3616	0.3287	0.3369	0.3205	0.3205	0.3123	0.3123	0.3369	0.3287	0.3369 (22b)
Effective ac	0.5746	0.5654	0.5654	0.5540	0.5568	0.5514	0.5514	0.5488	0.5488	0.5568	0.5540	0.5568 (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)			29.5100	1.1450	33.7901		(27)
Ground Floor			78.2900	0.1200	9.3948	84.0000	6576.3600 (28a)
Brick and Block	205.6900	31.6300	174.0600	0.2400	41.7744	42.2200	7348.8132 (29a)
Pitched Roof	78.2900		78.2900	0.1000	7.8290	9.1000	712.4390 (30)
Total net area of external elements Aum(A, m ²)			362.2700				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	95.1203	(33)
GF Block			75.9400			75.0000	5695.5000 (32c)
GF Stud			26.2700			9.0000	236.4300 (32c)
FF Stud			170.9000			9.0000	1538.1000 (32c)
Internal Floor 1			78.2900			18.0000	1409.2200 (32d)
Internal Ceiling 1			78.2900			18.0000	1409.2200 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 24926.0822 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							159.1907 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							11.5295 (36)
Total fabric heat loss							(33) + (36) = 106.6498 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	75.1155	73.9104	73.9104	72.4272	72.7848	72.0785	72.0785	71.7386	71.7386	72.7848	72.4272	72.7848 (38)
Average = Sum(39)m / 12 =	181.7653	180.5602	180.5602	179.0770	179.4345	178.7282	178.7282	178.3883	178.3883	179.4345	179.0770	179.4345 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1608	1.1531	1.1531	1.1437	1.1460	1.1415	1.1415	1.1393	1.1393	1.1460	1.1437	1.1460 (40)
HLP (average)												1.1462 (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												2.9440 (42)
Average daily hot water use (litres/day)												104.1209 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	114.5330	110.3682	106.2033	102.0385	97.8737	93.7088	93.7088	97.8737	102.0385	106.2033	110.3682	114.5330 (44)
Energy conte	169.8491	148.5512	153.2915	133.6432	128.2339	110.6561	102.5391	117.6651	119.0704	138.7651	151.4730	164.4898 (45)
Energy content (annual)										Total = Sum(45)m =		1638.2275 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	25.4774	22.2827	22.9937	20.0465	19.2351	16.5984	15.3809	17.6498	17.8606	20.8148	22.7209	24.6735 (46)
Water storage loss:												
Store volume												215.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.7300 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.9342 (55)
Total storage loss												
28.9602 26.1576 28.9602 28.0260 28.9602 28.0260 28.9602 28.9602 28.0260 28.9602 28.0260 28.9602 28.9602 (56)												
If cylinder contains dedicated solar storage												
28.9602 26.1576 28.9602 28.0260 28.9602 28.0260 28.9602 28.9602 28.0260 28.9602 28.0260 28.9602 28.9602 (57)												
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month												
222.0717 195.7200 205.5141 184.1812 180.4565 161.1941 154.7617 169.8877 169.6084 190.9877 202.0110 216.7124 (62)												
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Solar input (sum of months) = Sum(63)m =												0.0000 (63)
Output from w/h	222.0717	195.7200	205.5141	184.1812	180.4565	161.1941	154.7617	169.8877	169.6084	190.9877	202.0110	216.7124 (64)
RHI water heating demand												2253.1065 (64)
Heat gains from water heating, kWh/month	98.2529	87.1283	92.7475	84.8668	84.4158	77.2235	75.8723	80.9017	80.0213	87.9175	90.7952	96.4709 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	176.6423	176.6423	176.6423	176.6423	176.6423	176.6423	176.6423	176.6423	176.6423	176.6423	176.6423	176.6423 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	74.0619	65.7811	53.4968	40.5005	30.2746	25.5591	27.6175	35.8983	48.1826	61.1789	71.4048	76.1203 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	488.9442	494.0179	481.2324	454.0134	419.6543	387.3615	365.7880	360.7143	373.4999	400.7189	435.0780	467.3707 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.6083	55.6083	55.6083	55.6083	55.6083	55.6083	55.6083	55.6083	55.6083	55.6083	55.6083	55.6083 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-117.7616	-117.7616	-117.7616	-117.7616	-117.7616	-117.7616	-117.7616	-117.7616	-117.7616	-117.7616	-117.7616	-117.7616 (71)
Water heating gains (Table 5)	132.0604	129.6552	124.6606	117.8705	113.4621	107.2549	101.9789	108.7389	111.1407	118.1687	126.1044	129.6653 (72)
Total internal gains	812.5556	806.9433	776.8788	729.8734	680.8801	637.6646	612.8735	622.8405	650.3123	697.5555	750.0762	790.6453 (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			16.8400		13.4684		0.6300		0.7000		0.7700		69.3155 (74)
East			0.9600		25.1733		0.6300		0.7000		0.7700		7.3855 (76)
South			9.5400		56.5862		0.6300		0.7000		0.7700		164.9798 (78)
West			2.1700		25.1733		0.6300		0.7000		0.7700		16.6944 (80)
Solar gains	258.3753	383.3287	563.3614	758.9623	854.9770	967.1587	884.6351	801.3833	658.1368	464.9751	310.1617	208.3596	(83)
Total gains	1070.9308	1190.2720	1340.2402	1488.8358	1535.8571	1604.8233	1497.5087	1424.2239	1308.4490	1162.5306	1060.2380	999.0049	(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	38.0926	38.3468	38.3468	38.6644	38.5874	38.7399	38.7399	38.8137	38.8137	38.5874	38.6644	38.5874
Feb	3.5395	3.5565	3.5565	3.5776	3.5725	3.5827	3.5827	3.5876	3.5876	3.5725	3.5776	3.5725
util living area	0.9791	0.9692	0.9415	0.8733	0.7490	0.5330	0.3853	0.3916	0.6669	0.8857	0.9616	0.9826 (86)
MIT	19.5311	19.6928	20.0267	20.4507	20.7749	20.9527	20.9891	20.9890	20.8934	20.5222	19.9878	19.5145 (87)
Th 2	19.9515	19.9577	19.9577	19.9653	19.9635	19.9671	19.9671	19.9689	19.9689	19.9635	19.9653	19.9635 (88)
util rest of house	0.9743	0.9621	0.9277	0.8430	0.6883	0.4380	0.2688	0.2698	0.5744	0.8500	0.9511	0.9786 (89)
MIT 2	18.0279	18.2645	18.7412	19.3338	19.7483	19.9376	19.9637	19.9656	19.8904	19.4418	18.6977	18.0121 (90)
Living area fraction	18.2979	18.5210	18.9720	19.5344	19.9327	20.1199	20.1479	20.1494	20.0706	19.6358	18.9294	18.2819 (92)
MIT	18.2979	18.5210	18.9720	19.5344	19.9327	20.1199	20.1479	20.1494	20.0706	19.6358	18.9294	18.2819 (93)
Temperature adjustment												0.0000
adjusted MIT	18.2979	18.5210	18.9720	19.5344	19.9327	20.1199	20.1479	20.1494	20.0706	19.6358	18.9294	18.2819 (93)

8. Space heating requirement

Utilisation	0.9635	0.9489	0.9111	0.8281	0.6863	0.4528	0.2896	0.2917	0.5843	0.8362	0.9368	0.9690 (94)
Useful gains	1031.8396	1129.4448	1221.1069	1232.8417	1054.0570	726.6190	433.7234	415.4207	764.5883	972.0635	993.2053	968.0014 (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	2308.0331	2260.7996	2053.3392	1689.4885	1226.0184	754.2110	437.5074	419.1075	833.1719	1352.1906	1849.7606	2257.6331 (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	949.4880	760.2705	619.1808	328.7857	127.9393	0.0000	0.0000	0.0000	0.0000	282.8146	616.7198	959.4860 (98)
Space heating												4644.6846 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

RHI space heating demand

4645 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	78.2900 (1b)	x 2.3900 (2b)	= 187.1131 (1b) - (3b)
First floor	78.2900 (1c)	x 2.6700 (2c)	= 209.0343 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	156.5800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 396.1474 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					5 * 10 = 50.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					50.0000 / (5) = 0.1262 (8)
Pressure test					Yes
Measured/design AP50					4.0500
Infiltration rate					0.3287 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3287 (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	0.4191	0.4109	0.4027	0.3616	0.3534	0.3123	0.3123	0.3041	0.3287	0.3534	0.3698	0.3862 (22b)
Effective ac	0.5878	0.5844	0.5811	0.5654	0.5624	0.5488	0.5488	0.5462	0.5540	0.5624	0.5684	0.5746 (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)			29.5100	1.1450	33.7901		(27)
Ground Floor			78.2900	0.1200	9.3948	84.0000	6576.3600 (28a)
Brick and Block	205.6900	31.6300	174.0600	0.2400	41.7744	42.2200	7348.8132 (29a)
Pitched Roof	78.2900		78.2900	0.1000	7.8290	9.1000	712.4390 (30)
Total net area of external elements Aum(A, m ²)			362.2700				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	95.1203		(33)
GF Block			75.9400			75.0000	5695.5000 (32c)
GF Stud			26.2700			9.0000	236.4300 (32c)
FF Stud			170.9000			9.0000	1538.1000 (32c)
Internal Floor 1			78.2900			18.0000	1409.2200 (32d)
Internal Ceiling 1			78.2900			18.0000	1409.2200 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 24926.0822 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 159.1907 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 11.5295 (36)
Total fabric heat loss (33) + (36) = 106.6498 (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	76.8459	76.4001	75.9630	73.9104	73.5264	71.7386	71.7386	71.4075	72.4272	73.5264	74.3033	75.1155 (38)
Heat transfer coeff	183.4957	183.0498	182.6128	180.5602	180.1761	178.3883	178.3883	178.0573	179.0770	180.1761	180.9530	181.7653 (39)
Average = Sum(39)m / 12 =												180.5583 (39)
HLP	1.1719	1.1690	1.1663	1.1531	1.1507	1.1393	1.1393	1.1372	1.1437	1.1507	1.1557	1.1608 (40)
HLP (average)												1.1531 (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												2.9440 (42)
Average daily hot water use (litres/day)												104.1209 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	114.5330	110.3682	106.2033	102.0385	97.8737	93.7088	93.7088	97.8737	102.0385	106.2033	110.3682	114.5330 (44)
Energy conte	169.8491	148.5512	153.2915	133.6432	128.2339	110.6561	102.5391	117.6651	119.0704	138.7651	151.4730	164.4898 (45)
Energy content (annual)										Total = Sum(45)m =		1638.2275 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	25.4774	22.2827	22.9937	20.0465	19.2351	16.5984	15.3809	17.6498	17.8606	20.8148	22.7209	24.6735 (46)
Water storage loss:												
Store volume												215.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.7300 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.9342 (55)
Total storage loss												
28.9602 26.1576 28.9602 28.0260 28.9602 28.0260 28.9602 28.9602 28.0260 28.9602 28.0260 28.9602 28.9602 (56)												
If cylinder contains dedicated solar storage												
28.9602 26.1576 28.9602 28.0260 28.9602 28.0260 28.9602 28.9602 28.0260 28.9602 28.0260 28.9602 28.9602 (57)												
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month												
222.0717 195.7200 205.5141 184.1812 180.4565 161.1941 154.7617 169.8877 169.6084 190.9877 202.0110 216.7124 (62)												
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Solar input (sum of months) = Sum(63)m =												0.0000 (63)
Output from w/h	222.0717	195.7200	205.5141	184.1812	180.4565	161.1941	154.7617	169.8877	169.6084	190.9877	202.0110	216.7124 (64)
Total per year (kWh/year) = Sum(64)m =												2253.1065 (64)
Heat gains from water heating, kWh/month												
98.2529 87.1283 92.7475 84.8668 84.4158 77.2235 75.8723 80.9017 80.0213 87.9175 90.7952 96.4709 (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	176.6423	176.6423	176.6423	176.6423	176.6423	176.6423	176.6423	176.6423	176.6423	176.6423	176.6423	176.6423	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	74.0619	65.7811	53.4968	40.5005	30.2746	25.5591	27.6175	35.8983	48.1826	61.1789	71.4048	76.1203	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	488.9442	494.0179	481.2324	454.0134	419.6543	387.3615	365.7880	360.7143	373.4999	400.7189	435.0780	467.3707	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.6083	55.6083	55.6083	55.6083	55.6083	55.6083	55.6083	55.6083	55.6083	55.6083	55.6083	55.6083	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-117.7616	-117.7616	-117.7616	-117.7616	-117.7616	-117.7616	-117.7616	-117.7616	-117.7616	-117.7616	-117.7616	-117.7616	(71)
Water heating gains (Table 5)	132.0604	129.6552	124.6606	117.8705	113.4621	107.2549	101.9789	108.7389	111.1407	118.1687	126.1044	129.6653	(72)
Total internal gains	812.5556	806.9433	776.8788	729.8734	680.8801	637.6646	612.8735	622.8405	650.3123	697.5555	750.0762	790.6453	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data FF or Table 6c	Access factor Table 6d	Gains W
North	16.8400	10.6334	0.6300	0.7000	0.7700	54.7250 (74)
East	0.9600	19.6403	0.6300	0.7000	0.7700	5.7622 (76)
South	9.5400	46.7521	0.6300	0.7000	0.7700	136.3079 (78)
West	2.1700	19.6403	0.6300	0.7000	0.7700	13.0250 (80)

Solar gains	209.8201	364.5713	522.6005	695.1151	827.6192	844.6965	804.6700	701.3017	581.1116	408.8830	252.5072	178.8538 (83)
Total gains	1022.3757	1171.5147	1299.4793	1424.9886	1508.4993	1482.3611	1417.5435	1324.1422	1231.4239	1106.4385	1002.5834	969.4991 (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	37.7334	37.8253	37.9158	38.3468	38.4286	38.8137	38.8137	38.8859	38.6644	38.4286	38.2636	38.0926
alpha	3.5156	3.5217	3.5277	3.5565	3.5619	3.5876	3.5876	3.5924	3.5776	3.5619	3.5509	3.5395
util living area	0.9858	0.9762	0.9569	0.9113	0.8199	0.6708	0.5220	0.5713	0.7829	0.9311	0.9767	0.9882 (86)
MIT	19.2793	19.4899	19.8232	20.2549	20.6308	20.8757	20.9620	20.9472	20.7711	20.2903	19.7094	19.2416 (87)
Th 2	19.9425	19.9448	19.9471	19.9577	19.9596	19.9689	19.9689	19.9706	19.9653	19.9596	19.9556	19.9515 (88)
util rest of house	0.9828	0.9711	0.9472	0.8901	0.7755	0.5910	0.4125	0.4616	0.7157	0.9102	0.9707	0.9856 (89)
MIT 2	17.6562	17.9626	18.4440	19.0610	19.5673	19.8679	19.9488	19.9403	19.7566	19.1227	18.2906	17.6071 (90)
Living area fraction												
MIT	17.9477	18.2369	18.6917	19.2754	19.7583	20.0489	20.1308	20.1211	19.9388	19.3324	18.5454	17.9007 (91)
Temperature adjustment												0.0000
adjusted MIT	17.9477	18.2369	18.6917	19.2754	19.7583	20.0489	20.1308	20.1211	19.9388	19.3324	18.5454	17.9007 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9742	0.9593	0.9317	0.8730	0.7656	0.5977	0.4305	0.4787	0.7137	0.8941	0.9593	0.9780 (94)
Useful gains	995.9759	1123.8857	1210.7580	1244.0654	1154.9542	885.9729	610.3138	633.8563	878.8646	989.2199	961.7342	948.2053 (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												
	2504.2977	2441.3131	2226.3532	1873.3817	1451.9170	972.0156	629.8477	662.5696	1045.6006	1573.3628	2071.0810	2490.3069 (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												
	1122.1914	885.3112	755.6028	453.1077	220.9403	0.0000	0.0000	0.0000	0.0000	434.6023	798.7297	1147.3236 (98)
Space heating												5817.8090 (98)
Space heating per m2												(98) / (4) = 37.1555 (99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)														0.0000 (201)
Fraction of space heat from main system(s)														1.0000 (202)
Efficiency of main space heating system 1 (in %)														90.5000 (206)
Efficiency of secondary/supplementary heating system, %														0.0000 (208)
Space heating requirement														6428.5182 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	1122.1914	885.3112	755.6028	453.1077	220.9403	0.0000	0.0000	0.0000	0.0000	434.6023	798.7297	1147.3236	(98)	
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)	
Space heating fuel (main heating system)	1239.9905	978.2444	834.9202	500.6715	244.1329	0.0000	0.0000	0.0000	0.0000	480.2236	882.5743	1267.7608	(211)	
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)	
Water heating requirement	222.0717	195.7200	205.5141	184.1812	180.4565	161.1941	154.7617	169.8877	169.6084	190.9877	202.0110	216.7124	(64)	
Efficiency of water heater (217)m	88.5388	88.3551	87.9776	87.1238	85.3547	79.8000	79.8000	79.8000	79.8000	86.9411	88.1150	88.6123	(216)	
Fuel for water heating, kWh/month	250.8186	221.5152	233.5983	211.4017	211.4194	201.9976	193.9370	212.8919	212.5419	219.6749	229.2583	244.5625	(219)	
Water heating fuel used												2643.6171	(219)	
Annual totals kWh/year														
Space heating fuel - main system												6428.5182	(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)													523.1825	(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												8841.4952	(238)	

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	6428.5182	3.4800	223.7124 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2643.6171	3.4800	91.9979 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	523.1825	13.1900	69.0078 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-828.8227	13.1900	-109.3217 (252)
Total energy cost			405.2889 (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] =	0.8444 (257)
SAP value		88.2201
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	6428.5182	0.2160	1388.5599 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2643.6171	0.2160	571.0213 (264)
Space and water heating			1959.5812 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	523.1825	0.5190	271.5317 (268)
Energy saving/generation technologies			
PV Unit	-828.8227	0.5190	-430.1590 (269)
Total kg/year			1839.8790 (272)
CO2 emissions per m2			11.7500 (273)
EI value			87.7694
EI rating			88 (274)
EI band			B

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Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

Calculation of stars for heating and DHW

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9050 = 3.845$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9050 = 0.2387$, stars = 4
Water heating energy efficiency	$3.48 / 0.8502 = 4.093$, stars = 4
Water heating environmental impact	$0.216 / 0.8502 = 0.2541$, 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	78.2900 (1b)	x 2.3900 (2b)	= 187.1131 (1b) - (3b)
First floor	78.2900 (1c)	x 2.6700 (2c)	= 209.0343 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	156.5800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 396.1474 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour										
										heating	heating													
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)							
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)							
Number of intermittent fans																5 * 10 =	50.0000 (7a)							
Number of passive vents																0 * 10 =	0.0000 (7b)							
Number of flueless gas fires																0 * 40 =	0.0000 (7c)							
										Air changes per hour														
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =					50.0000	/ (5) =	0.1262 (8)							
Pressure test										Yes														
Measured/design AP50										4.0500														
Infiltration rate										0.3287 (18)														
Number of sides sheltered										0 (19)														
Shelter factor										(20) = 1 - [0.075 x (19)] =					1.0000 (20)									
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =					0.3287 (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													0.3862	0.3616	0.3616	0.3287	0.3369	0.3205	0.3205	0.3123	0.3123	0.3369	0.3287	0.3369 (22b)
Effective ac													0.5746	0.5654	0.5654	0.5540	0.5568	0.5514	0.5514	0.5488	0.5488	0.5568	0.5540	0.5568 (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)			29.5100	1.1450	33.7901			(27)					
Ground Floor			78.2900	0.1200	9.3948	84.0000	6576.3600	(28a)					
Brick and Block	205.6900	31.6300	174.0600	0.2400	41.7744	42.2200	7348.8132	(29a)					
Pitched Roof	78.2900		78.2900	0.1000	7.8290	9.1000	712.4390	(30)					
Total net area of external elements Aum(A, m2)			362.2700					(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	95.1203			(33)					
GF Block			75.9400			75.0000	5695.5000	(32c)					
GF Stud			26.2700			9.0000	236.4300	(32c)					
FF Stud			170.9000			9.0000	1538.1000	(32c)					
Internal Floor 1			78.2900			18.0000	1409.2200	(32d)					
Internal Ceiling 1			78.2900			18.0000	1409.2200	(32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	24926.0822	(34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							159.1907	(35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							11.5295	(36)					
Total fabric heat loss						(33) + (36) =	106.6498	(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 75.1155	Feb 73.9104	Mar 73.9104	Apr 72.4272	May 72.7848	Jun 72.0785	Jul 72.0785	Aug 71.7386	Sep 71.7386	Oct 72.7848	Nov 72.4272	Dec 72.7848	(38)
Heat transfer coeff	181.7653	180.5602	180.5602	179.0770	179.4345	178.7282	178.7282	178.3883	178.3883	179.4345	179.0770	179.4345	(39)
Average = Sum(39)m / 12 =													179.4647 (39)
HLP	Jan 1.1608	Feb 1.1531	Mar 1.1531	Apr 1.1437	May 1.1460	Jun 1.1415	Jul 1.1415	Aug 1.1393	Sep 1.1393	Oct 1.1460	Nov 1.1437	Dec 1.1460	(40)
HLP (average)													1.1462 (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												2.9440 (42)
Average daily hot water use (litres/day)												104.1209 (43)
Daily hot water use	Jan 114.5330	Feb 110.3682	Mar 106.2033	Apr 102.0385	May 97.8737	Jun 93.7088	Jul 93.7088	Aug 97.8737	Sep 102.0385	Oct 106.2033	Nov 110.3682	Dec 114.5330 (44)
Energy conte	169.8491	148.5512	153.2915	133.6432	128.2339	110.6561	102.5391	117.6651	119.0704	138.7651	151.4730	164.4898 (45)
Energy content (annual)										Total = Sum(45)m =		1638.2275 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Distribution loss (46)m = 0.15 x (45)m	25.4774	22.2827	22.9937	20.0465	19.2351	16.5984	15.3809	17.6498	17.8606	20.8148	22.7209	24.6735 (46)
Water storage loss:												
Store volume												215.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.7300 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.9342 (55)
Total storage loss												
28.9602 26.1576 28.9602 28.0260 28.9602 28.0260 28.9602 28.9602 28.0260 28.9602 28.0260 28.9602 28.9602 (56)												
If cylinder contains dedicated solar storage												
28.9602 26.1576 28.9602 28.0260 28.9602 28.0260 28.9602 28.9602 28.0260 28.9602 28.0260 28.9602 28.9602 (57)												
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month												
222.0717 195.7200 205.5141 184.1812 180.4565 161.1941 154.7617 169.8877 169.6084 190.9877 202.0110 216.7124 (62)												
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Solar input (sum of months) = Sum(63)m =												0.0000 (63)
Output from w/h	222.0717	195.7200	205.5141	184.1812	180.4565	161.1941	154.7617	169.8877	169.6084	190.9877	202.0110	216.7124 (64)
Total per year (kWh/year) = Sum(64)m =												2253.1065 (64)
Heat gains from water heating, kWh/month												
98.2529 87.1283 92.7475 84.8668 84.4158 77.2235 75.8723 80.9017 80.0213 87.9175 90.7952 96.4709 (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	176.6423	176.6423	176.6423	176.6423	176.6423	176.6423	176.6423	176.6423	176.6423	176.6423	176.6423	176.6423	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	74.0619	65.7811	53.4968	40.5005	30.2746	25.5591	27.6175	35.8983	48.1826	61.1789	71.4048	76.1203	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	488.9442	494.0179	481.2324	454.0134	419.6543	387.3615	365.7880	360.7143	373.4999	400.7189	435.0780	467.3707	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	55.6083	55.6083	55.6083	55.6083	55.6083	55.6083	55.6083	55.6083	55.6083	55.6083	55.6083	55.6083	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-117.7616	-117.7616	-117.7616	-117.7616	-117.7616	-117.7616	-117.7616	-117.7616	-117.7616	-117.7616	-117.7616	-117.7616	(71)
Water heating gains (Table 5)													
	132.0604	129.6552	124.6606	117.8705	113.4621	107.2549	101.9789	108.7389	111.1407	118.1687	126.1044	129.6653	(72)
Total internal gains													
	812.5556	806.9433	776.8788	729.8734	680.8801	637.6646	612.8735	622.8405	650.3123	697.5555	750.0762	790.6453	(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	16.8400	13.4684	0.6300	0.7000	0.7700	69.3155 (74)
East	0.9600	25.1733	0.6300	0.7000	0.7700	7.3855 (76)
South	9.5400	56.5862	0.6300	0.7000	0.7700	164.9798 (78)
West	2.1700	25.1733	0.6300	0.7000	0.7700	16.6944 (80)

Solar gains	258.3753	383.3287	563.3614	758.9623	854.9770	967.1587	884.6351	801.3833	658.1368	464.9751	310.1617	208.3596 (83)
Total gains	1070.9308	1190.2720	1340.2402	1488.8358	1535.8571	1604.8233	1497.5087	1424.2239	1308.4490	1162.5306	1060.2380	999.0049 (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	38.0926	38.3468	38.3468	38.6644	38.5874	38.7399	38.7399	38.8137	38.8137	38.5874	38.6644	38.5874	
alpha	3.5395	3.5565	3.5565	3.5776	3.5725	3.5827	3.5827	3.5876	3.5876	3.5725	3.5776	3.5725	
util living area	0.9791	0.9692	0.9415	0.8733	0.7490	0.5330	0.3853	0.3916	0.6669	0.8857	0.9616	0.9826 (86)	
MIT	19.5311	19.6928	20.0267	20.4507	20.7749	20.9527	20.9891	20.9890	20.8934	20.5222	19.9878	19.5145 (87)	
Th 2	19.9515	19.9577	19.9577	19.9653	19.9635	19.9671	19.9671	19.9689	19.9689	19.9635	19.9653	19.9635 (88)	
util rest of house													
	0.9743	0.9621	0.9277	0.8430	0.6883	0.4380	0.2688	0.2698	0.5744	0.8500	0.9511	0.9786 (89)	
MIT 2	18.0279	18.2645	18.7412	19.3338	19.7483	19.9376	19.9637	19.9656	19.8904	19.4418	18.6977	18.0121 (90)	
Living area fraction									fLA = Living area / (4) =				0.1796 (91)
MIT	18.2979	18.5210	18.9720	19.5344	19.9327	20.1199	20.1479	20.1494	20.0706	19.6358	18.9294	18.2819 (92)	
Temperature adjustment												0.0000	
adjusted MIT	18.2979	18.5210	18.9720	19.5344	19.9327	20.1199	20.1479	20.1494	20.0706	19.6358	18.9294	18.2819 (93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9635	0.9489	0.9111	0.8281	0.6863	0.4528	0.2896	0.2917	0.5843	0.8362	0.9368	0.9690	(94)
Useful gains	1031.8396	1129.4448	1221.1069	1232.8417	1054.0570	726.6190	433.7234	415.4207	764.5883	972.0635	993.2053	968.0014	(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													
	2308.0331	2260.7996	2053.3392	1689.4885	1226.0184	754.2110	437.5074	419.1075	833.1719	1352.1906	1849.7606	2257.6331	(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	949.4880	760.2705	619.1808	328.7857	127.9393	0.0000	0.0000	0.0000	0.0000	282.8146	616.7198	959.4860	(98)
Space heating												4644.6846	(98)
Space heating per m2												29.6633	(99)
										(98) / (4) =			

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)											
Fraction of space heat from main system(s)	1.0000 (202)											
Efficiency of main space heating system 1 (in %)	90.5000 (206)											
Efficiency of secondary/supplementary heating system, %	0.0000 (208)											
Space heating requirement	5132.2481 (211)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	949.4880	760.2705	619.1808	328.7857	127.9393	0.0000	0.0000	0.0000	0.0000	282.8146	616.7198	959.4860 (98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000 (210)
Space heating fuel (main heating system)	1049.1580	840.0779	684.1777	363.2991	141.3694	0.0000	0.0000	0.0000	0.0000	312.5023	681.4584	1060.2055 (211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating requirement	222.0717	195.7200	205.5141	184.1812	180.4565	161.1941	154.7617	169.8877	169.6084	190.9877	202.0110	216.7124 (64)
Efficiency of water heater (217)m	88.2569	88.0820	87.5738	86.3431	83.9160	79.8000	79.8000	79.8000	79.8000	85.8594	87.6018	79.8000 (216)
Fuel for water heating, kWh/month	251.6198	222.2019	234.6753	213.3131	215.0442	201.9976	193.9370	212.8919	212.5419	222.4425	230.6014	245.3771 (219)
Water heating fuel used												2656.6436 (219)
Annual totals kWh/year												
Space heating fuel - main system												5132.2481 (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)												523.1825 (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												7468.3547 (238)

10a. Fuel costs - using BEDF prices (497)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	5132.2481	3.6300	186.3006 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2656.6436	3.6300	96.4362 (247)
Pumps and fans for heating	75.0000	19.4400	14.5800 (249)
Energy for lighting	523.1825	19.4400	101.7067 (250)
Additional standing charges			95.0000 (251)
Energy saving/generation technologies			
PV Unit	-918.7195	19.4400	-178.5991 (252)
Total energy cost			315.4244 (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	5132.2481	0.2160	1108.5656 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2656.6436	0.2160	573.8350 (264)
Space and water heating			1682.4006 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	523.1825	0.5190	271.5317 (268)
Energy saving/generation technologies			
PV Unit	-918.7195	0.5190	-476.8154 (269)
Total kg/year			1516.0419 (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	5132.2481	1.2200	6261.3427 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2656.6436	1.2200	3241.1052 (264)
Space and water heating			9502.4479 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	523.1825	3.0700	1606.1703 (268)
Energy saving/generation technologies			

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PV Unit	-918.7195	3.0700	-2820.4690 (269)
Primary energy kWh/year			8518.3993 (272)
Primary energy kWh/m2/year			54.4029 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating:	B 88
Current environmental impact rating:	B 88

(For testing purposes):

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

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.1	-£ 40	-272 kg (17.9%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£40 1.74 kg/m²	B 89	B 89
Total Savings	£40 1.74 kg/m²		
Potential energy efficiency rating:		B 89	
Potential environmental impact rating:			B 89

Fuel prices for cost data on this page from database revision number 497 TEST (31 May 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	£116	£126	-£10
Mains gas	£378	£328	£50
Space heating	£296	£297	-£2
Water heating	£96	£55	£42
Lighting	£102	£102	£0
Generated (PV)	-£179	-£179	£0
Total cost of fuels	£315	£275	£40
Total cost of uses	£315	£275	£40
Delivered energy	48 kWh/m²	39 kWh/m²	8 kWh/m²
Carbon dioxide emissions	1.5 tonnes	1.2 tonnes	0.3 tonnes
CO2 emissions per m²	10 kg/m²	8 kg/m²	2 kg/m²
Primary energy	54 kWh/m²	45 kWh/m²	10 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	78.2900 (1b)	x 2.3900 (2b)	= 187.1131 (1b) - (3b)
First floor	78.2900 (1c)	x 2.6700 (2c)	= 209.0343 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	156.5800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 396.1474 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					5 * 10 = 50.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					50.0000 / (5) = 0.1262 (8)
Pressure test					Yes
Measured/design AP50					4.0500
Infiltration rate					0.3287 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3287 (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	0.4191	0.4109	0.4027	0.3616	0.3534	0.3123	0.3123	0.3041	0.3287	0.3534	0.3698	0.3862 (22b)
Effective ac	0.5878	0.5844	0.5811	0.5654	0.5624	0.5488	0.5488	0.5462	0.5540	0.5624	0.5684	0.5746 (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)			29.5100	1.1450	33.7901		(27)
Ground Floor			78.2900	0.1200	9.3948	84.0000	6576.3600 (28a)
Brick and Block	205.6900	31.6300	174.0600	0.2400	41.7744	42.2200	7348.8132 (29a)
Pitched Roof	78.2900		78.2900	0.1000	7.8290	9.1000	712.4390 (30)
Total net area of external elements Aum(A, m ²)			362.2700				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	95.1203		(33)
GF Block			75.9400			75.0000	5695.5000 (32c)
GF Stud			26.2700			9.0000	236.4300 (32c)
FF Stud			170.9000			9.0000	1538.1000 (32c)
Internal Floor 1			78.2900			18.0000	1409.2200 (32d)
Internal Ceiling 1			78.2900			18.0000	1409.2200 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 24926.0822 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 159.1907 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 11.5295 (36)
Total fabric heat loss (33) + (36) = 106.6498 (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	76.8459	76.4001	75.9630	73.9104	73.5264	71.7386	71.7386	71.4075	72.4272	73.5264	74.3033	75.1155 (38)
Heat transfer coeff	183.4957	183.0498	182.6128	180.5602	180.1761	178.3883	178.3883	178.0573	179.0770	180.1761	180.9530	181.7653 (39)
Average = Sum(39)m / 12 =												180.5583 (39)
HLP	1.1719	1.1690	1.1663	1.1531	1.1507	1.1393	1.1393	1.1372	1.1437	1.1507	1.1557	1.1608 (40)
HLP (average)												1.1531 (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												2.9440 (42)
Average daily hot water use (litres/day)												104.1209 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	114.5330	110.3682	106.2033	102.0385	97.8737	93.7088	93.7088	97.8737	102.0385	106.2033	110.3682	114.5330 (44)
Energy content (annual)	169.8491	148.5512	153.2915	133.6432	128.2339	110.6561	102.5391	117.6651	119.0704	138.7651	151.4730	164.4898 (45)
										Total = Sum(45)m =		1638.2275 (45)

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Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	25.4774	22.2827	22.9937	20.0465	19.2351	16.5984	15.3809	17.6498	17.8606	20.8148	22.7209	24.6735 (46)
Water storage loss:												
Store volume												215.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.7300 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.9342 (55)
Total storage loss												
28.9602 26.1576 28.9602 28.0260 28.9602 28.0260 28.9602 28.9602 28.0260 28.9602 28.0260 28.9602 28.9602 (56)												
If cylinder contains dedicated solar storage												
18.8578 17.0329 18.8578 18.2495 18.8578 18.2495 18.8578 18.2495 18.8578 18.2495 18.8578 18.2495 18.8578 (57)												
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month												
211.9694 186.5952 194.0159 167.6511 157.5597 138.8108 131.6324 147.6889 154.4290 179.4896 192.2345 206.6100 (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												1.1071 (H8)
Utilisation factor												0.5948 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												117.0000 (H13)
Daily hot water demand												104.1209 (H14)
Volume ratio Veff/V												1.1237 (H15)
Solar storage volume factor												1.0000 (H16)
Solar input												-948.4726 (H17)
Solar input	-27.5038	-45.8960	-78.1661	-104.7580	-129.4196	-127.2401	-125.5586	-109.7012	-85.9180	-58.6719	-32.6235	-23.0160 (63)
Solar input (sum of months) = Sum (63)m =												-948.4726 (63)
Output from w/h												
184.4655 140.6992 115.8499 62.8932 28.1401 11.5707 6.0738 37.9877 68.5110 120.8177 159.6110 183.5940 (64)												
Total per year (kWh/year) = Sum (64)m =												1120.2139 (64)
Heat gains from water heating, kWh/month												
90.1710 79.8285 83.5490 71.6427 66.0985 59.3170 57.3689 63.1427 67.8778 78.7190 82.9740 88.3890 (65)												

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

Metabolic gains (Table 5), Watts												
(66)m	176.6423	176.6423	176.6423	176.6423	176.6423	176.6423	176.6423	176.6423	176.6423	176.6423	176.6423	176.6423 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
74.0619 65.7811 53.4968 40.5005 30.2746 25.5591 27.6175 35.8983 48.1826 61.1789 71.4048 76.1203 (67)												
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
488.9442 494.0179 481.2324 454.0134 419.6543 387.3615 365.7880 360.7143 373.4999 400.7189 435.0780 467.3707 (68)												
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
55.6083 55.6083 55.6083 55.6083 55.6083 55.6083 55.6083 55.6083 55.6083 55.6083 55.6083 55.6083 (69)												
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)												
-117.7616 -117.7616 -117.7616 -117.7616 -117.7616 -117.7616 -117.7616 -117.7616 -117.7616 -117.7616 -117.7616 -117.7616 (71)												
Water heating gains (Table 5)												
121.1976 118.7924 112.2970 99.5037 88.8420 82.3847 77.1087 84.8692 94.2747 105.8051 115.2416 118.8025 (72)												
Total internal gains	801.6928	796.0805	764.5152	711.5067	656.2599	612.7944	588.0033	598.9708	633.4463	685.1919	739.2135	779.7825 (73)

6. Solar gains

[Jan]												Gains
					Area	Solar flux		g	FF		Access	W
					m2	Table 6a	Specific data		Specific data		factor	
						W/m2	or Table 6b		or Table 6c		Table 6d	
North					16.8400	10.6334	0.6300		0.7000		0.7700	54.7250 (74)
East					0.9600	19.6403	0.6300		0.7000		0.7700	5.7622 (76)
South					9.5400	46.7521	0.6300		0.7000		0.7700	136.3079 (78)
West					2.1700	19.6403	0.6300		0.7000		0.7700	13.0250 (80)

Solar gains	209.8201	364.5713	522.6005	695.1151	827.6192	844.6965	804.6700	701.3017	581.1116	408.8830	252.5072	178.8538 (83)
Total gains	1011.5129	1160.6519	1287.1158	1406.6218	1483.8792	1457.4908	1392.6733	1300.2725	1214.5579	1094.0749	991.7206	958.6363 (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)												
tau	37.7334	37.8253	37.9158	38.3468	38.4286	38.8137	38.8137	38.8859	38.6644	38.4286	38.2636	38.0926
alpha	3.5156	3.5217	3.5277	3.5565	3.5619	3.5876	3.5876	3.5924	3.5776	3.5619	3.5509	3.5395
util living area	0.9863	0.9769	0.9581	0.9140	0.8256	0.6784	0.5297	0.5796	0.7882	0.9330	0.9774	0.9886 (86)
MIT	19.2707	19.4817	19.8145	20.2441	20.6210	20.8710	20.9602	20.9447	20.7655	20.2824	19.7011	19.2329 (87)
Th 2	19.9425	19.9448	19.9471	19.9577	19.9596	19.9689	19.9689	19.9706	19.9653	19.9596	19.9556	19.9515 (88)
util rest of house												
0.9833 0.9718 0.9485 0.8933 0.7819 0.5986 0.4192 0.4691 0.7216 0.9127 0.9716 0.9861 (89)												
MIT 2	17.6438	17.9507	18.4317	19.0465	19.5556	19.8636	19.9477	19.9387	19.7507	19.1121	18.2787	17.5946 (90)
Living area fraction												
MIT	17.9360	18.2257	18.6800	19.2616	19.7469	20.0445	20.1296	20.1193	19.9329	19.3223	18.5342	17.8888 (92)
Temperature adjustment												0.0000

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CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

adjusted MIT 17.9360 18.2257 18.6800 19.2616 19.7469 20.0445 20.1296 20.1193 19.9329 19.3223 18.5342 17.8888 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9749	0.9603	0.9332	0.8763	0.7717	0.6050	0.4374	0.4861	0.7192	0.8965	0.9604	0.9787	(94)
Useful gains	986.1296	1114.5606	1201.1567	1232.5981	1145.0390	881.8055	609.0991	632.1074	873.5596	980.8735	952.4168	938.2214	(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	2502.1474	2439.2626	2224.2305	1870.8864	1449.8660	971.2345	629.6322	662.2567	1044.5439	1571.5429	2069.0499	2488.1475	(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	1127.9172	890.1998	761.1669	459.5675	226.7913	0.0000	0.0000	0.0000	0.0000	439.4580	803.9759	1153.1450	(98)
Space heating													
Space heating per m2													(98) / (4) = 37.4391 (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 %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													6477.5930 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1127.9172	890.1998	761.1669	459.5675	226.7913	0.0000	0.0000	0.0000	0.0000	439.4580	803.9759	1153.1450	(98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)	1246.3173	983.6462	841.0685	507.8094	250.5981	0.0000	0.0000	0.0000	0.0000	485.5890	888.3711	1274.1934	(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	184.4655	140.6992	115.8499	62.8932	28.1401	11.5707	6.0738	37.9877	68.5110	120.8177	159.6110	183.5940	(64)
Efficiency of water heater (217)m	88.8259	88.8736	88.9250	89.0624	89.1801	79.8000	79.8000	79.8000	79.8000	87.9568	88.5336	88.8635	(216)
Fuel for water heating, kWh/month	207.6708	158.3139	130.2782	70.6169	31.5543	14.4997	7.6113	47.6037	85.8534	137.3602	180.2828	206.6023	(219)
Water heating fuel used													(219)
Annual totals kWh/year													
Space heating fuel - main system													6477.5930 (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)													523.1825 (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													7575.2004 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	6477.5930	3.4800	225.4202 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1278.2476	3.4800	44.4830 (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	523.1825	13.1900	69.0078 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-828.8227	13.1900	-109.3217 (252)
Total energy cost			366.0768 (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] =	0.7627 (257)
SAP value		89.3598
SAP rating (Section 12)		89 (258)
SAP band		B

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	6477.5930	0.2160	1399.1601 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1278.2476	0.2160	276.1015 (264)
Space and water heating			1675.2616 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	523.1825	0.5190	271.5317 (268)
Energy saving/generation technologies			
PV Unit	-828.8227	0.5190	-430.1590 (269)
Total kg/year			1581.5093 (272)
CO2 emissions per m2			10.1000 (273)
EI value			89.4869
EI rating			89 (274)
EI band			B

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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	78.2900 (1b)	x 2.3900 (2b)	= 187.1131 (1b) - (3b)
First floor	78.2900 (1c)	x 2.6700 (2c)	= 209.0343 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	156.5800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 396.1474 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					5 * 10 = 50.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					50.0000 / (5) = 0.1262 (8)
Pressure test					Yes
Measured/design AP50					4.0500
Infiltration rate					0.3287 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3287 (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	0.3862	0.3616	0.3616	0.3287	0.3369	0.3205	0.3205	0.3123	0.3123	0.3369	0.3287	0.3369 (22b)
Effective ac	0.5746	0.5654	0.5654	0.5540	0.5568	0.5514	0.5514	0.5488	0.5488	0.5568	0.5540	0.5568 (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)			29.5100	1.1450	33.7901		(27)
Ground Floor			78.2900	0.1200	9.3948	84.0000	6576.3600 (28a)
Brick and Block	205.6900	31.6300	174.0600	0.2400	41.7744	42.2200	7348.8132 (29a)
Pitched Roof	78.2900		78.2900	0.1000	7.8290	9.1000	712.4390 (30)
Total net area of external elements Aum(A, m ²)			362.2700				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	95.1203	(33)
GF Block			75.9400			75.0000	5695.5000 (32c)
GF Stud			26.2700			9.0000	236.4300 (32c)
FF Stud			170.9000			9.0000	1538.1000 (32c)
Internal Floor 1			78.2900			18.0000	1409.2200 (32d)
Internal Ceiling 1			78.2900			18.0000	1409.2200 (32e)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		24926.0822 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							159.1907 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							11.5295 (36)
Total fabric heat loss						(33) + (36) =	106.6498 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	75.1155	73.9104	73.9104	72.4272	72.7848	72.0785	72.0785	71.7386	71.7386	72.7848	72.4272	72.7848 (38)
Average = Sum(39)m / 12 =	181.7653	180.5602	180.5602	179.0770	179.4345	178.7282	178.7282	178.3883	178.3883	179.4345	179.0770	179.4345 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1608	1.1531	1.1531	1.1437	1.1460	1.1415	1.1415	1.1393	1.1393	1.1460	1.1437	1.1460 (40)
HLP (average)												1.1462 (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												2.9440 (42)
Average daily hot water use (litres/day)												104.1209 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	114.5330	110.3682	106.2033	102.0385	97.8737	93.7088	93.7088	97.8737	102.0385	106.2033	110.3682	114.5330 (44)
Energy conte	169.8491	148.5512	153.2915	133.6432	128.2339	110.6561	102.5391	117.6651	119.0704	138.7651	151.4730	164.4898 (45)
Energy content (annual)										Total = Sum(45)m =		1638.2275 (45)

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Calculation Type: New Build (As Built)

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

Distribution loss (46)m = 0.15 x (45)m	25.4774	22.2827	22.9937	20.0465	19.2351	16.5984	15.3809	17.6498	17.8606	20.8148	22.7209	24.6735 (46)
Water storage loss:												
Store volume												215.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.7300 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.9342 (55)
Total storage loss												
28.9602 26.1576 28.9602 28.0260 28.9602 28.0260 28.9602 28.9602 28.0260 28.9602 28.0260 28.9602 (56)												
If cylinder contains dedicated solar storage												
18.8578 17.0329 18.8578 18.2495 18.8578 18.2495 18.8578 18.2495 18.8578 18.2495 18.8578 (57)												
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month												
211.9694 186.5952 194.0159 167.6511 157.5597 138.8108 131.6324 147.6889 154.4290 179.4896 192.2345 206.6100 (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												1.2368 (H8)
Utilisation factor												0.5545 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												117.0000 (H13)
Daily hot water demand												104.1209 (H14)
Volume ratio Veff/V												1.1237 (H15)
Solar storage volume factor												1.0000 (H16)
Solar input												-987.8646 (H17)
Solar input	-32.2353	-45.8422	-79.5480	-107.0055	-124.3476	-135.2541	-128.2415	-116.9439	-91.5317	-63.2634	-38.1270	-25.5244 (63)
Solar input (sum of months) = Sum (63)m =												-987.8646 (63)
Output from w/h												
179.7341 140.7530 114.4679 60.6456 33.2121 3.5567 3.3908 30.7450 62.8973 116.2261 154.1074 181.0856 (64)												
Total per year (kWh/year) = Sum (64)m =												1080.8219 (64)
Heat gains from water heating, kWh/month												
90.1710 79.8285 83.5490 71.6427 66.0985 59.3170 57.3689 63.1427 67.8778 78.7190 82.9740 88.3890 (65)												

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

Metabolic gains (Table 5), Watts												
(66)m	176.6423	176.6423	176.6423	176.6423	176.6423	176.6423	176.6423	176.6423	176.6423	176.6423	176.6423	176.6423 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
74.0619 65.7811 53.4968 40.5005 30.2746 25.5591 27.6175 35.8983 48.1826 61.1789 71.4048 76.1203 (67)												
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
488.9442 494.0179 481.2324 454.0134 419.6543 387.3615 365.7880 360.7143 373.4999 400.7189 435.0780 467.3707 (68)												
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
55.6083 55.6083 55.6083 55.6083 55.6083 55.6083 55.6083 55.6083 55.6083 55.6083 55.6083 55.6083 (69)												
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)												
-117.7616 -117.7616 -117.7616 -117.7616 -117.7616 -117.7616 -117.7616 -117.7616 -117.7616 -117.7616 -117.7616 -117.7616 (71)												
Water heating gains (Table 5)												
121.1976 118.7924 112.2970 99.5037 88.8420 82.3847 77.1087 84.8692 94.2747 105.8051 115.2416 118.8025 (72)												
Total internal gains	801.6928	796.0805	764.5152	711.5067	656.2599	612.7944	588.0033	598.9708	633.4463	685.1919	739.2135	779.7825 (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					16.8400	13.4684	0.6300	0.7000	0.7700		69.3155 (74)	
East					0.9600	25.1733	0.6300	0.7000	0.7700		7.3855 (76)	
South					9.5400	56.5862	0.6300	0.7000	0.7700		164.9798 (78)	
West					2.1700	25.1733	0.6300	0.7000	0.7700		16.6944 (80)	

Solar gains	258.3753	383.3287	563.3614	758.9623	854.9770	967.1587	884.6351	801.3833	658.1368	464.9751	310.1617	208.3596 (83)
Total gains	1060.0681	1179.4092	1327.8766	1470.4690	1511.2369	1579.9530	1472.6384	1400.3542	1291.5830	1150.1670	1049.3752	988.1421 (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)												
tau	38.0926	38.3468	38.3468	38.6644	38.5874	38.7399	38.7399	38.8137	38.8137	38.5874	38.6644	38.5874
alpha	3.5395	3.5565	3.5565	3.5776	3.5725	3.5827	3.5827	3.5876	3.5876	3.5725	3.5776	3.5725
util living area	0.9798	0.9700	0.9429	0.8768	0.7556	0.5399	0.3913	0.3978	0.6727	0.8885	0.9627	0.9832 (86)
MIT	19.5227	19.6847	20.0185	20.4415	20.7679	20.9507	20.9886	20.9884	20.8903	20.5157	19.9800	19.5060 (87)
Th 2	19.9515	19.9577	19.9577	19.9653	19.9635	19.9671	19.9671	19.9689	19.9689	19.9635	19.9653	19.9635 (88)
util rest of house												
0.9751 0.9631 0.9294 0.8470 0.6955 0.4442 0.2732 0.2743 0.5803 0.8533 0.9524 0.9792 (89)												
MIT 2	18.0159	18.2531	18.7298	19.3220	19.7408	19.9362	19.9636	19.9654	19.8878	19.4336	18.6867	17.9999 (90)
Living area fraction												
MIT	18.2865	18.5102	18.9613	19.5231	19.9252	20.1184	20.1476	20.1492	20.0679	19.6279	18.9190	18.2703 (92)
Temperature adjustment												0.0000

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

adjusted MIT 18.2865 18.5102 18.9613 19.5231 19.9252 20.1184 20.1476 20.1492 20.0679 19.6279 18.9190 18.2703 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9644	0.9500	0.9129	0.8319	0.6930	0.4590	0.2944	0.2965	0.5900	0.8394	0.9383	0.9699	(94)
Useful gains	1022.3755	1120.4769	1212.2175	1223.2562	1047.2737	725.1448	433.4726	415.1738	761.9997	965.4006	984.6299	958.3520	(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	2305.9670	2258.8400	2051.3903	1687.4516	1224.6805	753.9485	437.4620	419.0625	832.6908	1350.7713	1847.8944	2255.5524	(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	954.9921	764.9800	624.3445	334.2207	131.9907	0.0000	0.0000	0.0000	0.0000	286.7158	621.5504	965.1171	(98)
Space heating												4683.9113	(98)
Space heating per m2											(98) / (4) =	29.9139	(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 %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													5175.5926 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	954.9921	764.9800	624.3445	334.2207	131.9907	0.0000	0.0000	0.0000	0.0000	286.7158	621.5504	965.1171	(98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)	1055.2399	845.2818	689.8835	369.3046	145.8461	0.0000	0.0000	0.0000	0.0000	316.8130	686.7960	1066.4277	(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	179.7341	140.7530	114.4679	60.6456	33.2121	3.5567	3.3908	30.7450	62.8973	116.2261	154.1074	181.0856	(64)
Efficiency of water heater (217)m	88.6179	88.6527	88.6582	88.6739	88.1245	79.8000	79.8000	79.8000	79.8000	87.1301	88.1516	88.6226	(216)
Fuel for water heating, kWh/month	202.8191	158.7690	129.1116	68.3917	37.6877	4.4570	4.2492	38.5276	78.8187	133.3937	174.8208	204.3334	(219)
Water heating fuel used												1235.3796	(219)
Annual totals kWh/year													
Space heating fuel - main system												5175.5926	(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)												523.1825	(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												6140.4352	(238)

10a. Fuel costs - using BEDF prices (497)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	5175.5926	3.6300	187.8740	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1235.3796	3.6300	44.8443	(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	523.1825	19.4400	101.7067	(250)
Additional standing charges			95.0000	(251)
Energy saving/generation technologies				
PV Unit	-918.7195	19.4400	-178.5991	(252)
Total energy cost			275.1259	(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	5175.5926	0.2160	1117.9280	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1235.3796	0.2160	266.8420	(264)
Space and water heating			1384.7700	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Energy for lighting	523.1825	0.5190	271.5317 (268)
Energy saving/generation technologies			
PV Unit	-918.7195	0.5190	-476.8154 (269)
Total kg/year			1244.3613 (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	5175.5926	1.2200	6314.2230 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1235.3796	1.2200	1507.1631 (264)
Space and water heating			7821.3861 (265)
Pumps and fans	125.0000	3.0700	383.7500 (267)
Energy for lighting	523.1825	3.0700	1606.1703 (268)
Energy saving/generation technologies			
PV Unit	-918.7195	3.0700	-2820.4690 (269)
Primary energy kWh/year			6990.8375 (272)
Primary energy kWh/m2/year			44.6471 (273)

U-VALUE CALCULATOR REPORT

Property Reference	SAP 0647 Plot 12	Issued on Date	27/06/2022
Assessment Reference	As Built	Prop Type Ref	Fh
Project	12 Oram Way, West End, Southampton, SO30 3JW		
Calculation Type	New Build (As Built)		

SAP Rating	88 B	DER	13.03	TER	16.17
Environmental	88 B	% DER<TER	19.41		
CO ₂ Emissions (t/year)	1.52	DFEE	48.27	TREE	58.89
General Requirements Compliance	Pass	% DFEE<TFEE	18.03		

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

Building Elements

Roof 000002 - Mineral Wool between and above

Roof Type: Pitched Roof, insulated flat ceiling

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

Total resistance: Upper limit = 11.200 m² K/W Lower limit = 10.901 m² K/W Average = 11.050 m² K/W
Total correction = 0.0065 m² K/W U-value (unrounded) = 0.1 W/m² K

Unheated space: None

Total thickness: 463 mm

U-value: 0.10 W/m² K

Kappa: 9.10 kJ/m² K

U-VALUE CALCULATOR REPORT

Property Reference	SAP 0647 Plot 12	Issued on Date	27/06/2022
Assessment Reference	As Built	Prop Type Ref	Fh
Project	12 Oram Way, West End, Southampton, SO30 3JW		
Calculation Type	New Build (As Built)		

SAP Rating	88 B	DER	13.03	TER	16.17
Environmental	88 B	% DER<TER	19.41		
CO ₂ Emissions (t/year)	1.52	DFEE	48.27	TFEE	58.89
General Requirements Compliance	Pass	% DFEE<TFEE	18.03		

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 12	Issued on Date	27/06/2022
Assessment Reference	As Built	Prop Type Ref	Fh
Project	12 Oram Way, West End, Southampton, SO30 3JW		
Calculation Type	New Build (As Built)		

SAP Rating	88 B	DER	13.03	TER	16.17
Environmental	88 B	% DER<TER	19.41		
CO ₂ Emissions (t/year)	1.52	DFEE	48.27	TFEE	58.89
General Requirements Compliance	Pass	% DFEE<TFEE	18.03		

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

Building Elements

Floor 000003 - Worst Case Slab

Floor Type: Slab On Ground Floor

Area = 78.29 m², Perimeter = 40.65 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	45	1470
	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 12	Issued on Date	27/06/2022
Assessment Reference	As Built	Prop Type Ref	Fh
Property	12 Oram Way, West End, Southampton, SO30 3JW		
SAP Rating	88 B	DER	13.03
Environmental	88 B	TER	16.17
CO ₂ Emissions (t/year)	1.52	% DER<TER	19.41
General Requirements Compliance	Pass	DfEE	48.27
		TFEE	58.89
		% DfEE<TFEE	18.03
Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 07798936079, toby@abacusenergyuk.com		Assessor ID
			E477-0001
Client	Foreman Homes, FORE		

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

Orientation	South
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Suburban
1.0 Property Type	House, Detached
2.0 Number of Storeys	2
3.0 Date Built	2020
4.0 Sheltered Sides	0
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
	Ground Floor:	40.65 m	78.29 m ²
	1st Storey:	40.65 m	78.29 m ²
			2.39 m
			2.67 m

7.0 Living Area	28.12	m ²
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8.0 Thermal Mass Parameter	Precise calculation	
Thermal Mass	159.19	kJ/m²K

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	205.69	174.06

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	75.94	
GF Stud	Plasterboard on timber frame	9.00	26.27	
FF Stud	Plasterboard on timber frame	9.00	170.90	

10.0 External Roofs					
Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area (m ²)
Pitched Roof	External Plane Roof	Other	0.10	9.10	78.29
					78.29

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	78.29

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	78.29

11.2 Internal Floors

Description	Construction	Kappa (kJ/m²K)	Area (m²)
Internal Floor 1	Plasterboard ceiling, carpeted chipboard floor	18.00	78.29

12.0 Opening Types

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

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
Front Door	Solid Door	[1] Brick and Block	South							2.12	
Front Shaded	Window	[1] Brick and Block	South	None	1.15	Yes				1.92	
Front Elevation	Window	[1] Brick and Block	South	None	0.00					7.62	
West Elevation	Window	[1] Brick and Block	West	None	0.00					2.17	
North Elevation	Window	[1] Brick and Block	North	None	0.00					16.84	
East Elevation	Window	[1] Brick and Block	East	None	0.00					0.96	

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)	2.52	0.077	No	Birtley Supatherm
Independently assessed	E2 Other lintels (including other steel lintels)	9.15	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)	3.54	0.064	No	Birtley Supatherm
Independently assessed	E2 Other lintels (including other steel lintels)	5.54	0.056	No	Birtley Supatherm
Independently assessed	E3 Sill	15.21	0.021	No	Knauf P5
Independently assessed	E4 Jamb	50.10	0.016	No	Knauf P6
Table K1 - Approved	E5 Ground floor (normal)	40.65	0.160	No	
Independently assessed	E6 Intermediate floor within a dwelling	40.65	0.000	No	CD0029
Table K1 - Approved	E10 Eaves (insulation at ceiling level)	25.64	0.060	No	
Independently assessed	E12 Gable (insulation at ceiling level)	15.01	0.044	No	Knauf P21
Independently assessed	E16 Corner (normal)	30.30	0.039	No	Knauf P23
Independently assessed	E17 Corner (inverted – internal area greater than external area)	10.10	-0.091	No	Knauf P24

Y-value	0.032	W/m²K
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18.0 Pressure Testing

Designed AP ₅₀	5.00	m³/(h.m²) @ 50 Pa
Property Tested ?	Yes	
As Built AP ₅₀	4.05	m³/(h.m²) @ 50 Pa

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

19.0 Mechanical Ventilation

Summer Overheating

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

Mechanical Ventilation

Mechanical Ventilation System Present	No
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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				5
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System

No

22.0 Lighting

Internal

Total number of light fittings	26	
Total number of L.E.L. fittings	26	
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.	18911	
Fuel Type	Mains gas	
Main Heating	BGB	
SAP Code	102	
In Winter	90.5	
In Summer	79.8	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	

25.0 Main Heating 2

None

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	Hot Water Cylinder			
Cylinder Stat	Yes			
Cylinder In Heated Space	Yes			
Independent Time Control	Yes			
Insulation Type	Measured Loss			
Cylinder Volume	215.00	L		
Loss	1.73	kWh/day		
Pipes insulation	Fully insulated primary pipework			
31.0 Thermal Store	None			
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	£40	B 89	