



SAP Report Submission for Building Regulations Compliance

Client: Foreman Homes

Project: 4 Fred Woolley Walk
West End, Southampton, SO30 3LF

Contact: Tobias Whiting
Abacus Energy (UK) Ltd
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Report Issue Date: 21/03/2022

EXCELLENCE
IN ENERGY
ASSESSMENT

BUILDING REGULATION COMPLIANCE

Calculation Type: New Build (As Built)

Property Reference	SAP 0647 Plot 66	Issued on Date	21/03/2022
Assessment Reference	As Built	Prop Type Ref	N
Property	4 Fred Woolley Walk, West End, Southampton, SO30 3LF		
SAP Rating	88 B	DER	13.50
Environmental	88 B	TER	17.10
CO ₂ Emissions (t/year)	1.20	% DER<TER	21.06
General Requirements Compliance	Pass	DfEE	49.00
		TfEE	59.23
		% DfEE<TfEE	17.26
Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 01329 313079, tobiaswhiting26@gmail.com		Assessor ID
			E477-0001
Client	Foreman Homes, FORE		

SUMMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TfEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	17.10	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	13.50	kgCO ₂ /m ²	Pass
	-3.60 (-21.1%)	kgCO ₂ /m ²	

1b TfEE and DfEE

Target Fabric Energy Efficiency (TfEE)	59.23	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DfEE)	49.00	kWh/m ² /yr	
	-10.2 (-17.2%)	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	4.02 (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

Programmer, room thermostat and TRVs

Pass

Hot water controls

Cylinderstat

Pass

Independent timer for DHW

Pass

Boiler interlock

Yes

Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings

100 %

Minimum

75 %

Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)

Slight

Pass

Based on:

Overshading

Average

Windows facing East

10.07 m², No overhang

Windows facing South

2.52 m², No overhang

Windows facing South West

1.44 m², No overhang

Windows facing West

8.33 m², No overhang

Windows facing North West

1.44 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

4.02 (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	0.036	W/m ² K
Photovoltaic array	1.14	kW

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THERMAL BRIDGING

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SAP Rating	88 B	DER	13.50
Environmental	88 B	TER	17.10
CO ₂ Emissions (t/year)	1.20	% DER<TER	21.06
General Requirements Compliance	Pass	DFEE	49.00
		TFEE	59.23
		% DFEE<TFEE	17.26
Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 01329 313079, tobiaswhiting26@gmail.com		Assessor ID
			E477-0001
Client	Foreman Homes, FORE		

	Junction detail	Source Type	Psi (W/mK)	Length (m)	Result	Reference
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.053	4.68	0.25	CD0025
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.070	0.91	0.06	Birtley Supatherm
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.071	1.01	0.07	Birtley Supatherm
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.067	6.02	0.40	Birtley Supatherm
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.070	3.02	0.21	Birtley Supatherm
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.064	3.54	0.23	Birtley Supatherm
External wall	E3 Sill	Independently assessed	0.021	19.18	0.40	Knauf P5
External wall	E4 Jamb	Independently assessed	0.016	35.40	0.57	Knauf P6
External wall	E5 Ground floor (normal)	Table K1 - Approved	0.160	37.15	5.94	
External wall	E6 Intermediate floor within a dwelling	Independently assessed	0.000	34.91	0.00	CD0029
External wall	E10 Eaves (insulation at ceiling level)	Table K1 - Approved	0.060	24.71	1.48	
External wall	E24 Eaves (insulation at ceiling level - inverted)	Table K1 - Default	0.240	3.50	0.84	
External wall	E12 Gable (insulation at ceiling level)	Independently assessed	0.044	14.88	0.65	Knauf P21
External wall	E16 Corner (normal)	Independently assessed	0.039	34.33	1.34	Knauf P23
External wall	E17 Corner (inverted – internal area greater than external area)	Independently assessed	-0.091	14.13	-1.29	Knauf P24

Total: **11.17** W/mK:
Y-Value: **0.036** W/m²K:

FULL SAP CALCULATION PRINTOUT

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Environmental	88 B	% DER<TER	21.06		
CO ₂ Emissions (t/year)	1.20	DFEE	49.00	TFEE	59.23
General Requirements Compliance	Pass	% DFEE<TFEE	17.26		
Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 01329 313079, tobiaswhiting26@gmail.com			Assessor ID	E477-0001
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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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DWELLING AS BUILT

Detached House, total floor area 125 m²

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

1a TER and DER

Fuel for main heating:Mains gas

Fuel factor:1.00 (mains gas)

Target Carbon Dioxide Emission Rate (TER) 17.10 kgCO₂/m²

Dwelling Carbon Dioxide Emission Rate (DER) 13.50 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)59.2 kWh/m²/yr

Dwelling Fabric Energy Efficiency (DFEE)49.0 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: 4.02 (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: Programmer, room thermostat and TRVs OK

Hot water controls: Cylinderstat OK
Independent timer for DHW OK

Boiler interlock Yes OK

7 Low energy lights

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

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Southern England): Slight OK

Based on:

Overshading: Average
Windows facing East: 10.07 m², No overhang
Windows facing South: 2.52 m², No overhang
Windows facing South West: 1.44 m², No overhang
Windows facing West: 9.33 m², No overhang
Windows facing North West: 1.44 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 0.036 W/m²K
Photovoltaic array 1.14 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	63.5200 (1b)	x 2.3800 (2b)	= 151.1776 (1b) - (3b)
First floor	61.7500 (1c)	x 2.6700 (2c)	= 164.8725 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	125.2700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 316.0501 (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) = 0.1582 (8)
Pressure test					Yes
Measured/design AP50					4.0200
Infiltration rate					0.3592 (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) =	0.3592 (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	0.4580	0.4490	0.4400	0.3951	0.3861	0.3412	0.3412	0.3323	0.3592	0.3861	0.4041	0.4221 (22b)
Effective ac	0.6049	0.6008	0.5968	0.5781	0.5746	0.5582	0.5582	0.5552	0.5645	0.5746	0.5816	0.5891 (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)			23.8000	1.1450	27.2519		(27)
Ground Floor			63.5200	0.1200	7.6224	84.0000	5335.6800 (28a)
Brick and Block	181.4300	25.9200	155.5100	0.2400	37.3224	42.2200	6565.6322 (29a)
Pitched Roof	63.5200		63.5200	0.1000	6.3520	9.1000	578.0320 (30)
Total net area of external elements Aum(A, m ²)			308.4700				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	80.8807		(33)
GF Block			57.0500			75.0000	4278.7500 (32c)
GF Stud			33.7700			9.0000	303.9300 (32c)
FF Stud			149.0000			9.0000	1341.0000 (32c)
Internal Floor 1			61.8100			18.0000	1112.5800 (32d)
Internal Ceiling 1			61.8100			18.0000	1112.5800 (32e)

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

(28)...(30) + (32) + (32a)...(32e) =	20628.1842 (34)
	164.6698 (35)
	11.1683 (36)
(33) + (36) =	92.0490 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)	
(38)m	Jan 63.0863 Feb 62.6616 Mar 62.2452 Apr 60.2898 May 59.9239 Jun 58.2208 Jul 58.2208 Aug 57.9054 Sep 58.8768 Oct 59.9239 Nov 60.6640 Dec 61.4378 (38)
Heat transfer coeff	155.1353 154.7106 154.2942 152.3388 151.9729 150.2697 150.2697 149.9544 150.9258 151.9729 152.7130 153.4868 (39)
Average = Sum(39)m / 12 =	152.3370 (39)

HLP	Jan 1.2384 Feb 1.2350 Mar 1.2317 Apr 1.2161 May 1.2132 Jun 1.1996 Jul 1.1996 Aug 1.1970 Sep 1.2048 Oct 1.2132 Nov 1.2191 Dec 1.2252 (40)
HLP (average)	1.2161 (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												2.8816 (42)
Average daily hot water use (litres/day)												102.6375 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	112.9012	108.7957	104.6902	100.5847	96.4792	92.3737	92.3737	96.4792	100.5847	104.6902	108.7957	112.9012 (44)
Energy conte	167.4292	146.4347	151.1075	131.7391	126.4068	109.0795	101.0782	115.9887	117.3740	136.7880	149.3148	162.1463 (45)
Energy content (annual)										Total = Sum(45)m =		1614.8868 (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	25.1144	21.9652	22.6661	19.7609	18.9610	16.3619	15.1617	17.3983	17.6061	20.5182	22.3972	24.3219 (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												
219.6518 193.6035 203.3301 182.2771 178.6294 159.6175 153.3008 168.2113 167.9120 189.0106 199.8528 214.3689 (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												
219.6518 193.6035 203.3301 182.2771 178.6294 159.6175 153.3008 168.2113 167.9120 189.0106 199.8528 214.3689 (64)												
Total per year (kWh/year) = Sum(64)m =												2229.7658 (64)
Heat gains from water heating, kWh/month												
97.4483 86.4246 92.0213 84.2337 83.8084 76.6993 75.3866 80.3443 79.4572 87.2601 90.0776 95.6917 (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	144.0788	144.0788	144.0788	144.0788	144.0788	144.0788	144.0788	144.0788	144.0788	144.0788	144.0788	144.0788 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
26.3703 23.4218 19.0479 14.4205 10.7795 9.1005 9.8334 12.7818 17.1558 21.7832 25.4242 27.1032 (67)												
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
291.9243 294.9536 287.3199 271.0688 250.5547 231.2743 218.3939 215.3646 222.9982 239.2494 259.7635 279.0438 (68)												
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
37.4079 37.4079 37.4079 37.4079 37.4079 37.4079 37.4079 37.4079 37.4079 37.4079 37.4079 37.4079 (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)												
-115.2631 -115.2631 -115.2631 -115.2631 -115.2631 -115.2631 -115.2631 -115.2631 -115.2631 -115.2631 -115.2631 -115.2631 (71)												
Water heating gains (Table 5)												
130.9789 128.6080 123.6846 116.9912 112.6456 106.5268 101.3260 107.9897 110.3573 117.2851 125.1078 128.6179 (72)												
Total internal gains												
518.4971 516.2070 499.2761 471.7042 443.2035 416.1253 398.7770 405.3598 419.7349 447.5413 479.5191 503.9886 (73)												

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	Access factor Table 6d	Gains W
East	10.0700	19.6403	0.6300	0.7000	0.7700	60.4434 (76)
South	2.5200	46.7521	0.6300	0.7000	0.7700	36.0059 (78)
Southwest	1.4400	36.7938	0.6300	0.7000	0.7700	16.1923 (79)
West	8.3300	19.6403	0.6300	0.7000	0.7700	49.9993 (80)
Northwest	1.4400	11.2829	0.6300	0.7000	0.7700	4.9654 (81)
Solar gains	167.6063	312.7064	486.8660	680.4789	816.9936	831.0008 793.1944 691.0750 555.3315 362.7989 206.0307 139.8473 (83)
Total gains	686.1034	828.9135	986.1420	1152.1830	1260.1971	1247.1261 1191.9713 1096.4348 975.0664 810.3402 685.5498 643.8359 (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	36.9358	37.0372	37.1372	37.6139	37.7044	38.1318	38.1318	38.2120	37.9660	37.7044	37.5217	37.3325
alpha	3.4624	3.4691	3.4758	3.5076	3.5136	3.5421	3.5421	3.5475	3.5311	3.5136	3.5014	3.4888
util living area	0.9926	0.9852	0.9667	0.9180	0.8208	0.6697	0.5218	0.5778	0.8042	0.9510	0.9870	0.9941 (86)
MIT	19.0815	19.3167	19.7080	20.2065	20.6169	20.8717	20.9602	20.9429	20.7394	20.1813	19.5404	19.0462 (87)
Th 2	19.8894	19.8921	19.8947	19.9072	19.9095	19.9203	19.9203	19.9224	19.9162	19.9095	19.9048	19.8999 (88)
util rest of house	0.9908	0.9817	0.9585	0.8971	0.7745	0.5861	0.4072	0.4623	0.7367	0.9344	0.9833	0.9926 (89)
MIT 2	18.1427	18.3782	18.7663	19.2575	19.6350	19.8509	19.9066	19.9008	19.7546	19.2448	18.6114	18.1154 (90)
Living area fraction									fLA = Living area / (4) =			0.1415 (91)
MIT	18.2756	18.5111	18.8995	19.3918	19.7740	19.9954	20.0557	20.0483	19.8940	19.3773	18.7429	18.2471 (92)
Temperature adjustment												0.0000
adjusted MIT	18.2756	18.5111	18.8995	19.3918	19.7740	19.9954	20.0557	20.0483	19.8940	19.3773	18.7429	18.2471 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.9872 0.9757 0.9490 0.8852 0.7680 0.5925 0.4224 0.4768 0.7351 0.9238 0.9779 0.9896 (94)												
Useful gains	677.3213	808.8059	935.8096	1019.8907	967.7702	738.8770	503.4869	522.7723	716.7523	748.6320	670.3701	637.1460 (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												
2168.1102 2105.7748 1913.1786 1598.3124 1227.0228 810.7579 519.2943 547.0721 874.4635 1333.9143 1778.0230 2156.0463 (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												
1109.1469 871.5631 727.1626 416.4636 192.8840 0.0000 0.0000 0.0000 0.0000 435.4500 797.5101 1130.0618 (98)												
Space heating												5680.2421 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Space heating per m2 (98) / (4) = 45.3440 (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													6276.5106 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1109.1469	871.5631	727.1626	416.4636	192.8840	0.0000	0.0000	0.0000	0.0000	435.4500	797.5101	1130.0618	(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)	1225.5767	963.0531	803.4945	460.1808	213.1315	0.0000	0.0000	0.0000	0.0000	481.1602	881.2266	1248.6870	(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	219.6518	193.6035	203.3301	182.2771	178.6294	159.6175	153.3008	168.2113	167.9120	189.0106	199.8528	214.3689	(64)
Efficiency of water heater (217)m	88.5376	88.3469	87.9238	86.9507	85.0188	79.8000	79.8000	79.8000	79.8000	86.9703	88.1321	79.8000	(216)
Fuel for water heating, kWh/month	248.0887	219.1401	231.2571	209.6328	210.1058	200.0219	192.1062	210.7911	210.4160	217.3277	226.7652	241.9359	(219)
Water heating fuel used												2617.5886	(219)
Annual totals kWh/year													
Space heating fuel - main system												6276.5106	(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)												465.7069	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.14 * 1080 * 1.00) =										-984.5265		-984.5265	(233)
Total delivered energy for all uses												8450.2797	(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	6276.5106	0.2160	1355.7263 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2617.5886	0.2160	565.3991 (264)
Space and water heating			1921.1254 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	465.7069	0.5190	241.7019 (268)
Energy saving/generation technologies			
PV Unit	-984.5265	0.5190	-510.9692 (269)
Total CO2, kg/year			1690.7831 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.5000 (273)

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

DER		13.5000	ZC1
Total Floor Area	TFA	125.2700	
Assumed number of occupants	N	2.8816	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		13.8092	ZC2
CO2 emissions from cooking, equation (L16)		1.5020	ZC3
Total CO2 emissions		28.8112	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		28.8112	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	63.5200 (1b)	x 2.3800 (2b)	= 151.1776 (1b) - (3b)
First floor	61.7500 (1c)	x 2.6700 (2c)	= 164.8725 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	125.2700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 316.0501 (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					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) = 0.1266 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3766 (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) =	0.3766 (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	0.4801	0.4707	0.4613	0.4142	0.4048	0.3577	0.3577	0.3483	0.3766	0.4048	0.4236	0.4425 (22b)
Effective ac	0.6153	0.6108	0.6064	0.5858	0.5819	0.5640	0.5640	0.5607	0.5709	0.5819	0.5897	0.5979 (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
TER Opaque door			2.1200	1.0000	2.1200		(26)
TER Opening Type (Uw = 1.40)			23.8000	1.3258	31.5530		(27)
Ground Floor			63.5200	0.1300	8.2576		(28a)
Brick and Block	181.4300	25.9200	155.5100	0.1800	27.9918		(29a)
Pitched Roof	63.5200		63.5200	0.1300	8.2576		(30)
Total net area of external elements Aum(A, m ²)			308.4700				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	78.1800		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							14.6654 (36)
Total fabric heat loss						(33) + (36) =	92.8454 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	64.1691	63.7023	63.2448	61.0957	60.6936	58.8219	58.8219	58.4753	59.5428	60.6936	61.5070	62.3574 (38)
Heat transfer coeff	157.0145	156.5477	156.0902	153.9411	153.5391	151.6673	151.6673	151.3207	152.3883	153.5391	154.3525	155.2028 (39)
Average = Sum(39)m / 12 =												153.9392 (39)
HLP	1.2534	1.2497	1.2460	1.2289	1.2257	1.2107	1.2107	1.2080	1.2165	1.2257	1.2322	1.2389 (40)
HLP (average)												1.2289 (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												2.8816 (42)
Average daily hot water use (litres/day)												102.6375 (43)
Daily hot water use	112.9012	108.7957	104.6902	100.5847	96.4792	92.3737	92.3737	96.4792	100.5847	104.6902	108.7957	112.9012 (44)
Energy conte	167.4292	146.4347	151.1075	131.7391	126.4068	109.0795	101.0782	115.9887	117.3740	136.7880	149.3148	162.1463 (45)
Energy content (annual)										Total = Sum(45)m =		1614.8868 (45)
Distribution loss (46)m = 0.15 x (45)m	25.1144	21.9652	22.6661	19.7609	18.9610	16.3619	15.1617	17.3983	17.6061	20.5182	22.3972	24.3219 (46)
Water storage loss:												215.0000 (47)
Store volume												1.7258 (48)
a) If manufacturer declared loss factor is known (kWh/day):												0.5400 (49)
Temperature factor from Table 2b												

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												
	219.5812	193.5396	203.2594	182.2088	178.5588	159.5491	153.2301	168.1406	167.8436	188.9400	199.7845	214.2982 (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												
	219.5812	193.5396	203.2594	182.2088	178.5588	159.5491	153.2301	168.1406	167.8436	188.9400	199.7845	214.2982 (64)
Heat gains from water heating, kWh/month												
	97.3918	86.3735	91.9648	84.1790	83.7518	76.6446	75.3301	80.2878	79.4025	87.2036	90.0229	95.6352 (65)

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	144.0788	144.0788	144.0788	144.0788	144.0788	144.0788	144.0788	144.0788	144.0788	144.0788	144.0788	144.0788 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	26.3703	23.4218	19.0479	14.4205	10.7795	9.1005	9.8334	12.7818	17.1558	21.7832	25.4242	27.1032 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	291.9243	294.9536	287.3199	271.0688	250.5547	231.2743	218.3939	215.3646	222.9982	239.2494	259.7635	279.0438 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.4079	37.4079	37.4079	37.4079	37.4079	37.4079	37.4079	37.4079	37.4079	37.4079	37.4079	37.4079 (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)	-115.2631	-115.2631	-115.2631	-115.2631	-115.2631	-115.2631	-115.2631	-115.2631	-115.2631	-115.2631	-115.2631	-115.2631 (71)
Water heating gains (Table 5)	130.9029	128.5320	123.6086	116.9152	112.5697	106.4509	101.2501	107.9137	110.2813	117.2091	125.0318	128.5419 (72)
Total internal gains	518.4211	516.1311	499.2001	471.6282	443.1275	416.0494	398.7010	405.2838	419.6590	447.4653	479.4431	503.9126 (73)

[Jan					Area	Solar flux		g		FF	Access		Gains
					m2	Table 6a	Specific data		Specific data		factor	W	
						W/m2	or Table 6b		or Table 6c		Table 6d		
East					10.0700	19.6403	0.6300		0.7000		0.7700	60.4434 (76)	
South					2.5200	46.7521	0.6300		0.7000		0.7700	36.0059 (78)	
Southwest					1.4400	36.7938	0.6300		0.7000		0.7700	16.1923 (79)	
West					8.3300	19.6403	0.6300		0.7000		0.7700	49.9993 (80)	
Northwest					1.4400	11.2829	0.6300		0.7000		0.7700	4.9654 (81)	

Solar gains	167.6063	312.7064	486.8660	680.4789	816.9936	831.0008	793.1944	691.0750	555.3315	362.7989	206.0307	139.8473 (83)	
Total gains	686.0275	828.8375	986.0661	1152.1071	1260.1211	1247.0501	1191.8954	1096.3588	974.9904	810.2642	685.4738	643.7599 (84)	

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, n11,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	55.4045	55.5697	55.7326	56.5106	56.6586	57.3578	57.3578	57.4892	57.0864	56.6586	56.3600	56.0512
alpha	4.6936	4.7046	4.7155	4.7674	4.7772	4.8239	4.8239	4.8326	4.8058	4.7772	4.7573	4.7367
util living area												
	0.9986	0.9964	0.9887	0.9588	0.8743	0.7113	0.5443	0.6071	0.8575	0.9803	0.9970	0.9990 (86)
MIT	19.5746	19.7522	20.0507	20.4397	20.7587	20.9379	20.9863	20.9774	20.8404	20.4066	19.9200	19.5508 (87)
Th 2	19.8775	19.8805	19.8834	19.8970	19.8995	19.9114	19.9114	19.9136	19.9068	19.8995	19.8944	19.8890 (88)
util rest of house												
	0.9982	0.9951	0.9845	0.9428	0.8265	0.6158	0.4176	0.4773	0.7853	0.9700	0.9957	0.9987 (89)
MIT 2	17.9794	18.2408	18.6765	19.2402	19.6640	19.8706	19.9065	19.9045	19.7775	19.2043	18.4963	17.9525 (90)
Living area fraction												
MIT	18.2052	18.4547	18.8710	19.4100	19.8190	20.0217	20.0593	20.0564	19.9279	19.3744	18.6978	18.1787 (91)
Temperature adjustment												
adjusted MIT	18.2052	18.4547	18.8710	19.4100	19.8190	20.0217	20.0593	20.0564	19.9279	19.3744	18.6978	18.1787 (93)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9970	0.9927	0.9790	0.9336	0.8224	0.6263	0.4355	0.4953	0.7870	0.9629	0.9936	0.9978 (94)
Useful gains	683.9702	822.7470	965.3356	1075.5848	1036.3347	781.0732	519.0113	543.0332	767.3101	780.2097	681.0607	642.3246 (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												
	2183.3193	2121.9603	1930.9971	1617.9188	1246.5771	822.2893	524.6684	553.2816	888.1104	1347.2179	1790.1463	2169.5410 (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												
	1115.5157	873.0714	718.4521	390.4804	156.4203	0.0000	0.0000	0.0000	0.0000	421.8541	798.5417	1136.2489 (98)
Space heating												5610.5848 (98)
Space heating per m2												44.7879 (99)
										(98) / (4) =		

Regs Region: England
Elmhurst Energy Systems
SAP2012 Calculator (Design
System) version 4.14r19

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													6000.6254 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1115.5157	873.0714	718.4521	390.4804	156.4203	0.0000	0.0000	0.0000	0.0000	421.8541	798.5417	1136.2489	(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)	1193.0649	933.7662	768.3980	417.6261	167.2945	0.0000	0.0000	0.0000	0.0000	451.1809	854.0553	1215.2395	(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	219.5812	193.5396	203.2594	182.2088	178.5588	159.5491	153.2301	168.1406	167.8436	188.9400	199.7845	214.2982	(64)
Efficiency of water heater (217)m	88.5473	88.3504	87.9009	86.7971	84.4631	79.8000	79.8000	79.8000	79.8000	86.8958	88.1351	79.8000	(216)
Fuel for water heating, kWh/month	247.9818	219.0591	231.2371	209.9248	211.4044	199.9362	192.0177	210.7026	210.3303	217.4328	226.6799	241.8316	(219)
Water heating fuel used												2618.5385	(219)
Annual totals kWh/year													
Space heating fuel - main system												6000.6254	(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)												465.7069	(232)
Total delivered energy for all uses												9159.8708	(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	6000.6254	0.2160	1296.1351 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2618.5385	0.2160	565.6043 (264)
Space and water heating			1861.7394 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	465.7069	0.5190	241.7019 (268)
Total CO2, kg/m2/year			2142.3663 (272)
Emissions per m2 for space and water heating			14.8618 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			1.9294 (272b)
Emissions per m2 for pumps and fans			0.3107 (272c)
Target Carbon Dioxide Emission Rate (TER) = (14.8618 * 1.00) + 1.9294 + 0.3107, rounded to 2 d.p.			17.1000 (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	63.5200 (1b)	x 2.3800 (2b)	= 151.1776 (1b) - (3b)
First floor	61.7500 (1c)	x 2.6700 (2c)	= 164.8725 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	125.2700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 316.0501 (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) = 0.1266 (8)
Pressure test					Yes
Measured/design AP50					4.0200
Infiltration rate					0.3276 (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) =	0.3276 (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	0.4176	0.4095	0.4013	0.3603	0.3521	0.3112	0.3112	0.3030	0.3276	0.3521	0.3685	0.3849 (22b)
Effective ac	0.5872	0.5838	0.5805	0.5649	0.5620	0.5484	0.5484	0.5459	0.5536	0.5620	0.5679	0.5741 (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)			23.8000	1.1450	27.2519		(27)
Ground Floor			63.5200	0.1200	7.6224	84.0000	5335.6800 (28a)
Brick and Block	181.4300	25.9200	155.5100	0.2400	37.3224	42.2200	6565.6322 (29a)
Pitched Roof	63.5200		63.5200	0.1000	6.3520	9.1000	578.0320 (30)
Total net area of external elements Aum(A, m ²)			308.4700				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	80.8807		(33)
GF Block			57.0500			75.0000	4278.7500 (32c)
GF Stud			33.7700			9.0000	303.9300 (32c)
FF Stud			149.0000			9.0000	1341.0000 (32c)
Internal Floor 1			61.8100			18.0000	1112.5800 (32d)
Internal Ceiling 1			61.8100			9.0000	556.2900 (32e)

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

(28)...(30) + (32) + (32a)...(32e) =	20071.8942 (34)
	160.2291 (35)
	11.1683 (36)
(33) + (36) =	92.0490 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)	
(38)m	Jan 61.2442 Feb 60.8910 Mar 60.5448 Apr 58.9186 May 58.6144 Jun 57.1981 Jul 57.1981 Aug 56.9358 Sep 57.7436 Oct 58.6144 Nov 59.2299 Dec 59.8734 (38)
Heat transfer coeff	153.2932 152.9400 152.5938 150.9676 150.6634 149.2471 149.2471 148.9848 149.7926 150.6634 151.2789 151.9223 (39)
Average = Sum(39)m / 12 =	150.9662 (39)

HLP	Jan 1.2237 Feb 1.2209 Mar 1.2181 Apr 1.2051 May 1.2027 Jun 1.1914 Jul 1.1914 Aug 1.1893 Sep 1.1958 Oct 1.2027 Nov 1.2076 Dec 1.2128 (40)
HLP (average)	1.2051 (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												2.8816 (42)
Average daily hot water use (litres/day)												102.6375 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.9012	108.7957	104.6902	100.5847	96.4792	92.3737	92.3737	96.4792	100.5847	104.6902	108.7957	112.9012 (44)
Energy conte	167.4292	146.4347	151.1075	131.7391	126.4068	109.0795	101.0782	115.9887	117.3740	136.7880	149.3148	162.1463 (45)
Energy content (annual)										Total = Sum(45)m =		1614.8868 (45)

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Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	35.5787	31.1174	32.1103	27.9946	26.8615	23.1794	21.4791	24.6476	24.9420	29.0675	31.7294	34.4561 (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	144.0788	144.0788	144.0788	144.0788	144.0788	144.0788	144.0788	144.0788	144.0788	144.0788	144.0788	144.0788	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	26.3703	23.4218	19.0479	14.4205	10.7795	9.1005	9.8334	12.7818	17.1558	21.7832	25.4242	27.1032	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	291.9243	294.9536	287.3199	271.0688	250.5547	231.2743	218.3939	215.3646	222.9982	239.2494	259.7635	279.0438	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.4079	37.4079	37.4079	37.4079	37.4079	37.4079	37.4079	37.4079	37.4079	37.4079	37.4079	37.4079	(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)	-115.2631	-115.2631	-115.2631	-115.2631	-115.2631	-115.2631	-115.2631	-115.2631	-115.2631	-115.2631	-115.2631	-115.2631	(71)
Water heating gains (Table 5)	47.8208	46.3056	43.1591	38.8813	36.1041	32.1936	28.8698	33.1285	34.6416	39.0692	44.0686	46.3119	(72)
Total internal gains	432.3391	430.9047	415.7506	390.5943	363.6620	338.7921	323.3207	327.4986	341.0193	366.3253	395.4799	418.6826	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	g Specific data or Table 6c	FF Specific data or Table 6c	Access factor Table 6d	Gains W		
East					10.0700	19.6403	0.6300		0.7000	0.7700	60.4434 (76)		
South					2.5200	46.7521	0.6300		0.7000	0.7700	36.0059 (78)		
Southwest					1.4400	36.7938	0.6300		0.7000	0.7700	16.1923 (79)		
West					8.3300	19.6403	0.6300		0.7000	0.7700	49.9993 (80)		
Northwest					1.4400	11.2829	0.6300		0.7000	0.7700	4.9654 (81)		
Solar gains	167.6063	312.7064	486.8660	680.4789	816.9936	831.0008	793.1944	691.0750	555.3315	362.7989	206.0307	139.8473	(83)
Total gains	599.9454	743.6111	902.6165	1071.0732	1180.6555	1169.7928	1116.5151	1018.5736	896.3507	729.1243	601.5107	558.5299	(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	36.3716	36.4556	36.5384	36.9319	37.0065	37.3577	37.3577	37.4235	37.2216	37.0065	36.8559	36.6998	
alpha	3.4248	3.4304	3.4359	3.4621	3.4671	3.4905	3.4905	3.4949	3.4814	3.4671	3.4571	3.4467	
util living area	0.9947	0.9885	0.9723	0.9282	0.8374	0.6930	0.5463	0.6066	0.8286	0.9610	0.9905	0.9958	(86)
MIT	18.9825	19.2237	19.6262	20.1405	20.5739	20.8502	20.9516	20.9300	20.6990	20.1052	19.4452	18.9432	(87)
Th 2	19.9011	19.9033	19.9055	19.9159	19.9178	19.9269	19.9269	19.9286	19.9234	19.9178	19.9139	19.9098	(88)
util rest of house	0.9934	0.9857	0.9655	0.9097	0.7942	0.6109	0.4297	0.4900	0.7662	0.9476	0.9879	0.9949	(89)
MIT 2	18.0559	18.2975	18.6973	19.2049	19.6075	19.8437	19.9095	19.9010	19.7314	19.1813	18.5269	18.0231	(90)
Living area fraction									fLA = Living area / (4) =			0.1415	(91)
MIT	18.1871	18.4286	18.8287	19.3373	19.7443	19.9861	20.0570	20.0467	19.8683	19.3121	18.6569	18.1533	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.1871	18.4286	18.8287	19.3373	19.7443	19.9861	20.0570	20.0467	19.8683	19.3121	18.6569	18.1533	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	594.2928	729.2206	863.4569	961.3432	928.2197	720.5163	496.5935	513.3337	683.3723	683.6200	591.5579	554.3717	(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	2128.7948	2069.0573	1881.2899	1575.6997	1211.9752	803.8630	515.9518	543.2973	864.0560	1312.5949	1748.3150	2119.8154	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	1141.6694	900.3703	757.2677	442.3367	211.1141	0.0000	0.0000	0.0000	0.0000	467.9574	832.8652	1164.6901	(98)
Space heating												5918.2708	(98)
Space heating per m2										(98) / (4) =		47.2441	(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													

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Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	1402.9225	1104.4283	1132.2844	0.0000	0.0000	0.0000	0.0000 (100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.7987	0.8632	0.8297	0.0000	0.0000	0.0000	0.0000 (101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1120.4773	953.3790	939.4630	0.0000	0.0000	0.0000	0.0000 (102)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1484.2326	1419.3272	1307.0753	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	261.9038	346.6654	273.5036	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction									FC = cooled area / (4) =			882.0728 (104)
Intermittency factor (Table 10b)												1.0000 (105)
Space cooling kWh	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	0.0000	0.0000	0.0000	0.0000	0.0000	65.4759	86.6664	68.3759	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling per m2												220.5182 (107)
Energy for space heating												1.7603 (108)
Energy for space cooling												47.2441 (99)
Total												1.7603 (108)
Dwelling Fabric Energy Efficiency (DFEE)												49.0045 (109)
												49.0 (109)

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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	63.5200 (1b)	x 2.3800 (2b)	= 151.1776 (1b) - (3b)
First floor	61.7500 (1c)	x 2.6700 (2c)	= 164.8725 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	125.2700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 316.0501 (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) =	0.1266 (8)
Pressure test										Yes							
Measured/design AP50										5.0000							
Infiltration rate										0.3766 (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) =					0.3766	(21)	
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
Wind factor	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)				
Adj infilt rate	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)				
	0.4801	0.4707	0.4613	0.4142	0.4048	0.3577	0.3577	0.3483	0.3766	0.4048	0.4236	0.4425	(22b)				
Effective ac	0.6153	0.6108	0.6064	0.5858	0.5819	0.5640	0.5640	0.5607	0.5709	0.5819	0.5897	0.5979	(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)			23.8000	1.3258	31.5530		(27)					
Ground Floor			63.5200	0.1300	8.2576		(28a)					
Brick and Block	181.4300	25.9200	155.5100	0.1800	27.9918		(29a)					
Pitched Roof	63.5200		63.5200	0.1300	8.2576		(30)					
Total net area of external elements Aum(A, m2)			308.4700				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	78.1800		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							14.6654 (36)					
Total fabric heat loss						(33) + (36) =	92.8454 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 64.1691	Feb 63.7023	Mar 63.2448	Apr 61.0957	May 60.6936	Jun 58.8219	Jul 58.8219	Aug 58.4753	Sep 59.5428	Oct 60.6936	Nov 61.5070	Dec 62.3574 (38)
Heat transfer coeff	157.0145	156.5477	156.0902	153.9411	153.5391	151.6673	151.6673	151.3207	152.3883	153.5391	154.3525	155.2028 (39)
Average = Sum(39)m / 12 =												153.9392 (39)
HLP	Jan 1.2534	Feb 1.2497	Mar 1.2460	Apr 1.2289	May 1.2257	Jun 1.2107	Jul 1.2107	Aug 1.2080	Sep 1.2165	Oct 1.2257	Nov 1.2322	Dec 1.2389 (40)
HLP (average)												1.2289 (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												2.8816 (42)
Average daily hot water use (litres/day)												102.6375 (43)
Daily hot water use	Jan 112.9012	Feb 108.7957	Mar 104.6902	Apr 100.5847	May 96.4792	Jun 92.3737	Jul 92.3737	Aug 96.4792	Sep 100.5847	Oct 104.6902	Nov 108.7957	Dec 112.9012 (44)
Energy conte	167.4292	146.4347	151.1075	131.7391	126.4068	109.0795	101.0782	115.9887	117.3740	136.7880	149.3148	162.1463 (45)
Energy content (annual)										Total = Sum(45)m =		1614.8868 (45)
Distribution loss (46)m = 0.15 x (45)m												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												

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Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Heat gains from water heating, kWh/month	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
	35.5787	31.1174	32.1103	27.9946	26.8615	23.1794	21.4791	24.6476	24.9420	29.0675	31.7294	34.4561 (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	144.0788	144.0788	144.0788	144.0788	144.0788	144.0788	144.0788	144.0788	144.0788	144.0788	144.0788	144.0788	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	26.3703	23.4218	19.0479	14.4205	10.7795	9.1005	9.8334	12.7818	17.1558	21.7832	25.4242	27.1032	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	291.9243	294.9536	287.3199	271.0688	250.5547	231.2743	218.3939	215.3646	222.9982	239.2494	259.7635	279.0438	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.4079	37.4079	37.4079	37.4079	37.4079	37.4079	37.4079	37.4079	37.4079	37.4079	37.4079	37.4079	(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)	-115.2631	-115.2631	-115.2631	-115.2631	-115.2631	-115.2631	-115.2631	-115.2631	-115.2631	-115.2631	-115.2631	-115.2631	(71)
Water heating gains (Table 5)	47.8208	46.3056	43.1591	38.8813	36.1041	32.1936	28.8698	33.1285	34.6416	39.0692	44.0686	46.3119	(72)
Total internal gains	432.3391	430.9047	415.7506	390.5943	363.6620	338.7921	323.3207	327.4986	341.0193	366.3253	395.4799	418.6826	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	g	FF Specific data or Table 6c	Access factor Table 6d	Gains W
East	10.0700	19.6403	0.6300	0.6300	0.7000	0.7700	60.4434 (76)
South	2.5200	46.7521	0.6300	0.6300	0.7000	0.7700	36.0059 (78)
Southwest	1.4400	36.7938	0.6300	0.6300	0.7000	0.7700	16.1923 (79)
West	8.3300	19.6403	0.6300	0.6300	0.7000	0.7700	49.9993 (80)
Northwest	1.4400	11.2829	0.6300	0.6300	0.7000	0.7700	4.9654 (81)

Solar gains	167.6063	312.7064	486.8660	680.4789	816.9936	831.0008	793.1944	691.0750	555.3315	362.7989	206.0307	139.8473	(83)
Total gains	599.9454	743.6111	902.6165	1071.0732	1180.6555	1169.7928	1116.5151	1018.5736	896.3507	729.1243	601.5107	558.5299	(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	55.4045	55.5697	55.7326	56.5106	56.6586	57.3578	57.3578	57.4892	57.0864	56.6586	56.3600	56.0512	
alpha	4.6936	4.7046	4.7155	4.7674	4.7772	4.8239	4.8239	4.8326	4.8058	4.7772	4.7573	4.7367	
util living area	0.9992	0.9977	0.9921	0.9683	0.8953	0.7431	0.5766	0.6448	0.8866	0.9870	0.9983	0.9995	(86)
MIT	19.5116	19.6904	19.9921	20.3898	20.7257	20.9248	20.9825	20.9709	20.8098	20.3513	19.8588	19.4882	(87)
Th 2	19.8775	19.8805	19.8834	19.8970	19.8995	19.9114	19.9114	19.9136	19.9068	19.8995	19.8944	19.8890	(88)
util rest of house	0.9990	0.9969	0.9891	0.9554	0.8523	0.6486	0.4445	0.5110	0.8224	0.9798	0.9976	0.9993	(89)
MIT 2	18.5187	18.6995	19.0019	19.4021	19.7127	19.8767	19.9070	19.9053	19.7974	19.3719	18.8789	18.5043	(90)
Living area fraction									fLA = Living area / (4) =				0.1415 (91)
MIT	18.6592	18.8397	19.1421	19.5419	19.8561	20.0251	20.0593	20.0561	19.9407	19.5106	19.0176	18.6436	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6592	18.8397	19.1421	19.5419	19.8561	20.0251	20.0593	20.0561	19.9407	19.5106	19.0176	18.6436	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9985	0.9958	0.9863	0.9500	0.8503	0.6595	0.4633	0.5298	0.8248	0.9763	0.9967	0.9990	(94)
Ext temp.	599.0636	740.5091	890.2240	1017.5595	1003.9382	771.4878	517.2872	539.6251	739.3334	711.8241	599.5224	557.9492	(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	2254.6101	2182.2352	1973.3020	1638.2238	1252.2763	822.8046	524.6565	553.2463	890.0525	1368.1194	1839.5033	2241.6828	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000	(97a)
Space heating per m2	1231.7265	968.8400	805.8100	446.8783	184.7635	0.0000	0.0000	0.0000	0.0000	488.2837	892.7862	1252.6978	(98)
												6271.7861	(98)
												50.0661	(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	1425.6726	1122.3380	1150.0372	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8445	0.9095	0.8770	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1204.0169	1020.7888	1008.5274	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1484.2326	1419.3272	1307.0753	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													

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	201.7552	296.5125	222.1197	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												720.3875 (104)
Cooled fraction									FC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	50.4388	74.1281	55.5299	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												180.0969 (107)
Space cooling per m2												1.4377 (108)
Energy for space heating												50.0661 (99)
Energy for space cooling												1.4377 (108)
Total												51.5038 (109)
Target Fabric Energy Efficiency (TFEE)												59.2 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	63.5200 (1b)	x 2.3800 (2b)	= 151.1776 (1b) - (3b)
First floor	61.7500 (1c)	x 2.6700 (2c)	= 164.8725 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	125.2700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 316.0501 (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) = 0.1582 (8)
Pressure test					Yes
Measured/design AP50					4.0200
Infiltration rate					0.3592 (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) =	0.3592 (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	0.4221	0.3951	0.3951	0.3592	0.3682	0.3502	0.3502	0.3412	0.3412	0.3682	0.3592	0.3682 (22b)
Effective ac	0.5891	0.5781	0.5781	0.5645	0.5678	0.5613	0.5613	0.5582	0.5582	0.5678	0.5645	0.5678 (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)			23.8000	1.1450	27.2519		(27)
Ground Floor			63.5200	0.1200	7.6224	84.0000	5335.6800 (28a)
Brick and Block	181.4300	25.9200	155.5100	0.2400	37.3224	42.2200	6565.6322 (29a)
Pitched Roof	63.5200		63.5200	0.1000	6.3520	9.1000	578.0320 (30)
Total net area of external elements Aum(A, m ²)			308.4700				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	80.8807		(33)
GF Block			57.0500			75.0000	4278.7500 (32c)
GF Stud			33.7700			9.0000	303.9300 (32c)
FF Stud			149.0000			9.0000	1341.0000 (32c)
Internal Floor 1			61.8100			18.0000	1112.5800 (32d)
Internal Ceiling 1			61.8100			18.0000	1112.5800 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 20628.1842 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 164.6698 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 11.1683 (36)
Total fabric heat loss (33) + (36) = 92.0490 (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	61.4378	60.2898	60.2898	58.8768	59.2174	58.5446	58.5446	58.2208	58.2208	59.2174	58.8768	59.2174 (38)
Heat transfer coeff	153.4868	152.3388	152.3388	150.9258	151.2664	150.5936	150.5936	150.2697	150.2697	151.2664	150.9258	151.2664 (39)
Average = Sum(39)m / 12 =												151.2951 (39)
HLP	1.2252	1.2161	1.2161	1.2048	1.2075	1.2022	1.2022	1.1996	1.1996	1.2075	1.2048	1.2075 (40)
HLP (average)												1.2078 (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												2.8816 (42)
Average daily hot water use (litres/day)												102.6375 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.9012	108.7957	104.6902	100.5847	96.4792	92.3737	92.3737	96.4792	100.5847	104.6902	108.7957	112.9012 (44)
Energy conte	167.4292	146.4347	151.1075	131.7391	126.4068	109.0795	101.0782	115.9887	117.3740	136.7880	149.3148	162.1463 (45)
Energy content (annual)										Total = Sum(45)m =		1614.8868 (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	25.1144	21.9652	22.6661	19.7609	18.9610	16.3619	15.1617	17.3983	17.6061	20.5182	22.3972	24.3219 (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												
219.6518 193.6035 203.3301 182.2771 178.6294 159.6175 153.3008 168.2113 167.9120 189.0106 199.8528 214.3689 (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	219.6518	193.6035	203.3301	182.2771	178.6294	159.6175	153.3008	168.2113	167.9120	189.0106	199.8528	214.3689 (64)
RHI water heating demand												2229.7658 (64)
Heat gains from water heating, kWh/month	97.4483	86.4246	92.0213	84.2337	83.8084	76.6993	75.3866	80.3443	79.4572	87.2601	90.0776	95.6917 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	172.8946	172.8946	172.8946	172.8946	172.8946	172.8946	172.8946	172.8946	172.8946	172.8946	172.8946	172.8946 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	65.9256	58.5546	47.6198	36.0512	26.9487	22.7512	24.5835	31.9546	42.8894	54.4579	63.5604	67.7579 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	435.7079	440.2292	428.8357	404.5803	373.9623	345.1856	325.9610	321.4397	332.8332	357.0886	387.7067	416.4833 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.1710	55.1710	55.1710	55.1710	55.1710	55.1710	55.1710	55.1710	55.1710	55.1710	55.1710	55.1710 (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)	-115.2631	-115.2631	-115.2631	-115.2631	-115.2631	-115.2631	-115.2631	-115.2631	-115.2631	-115.2631	-115.2631	-115.2631 (71)
Water heating gains (Table 5)	130.9789	128.6080	123.6846	116.9912	112.6456	106.5268	101.3260	107.9897	110.3573	117.2851	125.1078	128.6179 (72)
Total internal gains	748.4150	743.1943	715.9426	673.4253	629.3592	590.2662	567.6731	577.1865	601.8824	644.6342	692.1774	728.6617 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	Access factor Table 6d	Gains W
East	10.0700	25.1733	0.6300	0.7000	0.7700	77.4713 (76)
South	2.5200	56.5862	0.6300	0.7000	0.7700	43.5796 (78)
Southwest	1.4400	45.0642	0.6300	0.7000	0.7700	19.8320 (79)
West	8.3300	25.1733	0.6300	0.7000	0.7700	64.0850 (80)
Northwest	1.4400	14.6130	0.6300	0.7000	0.7700	6.4309 (81)

Solar gains	211.3987	336.0512	532.7419	746.6563	842.6355	947.9679	869.5150	791.1160	635.8822	420.8042	259.1132	166.9030 (83)
Total gains	959.8138	1079.2455	1248.6845	1420.0817	1471.9947	1538.2341	1437.1882	1368.3025	1237.7647	1065.4384	951.2907	895.5647 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	37.3325	37.6139	37.6139	37.9660	37.8805	38.0498	38.0498	38.1318	38.1318	37.8805	37.9660	37.8805
alpha	3.4888	3.5076	3.5076	3.5311	3.5254	3.5367	3.5367	3.5421	3.5421	3.5254	3.5311	3.5254
util living area	0.9739	0.9607	0.9223	0.8327	0.6919	0.4769	0.3405	0.3458	0.6127	0.8600	0.9527	0.9781 (86)
MIT	19.5599	19.7391	20.1013	20.5315	20.8213	20.9651	20.9922	20.9921	20.9157	20.5647	20.0224	19.5440 (87)
Th 2	19.8999	19.9072	19.9072	19.9162	19.9140	19.9183	19.9183	19.9203	19.9203	19.9140	19.9162	19.9140 (88)
util rest of house	0.9678	0.9516	0.9044	0.7955	0.6256	0.3845	0.2314	0.2318	0.5172	0.8176	0.9396	0.9729 (89)
MIT 2	18.6240	18.8046	19.1541	19.5598	19.8028	19.9043	19.9168	19.9189	19.8806	19.5993	19.0916	18.6195 (90)
Living area fraction									fLA = Living area / (4) =			0.1415 (91)
MIT	18.7565	18.9368	19.2882	19.6973	19.9469	20.0545	20.0690	20.0708	20.0271	19.7359	19.2234	18.7504 (92)
Temperature adjustment												0.0000
adjusted MIT	18.7565	18.9368	19.2882	19.6973	19.9469	20.0545	20.0690	20.0708	20.0271	19.7359	19.2234	18.7504 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	920.8372	1015.9912	1114.0451	1117.5358	924.0621	609.9627	354.8102	339.3611	652.6989	862.3190	883.7033	864.5385 (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	2019.3448	1970.7828	1780.5608	1448.4815	1035.7087	625.6377	356.7558	341.2358	695.3188	1155.0575	1603.3379	1974.0815 (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	817.2897	641.6199	495.8876	238.2809	83.0650	0.0000	0.0000	0.0000	0.0000	217.7974	518.1369	825.5001 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF HEAT DEMAND 09 Jan 2014

Space heating	3837.5775 (98)
RHI space heating demand	3838 (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	63.5200 (1b)	x 2.3800 (2b)	= 151.1776 (1b) - (3b)
First floor	61.7500 (1c)	x 2.6700 (2c)	= 164.8725 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	125.2700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 316.0501 (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) = 0.1582 (8)
Pressure test					Yes
Measured/design AP50					4.0200
Infiltration rate					0.3592 (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) =	0.3592 (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	0.4580	0.4490	0.4400	0.3951	0.3861	0.3412	0.3412	0.3323	0.3592	0.3861	0.4041	0.4221 (22b)
Effective ac	0.6049	0.6008	0.5968	0.5781	0.5746	0.5582	0.5582	0.5552	0.5645	0.5746	0.5816	0.5891 (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)			23.8000	1.1450	27.2519		(27)
Ground Floor			63.5200	0.1200	7.6224	84.0000	5335.6800 (28a)
Brick and Block	181.4300	25.9200	155.5100	0.2400	37.3224	42.2200	6565.6322 (29a)
Pitched Roof	63.5200		63.5200	0.1000	6.3520	9.1000	578.0320 (30)
Total net area of external elements Aum(A, m ²)			308.4700				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	80.8807		(33)
GF Block			57.0500			75.0000	4278.7500 (32c)
GF Stud			33.7700			9.0000	303.9300 (32c)
FF Stud			149.0000			9.0000	1341.0000 (32c)
Internal Floor 1			61.8100			18.0000	1112.5800 (32d)
Internal Ceiling 1			61.8100			18.0000	1112.5800 (32e)

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

(28)...(30) + (32) + (32a)...(32e) =	20628.1842 (34)
	164.6698 (35)
	11.1683 (36)
(33) + (36) =	92.0490 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)	
(38)m	Jan 63.0863 Feb 62.6616 Mar 62.2452 Apr 60.2898 May 59.9239 Jun 58.2208 Jul 58.2208 Aug 57.9054 Sep 58.8768 Oct 59.9239 Nov 60.6640 Dec 61.4378 (38)
Heat transfer coeff	155.1353 154.7106 154.2942 152.3388 151.9729 150.2697 150.2697 149.9544 150.9258 151.9729 152.7130 153.4868 (39)
Average = Sum(39)m / 12 =	152.3370 (39)

HLP	Jan 1.2384 Feb 1.2350 Mar 1.2317 Apr 1.2161 May 1.2132 Jun 1.1996 Jul 1.1996 Aug 1.1970 Sep 1.2048 Oct 1.2132 Nov 1.2191 Dec 1.2252 (40)
HLP (average)	1.2161 (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												2.8816 (42)
Average daily hot water use (litres/day)												102.6375 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	112.9012	108.7957	104.6902	100.5847	96.4792	92.3737	92.3737	96.4792	100.5847	104.6902	108.7957	112.9012 (44)
Energy conte	167.4292	146.4347	151.1075	131.7391	126.4068	109.0795	101.0782	115.9887	117.3740	136.7880	149.3148	162.1463 (45)
Energy content (annual)	Total = Sum(45)m =											1614.8868 (45)

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Calculation Type: New Build (As Built)

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Distribution loss (46)m = 0.15 x (45)m	25.1144	21.9652	22.6661	19.7609	18.9610	16.3619	15.1617	17.3983	17.6061	20.5182	22.3972	24.3219 (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												
219.6518 193.6035 203.3301 182.2771 178.6294 159.6175 153.3008 168.2113 167.9120 189.0106 199.8528 214.3689 (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	219.6518	193.6035	203.3301	182.2771	178.6294	159.6175	153.3008	168.2113	167.9120	189.0106	199.8528	214.3689 (64)
Total per year (kWh/year) = Sum(64)m =												2229.7658 (64)
Heat gains from water heating, kWh/month												
97.4483 86.4246 92.0213 84.2337 83.8084 76.6993 75.3866 80.3443 79.4572 87.2601 90.0776 95.6917 (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	172.8946	172.8946	172.8946	172.8946	172.8946	172.8946	172.8946	172.8946	172.8946	172.8946	172.8946	172.8946 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
65.9256 58.5546 47.6198 36.0512 26.9487 22.7512 24.5835 31.9546 42.8894 54.4579 63.5604 67.7579 (67)												
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
435.7079 440.2292 428.8357 404.5803 373.9623 345.1856 325.9610 321.4397 332.8332 357.0886 387.7067 416.4833 (68)												
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
55.1710 55.1710 55.1710 55.1710 55.1710 55.1710 55.1710 55.1710 55.1710 55.1710 55.1710 55.1710 (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)												
-115.2631 -115.2631 -115.2631 -115.2631 -115.2631 -115.2631 -115.2631 -115.2631 -115.2631 -115.2631 -115.2631 -115.2631 (71)												
Water heating gains (Table 5)												
130.9789 128.6080 123.6846 116.9912 112.6456 106.5268 101.3260 107.9897 110.3573 117.2851 125.1078 128.6179 (72)												
Total internal gains	748.4150	743.1943	715.9426	673.4253	629.3592	590.2662	567.6731	577.1865	601.8824	644.6342	692.1774	728.6617 (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	
East						10.0700	19.6403	0.6300	0.7000	0.7700	60.4434 (76)	
South						2.5200	46.7521	0.6300	0.7000	0.7700	36.0059 (78)	
Southwest						1.4400	36.7938	0.6300	0.7000	0.7700	16.1923 (79)	
West						8.3300	19.6403	0.6300	0.7000	0.7700	49.9993 (80)	
Northwest						1.4400	11.2829	0.6300	0.7000	0.7700	4.9654 (81)	
Solar gains	167.6063	312.7064	486.8660	680.4789	816.9936	831.0008	793.1944	691.0750	555.3315	362.7989	206.0307	139.8473 (83)
Total gains	916.0213	1055.9008	1202.8086	1353.9042	1446.3528	1421.2670	1360.8675	1268.2615	1157.2139	1007.4331	898.2082	868.5091 (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	36.9358	37.0372	37.1372	37.6139	37.7044	38.1318	38.1318	38.2120	37.9660	37.7044	37.5217	37.3325
alpha	3.4624	3.4691	3.4758	3.5076	3.5136	3.5421	3.5421	3.5475	3.5311	3.5136	3.5014	3.4888
util living area	0.9822	0.9700	0.9430	0.8802	0.7694	0.6106	0.4657	0.5134	0.7365	0.9143	0.9710	0.9850 (86)
MIT	19.3011	19.5254	19.8901	20.3419	20.6962	20.9048	20.9722	20.9607	20.8085	20.3334	19.7377	19.2634 (87)
Th 2	19.8894	19.8921	19.8947	19.9072	19.9095	19.9203	19.9203	19.9224	19.9162	19.9095	19.9048	19.8999 (88)
util rest of house	0.9782	0.9634	0.9301	0.8530	0.7178	0.5279	0.3599	0.4054	0.6619	0.8886	0.9634	0.9816 (89)
MIT 2	18.3599	18.5828	18.9408	19.3800	19.6977	19.8705	19.9111	19.9081	19.8029	19.3843	18.8045	18.3305 (90)
Living area fraction									fLA = Living area / (4) =			0.1415 (91)
MIT	18.4932	18.7162	19.0752	19.5161	19.8390	20.0169	20.0613	20.0571	19.9452	19.5186	18.9366	18.4625 (92)
Temperature adjustment												0.0000
adjusted MIT	18.4932	18.7162	19.0752	19.5161	19.8390	20.0169	20.0613	20.0571	19.9452	19.5186	18.9366	18.4625 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.9714 0.9542 0.9183 0.8416 0.7141 0.5358 0.3743 0.4196 0.6641 0.8773 0.9546 0.9756 (94)												
Useful gains	889.8218	1007.5706	1104.4949	1139.4720	1032.7761	761.5177	509.3364	532.1353	768.5311	883.8551	857.4131	847.3529 (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	2201.8599	2137.5165	1940.2766	1617.2456	1236.9146	813.9899	520.1238	548.3967	882.1891	1355.3907	1807.5965	2189.1091 (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	976.1564	759.3237	621.8216	343.9970	151.8790	0.0000	0.0000	0.0000	0.0000	350.8225	684.1321	998.2666 (98)
Space heating												4886.3987 (98)

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Space heating per m2 (98) / (4) = 39.0069 (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													5399.3356 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	976.1564	759.3237	621.8216	343.9970	151.8790	0.0000	0.0000	0.0000	0.0000	350.8225	684.1321	998.2666	(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)	1078.6258	839.0317	687.0956	380.1071	167.8221	0.0000	0.0000	0.0000	0.0000	387.6492	755.9470	1103.0571	(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	219.6518	193.6035	203.3301	182.2771	178.6294	159.6175	153.3008	168.2113	167.9120	189.0106	199.8528	214.3689	(64)
Efficiency of water heater (217)m	88.3246	88.1000	87.6055	86.4836	84.3847	79.8000	79.8000	79.8000	79.8000	86.4418	87.8373	79.8000	(216)
Fuel for water heating, kWh/month	248.6870	219.7542	232.0975	210.7649	211.6845	200.0219	192.1062	210.7911	210.4160	218.6565	227.5262	88.4045	(217)
Water heating fuel used												242.4863	(219)
Annual totals kWh/year												2624.9924	(219)
Space heating fuel - main system												5399.3356	(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)												465.7069	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.14 * 1080 * 1.00) =										-984.5265		-984.5265	(233)
Total delivered energy for all uses												7580.5085	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	5399.3356	3.4800	187.8969 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2624.9924	3.4800	91.3497 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	465.7069	13.1900	61.4267 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-984.5265	13.1900	-129.8590 (252)
Total energy cost			340.7068 (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] =	0.8404 (257)
SAP value		88.2763
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	5399.3356	0.2160	1166.2565 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2624.9924	0.2160	566.9984 (264)
Space and water heating			1733.2549 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	465.7069	0.5190	241.7019 (268)
Energy saving/generation technologies			
PV Unit	-984.5265	0.5190	-510.9692 (269)
Total kg/year			1502.9125 (272)
CO2 emissions per m2			12.0000 (273)
EI value			88.1723
EI rating			88 (274)
EI band			B

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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	$3.48 / 0.8473 = 4.107$, stars = 4
Water heating environmental impact	$0.216 / 0.8473 = 0.2549$, 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	63.5200 (1b)	x 2.3800 (2b)	= 151.1776 (1b) - (3b)
First floor	61.7500 (1c)	x 2.6700 (2c)	= 164.8725 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	125.2700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 316.0501 (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) =	0.1582 (8)
Pressure test										Yes							
Measured/design AP50										4.0200							
Infiltration rate										0.3592 (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) =					0.3592 (21)		
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
	4.7000	4.4000	4.4000	4.0000	4.1000	3.9000	3.9000	3.8000	3.8000	4.1000	4.0000	4.1000	(22)				
Wind factor	1.1750	1.1000	1.1000	1.0000	1.0250	0.9750	0.9750	0.9500	0.9500	1.0250	1.0000	1.0250	(22a)				
Adj infilt rate	0.4221	0.3951	0.3951	0.3592	0.3682	0.3502	0.3502	0.3412	0.3412	0.3682	0.3592	0.3682	(22b)				
Effective ac	0.5891	0.5781	0.5781	0.5645	0.5678	0.5613	0.5613	0.5582	0.5582	0.5678	0.5645	0.5678	(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)			23.8000	1.1450	27.2519		(27)
Ground Floor			63.5200	0.1200	7.6224	84.0000	5335.6800 (28a)
Brick and Block	181.4300	25.9200	155.5100	0.2400	37.3224	42.2200	6565.6322 (29a)
Pitched Roof	63.5200		63.5200	0.1000	6.3520	9.1000	578.0320 (30)
Total net area of external elements Aum(A, m ²)			308.4700				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	80.8807		(33)
GF Block			57.0500			75.0000	4278.7500 (32c)
GF Stud			33.7700			9.0000	303.9300 (32c)
FF Stud			149.0000			9.0000	1341.0000 (32c)
Internal Floor 1			61.8100			18.0000	1112.5800 (32d)
Internal Ceiling 1			61.8100			18.0000	1112.5800 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 20628.1842 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 164.6698 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 11.1683 (36)
Total fabric heat loss (33) + (36) = 92.0490 (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	61.4378	60.2898	60.2898	58.8768	59.2174	58.5446	58.5446	58.2208	58.2208	59.2174	58.8768	59.2174 (38)
Heat transfer coeff	153.4868	152.3388	152.3388	150.9258	151.2664	150.5936	150.5936	150.2697	150.2697	151.2664	150.9258	151.2664 (39)
Average = Sum(39)m / 12 =												151.2951 (39)
HLP	1.2252	1.2161	1.2161	1.2048	1.2075	1.2022	1.2022	1.1996	1.1996	1.2075	1.2048	1.2075 (40)
HLP (average)												1.2078 (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												2.8816 (42)
Average daily hot water use (litres/day)												102.6375 (43)
Daily hot water use	Jan 112.9012	Feb 108.7957	Mar 104.6902	Apr 100.5847	May 96.4792	Jun 92.3737	Jul 92.3737	Aug 96.4792	Sep 100.5847	Oct 104.6902	Nov 108.7957	Dec 112.9012 (44)
Energy conte	167.4292	146.4347	151.1075	131.7391	126.4068	109.0795	101.0782	115.9887	117.3740	136.7880	149.3148	162.1463 (45)
Energy content (annual)										Total = Sum(45)m =		1614.8868 (45)

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Calculation Type: New Build (As Built)

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Distribution loss (46)m = 0.15 x (45)m	25.1144	21.9652	22.6661	19.7609	18.9610	16.3619	15.1617	17.3983	17.6061	20.5182	22.3972	24.3219 (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												
219.6518 193.6035 203.3301 182.2771 178.6294 159.6175 153.3008 168.2113 167.9120 189.0106 199.8528 214.3689 (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												
219.6518 193.6035 203.3301 182.2771 178.6294 159.6175 153.3008 168.2113 167.9120 189.0106 199.8528 214.3689 (64)												
Total per year (kWh/year) = Sum(64)m =												2229.7658 (64)
Heat gains from water heating, kWh/month												
97.4483 86.4246 92.0213 84.2337 83.8084 76.6993 75.3866 80.3443 79.4572 87.2601 90.0776 95.6917 (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	172.8946	172.8946	172.8946	172.8946	172.8946	172.8946	172.8946	172.8946	172.8946	172.8946	172.8946	172.8946 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
65.9256 58.5546 47.6198 36.0512 26.9487 22.7512 24.5835 31.9546 42.8894 54.4579 63.5604 67.7579 (67)												
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
435.7079 440.2292 428.8357 404.5803 373.9623 345.1856 325.9610 321.4397 332.8332 357.0886 387.7067 416.4833 (68)												
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
55.1710 55.1710 55.1710 55.1710 55.1710 55.1710 55.1710 55.1710 55.1710 55.1710 55.1710 55.1710 (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)												
-115.2631 -115.2631 -115.2631 -115.2631 -115.2631 -115.2631 -115.2631 -115.2631 -115.2631 -115.2631 -115.2631 -115.2631 (71)												
Water heating gains (Table 5)												
130.9789 128.6080 123.6846 116.9912 112.6456 106.5268 101.3260 107.9897 110.3573 117.2851 125.1078 128.6179 (72)												
Total internal gains	748.4150	743.1943	715.9426	673.4253	629.3592	590.2662	567.6731	577.1865	601.8824	644.6342	692.1774	728.6617 (73)

6. Solar gains

[Jan]					Area m ²	Solar flux Table 6a W/m ²	g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
East					10.0700	25.1733	0.6300		0.7000		0.7700		77.4713 (76)
South					2.5200	56.5862	0.6300		0.7000		0.7700		43.5796 (78)
Southwest					1.4400	45.0642	0.6300		0.7000		0.7700		19.8320 (79)
West					8.3300	25.1733	0.6300		0.7000		0.7700		64.0850 (80)
Northwest					1.4400	14.6130	0.6300		0.7000		0.7700		6.4309 (81)
Solar gains	211.3987	336.0512	532.7419	746.6563	842.6355	947.9679	869.5150	791.1160	635.8822	420.8042	259.1132	166.9030 (83)	
Total gains	959.8138	1079.2455	1248.6845	1420.0817	1471.9947	1538.2341	1437.1882	1368.3025	1237.7647	1065.4384	951.2907	895.5647 (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	37.3325	37.6139	37.6139	37.9660	37.8805	38.0498	38.0498	38.1318	38.1318	37.8805	37.9660	37.8805
alpha	3.4888	3.5076	3.5076	3.5311	3.5254	3.5367	3.5367	3.5421	3.5421	3.5254	3.5311	3.5254
util living area	0.9739	0.9607	0.9223	0.8327	0.6919	0.4769	0.3405	0.3458	0.6127	0.8600	0.9527	0.9781 (86)
MIT	19.5599	19.7391	20.1013	20.5315	20.8213	20.9651	20.9922	20.9921	20.9157	20.5647	20.0224	19.5440 (87)
Th 2	19.8999	19.9072	19.9072	19.9162	19.9140	19.9183	19.9183	19.9203	19.9203	19.9140	19.9162	19.9140 (88)
util rest of house	0.9678	0.9516	0.9044	0.7955	0.6256	0.3845	0.2314	0.2318	0.5172	0.8176	0.9396	0.9729 (89)
MIT 2	18.6240	18.8046	19.1541	19.5598	19.8028	19.9043	19.9168	19.9189	19.8806	19.5993	19.0916	18.6195 (90)
Living area fraction									fLA = Living area / (4) =			0.1415 (91)
MIT	18.7565	18.9368	19.2882	19.6973	19.9469	20.0545	20.0690	20.0708	20.0271	19.7359	19.2234	18.7504 (92)
Temperature adjustment												0.0000
adjusted MIT	18.7565	18.9368	19.2882	19.6973	19.9469	20.0545	20.0690	20.0708	20.0271	19.7359	19.2234	18.7504 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.9594 0.9414 0.8922 0.7870 0.6278 0.3965 0.2469 0.2480 0.5273 0.8094 0.9290 0.9654 (94)												
Useful gains	920.8372	1015.9912	1114.0451	1117.5358	924.0621	609.9627	354.8102	339.3611	652.6989	862.3190	883.7033	864.5385 (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												
2019.3448 1970.7828 1780.5608 1448.4815 1035.7087 625.6377 356.7558 341.2358 695.3188 1155.0575 1603.3379 1974.0815 (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												
817.2897 641.6199 495.8876 238.2809 83.0650 0.0000 0.0000 0.0000 0.0000 217.7974 518.1369 825.5001 (98)												
Space heating												3837.5775 (98)

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

Space heating per m2 (98) / (4) = 30.6344 (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													4240.4171 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	817.2897	641.6199	495.8876	238.2809	83.0650	0.0000	0.0000	0.0000	0.0000	217.7974	518.1369	825.5001	(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)	903.0825	708.9723	547.9421	263.2938	91.7846	0.0000	0.0000	0.0000	0.0000	240.6601	572.5269	912.1548	(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	219.6518	193.6035	203.3301	182.2771	178.6294	159.6175	153.3008	168.2113	167.9120	189.0106	199.8528	214.3689	(64)
Efficiency of water heater (217)m	88.0005	87.7720	87.1037	85.5295	82.9115	79.8000	79.8000	79.8000	79.8000	85.1926	87.2438	79.8000	(216)
Fuel for water heating, kWh/month	249.6028	220.5755	233.4345	213.1162	215.4458	200.0219	192.1062	210.7911	210.4160	221.8627	229.0739	243.4192	(219)
Water heating fuel used												2639.8658	(219)
Annual totals kWh/year													
Space heating fuel - main system												4240.4171	(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)												465.7069	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.14 * 1206 * 1.00) =									-1099.8813			-1099.8813	(233)
Total delivered energy for all uses												6321.1085	(238)

10a. Fuel costs - using BEDF prices (491)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	4240.4171	3.6300	153.9271 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2639.8658	3.6300	95.8271 (247)
Pumps and fans for heating	75.0000	19.4400	14.5800 (249)
Energy for lighting	465.7069	19.4400	90.5334 (250)
Additional standing charges			95.0000 (251)
Energy saving/generation technologies			
PV Unit	-1099.8813	19.4400	-213.8169 (252)
Total energy cost			236.0508 (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	4240.4171	0.2160	915.9301 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2639.8658	0.2160	570.2110 (264)
Space and water heating			1486.1411 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	465.7069	0.5190	241.7019 (268)
Energy saving/generation technologies			
PV Unit	-1099.8813	0.5190	-570.8384 (269)
Total kg/year			1195.9296 (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	4240.4171	1.2200	5173.3088 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2639.8658	1.2200	3220.6363 (264)
Space and water heating			8393.9452 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	465.7069	3.0700	1429.7203 (268)

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Energy saving/generation technologies			
PV Unit	-1099.8813	3.0700	-3376.6357 (269)
Primary energy kWh/year			6677.2798 (272)
Primary energy kWh/m2/year			53.3031 (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	+ 1.3	-£ 40	-271 kg (22.6%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£40 2.16 kg/m²	B 90	B 90
Total Savings	£40 2.16 kg/m²		

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

Fuel prices for cost data on this page from database revision number 491 TEST (28 Feb 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	£105	£115	-£10
Mains gas	£345	£295	£50
Space heating	£264	£265	-£2
Water heating	£96	£54	£42
Lighting	£91	£91	£0
Generated (PV)	-£214	-£214	£0
Total cost of fuels	£236	£196	£40
Total cost of uses	£237	£196	£40
Delivered energy	50 kWh/m²	40 kWh/m²	11 kWh/m²
Carbon dioxide emissions	1.2 tonnes	0.9 tonnes	0.3 tonnes
CO2 emissions per m²	10 kg/m²	7 kg/m²	2 kg/m²
Primary energy	53 kWh/m²	41 kWh/m²	12 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	63.5200 (1b)	x 2.3800 (2b)	= 151.1776 (1b) - (3b)
First floor	61.7500 (1c)	x 2.6700 (2c)	= 164.8725 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	125.2700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 316.0501 (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) = 0.1582 (8)
Pressure test					Yes
Measured/design AP50					4.0200
Infiltration rate					0.3592 (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) =	0.3592 (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	0.4580	0.4490	0.4400	0.3951	0.3861	0.3412	0.3412	0.3323	0.3592	0.3861	0.4041	0.4221 (22b)
Effective ac	0.6049	0.6008	0.5968	0.5781	0.5746	0.5582	0.5582	0.5552	0.5645	0.5746	0.5816	0.5891 (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)			23.8000	1.1450	27.2519		(27)
Ground Floor			63.5200	0.1200	7.6224	84.0000	5335.6800 (28a)
Brick and Block	181.4300	25.9200	155.5100	0.2400	37.3224	42.2200	6565.6322 (29a)
Pitched Roof	63.5200		63.5200	0.1000	6.3520	9.1000	578.0320 (30)
Total net area of external elements Aum(A, m ²)			308.4700				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	80.8807		(33)
GF Block			57.0500			75.0000	4278.7500 (32c)
GF Stud			33.7700			9.0000	303.9300 (32c)
FF Stud			149.0000			9.0000	1341.0000 (32c)
Internal Floor 1			61.8100			18.0000	1112.5800 (32d)
Internal Ceiling 1			61.8100			18.0000	1112.5800 (32e)

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

(28)...(30) + (32) + (32a)...(32e) =	20628.1842 (34)
	164.6698 (35)
	11.1683 (36)
(33) + (36) =	92.0490 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)	
(38)m	Jan 63.0863 Feb 62.6616 Mar 62.2452 Apr 60.2898 May 59.9239 Jun 58.2208 Jul 58.2208 Aug 57.9054 Sep 58.8768 Oct 59.9239 Nov 60.6640 Dec 61.4378 (38)
Heat transfer coeff	155.1353 154.7106 154.2942 152.3388 151.9729 150.2697 150.2697 149.9544 150.9258 151.9729 152.7130 153.4868 (39)
Average = Sum(39)m / 12 =	152.3370 (39)

HLP	Jan 1.2384 Feb 1.2350 Mar 1.2317 Apr 1.2161 May 1.2132 Jun 1.1996 Jul 1.1996 Aug 1.1970 Sep 1.2048 Oct 1.2132 Nov 1.2191 Dec 1.2252 (40)
HLP (average)	1.2161 (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												2.8816 (42)
Average daily hot water use (litres/day)												102.6375 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	112.9012	108.7957	104.6902	100.5847	96.4792	92.3737	92.3737	96.4792	100.5847	104.6902	108.7957	112.9012 (44)
Energy conte	167.4292	146.4347	151.1075	131.7391	126.4068	109.0795	101.0782	115.9887	117.3740	136.7880	149.3148	162.1463 (45)
Energy content (annual)	Total = Sum(45)m =											1614.8868 (45)

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CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	25.1144	21.9652	22.6661	19.7609	18.9610	16.3619	15.1617	17.3983	17.6061	20.5182	22.3972	24.3219 (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												
209.5494 184.4787 191.8319 165.7470 155.7327 137.2343 130.1714 146.0125 152.7326 177.5125 190.0763 204.2665 (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												1.1231 (H8)
Utilisation factor												0.5895 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												117.0000 (H13)
Daily hot water demand												102.6375 (H14)
Volume ratio Veff/V												1.1399 (H15)
Solar storage volume factor												1.0000 (H16)
Solar input												-940.1022 (H17)
Solar input	-27.2611	-45.4909	-77.4763	-103.8334	-128.2775	-126.1172	-124.4505	-108.7330	-85.1598	-58.1541	-32.3356	-22.8129 (63)
Solar input (sum of months) = Sum (63)m =												-940.1022 (63)
Output from w/h												
182.2883 138.9878 114.3557 61.9136 27.4553 11.1171 5.7209 37.2794 67.5728 119.3584 157.7408 181.4536 (64)												
Total per year (kWh/year) = Sum (64)m =												1105.2436 (64)
Heat gains from water heating, kWh/month												
89.3664 79.1248 82.8228 71.0096 65.4910 58.7927 56.8831 62.5852 67.3137 78.0616 82.2564 87.6098 (65)												

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

Metabolic gains (Table 5), Watts												
(66)m	172.8946	172.8946	172.8946	172.8946	172.8946	172.8946	172.8946	172.8946	172.8946	172.8946	172.8946	172.8946 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
65.9256 58.5546 47.6198 36.0512 26.9487 22.7512 24.5835 31.9546 42.8894 54.4579 63.5604 67.7579 (67)												
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
435.7079 440.2292 428.8357 404.5803 373.9623 345.1856 325.9610 321.4397 332.8332 357.0886 387.7067 416.4833 (68)												
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
55.1710 55.1710 55.1710 55.1710 55.1710 55.1710 55.1710 55.1710 55.1710 55.1710 55.1710 55.1710 (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)												
-115.2631 -115.2631 -115.2631 -115.2631 -115.2631 -115.2631 -115.2631 -115.2631 -115.2631 -115.2631 -115.2631 -115.2631 (71)												
Water heating gains (Table 5)												
120.1161 117.7452 111.3210 98.6244 88.0255 81.6566 76.4558 84.1200 93.4913 104.9215 114.2450 117.7551 (72)												
Total internal gains	737.5522	732.3316	703.5790	655.0586	604.7391	565.3960	542.8029	553.3168	585.0164	632.2706	681.3147	717.7989 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a		g	FF		Access		Gains		
								Specific data or Table 6b	Specific data or Table 6c		factor Table 6d		W		

East				10.0700	19.6403		0.6300		0.7000		0.7700		60.4434 (76)		
South				2.5200	46.7521		0.6300		0.7000		0.7700		36.0059 (78)		
Southwest				1.4400	36.7938		0.6300		0.7000		0.7700		16.1923 (79)		
West				8.3300	19.6403		0.6300		0.7000		0.7700		49.9993 (80)		
Northwest				1.4400	11.2829		0.6300		0.7000		0.7700		4.9654 (81)		

Solar gains				167.6063	312.7064	486.8660	680.4789	816.9936	831.0008	793.1944	691.0750	555.3315	362.7989	206.0307	139.8473 (83)
Total gains				905.1586	1045.0380	1190.4450	1335.5374	1421.7326	1396.3967	1335.9972	1244.3918	1140.3479	995.0695	887.3454	857.6463 (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	36.9358	37.0372	37.1372	37.6139	37.7044	38.1318	38.1318	38.2120	37.9660	37.7044	37.5217	37.3325
alpha	3.4624	3.4691	3.4758	3.5076	3.5136	3.5421	3.5421	3.5475	3.5311	3.5136	3.5014	3.4888
util living area	0.9828	0.9709	0.9445	0.8839	0.7761	0.6186	0.4733	0.5216	0.7427	0.9168	0.9720	0.9856 (86)
MIT	19.2910	19.5157	19.8801	20.3304	20.6868	20.9007	20.9708	20.9587	20.8030	20.3245	19.7280	19.2531 (87)
Th 2	19.8894	19.8921	19.8947	19.9072	19.9095	19.9203	19.9203	19.9224	19.9162	19.9095	19.9048	19.8999 (88)
util rest of house	0.9789	0.9644	0.9319	0.8572	0.7251	0.5357	0.3662	0.4125	0.6685	0.8917	0.9646	0.9823 (89)
MIT 2	18.3500	18.5734	18.9314	19.3698	19.6904	19.8681	19.9106	19.9073	19.7991	19.3763	18.7950	18.3203 (90)
Living area fraction									fLA = Living area / (4) =			0.1415 (91)
MIT	18.4831	18.7068	19.0657	19.5057	19.8314	20.0143	20.0606	20.0561	19.9412	19.5105	18.9270	18.4523 (92)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Temperature adjustment													0.0000
adjusted MIT	18.4831	18.7068	19.0657	19.5057	19.8314	20.0143	20.0606	20.0561	19.9412	19.5105	18.9270	18.4523	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9723	0.9554	0.9202	0.8457	0.7210	0.5434	0.3807	0.4268	0.6704	0.8804	0.9560	0.9765	(94)
Useful gains	880.0834	998.4347	1095.3963	1129.4327	1025.0988	758.7738	508.6375	531.0911	764.4807	876.0822	848.2709	837.4636	(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													
	2200.3058	2136.0516	1938.8130	1615.6633	1235.7565	813.6008	520.0247	548.2493	881.5916	1354.1591	1806.1445	2187.5463	(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													
	982.2454	764.4785	627.5021	350.0860	156.7293	0.0000	0.0000	0.0000	0.0000	355.6893	689.6689	1004.4615	(98)
Space heating													
Space heating per m2													(98) / (4) = 39.3619 (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													5448.4653 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	982.2454	764.4785	627.5021	350.0860	156.7293	0.0000	0.0000	0.0000	0.0000	355.6893	689.6689	1004.4615	(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)	1085.3541	844.7277	693.3724	386.8354	173.1816	0.0000	0.0000	0.0000	0.0000	393.0268	762.0651	1109.9022	(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	182.2883	138.9878	114.3557	61.9136	27.4553	11.1171	5.7209	37.2794	67.5728	119.3584	157.7408	181.4536	(64)
Efficiency of water heater (217)m	88.6396	88.6709	88.6673	88.7125	88.7266	79.8000	79.8000	79.8000	79.8000	87.5505	88.2962	79.8000	(216)
Fuel for water heating, kWh/month	205.6512	156.7456	128.9716	69.7913	30.9437	13.9312	7.1691	46.7161	84.6777	136.3310	178.6496	204.6147	(219)
Water heating fuel used													1264.1926 (219)
Annual totals kWh/year													
Space heating fuel - main system													5448.4653 (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)													465.7069 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.14 * 1080 * 1.00) =										-984.5265			-984.5265 (233)
Total delivered energy for all uses													6318.8384 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	5448.4653	3.4800	189.6066	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1264.1926	3.4800	43.9939	(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	465.7069	13.1900	61.4267	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-984.5265	13.1900	-129.8590	(252)
Total energy cost			301.6557	(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] =	0.7441 (257)
SAP value			89.6200
SAP rating (Section 12)			90 (258)
SAP band			B

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	5448.4653	0.2160	1176.8685 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1264.1926	0.2160	273.0656 (264)
Space and water heating			1449.9341 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	465.7069	0.5190	241.7019 (268)
Energy saving/generation technologies			
PV Unit	-984.5265	0.5190	-510.9692 (269)
Total kg/year			1245.5418 (272)
CO2 emissions per m2			9.9400 (273)
EI value			90.1978
EI rating			90 (274)
EI band			B

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	63.5200 (1b)	x 2.3800 (2b)	= 151.1776 (1b) - (3b)
First floor	61.7500 (1c)	x 2.6700 (2c)	= 164.8725 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	125.2700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 316.0501 (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) =	0.1582 (8)
Pressure test										Yes							
Measured/design AP50										4.0200							
Infiltration rate										0.3592 (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) =					0.3592 (21)		
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
	4.7000	4.4000	4.4000	4.0000	4.1000	3.9000	3.9000	3.8000	3.8000	4.1000	4.0000	4.1000	(22)				
Wind factor	1.1750	1.1000	1.1000	1.0000	1.0250	0.9750	0.9750	0.9500	0.9500	1.0250	1.0000	1.0250	(22a)				
Adj infilt rate	0.4221	0.3951	0.3951	0.3592	0.3682	0.3502	0.3502	0.3412	0.3412	0.3682	0.3592	0.3682	(22b)				
Effective ac	0.5891	0.5781	0.5781	0.5645	0.5678	0.5613	0.5613	0.5582	0.5582	0.5678	0.5645	0.5678	(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)			23.8000	1.1450	27.2519		(27)
Ground Floor			63.5200	0.1200	7.6224	84.0000	5335.6800 (28a)
Brick and Block	181.4300	25.9200	155.5100	0.2400	37.3224	42.2200	6565.6322 (29a)
Pitched Roof	63.5200		63.5200	0.1000	6.3520	9.1000	578.0320 (30)
Total net area of external elements Aum(A, m ²)			308.4700				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	80.8807		(33)
GF Block			57.0500			75.0000	4278.7500 (32c)
GF Stud			33.7700			9.0000	303.9300 (32c)
FF Stud			149.0000			9.0000	1341.0000 (32c)
Internal Floor 1			61.8100			18.0000	1112.5800 (32d)
Internal Ceiling 1			61.8100			18.0000	1112.5800 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	20628.1842 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							164.6698 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							11.1683 (36)
Total fabric heat loss						(33) + (36) =	92.0490 (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	61.4378	60.2898	60.2898	58.8768	59.2174	58.5446	58.5446	58.2208	58.2208	59.2174	58.8768	59.2174 (38)
Heat transfer coeff	153.4868	152.3388	152.3388	150.9258	151.2664	150.5936	150.5936	150.2697	150.2697	151.2664	150.9258	151.2664 (39)
Average = Sum(39)m / 12 =												151.2951 (39)
HLP	1.2252	1.2161	1.2161	1.2048	1.2075	1.2022	1.2022	1.1996	1.1996	1.2075	1.2048	1.2075 (40)
HLP (average)												1.2078 (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												2.8816 (42)
Average daily hot water use (litres/day)												102.6375 (43)
Daily hot water use	Jan 112.9012	Feb 108.7957	Mar 104.6902	Apr 100.5847	May 96.4792	Jun 92.3737	Jul 92.3737	Aug 96.4792	Sep 100.5847	Oct 104.6902	Nov 108.7957	Dec 112.9012 (44)
Energy conte	167.4292	146.4347	151.1075	131.7391	126.4068	109.0795	101.0782	115.9887	117.3740	136.7880	149.3148	162.1463 (45)
Energy content (annual)										Total = Sum(45)m =		1614.8868 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Distribution loss (46)m = 0.15 x (45)m	25.1144	21.9652	22.6661	19.7609	18.9610	16.3619	15.1617	17.3983	17.6061	20.5182	22.3972	24.3219 (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												
209.5494 184.4787 191.8319 165.7470 155.7327 137.2343 130.1714 146.0125 152.7326 177.5125 190.0763 204.2665 (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												1.2546 (H8)
Utilisation factor												0.5493 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												117.0000 (H13)
Daily hot water demand												102.6375 (H14)
Volume ratio Veff/V												1.1399 (H15)
Solar storage volume factor												1.0000 (H16)
Solar input												-978.6687 (H17)
Solar input	-31.9352	-45.4155	-78.8075	-106.0094	-123.1901	-133.9951	-127.0477	-115.8552	-90.6796	-62.6745	-37.7721	-25.2868 (63)
Solar input (sum of months) = Sum (63)m =												-978.6687 (63)
Output from w/h												
177.6142 139.0633 113.0244 59.7376 32.5427 3.2392 3.1237 30.1572 62.0529 114.8380 152.3042 178.9797 (64)												
Total per year (kWh/year) = Sum (64)m =												1066.6772 (64)
Heat gains from water heating, kWh/month												
89.3664 79.1248 82.8228 71.0096 65.4910 58.7927 56.8831 62.5852 67.3137 78.0616 82.2564 87.6098 (65)												

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

Metabolic gains (Table 5), Watts												
(66)m	172.8946	172.8946	172.8946	172.8946	172.8946	172.8946	172.8946	172.8946	172.8946	172.8946	172.8946	172.8946 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
65.9256 58.5546 47.6198 36.0512 26.9487 22.7512 24.5835 31.9546 42.8894 54.4579 63.5604 67.7579 (67)												
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
435.7079 440.2292 428.8357 404.5803 373.9623 345.1856 325.9610 321.4397 332.8332 357.0886 387.7067 416.4833 (68)												
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
55.1710 55.1710 55.1710 55.1710 55.1710 55.1710 55.1710 55.1710 55.1710 55.1710 55.1710 55.1710 (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)												
-115.2631 -115.2631 -115.2631 -115.2631 -115.2631 -115.2631 -115.2631 -115.2631 -115.2631 -115.2631 -115.2631 -115.2631 (71)												
Water heating gains (Table 5)												
120.1161 117.7452 111.3210 98.6244 88.0255 81.6566 76.4558 84.1200 93.4913 104.9215 114.2450 117.7551 (72)												
Total internal gains	737.5522	732.3316	703.5790	655.0586	604.7391	565.3960	542.8029	553.3168	585.0164	632.2706	681.3147	717.7989 (73)

6. Solar gains

[Jan]												
Area												
m2												
Solar flux												
Table 6a												
W/m2												
Specific data												
g												
or Table 6b												
Specific data												
or Table 6c												
Access												
factor												
Table 6d												
Gains												
W												
East												77.4713 (76)
South												43.5796 (78)
Southwest												19.8320 (79)
West												64.0850 (80)
Northwest												6.4309 (81)
Solar gains	211.3987	336.0512	532.7419	746.6563	842.6355	947.9679	869.5150	791.1160	635.8822	420.8042	259.1132	166.9030 (83)
Total gains	948.9510	1068.3827	1236.3209	1401.7149	1447.3746	1513.3639	1412.3179	1344.4328	1220.8987	1053.0748	940.4279	884.7019 (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	37.3325	37.6139	37.6139	37.9660	37.8805	38.0498	38.0498	38.1318	38.1318	37.8805	37.9660	37.8805 (86)
alpha	3.4888	3.5076	3.5076	3.5311	3.5254	3.5367	3.5367	3.5421	3.5421	3.5254	3.5311	3.5254 (87)
util living area	0.9748	0.9618	0.9242	0.8371	0.6993	0.4837	0.3462	0.3516	0.6190	0.8635	0.9542	0.9789 (88)
MIT	19.5501	19.7297	20.0922	20.5221	20.8149	20.9635	20.9918	20.9917	20.9130	20.5577	20.0133	19.5340 (89)
Th 2	19.8999	19.9072	19.9072	19.9162	19.9140	19.9183	19.9183	19.9203	19.9203	19.9140	19.9162	19.9140 (90)
util rest of house	0.9688	0.9529	0.9067	0.8004	0.6332	0.3903	0.2354	0.2359	0.5231	0.8217	0.9414	0.9738 (91)
MIT 2	18.6144	18.7955	19.1456	19.5519	19.7984	19.9037	19.9167	19.9188	19.8792	19.5934	19.0830	18.6097 (92)
Living area fraction									fLA = Living area / (4) =			0.1415 (93)
MIT	18.7468	18.9278	19.2796	19.6892	19.9422	20.0537	20.0689	20.0707	20.0255	19.7299	19.2147	18.7405 (94)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Temperature adjustment													0.0000
adjusted MIT	18.7468	18.9278	19.2796	19.6892	19.9422	20.0537	20.0689	20.0707	20.0255	19.7299	19.2147	18.7405	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9606	0.9428	0.8944	0.7916	0.6351	0.4025	0.2511	0.2523	0.5332	0.8133	0.9309	0.9665	(94)
Useful gains	911.5288	1007.2919	1105.8193	1109.5812	919.2025	609.0879	354.6783	339.2326	650.9546	856.4248	875.4039	855.0291	(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													
	2017.8631	1969.3993	1779.2517	1447.2571	1034.9995	625.5151	356.7356	341.2158	695.0711	1154.1427	1602.0252	1972.5869	(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													
	823.1127	646.5362	501.0337	243.1267	86.1529	0.0000	0.0000	0.0000	0.0000	221.5021	523.1673	831.4630	(98)
Space heating													3876.0947 (98)
Space heating per m2											(98) / (4) =		30.9419 (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													4282.9775	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	823.1127	646.5362	501.0337	243.1267	86.1529	0.0000	0.0000	0.0000	0.0000	221.5021	523.1673	831.4630	(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)	909.5168	714.4046	553.6284	268.6482	95.1966	0.0000	0.0000	0.0000	0.0000	244.7537	578.0854	918.7437	(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	177.6142	139.0633	113.0244	59.7376	32.5427	3.2392	3.1237	30.1572	62.0529	114.8380	152.3042	178.9797	(64)	
Efficiency of water heater (217)m	88.3963	88.4018	88.3203	88.1682	87.2910	79.8000	79.8000	79.8000	79.8000	86.5382	87.8442	79.8000	(216)	
Fuel for water heating, kWh/month	200.9294	157.3082	127.9711	67.7542	37.2807	4.0592	3.9144	37.7910	77.7606	132.7021	173.3800	202.4647	(219)	
Water heating fuel used												1223.3155	(219)	
Annual totals kWh/year														
Space heating fuel - main system												4282.9775	(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)												465.7069	(232)	
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 1.14 * 1206 * 1.00) =										-1099.8813		-1099.8813	(233)	
Total delivered energy for all uses												4997.1187	(238)	

10a. Fuel costs - using BEDF prices (491)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4282.9775	3.6300	155.4721	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1223.3155	3.6300	44.4064	(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	465.7069	19.4400	90.5334	(250)
Additional standing charges			95.0000	(251)
Energy saving/generation technologies				
PV Unit	-1099.8813	19.4400	-213.8169	(252)
Total energy cost			195.8949	(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	4282.9775	0.2160	925.1231	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1223.3155	0.2160	264.2362	(264)
Space and water heating			1189.3593	(265)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	465.7069	0.5190	241.7019 (268)
Energy saving/generation technologies			
PV Unit	-1099.8813	0.5190	-570.8384 (269)
Total kg/year			925.0978 (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	4282.9775	1.2200	5225.2326 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1223.3155	1.2200	1492.4449 (264)
Space and water heating			6717.6775 (265)
Pumps and fans	125.0000	3.0700	383.7500 (267)
Energy for lighting	465.7069	3.0700	1429.7203 (268)
Energy saving/generation technologies			
PV Unit	-1099.8813	3.0700	-3376.6357 (269)
Primary energy kWh/year			5154.5121 (272)
Primary energy kWh/m2/year			41.1472 (273)

U-VALUE CALCULATOR REPORT

Property Reference	SAP 0647 Plot 66	Issued on Date	21/03/2022
Assessment Reference	As Built	Prop Type Ref	N
Project	4 Fred Woolley Walk, West End, Southampton, SO30 3LF		
Calculation Type	New Build (As Built)		

SAP Rating	88 B	DER	13.50	TER	17.10
Environmental	88 B	% DER<TER	21.06		
CO ₂ Emissions (t/year)	1.20	DFEE	49.00	TREE	59.23
General Requirements Compliance	Pass	% DFEE<TFEE	17.26		

Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 01329 313079, tobiaswhiting26@gmail.com	Assessor ID	E477-0001
Client	Foreman Homes, FORE		

Building Elements

Roof 000002 - Mineral Wool between and above

Roof Type: Pitched Roof, insulated flat ceiling

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

Total resistance:	Upper limit = 11.200 m ² K/W	Lower limit = 10.901 m ² K/W	Average = 11.050 m ² K/W
	Total correction = 0.0065 m ² K/W	U-value (unrounded) = 0.1 W/m ² K	

Unheated space: None

Total thickness: 463 mm

U-value: 0.10 W/m² K

Kappa: 9.10 kJ/m² K

U-VALUE CALCULATOR REPORT

Property Reference	SAP 0647 Plot 66	Issued on Date	21/03/2022
Assessment Reference	As Built	Prop Type Ref	N
Project	4 Fred Woolley Walk, West End, Southampton, SO30 3LF		
Calculation Type	New Build (As Built)		

SAP Rating	88 B	DER	13.50	TER	17.10
Environmental	88 B	% DER<TER	21.06		
CO ₂ Emissions (t/year)	1.20	DFEE	49.00	TFEE	59.23
General Requirements Compliance	Pass	% DFEE<TFEE	17.26		

Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 01329 313079, tobiaswhiting26@gmail.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 66	Issued on Date	21/03/2022
Assessment Reference	As Built	Prop Type Ref	N
Project	4 Fred Woolley Walk, West End, Southampton, SO30 3LF		
Calculation Type	New Build (As Built)		

SAP Rating	88 B	DER	13.50	TER	17.10
Environmental	88 B	% DER<TER	21.06		
CO ₂ Emissions (t/year)	1.20	DFEE	49.00	TFEE	59.23
General Requirements Compliance	Pass	% DFEE<TFEE	17.26		

Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 01329 313079, tobiaswhiting26@gmail.com	Assessor ID	E477-0001
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Client	Foreman Homes, FORE
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Building Elements

Floor 000003 - Worst Case Slab

Floor Type: Slab On Ground Floor

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

Horizontal edge insulation: none

Vertical edge insulation: none

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

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

Total correction = 0.0096 m² K/W U-value (unrounded) = 0.12 W/m² K

Unheated space: None

Total thickness: 321 mm

U-value: 0.12 W/m² K

Kappa: 84.00 kJ/m² K

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

Property Reference	SAP 0647 Plot 66	Issued on Date	21/03/2022
Assessment Reference	As Built	Prop Type Ref	N
Property	4 Fred Woolley Walk, West End, Southampton, SO30 3LF		
SAP Rating	88 B	DER	13.50
Environmental	88 B	TER	17.10
CO ₂ Emissions (t/year)	1.20	% DER<TER	21.06
General Requirements Compliance	Pass	DfEE	49.00
		TfEE	59.23
		% DfEE<TfEE	17.26
Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 01329 313079, tobiaswhiting26@gmail.com		Assessor ID
			E477-0001
Client	Foreman Homes, FORE		

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

Orientation	West
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Suburban
1.0 Property Type	House, Detached
2.0 Number of Storeys	2
3.0 Date Built	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:	37.17 m	63.52 m ²
	1st Storey:	34.91 m	61.75 m ²
			2.38 m
			2.67 m

7.0 Living Area	17.73	m ²
8.0 Thermal Mass Parameter	Precise calculation	
Thermal Mass	164.67	kJ/m ² K

9.0 External Walls						
Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area (m ²)	Nett Area (m ²)
Brick and Block	Cavity Wall	Other	0.24	42.22	181.43	155.51

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	57.05	
GF Stud	Plasterboard on timber frame	9.00	33.77	
FF Stud	Plasterboard on timber frame	9.00	149.00	

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	63.52
					63.52

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	61.81

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	63.52

11.2 Internal Floors

Description	Construction	Kappa (kJ/m²K)	Area (m²)
Internal Floor 1	Plasterboard ceiling, carpeted chipboard floor	18.00	61.81

12.0 Opening Types

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

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	West							2.12	
Front Elevation	Window	[1] Brick and Block	West	None	0.00					8.33	
Side Elevation	Window	[1] Brick and Block	South	None	0.00					2.52	
Rear Elevation	Window	[1] Brick and Block	East	None	0.00					10.07	
Bay	Window	[1] Brick and Block	South West	None	0.00					1.44	
Bay	Window	[1] Brick and Block	North West	None	0.00					1.44	

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)	4.68	0.053	No	CD0025
Independently assessed	E2 Other lintels (including other steel lintels)	0.91	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)	6.02	0.067	No	Birtley Supatherm
Independently assessed	E2 Other lintels (including other steel lintels)	3.02	0.070	No	Birtley Supatherm
Independently assessed	E2 Other lintels (including other steel lintels)	3.54	0.064	No	Birtley Supatherm
Independently assessed	E3 Sill	19.18	0.021	No	Knauf P5
Independently assessed	E4 Jamb	35.40	0.016	No	Knauf P6
Table K1 - Approved	E5 Ground floor (normal)	37.15	0.160	No	
Independently assessed	E6 Intermediate floor within a dwelling	34.91	0.000	No	CD0029
Table K1 - Approved	E10 Eaves (insulation at ceiling level)	24.71	0.060	No	
Table K1 - Default	E24 Eaves (insulation at ceiling level - inverted)	3.50	0.240	No	
Independently assessed	E12 Gable (insulation at ceiling level)	14.88	0.044	No	Knauf P21
Independently assessed	E16 Corner (normal)	34.33	0.039	No	Knauf P23
Independently assessed	E17 Corner (inverted – internal area greater than external area)	14.13	-0.091	No	Knauf P24

Y-value 0.036 W/m²K

18.0 Pressure Testing

Yes

Designed AP₅₀ 5.00 m³/(h.m²) @ 50 Pa

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

Property Tested ? Yes
As Built AP₅₀ 4.02 m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

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

Mechanical Ventilation

Mechanical Ventilation System Present No

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				5
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System

No

22.0 Lighting

Internal

Total number of light fittings 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 Database
Description Gas System
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 CBE Programmer, room thermostat and TRVs
PCDF Controls 0
Delayed Start Stat No
Sap Code 2106
Flue Type Balanced
Fan Assisted Flue Yes
Is MHS Pumped Pump in heated space
Heat Emitter Radiators
Flow Temperature Normal (> 45°C)

25.0 Main Heating 2

None

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
1.14	South	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£40	B 90	