



SAP Report Submission for Building Regulations Compliance

Client: Foreman Homes

Project: 1 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 63	Issued on Date	21/03/2022
Assessment Reference	As Built	Prop Type Ref	N
Property	1 Fred Woolley Walk, West End, Southampton, SO30 3LF		
SAP Rating	88 B	DER	13.47
Environmental	88 B	TER	17.10
CO ₂ Emissions (t/year)	1.19	% DER<TER	21.24
General Requirements Compliance	Pass	DLEE	48.90
		TLEE	59.23
		% DLEE<TLEE	17.44
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 TLEE 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)	13.47	kgCO ₂ /m ²	Pass
	-3.63 (-21.2%)	kgCO ₂ /m ²	

1b TLEE and DLEE

Target Fabric Energy Efficiency (TLEE)	59.23	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DLEE)	48.90	kWh/m ² /yr	
	-10.3 (-17.4%)	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	3.91 (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

3.91 (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
Air permeability	3.9	m ³ /m ² h
Photovoltaic array	1.14	kW

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THERMAL BRIDGING

Calculation Type: New Build (As Built)

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Environmental	88 B	TER	17.10
CO ₂ Emissions (t/year)	1.19	% DER<TER	21.24
General Requirements Compliance	Pass	DFEE	48.90
		TFEE	59.23
		% DFEE<TFEE	17.44
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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CO ₂ Emissions (t/year)	1.19	DFEE	48.90	TFEE	59.23
General Requirements Compliance	Pass	% DFEE<TFEE	17.44		
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) 13.47 kgCO₂/m²OK

1b TFEE and DFEE

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

Dwelling Fabric Energy Efficiency (DFEE)48.9 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:	3.91 (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 m ² , No overhang
Windows facing South:	2.52 m ² , No overhang
Windows facing South West:	1.44 m ² , No overhang
Windows facing West:	8.33 m ² , No overhang
Windows facing North West:	1.44 m ² , No overhang
Air change rate:	4.00 ach
Blinds/curtains:	None

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 y-value	0.036 W/m ² K
Air permeability	3.9 m ³ /m ² h
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					3.9100
Infiltration rate					0.3537 (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) =	0.3537 (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	0.4510	0.4421	0.4333	0.3891	0.3802	0.3360	0.3360	0.3272	0.3537	0.3802	0.3979	0.4156 (22b)
Effective ac	0.6017	0.5977	0.5939	0.5757	0.5723	0.5565	0.5565	0.5535	0.5626	0.5723	0.5792	0.5864 (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 62.7539 Feb 62.3421 Mar 61.9384 Apr 60.0424 May 59.6876 Jun 58.0362 Jul 58.0362 Aug 57.7304 Sep 58.6723 Oct 59.6876 Nov 60.4053 Dec 61.1555 (38)
Heat transfer coeff	154.8029 154.3911 153.9874 152.0914 151.7366 150.0852 150.0852 149.7794 150.7213 151.7366 152.4543 153.2045 (39)
Average = Sum(39)m / 12 =	152.0897 (39)

HLP	Jan 1.2358 Feb 1.2325 Mar 1.2292 Apr 1.2141 May 1.2113 Jun 1.1981 Jul 1.1981 Aug 1.1957 Sep 1.2032 Oct 1.2113 Nov 1.2170 Dec 1.2230 (40)
HLP (average)	1.2141 (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 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	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	37.0151	37.1139	37.2112	37.6751	37.7631	38.1787	38.1787	38.2566	38.0175	37.7631	37.5854	37.4013	
alpha	3.4677	3.4743	3.4807	3.5117	3.5175	3.5452	3.5452	3.5504	3.5345	3.5175	3.5057	3.4934	
util living area	0.9926	0.9852	0.9667	0.9179	0.8204	0.6693	0.5213	0.5774	0.8039	0.9509	0.9870	0.9941 (86)	
MIT	19.0858	19.3208	19.7117	20.2089	20.6185	20.8723	20.9605	20.9432	20.7404	20.1834	19.5433	19.0499 (87)	
Th 2	19.8915	19.8941	19.8967	19.9087	19.9110	19.9215	19.9215	19.9235	19.9175	19.9110	19.9064	19.9016 (88)	
util rest of house	0.9908	0.9817	0.9585	0.8970	0.7742	0.5858	0.4069	0.4620	0.7364	0.9343	0.9833	0.9927 (89)	
MIT 2	18.1486	18.3838	18.7713	19.2611	19.6376	19.8524	19.9079	19.9020	19.7565	19.2479	18.6155	18.1204 (90)	
Living area fraction									fLA = Living area / (4) =				0.1415 (91)
MIT	18.2813	18.5164	18.9044	19.3953	19.7765	19.9967	20.0569	20.0494	19.8958	19.3803	18.7468	18.2519 (92)	
Temperature adjustment												0.0000	
adjusted MIT	18.2813	18.5164	18.9044	19.3953	19.7765	19.9967	20.0569	20.0494	19.8958	19.3803	18.7468	18.2519 (93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	9872	0.9757	0.9489	0.8850	0.7676	0.5921	0.4221	0.4765	0.7348	0.9238	0.9779	0.9896 (94)
Useful gains	677.3287	808.8059	935.7691	1019.7305	967.3844	738.4404	503.1138	522.4296	716.4742	748.5787	670.3717	637.1524 (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	2164.3385	2102.2558	1910.1220	1596.2372	1225.4967	809.9692	518.8239	546.5982	873.5498	1332.2913	1775.6065	2152.8192 (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	1106.3352	869.1984	724.9186	415.0848	192.0355	0.0000	0.0000	0.0000	0.0000	434.2822	795.7690	1127.6562 (98)
Space heating												5665.2800 (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) = 45.2246 (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													6259.9779 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1106.3352	869.1984	724.9186	415.0848	192.0355	0.0000	0.0000	0.0000	0.0000	434.2822	795.7690	1127.6562	(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)	1222.4699	960.4402	801.0150	458.6573	212.1940	0.0000	0.0000	0.0000	0.0000	479.8698	879.3028	1246.0289	(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	88.5335	88.3422	87.9178	86.9428	85.0070	79.8000	79.8000	79.8000	79.8000	86.9640	88.1280	79.8000	(216)
Fuel for water heating, kWh/month	248.1001	219.1517	231.2730	209.6518	210.1349	200.0219	192.1062	210.7911	210.4160	217.3436	226.7756	241.9450	(219)
Water heating fuel used												2617.7110	(219)
Annual totals kWh/year													
Space heating fuel - main system												6259.9779	(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	(233)
Total delivered energy for all uses												8433.8693	(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	6259.9779	0.2160	1352.1552 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2617.7110	0.2160	565.4256 (264)
Space and water heating			1917.5808 (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			1687.2385 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.4700 (273)

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

DER		13.4700	ZC1
Total Floor Area		125.2700	
Assumed number of occupants		2.8816	
CO2 emission factor in Table 12 for electricity displaced from grid		0.5190	
CO2 emissions from appliances, equation (L14)		13.8092	ZC2
CO2 emissions from cooking, equation (L16)		1.5020	ZC3
Total CO2 emissions		28.7812	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		28.7812	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												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Enter (49) or (54) in (55)	0.9319 (55)											
Total storage loss	28.8896	26.0938	28.8896	27.9576	28.8896	27.9576	28.8896	28.8896	27.9576	28.8896	27.9576	28.8896 (56)
If cylinder contains dedicated solar storage	28.8896	26.0938	28.8896	27.9576	28.8896	27.9576	28.8896	28.8896	27.9576	28.8896	27.9576	28.8896 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	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)

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)	130.9029	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)

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	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)

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	0.9986	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	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)
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 (92)
Temperature adjustment	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)
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)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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	(94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	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 m ²												44.7879	(99)

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													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					3.9100
Infiltration rate					0.3221 (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) =	0.3221 (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	0.4106	0.4026	0.3945	0.3543	0.3462	0.3060	0.3060	0.2979	0.3221	0.3462	0.3623	0.3784 (22b)
Effective ac	0.5843	0.5810	0.5778	0.5628	0.5599	0.5468	0.5468	0.5444	0.5519	0.5599	0.5656	0.5716 (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) (28)...(30) + (32) + (32a)...(32e) = 20071.8942 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 160.2291 (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	60.9413	60.5999	60.2652	58.6932	58.3991	57.0299	57.0299	56.7764	57.5573	58.3991	58.9941	59.6161 (38)
Heat transfer coeff	152.9903	152.6489	152.3142	150.7422	150.4481	149.0789	149.0789	148.8254	149.6063	150.4481	151.0431	151.6651 (39)
Average = Sum(39)m / 12 =												150.7408 (39)
HLP	1.2213	1.2186	1.2159	1.2033	1.2010	1.1901	1.1901	1.1880	1.1943	1.2010	1.2057	1.2107 (40)
HLP (average)												1.2033 (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	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		0.7000	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	36.4437	36.5252	36.6054	36.9872	37.0595	37.3998	37.3998	37.4635	37.2680	37.0595	36.9135	36.7621	
alpha	3.4296	3.4350	3.4404	3.4658	3.4706	3.4933	3.4933	3.4976	3.4845	3.4706	3.4609	3.4508	
util living area	0.9947	0.9885	0.9723	0.9281	0.8371	0.6926	0.5459	0.6062	0.8284	0.9610	0.9905	0.9958	(86)
MIT	18.9865	19.2275	19.6296	20.1428	20.5755	20.8509	20.9519	20.9303	20.7000	20.1071	19.4478	18.9465	(87)
Th 2	19.9030	19.9052	19.9073	19.9173	19.9192	19.9280	19.9280	19.9296	19.9246	19.9192	19.9154	19.9114	(88)
util rest of house	0.9934	0.9857	0.9654	0.9096	0.7939	0.6106	0.4294	0.4898	0.7659	0.9476	0.9879	0.9949	(89)
MIT 2	18.0613	18.3026	18.7019	19.2082	19.6100	19.8451	19.9107	19.9022	19.7332	19.1842	18.5307	18.0276	(90)
Living area fraction									fLA = Living area / (4) =			0.1415	(91)
MIT	18.1923	18.4335	18.8332	19.3405	19.7466	19.9874	20.0581	20.0477	19.8700	19.3148	18.6605	18.1577	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.1923	18.4335	18.8332	19.3405	19.7466	19.9874	20.0581	20.0477	19.8700	19.3148	18.6605	18.1577	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9906	0.9807	0.9566	0.8974	0.7859	0.6156	0.4445	0.5037	0.7622	0.9376	0.9835	0.9926	(94)
Ext temp.	594.2996	729.2249	863.4354	961.2311	927.9216	720.1566	496.2701	513.0442	683.1666	683.5914	591.5619	554.3770	(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	2125.3801	2065.8718	1878.5242	1573.8256	1210.5991	803.1510	515.5248	542.8685	863.2350	1311.1313	1746.1307	2116.8956	(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	1139.1239	898.2267	755.2260	441.0681	210.3121	0.0000	0.0000	0.0000	0.0000	466.8896	831.2895	1162.5138	(98)
Space heating per m2												5904.6497	(98)
												47.1354	(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	1401.3418	1103.1840	1131.0728	0.0000	0.0000	0.0000	0.0000 (100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.7992	0.8637	0.8302	0.0000	0.0000	0.0000	0.0000 (101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1119.9980	952.8252	939.0201	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	262.2489	347.0774	273.8331	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction									FC = cooled area / (4) =			883.1594 (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	65.5622	86.7694	68.4583	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling per m2												220.7899 (107)
Energy for space heating												1.7625 (108)
Energy for space cooling												47.1354 (99)
Total												1.7625 (108)
Dwelling Fabric Energy Efficiency (DFEE)												48.8979 (109)
												48.9 (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		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	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	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)
Space heating per m2												6271.7861	(98)
										(98) / (4) =		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	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																3.9100	
Infiltration rate																0.3537 (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) =	0.3537 (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	0.4156	0.3891	0.3891	0.3537	0.3625	0.3449	0.3449	0.3360	0.3360	0.3625	0.3537	0.3625	(22b)				
Effective ac	0.5864	0.5757	0.5757	0.5626	0.5657	0.5595	0.5595	0.5565	0.5565	0.5657	0.5626	0.5657	(25)				

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K						
Front Door			2.1200	1.1000	2.3320			(26)					
Windows (Uw = 1.20)			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, m2)			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)													
(38)m	Jan 61.1555	Feb 60.0424	Mar 60.0424	Apr 58.6723	May 59.0026	Jun 58.3502	Jul 58.3502	Aug 58.0362	Sep 58.0362	Oct 59.0026	Nov 58.6723	Dec 59.0026	(38)
Heat transfer coeff	153.2045	152.0914	152.0914	150.7213	151.0516	150.3992	150.3992	150.0852	150.0852	151.0516	150.7213	151.0516	(39)
Average = Sum(39)m / 12 =												151.0795	(39)
HLP	Jan 1.2230	Feb 1.2141	Mar 1.2141	Apr 1.2032	May 1.2058	Jun 1.2006	Jul 1.2006	Aug 1.1981	Sep 1.1981	Oct 1.2058	Nov 1.2032	Dec 1.2058	(40)
HLP (average)												1.2060	(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)
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												2230 (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		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	37.4013	37.6751	37.6751	38.0175	37.9344	38.0990	38.0990	38.1787	38.1787	37.9344	38.0175	37.9344
alpha	3.4934	3.5117	3.5117	3.5345	3.5290	3.5399	3.5399	3.5452	3.5452	3.5290	3.5345	3.5290
util living area	0.9739	0.9606	0.9221	0.8325	0.6914	0.4764	0.3401	0.3454	0.6123	0.8597	0.9527	0.9781 (86)
MIT	19.5635	19.7422	20.1040	20.5332	20.8222	20.9653	20.9923	20.9922	20.9162	20.5662	20.0245	19.5467 (87)
Th 2	19.9016	19.9087	19.9087	19.9175	19.9154	19.9195	19.9195	19.9215	19.9215	19.9154	19.9175	19.9154 (88)
util rest of house	0.9678	0.9516	0.9043	0.7952	0.6251	0.3841	0.2313	0.2317	0.5168	0.8173	0.9396	0.9729 (89)
MIT 2	18.6289	18.8088	19.1580	19.5624	19.8047	19.9057	19.9180	19.9201	19.8820	19.6017	19.0947	18.6232 (90)
Living area fraction	18.7611	18.9409	19.2919	19.6998	19.9487	20.0557	20.0701	20.0719	20.0284	19.7382	19.2263	18.7539 (92)
MIT	18.7611	18.9409	19.2919	19.6998	19.9487	20.0557	20.0701	20.0719	20.0284	19.7382	19.2263	18.7539 (93)
Temperature adjustment												0.0000
adjusted MIT	18.7611	18.9409	19.2919	19.6998	19.9487	20.0557	20.0701	20.0719	20.0284	19.7382	19.2263	18.7539 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9594	0.9413	0.8920	0.7867	0.6274	0.3962	0.2467	0.2478	0.5270	0.8091	0.9289	0.9653 (94)
Useful gains	920.8156	1015.9402	1113.8832	1117.1764	923.4675	609.4411	354.5285	339.1108	652.2628	862.0809	883.6512	864.5282 (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	2016.3462	1968.1984	1778.2311	1446.8885	1034.5105	625.0073	356.4584	340.9712	694.6526	1153.7665	1601.6062	1971.8143 (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	815.0747	639.9176	494.2748	237.3927	82.6160	0.0000	0.0000	0.0000	0.0000	217.0141	516.9276	823.8208 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF HEAT DEMAND 09 Jan 2014

Space heating	3827.0384 (98)
RHI space heating demand	3827 (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	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					3.9100
Infiltration rate					0.3537 (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) =	0.3537 (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	0.4510	0.4421	0.4333	0.3891	0.3802	0.3360	0.3360	0.3272	0.3537	0.3802	0.3979	0.4156 (22b)
Effective ac	0.6017	0.5977	0.5939	0.5757	0.5723	0.5565	0.5565	0.5535	0.5626	0.5723	0.5792	0.5864 (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)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2358	1.2325	1.2292	1.2141	1.2113	1.1981	1.1981	1.1957	1.2032	1.2113	1.2170	1.2230 (40)
HLP (average)												1.2141 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

HLP	Jan 1.2358	Feb 1.2325	Mar 1.2292	Apr 1.2141	May 1.2113	Jun 1.1981	Jul 1.1981	Aug 1.1957	Sep 1.2032	Oct 1.2113	Nov 1.2170	Dec 1.2230 (40)
HLP (average)												1.2141 (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)

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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)												
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	Specific data or Table 6b	Specific data FF 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	37.0151	37.1139	37.2112	37.6751	37.7631	38.1787	38.1787	38.2566	38.0175	37.7631	37.5854	37.4013	
alpha	3.4677	3.4743	3.4807	3.5117	3.5175	3.5452	3.5452	3.5504	3.5345	3.5175	3.5057	3.4934	
util living area	0.9821	0.9700	0.9429	0.8800	0.7690	0.6101	0.4653	0.5129	0.7361	0.9141	0.9710	0.9850 (86)	
MIT	19.3056	19.5296	19.8937	20.3443	20.6976	20.9053	20.9724	20.9610	20.8094	20.3354	19.7407	19.2672 (87)	
Th 2	19.8915	19.8941	19.8967	19.9087	19.9110	19.9215	19.9215	19.9235	19.9175	19.9110	19.9064	19.9016 (88)	
util rest of house	0.9782	0.9633	0.9300	0.8528	0.7173	0.5275	0.3597	0.4051	0.6615	0.8885	0.9634	0.9816 (89)	
MIT 2	18.3659	18.5885	18.9459	19.3835	19.7003	19.8719	19.9123	19.9093	19.8047	19.3874	18.8086	18.3356 (90)	
Living area fraction									fLA = Living area / (4) =				0.1415 (91)
MIT	18.4989	18.7217	19.0800	19.5194	19.8414	20.0182	20.0624	20.0582	19.9469	19.5216	18.9405	18.4675 (92)	
Temperature adjustment												0.0000	
adjusted MIT	18.4989	18.7217	19.0800	19.5194	19.8414	20.0182	20.0624	20.0582	19.9469	19.5216	18.9405	18.4675 (93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9714	0.9542	0.9182	0.8414	0.7137	0.5354	0.3740	0.4193	0.6638	0.8772	0.9546	0.9756 (94)
Useful gains	889.8162	1007.5346	1104.3723	1139.1805	1032.2345	760.9991	508.9329	531.7512	768.1263	883.7124	857.3888	847.3520 (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												
	2198.0352	2133.9455	1937.1679	1615.1258	1235.3519	813.1863	519.6483	547.9158	881.2478	1353.7287	1805.1403	2185.8380 (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												
	973.3149	756.9481	619.6000	342.6806	151.1193	0.0000	0.0000	0.0000	0.0000	349.6922	682.3811	995.8336 (98)
Space heating												4871.5697 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Space heating per m2 (98) / (4) = 38.8886 (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													5382.9500 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	973.3149	756.9481	619.6000	342.6806	151.1193	0.0000	0.0000	0.0000	0.0000	349.6922	682.3811	995.8336	(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)	1075.4861	836.4067	684.6408	378.6526	166.9826	0.0000	0.0000	0.0000	0.0000	386.4002	754.0123	1100.3686	(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	88.3196	88.0942	87.5979	86.4740	84.3716	79.8000	79.8000	79.8000	79.8000	86.4337	87.8322	79.8000	(216)
Fuel for water heating, kWh/month	248.7012	219.7688	232.1175	210.7884	211.7175	200.0219	192.1062	210.7911	210.4160	218.6771	227.5395	242.4976	(219)
Water heating fuel used												2625.1428	(219)
Annual totals kWh/year													
Space heating fuel - main system												5382.9500	(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												7564.2733	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	5382.9500	3.4800	187.3267 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2625.1428	3.4800	91.3550 (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			340.1418 (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] =	0.8390 (257)
SAP value		88.2957
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	5382.9500	0.2160	1162.7172 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2625.1428	0.2160	567.0309 (264)
Space and water heating			1729.7480 (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			1499.4057 (272)
CO2 emissions per m2			11.9700 (273)
EI value			88.1999
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 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					3.9100
Infiltration rate					0.3537 (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) =	0.3537 (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	0.4156	0.3891	0.3891	0.3537	0.3625	0.3449	0.3449	0.3360	0.3360	0.3625	0.3537	0.3625 (22b)
Effective ac	0.5864	0.5757	0.5757	0.5626	0.5657	0.5595	0.5595	0.5565	0.5565	0.5657	0.5626	0.5657 (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)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	61.1555	60.0424	60.0424	58.6723	59.0026	58.3502	58.3502	58.0362	58.0362	59.0026	58.6723	59.0026 (38)
Average = Sum(39)m / 12 =	153.2045	152.0914	152.0914	150.7213	151.0516	150.3992	150.3992	150.0852	150.0852	151.0516	150.7213	151.0516 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2230	1.2141	1.2141	1.2032	1.2058	1.2006	1.2006	1.1981	1.1981	1.2058	1.2032	1.2058 (40)
HLP (average)												1.2060 (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 EPC COSTS, EMISSIONS AND PRIMARY ENERGY 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	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	37.4013	37.6751	37.6751	38.0175	37.9344	38.0990	38.0990	38.1787	38.1787	37.9344	38.0175	37.9344
alpha	3.4934	3.5117	3.5117	3.5345	3.5290	3.5399	3.5399	3.5452	3.5452	3.5290	3.5345	3.5290
util living area	0.9739	0.9606	0.9221	0.8325	0.6914	0.4764	0.3401	0.3454	0.6123	0.8597	0.9527	0.9781 (86)
MIT	19.5635	19.7422	20.1040	20.5332	20.8222	20.9653	20.9923	20.9922	20.9162	20.5662	20.0245	19.5467 (87)
Th 2	19.9016	19.9087	19.9087	19.9175	19.9154	19.9195	19.9195	19.9215	19.9215	19.9154	19.9175	19.9154 (88)
util rest of house	0.9678	0.9516	0.9043	0.7952	0.6251	0.3841	0.2313	0.2317	0.5168	0.8173	0.9396	0.9729 (89)
MIT 2	18.6289	18.8088	19.1580	19.5624	19.8047	19.9057	19.9180	19.9201	19.8820	19.6017	19.0947	18.6232 (90)
Living area fraction									FLA = Living area / (4) =			0.1415 (91)
MIT	18.7611	18.9409	19.2919	19.6998	19.9487	20.0557	20.0701	20.0719	20.0284	19.7382	19.2263	18.7539 (92)
Temperature adjustment												0.0000
adjusted MIT	18.7611	18.9409	19.2919	19.6998	19.9487	20.0557	20.0701	20.0719	20.0284	19.7382	19.2263	18.7539 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.9594 0.9413 0.8920 0.7867 0.6274 0.3962 0.2467 0.2478 0.5270 0.8091 0.9289 0.9653 (94)												
Useful gains	920.8156	1015.9402	1113.8832	1117.1764	923.4675	609.4411	354.5285	339.1108	652.2628	862.0809	883.6512	864.5282 (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	2016.3462	1968.1984	1778.2311	1446.8885	1034.5105	625.0073	356.4584	340.9712	694.6526	1153.7665	1601.6062	1971.8143 (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	815.0747	639.9176	494.2748	237.3927	82.6160	0.0000	0.0000	0.0000	0.0000	217.0141	516.9276	823.8208 (98)
Space heating												3827.0384 (98)

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Space heating per m2 (98) / (4) = 30.5503 (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													4228.7717 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	815.0747	639.9176	494.2748	237.3927	82.6160	0.0000	0.0000	0.0000	0.0000	217.0141	516.9276	823.8208	(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)	900.6351	707.0912	546.1600	262.3124	91.2884	0.0000	0.0000	0.0000	0.0000	239.7945	571.1907	910.2993	(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	87.9953	87.7666	87.0961	85.5195	82.8996	79.8000	79.8000	79.8000	79.8000	85.1830	87.2385	79.8000	(216)
Fuel for water heating, kWh/month	249.6176	220.5890	233.4547	213.1410	215.4769	200.0219	192.1062	210.7911	210.4160	221.8878	229.0878	243.4298	(219)
Water heating fuel used												2640.0198	(219)
Annual totals kWh/year													
Space heating fuel - main system												4228.7717	(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												6309.6171	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4228.7717	3.6300	153.5044	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	2640.0198	3.6300	95.8327	(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			235.6336	(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	4228.7717	0.2160	913.4147	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2640.0198	0.2160	570.2443	(264)
Space and water heating			1483.6590	(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			1193.4475	(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	4228.7717	1.2200	5159.1015	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2640.0198	1.2200	3220.8242	(264)
Space and water heating			8379.9257	(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			6663.2603 (272)
Primary energy kWh/m2/year			53.1912 (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 (22.7%)

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	£344	£294	£50
Space heating	£263	£265	-£2
Water heating	£96	£54	£42
Lighting	£91	£91	£0
Generated (PV)	-£214	-£214	£0
Total cost of fuels	£235	£195	£40
Total cost of uses	£236	£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					3.9100
Infiltration rate					0.3537 (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) =	0.3537 (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	0.4510	0.4421	0.4333	0.3891	0.3802	0.3360	0.3360	0.3272	0.3537	0.3802	0.3979	0.4156 (22b)
Effective ac	0.6017	0.5977	0.5939	0.5757	0.5723	0.5565	0.5565	0.5535	0.5626	0.5723	0.5792	0.5864 (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 62.7539 Feb 62.3421 Mar 61.9384 Apr 60.0424 May 59.6876 Jun 58.0362 Jul 58.0362 Aug 57.7304 Sep 58.6723 Oct 59.6876 Nov 60.4053 Dec 61.1555 (38)
Heat transfer coeff	154.8029 154.3911 153.9874 152.0914 151.7366 150.0852 150.0852 149.7794 150.7213 151.7366 152.4543 153.2045 (39)
Average = Sum(39)m / 12 =	152.0897 (39)

HLP	Jan 1.2358 Feb 1.2325 Mar 1.2292 Apr 1.2141 May 1.2113 Jun 1.1981 Jul 1.1981 Aug 1.1957 Sep 1.2032 Oct 1.2113 Nov 1.2170 Dec 1.2230 (40)
HLP (average)	1.2141 (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												
W/m2												
Specific data												
g												
or Table 6b												
Specific data												
FF												
or Table 6c												
Access												
factor												
Table 6d												
Gains												
W												
East			10.0700		19.6403		0.6300		0.7000			60.4434 (76)
South			2.5200		46.7521		0.6300		0.7000			36.0059 (78)
Southwest			1.4400		36.7938		0.6300		0.7000			16.1923 (79)
West			8.3300		19.6403		0.6300		0.7000			49.9993 (80)
Northwest			1.4400		11.2829		0.6300		0.7000			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	37.0151	37.1139	37.2112	37.6751	37.7631	38.1787	38.1787	38.2566	38.0175	37.7631	37.5854	37.4013
alpha	3.4677	3.4743	3.4807	3.5117	3.5175	3.5452	3.5452	3.5504	3.5345	3.5175	3.5057	3.4934
util living area	0.9828	0.9708	0.9444	0.8836	0.7757	0.6182	0.4729	0.5212	0.7423	0.9167	0.9720	0.9856 (86)
MIT	19.2954	19.5200	19.8838	20.3328	20.6882	20.9012	20.9710	20.9589	20.8039	20.3266	19.7309	19.2569 (87)
Th 2	19.8915	19.8941	19.8967	19.9087	19.9110	19.9215	19.9215	19.9235	19.9175	19.9110	19.9064	19.9016 (88)
util rest of house	0.9789	0.9644	0.9318	0.8569	0.7247	0.5353	0.3660	0.4122	0.6681	0.8916	0.9646	0.9823 (89)
MIT 2	18.3559	18.5790	18.9365	19.3733	19.6930	19.8696	19.9118	19.9085	19.8010	19.3794	18.7991	18.3254 (90)
Living area fraction									fLA = Living area / (4) =			0.1415 (91)
MIT	18.4889	18.7122	19.0706	19.5091	19.8338	20.0156	20.0617	20.0572	19.9429	19.5135	18.9310	18.4573 (92)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Temperature adjustment
adjusted MIT 18.4889 18.7122 19.0706 19.5091 19.8338 20.0156 20.0617 20.0572 19.9429 19.5135 18.9310 0.0000
18.4573 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9723	0.9554	0.9201	0.8455	0.7207	0.5430	0.3804	0.4265	0.6700	0.8803	0.9559	0.9765	(94)
Useful gains	880.0790	998.4014	1095.2796	1129.1545	1024.5779	758.2658	508.2378	530.7119	764.0874	875.9463	848.2488	837.4635	(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	2196.4835	2132.4831	1935.7075	1613.5477	1234.1984	812.7990	519.5499	547.7692	880.6527	1352.4997	1803.6904	2184.2773	(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	979.4050	762.1029	625.2783	348.7631	155.9576	0.0000	0.0000	0.0000	0.0000	354.5557	687.9180	1002.0295	(98)
Space heating												4916.0101	(98)
Space heating per m2												39.2433	(99)
												(98) / (4) =	

8c. Space cooling requirement

Not applicable

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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													5432.0553 (211)
Space heating requirement	979.4050	762.1029	625.2783	348.7631	155.9576	0.0000	0.0000	0.0000	0.0000	354.5557	687.9180	1002.0295	(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)	1082.2154	842.1027	690.9153	385.3736	172.3289	0.0000	0.0000	0.0000	0.0000	391.7743	760.1303	1107.2149	(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	88.6351	88.6662	88.6619	88.7068	88.7193	79.8000	79.8000	79.8000	79.8000	87.5436	88.2917	79.8000	(216)
Fuel for water heating, kWh/month	205.6615	156.7539	128.9794	69.7957	30.9462	13.9312	7.1691	46.7161	84.6777	136.3416	178.6586	204.6231	(219)
Water heating fuel used												1264.2542	(219)
Annual totals kWh/year													
Space heating fuel - main system												5432.0553	(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												6302.4900	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	5432.0553	3.4800	189.0355	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1264.2542	3.4800	43.9960	(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			301.0868	(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] =	0.7427 (257)
SAP value			89.6396
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	5432.0553	0.2160	1173.3240 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1264.2542	0.2160	273.0789 (264)
Space and water heating			1446.4029 (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			1242.0105 (272)
CO2 emissions per m2			9.9100 (273)
EI value			90.2256
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 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					3.9100
Infiltration rate					0.3537 (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) =	0.3537 (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	0.4156	0.3891	0.3891	0.3537	0.3625	0.3449	0.3449	0.3360	0.3360	0.3625	0.3537	0.3625 (22b)
Effective ac	0.5864	0.5757	0.5757	0.5626	0.5657	0.5595	0.5595	0.5565	0.5565	0.5657	0.5626	0.5657 (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)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	61.1555	60.0424	60.0424	58.6723	59.0026	58.3502	58.3502	58.0362	58.0362	59.0026	58.6723	59.0026 (38)
Average = Sum(39)m / 12 =	153.2045	152.0914	152.0914	150.7213	151.0516	150.3992	150.3992	150.0852	150.0852	151.0516	150.7213	151.0516 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2230	1.2141	1.2141	1.2032	1.2058	1.2006	1.2006	1.1981	1.1981	1.2058	1.2032	1.2058 (40)
HLP (average)												1.2060 (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 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 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												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	37.4013	37.6751	37.6751	38.0175	37.9344	38.0990	38.0990	38.1787	38.1787	37.9344	38.0175	37.9344 (86)
alpha	3.4934	3.5117	3.5117	3.5345	3.5290	3.5399	3.5399	3.5452	3.5452	3.5290	3.5345	3.5290 (87)
util living area	0.9748	0.9617	0.9240	0.8368	0.6988	0.4832	0.3457	0.3512	0.6185	0.8632	0.9541	0.9789 (88)
MIT	19.5536	19.7328	20.0949	20.5238	20.8158	20.9637	20.9919	20.9918	20.9134	20.5592	20.0154	19.5366 (89)
Th 2	19.9016	19.9087	19.9087	19.9175	19.9154	19.9195	19.9195	19.9215	19.9215	19.9154	19.9175	19.9154 (90)
util rest of house	0.9688	0.9529	0.9065	0.8001	0.6328	0.3900	0.2353	0.2357	0.5228	0.8214	0.9414	0.9738 (91)
MIT 2	18.6192	18.7998	19.1495	19.5545	19.8003	19.9050	19.9180	19.9200	19.8806	19.5958	19.0860	18.6134 (92)
Living area fraction									fLA = Living area / (4) =			0.1415 (93)
MIT	18.7515	18.9318	19.2833	19.6917	19.9440	20.0548	20.0699	20.0717	20.0267	19.7322	19.2176	18.7440 (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	18.7515	18.9318	19.2833	19.6917	19.9440	20.0548	20.0699	20.0717	20.0267	19.7322	19.2176	18.7440	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9605	0.9428	0.8943	0.7913	0.6347	0.4021	0.2509	0.2521	0.5328	0.8130	0.9308	0.9664	(94)
Useful gains	911.5092	1007.2438	1105.6640	1109.2349	918.6246	608.5713	354.3975	338.9831	650.5253	856.1952	875.3549	855.0201	(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													
	2014.8668	1966.8170	1776.9248	1445.6675	1033.8046	624.8855	356.4383	340.9514	694.4061	1152.8541	1600.2954	1970.3214	(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													
	820.8980	644.8332	499.4180	242.2315	85.6939	0.0000	0.0000	0.0000	0.0000	220.7142	521.9571	829.7842	(98)
Space heating												3865.5301	(98)
Space heating per m2												(98) / (4) =	30.8576 (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													4271.3040 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	820.8980	644.8332	499.4180	242.2315	85.6939	0.0000	0.0000	0.0000	0.0000	220.7142	521.9571	829.7842	(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)	907.0696	712.5229	551.8431	267.6591	94.6894	0.0000	0.0000	0.0000	0.0000	243.8831	576.7482	916.8886	(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	88.3918	88.3973	88.3147	88.1615	87.2790	79.8000	79.8000	79.8000	79.8000	86.5293	87.8396	79.8000	(216)
Fuel for water heating, kWh/month	200.9397	157.3162	127.9792	67.7594	37.2858	4.0592	3.9144	37.7910	77.7606	132.7158	173.3891	202.4725	(219)
Water heating fuel used												1223.3828	(219)
Annual totals kWh/year													
Space heating fuel - main system												4271.3040	(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												4985.5124	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4271.3040	3.6300	155.0483	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1223.3828	3.6300	44.4088	(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			195.4736	(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	4271.3040	0.2160	922.6017	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1223.3828	0.2160	264.2507	(264)
Space and water heating			1186.8524	(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			922.5908 (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	4271.3040	1.2200	5210.9909 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1223.3828	1.2200	1492.5271 (264)
Space and water heating			6703.5179 (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			5140.3526 (272)
Primary energy kWh/m2/year			41.0342 (273)

U-VALUE CALCULATOR REPORT

Property Reference	SAP 0647 Plot 63	Issued on Date	21/03/2022
Assessment Reference	As Built	Prop Type Ref	N
Project	1 Fred Woolley Walk, West End, Southampton, SO30 3LF		
Calculation Type	New Build (As Built)		

SAP Rating	88 B	DER	13.47	TER	17.10
Environmental	88 B	% DER<TER	21.24		
CO ₂ Emissions (t/year)	1.19	DFEE	48.90	TREE	59.23
General Requirements Compliance	Pass	% DFEE<TFEE	17.44		

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 63	Issued on Date	21/03/2022
Assessment Reference	As Built	Prop Type Ref	N
Project	1 Fred Woolley Walk, West End, Southampton, SO30 3LF		
Calculation Type	New Build (As Built)		

SAP Rating	88 B	DER	13.47	TER	17.10
Environmental	88 B	% DER<TER	21.24		
CO ₂ Emissions (t/year)	1.19	DFEE	48.90	TFEE	59.23
General Requirements Compliance	Pass	% DFEE<TFEE	17.44		

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/m ² K	Kappa: 42.22 kJ/m ² K

U-VALUE CALCULATOR REPORT

Property Reference	SAP 0647 Plot 63	Issued on Date	21/03/2022
Assessment Reference	As Built	Prop Type Ref	N
Project	1 Fred Woolley Walk, West End, Southampton, SO30 3LF		
Calculation Type	New Build (As Built)		

SAP Rating	88 B	DER	13.47	TER	17.10
Environmental	88 B	% DER<TER	21.24		
CO ₂ Emissions (t/year)	1.19	DFEE	48.90	TFEE	59.23
General Requirements Compliance	Pass	% DFEE<TFEE	17.44		

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 63	Issued on Date	21/03/2022
Assessment Reference	As Built	Prop Type Ref	N
Property	1 Fred Woolley Walk, West End, Southampton, SO30 3LF		
SAP Rating	88 B	DER	13.47
Environmental	88 B	TER	17.10
CO ₂ Emissions (t/year)	1.19	% DER<TER	21.24
General Requirements Compliance	Pass	DfEE	48.90
		TFEE	59.23
		% DfEE<TFEE	17.44
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
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8.0 Thermal Mass Parameter	Precise calculation	
Thermal Mass	164.67	kJ/m²K

9.0 External Walls	Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area (m ²)	Nett Area (m ²)
	Brick and Block	Cavity Wall	Other	0.24	42.22	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)	Nett 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	Manufacturer	Solid Door							1.10
Windows	Manufacturer	Window	Double Low-E Soft 0.1			0.63		0.70	1.20

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
Front Door	Solid Door	[1] Brick and Block	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 3.91 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
Description Gas Combi
Percentage of Heat 100 %
Database Ref. No. 18911
Fuel Type Mains gas
Main Heating BGB
SAP Code 102
In Winter 90.5
In Summer 79.8
Controls 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	