



SAP Report Submission for Building Regulations Compliance

Client: The Keen Partnership

Project: Plot 2, 71, Oak Tree Road
Reading, RG31 6LA

Contact: JosTec
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Report Issue Date: 08/04/2022

EXCELLENCE
IN ENERGY
ASSESSMENT

PREDICTED ENERGY ASSESSMENT

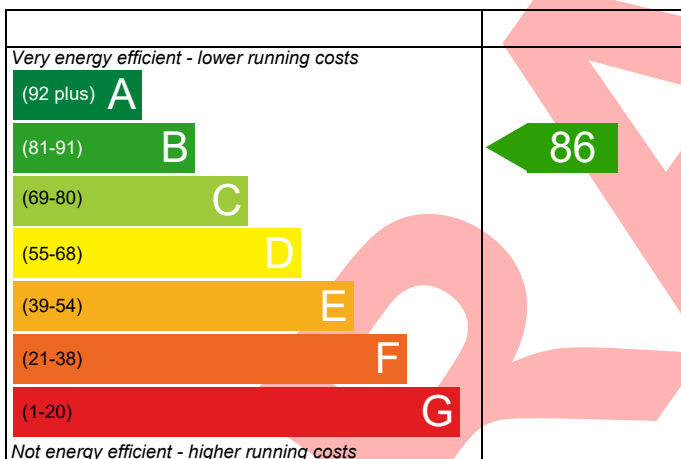
Plot 2, 71, Oak Tree Road,
Reading,
RG31 6LA

Dwelling type: House, Detached
Date of assessment: 08/04/2022
Produced by: Carlos Val
Total floor area: 191.5 m²

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

The energy performance has been assessed using the Government approved SAP2012 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO₂) emissions.

Energy Efficiency Rating

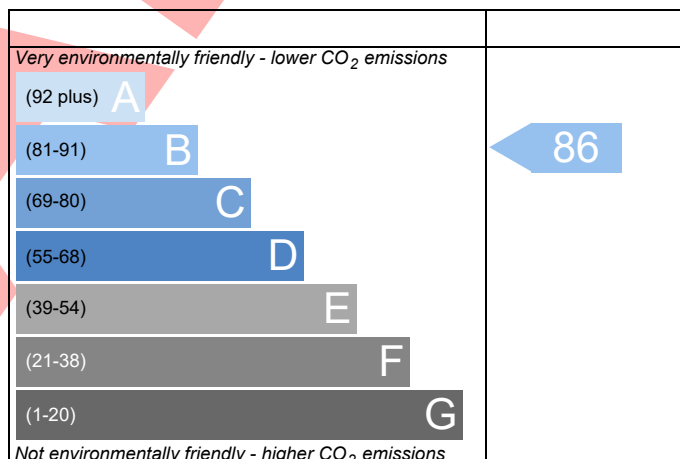


England

EU Directive
2002/91/EC

The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

Environmental Impact (CO₂) Rating



England

EU Directive
2002/91/EC

The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO₂) emissions. The higher the rating the less impact it has on the environment.

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

BUILDING REGULATION COMPLIANCE

Calculation Type: New Build (As Designed)

Property Reference	22098 - Plot 2	Issued on Date	08/04/2022
Assessment Reference	As Designed	Prop Type Ref	Plot 2
Property	Plot 2, 71, Oak Tree Road, Reading, RG31 6LA		
SAP Rating	86 B	DER	13.91
Environmental	86 B	TER	17.45
CO ₂ Emissions (t/year)	2.24	% DER<TER	20.27
General Requirements Compliance	Pass	DFEE	59.65
		TREE	69.96
		% DFEE<TFEE	14.75
Assessor Details	Mr. Carlos Val Escudero, Carlos Val, Tel: , cd.val@live.com		Assessor ID
Client	The Keen Partnership, 22098		H664-0001

SUMMARY FOR INPUT DATA FOR New Build (As Designed)

Criterion 1 – Achieving the TER and TFE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	17.45	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	13.91	kgCO ₂ /m ²	Pass
	-3.54 (-20.3%)	kgCO ₂ /m ²	

1b TFE and DFEE

Target Fabric Energy Efficiency (TFEE)	69.96	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DFEE)	59.65	kWh/m ² /yr	
	-10.4 (-14.9%)	kWh/m ² /yr	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.22 (max. 0.70)	Pass
Floor	0.11 (max. 0.25)	0.11 (max. 0.70)	Pass
Roof	0.17 (max. 0.20)	0.19 (max. 0.35)	Pass
Openings	1.41 (max. 2.00)	1.70 (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	5.00 (design value)	m ³ /(h.m ²) @ 50 Pa	
Maximum	10.0	m ³ /(h.m ²) @ 50 Pa	Pass

Limiting System Efficiencies

4 Heating efficiency

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BUILDING REGULATION COMPLIANCE

Calculation Type: New Build (As Designed)

Main heating system

Boiler system with radiators or underfloor - Mains gas
Data from database
Worcester Greenstar 8000 Style GR8700iW 30 S NG

Efficiency: 89.5% SEDBUK2009
Minimum: 88.0%

Pass

Secondary heating system

Room heaters - Wood Logs
Closed room heater
Efficiency: 65%
Minimum: 65%

Pass

5 Cylinder insulation

Hot water storage

Measured cylinder loss: 1.78 kWh/day
Permitted by DBSCG 2.56

Pass

Primary pipework insulated

Yes

Pass

6 Controls

Space heating controls

Time and temperature zone control

Pass

Hot water controls

Cylinderstat

Pass

Independent timer for DHW

Pass

Boiler interlock

Yes

Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings

100 %

Minimum

75 %

Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Thames Valley)

Slight

Pass

Based on:

Overshading

Average

Windows facing North

13.70 m², No overhang

Windows facing East

26.96 m², No overhang

Windows facing South

20.56 m², No overhang

Windows facing West

5.24 m², No overhang

Air change rate

8.00 ach

Blinds/curtains

None

Criterion 4 – Building performance consistent with DER and DFEE rate

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals

5.00 (design value) 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 Designed)

10 Key features

Floor U-value	0.11	W/m ² K
Thermal bridging y-value	0.035	W/m ² K
Secondary heating (wood logs)	N/A	
Secondary heating fuel:	wood logs	
Photovoltaic array	1.00	kW

DRAFT

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RECOMMENDATIONS

	Typical cost	Typical savings per year	Energy efficiency	Environmental impact	Result
Low energy lights			0	0	Already installed
Solar water heating	£4,000 - £6,000	£39	B 87	B 87	Recommended
Photovoltaic			0	0	Already installed
Wind turbine			0	0	Not applicable
Totals	£4,000 - £6,000	£39	B 87	B 87	

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FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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SAP Rating	86 B	DER	13.91	TER	17.45
Environmental	86 B	% DER<TER	20.27		
CO ₂ Emissions (t/year)	2.24	DFEE	59.65	TFEE	69.96
General Requirements Compliance	Pass	% DFEE<TFEE	14.75		
Assessor Details	Mr. Carlos Val Escudero, Carlos Val, Tel: , cd.val@live.com			Assessor ID	H664-0001
Client	The Keen Partnership, 22098				

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

DWELLING AS DESIGNED

Detached House, total floor area 192 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) 17.45 kgCO₂/m²

Dwelling Carbon Dioxide Emission Rate (DER) 13.91 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)70.0 kWh/m²/yr

Dwelling Fabric Energy Efficiency (DFEE)59.6 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.22 (max. 0.70)	OK
Floor	0.11 (max. 0.25)	0.11 (max. 0.70)	OK
Roof	0.17 (max. 0.20)	0.19 (max. 0.35)	OK
Openings	1.41 (max. 2.00)	1.70 (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:	5.00 (design value)	
Maximum	10.0	OK

4 Heating efficiency

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

Data from database

Worcester Greenstar 8000 Style GR8700iW 30 S NG

Efficiency: 89.5% SEDBUK2009

Minimum: 88.0% OK

Secondary heating system: Room heaters - Wood Logs

Closed room heater

Efficiency: 65%

Minimum: 65% OK

5 Cylinder insulation

Hot water storage Measured cylinder loss: 1.78 kWh/day

Permitted by DBSCG 2.56 OK

Primary pipework insulated: Yes OK

6 Controls

Space heating controls: Time and temperature zone control OK

Hot water controls:

Cylinderstat OK

Independent timer for DHW OK

Boiler interlock

Yes OK

7 Low energy lights

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

Minimum 75% OK

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Thames Valley): Slight OK

Based on:

Overshading:	Average
Windows facing North:	13.70 m ² , No overhang
Windows facing East:	26.96 m ² , No overhang
Windows facing South:	20.56 m ² , No overhang
Windows facing West:	5.24 m ² , No overhang
Air change rate:	8.00 ach
Blinds/curtains:	None

10 Key features

Floor U-value 0.11 W/m²K

Thermal bridging y-value 0.035 W/m²K

Secondary heating (wood logs)

Secondary heating fuel: wood logs

Photovoltaic array 1.00 kW

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (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	126.0000 (1b)	x 2.8700 (2b)	= 361.6200 (1b) - (3b)
First floor	65.5000 (1c)	x 3.1400 (2c)	= 205.6700 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	191.5000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	567.2900 (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) = 0.0881 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3381 (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) =	0.3381 (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	0.4311	0.4227	0.4142	0.3720	0.3635	0.3212	0.3212	0.3128	0.3381	0.3635	0.3804	0.3973 (22b)
Effective ac	0.5929	0.5893	0.5858	0.5692	0.5661	0.5516	0.5516	0.5489	0.5572	0.5661	0.5724	0.5789 (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
Windows (Uw = 1.40)			63.2000	1.3258	83.7879		(27)
Entrance Door			3.7800	1.4000	5.2920		(26a)
Oriel Window (Uw = 1.70)			3.2600	1.5918	5.1891		(27)
Rooflight (Uw = 1.40)			0.5100	1.3258	0.6761		(27a)
Ground Floor			126.0000	0.1100	13.8600		(28a)
EW1 - Facing Brick	173.8600	41.1300	132.7300	0.2100	27.8733		(29a)
EW2 - Facing block	53.2600	13.8900	39.3700	0.2000	7.8740		(29a)
EW3 - Timber frame	22.4700	15.2200	7.2500	0.2200	1.5950		(29a)
R1 - Pitched - Top Floor	90.7500	0.5100	90.2400	0.1600	14.4384		(30)
R2 - Pitched - Ground Floor	46.8500		46.8500	0.1900	8.9015		(30)
R3 - Flat Roof	5.1700		5.1700	0.1800	0.9306		(30)
Total net area of external elements Aum(A, m ²)			518.3600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	170.4180		(33)

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

100.0000 (35)
18.0559 (36)
(33) + (36) = 188.4739 (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	111.0008	110.3252	109.6630	106.5527	105.9707	103.2617	103.2617	102.7600	104.3052	105.9707	107.1480	108.3787 (38)
Heat transfer coeff	299.4747	298.7991	298.1369	295.0265	294.4446	291.7356	291.7356	291.2339	292.7790	294.4446	295.6218	296.8526 (39)
Average = Sum(39)m / 12 =												295.0237 (39)
HLP	1.5638	1.5603	1.5569	1.5406	1.5376	1.5234	1.5234	1.5208	1.5289	1.5376	1.5437	1.5501 (40)
HLP (average)												1.5406 (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												2.9909 (42)
Average daily hot water use (litres/day)												105.2327 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	115.7560	111.5467	107.3374	103.1281	98.9187	94.7094	94.7094	98.9187	103.1281	107.3374	111.5467	115.7560 (44)
Energy conte	171.6628	150.1374	154.9283	135.0702	129.6031	111.8376	103.6340	118.9215	120.3418	140.2468	153.0904	166.2462 (45)
Energy content (annual)										Total = Sum(45)m =		1655.7203 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	25.7494	22.5206	23.2392	20.2605	19.4405	16.7756	15.5451	17.8382	18.0513	21.0370	22.9636	24.9369 (46)
Water storage loss:												
Store volume												250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.7800 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.9612 (55)
Total storage loss												
29.7972 26.9136 29.7972 28.8360 29.7972 28.8360 29.7972 29.7972 28.8360 29.7972 28.8360 29.7972 (56)												
If cylinder contains dedicated solar storage												
29.7972 26.9136 29.7972 28.8360 29.7972 28.8360 29.7972 29.7972 28.8360 29.7972 28.8360 29.7972 (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												
224.7224 198.0622 207.9879 186.4182 182.6627 163.1856 156.6936 171.9811 171.6898 193.3064 204.4384 219.3058 (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												
224.7224 198.0622 207.9879 186.4182 182.6627 163.1856 156.6936 171.9811 171.6898 193.3064 204.4384 219.3058 (64)												
Total per year (kWh/year) = Sum(64)m =												2280.4543 (64)
Heat gains from water heating, kWh/month												
99.5256 88.2605 93.9613 85.9893 85.5407 78.2644 76.9060 81.9891 81.0921 89.0797 91.9809 97.7246 (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	149.5425	149.5425	149.5425	149.5425	149.5425	149.5425	149.5425	149.5425	149.5425	149.5425	149.5425	149.5425 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
32.3522 28.7350 23.3689 17.6917 13.2248 11.1649 12.0641 15.6813 21.0475 26.7246 31.1915 33.2514 (67)												
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
362.8937 366.6594 357.1700 336.9681 311.4668 287.4992 271.4874 267.7217 277.2111 297.4130 322.9143 346.8819 (68)												
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
37.9543 37.9543 37.9543 37.9543 37.9543 37.9543 37.9543 37.9543 37.9543 37.9543 37.9543 37.9543 (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)												
-119.6340 -119.6340 -119.6340 -119.6340 -119.6340 -119.6340 -119.6340 -119.6340 -119.6340 -119.6340 -119.6340 -119.6340 (71)												
Water heating gains (Table 5)												
133.7709 131.3400 126.2921 119.4295 114.9741 108.7006 103.3683 110.2004 112.6279 119.7308 127.7513 131.3502 (72)												
Total internal gains	599.8797	597.5972	577.6937	544.9521	510.5284	478.2275	457.7825	464.4662	481.7492	514.7312	552.7199	582.3463 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
North				10.4400	10.6334	0.6300	0.7000	0.7700	33.9269 (74)			
East				26.9600	19.6403	0.6300	0.7000	0.7700	161.8225 (76)			
South				20.5600	46.7521	0.6300	0.7000	0.7700	293.7621 (78)			
West				5.2400	19.6403	0.6300	0.7000	0.7700	31.4522 (80)			
North				3.2600	10.6334	0.6300	0.7000	0.7700	10.5940 (74)			
North				0.5100	16.1759	0.6300	0.7000	1.0000	3.2743 (82)			
Solar gains	534.8320	950.4758	1391.3490	1853.4773	2177.7900	2202.3913	2106.8729	1861.6645	1552.4090	1076.3251	648.1293	452.6533 (83)
Total gains	1134.7117	1548.0730	1969.0427	2398.4294	2688.3184	2680.6188	2564.6554	2326.1306	2034.1583	1591.0563	1200.8493	1034.9996 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	17.7626	17.8027	17.8423	18.0304	18.0660	18.2338	18.2338	18.2652	18.1688	18.0660	17.9941	17.9195
alpha	2.1842	2.1868	2.1895	2.2020	2.2044	2.2156	2.2156	2.2177	2.2113	2.2044	2.1996	2.1946
util living area	0.9694	0.9416	0.8940	0.8102	0.6942	0.5585	0.4400	0.4894	0.6862	0.8707	0.9518	0.9747 (86)
MIT	18.4905	18.8239	19.3066	19.8763	20.3410	20.6503	20.7834	20.7549	20.4931	19.8445	19.0523	18.4337 (87)
Th 2	19.6400	19.6426	19.6451	19.6572	19.6594	19.6700	19.6700	19.6719	19.6659	19.6594	19.6549	19.6501 (88)
util rest of house	0.9641	0.9317	0.8759	0.7774	0.6396	0.4740	0.3263	0.3742	0.6096	0.8403	0.9419	0.9702 (89)
MIT 2	16.3311	16.8114	17.5000	18.3001	18.9194	19.3049	19.4406	19.4211	19.1369	18.2822	17.1545	16.2542 (90)
Living area fraction	16.8611	17.3053	17.9434	18.6870	19.2683	19.6351	19.7702	19.7485	19.4697	18.6657	17.6203	16.7891 (92)
MIT	16.8611	17.3053	17.9434	18.6870	19.2683	19.6351	19.7702	19.7485	19.4697	18.6657	17.6203	16.7891 (92)
Temperature adjustment												-0.1500
adjusted MIT	16.7111	17.1553	17.7934	18.5370	19.1183	19.4851	19.6202	19.5985	19.3197	18.5157	17.4703	16.6391 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9467	0.9061	0.8434	0.7439	0.6141	0.4610	0.3217	0.3672	0.5860	0.8062	0.9185	0.9551 (94)
Useful gains	1074.2801	1402.7486	1660.7759	1784.1968	1650.9752	1235.6745	825.0621	854.0412	1192.0888	1282.6886	1103.0166	988.5124 (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	3716.8127	3661.8772	3366.9833	2843.1647	2184.2709	1425.1679	881.0873	931.4982	1528.2333	2330.7253	3065.6787	3692.5892 (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	1966.0442	1518.1344	1269.4183	762.4569	396.7720	0.0000	0.0000	0.0000	0.0000	779.7393	1413.1167	2011.8332 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Space heating 10117.5150 (98)
Space heating per m2 (98) / (4) = 52.8330 (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)													0.1000 (201)
Fraction of space heat from main system(s)													0.9000 (202)
Efficiency of main space heating system 1 (in %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													65.0000 (208)
Space heating requirement													10061.6171 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1966.0442	1518.1344	1269.4183	762.4569	396.7720	0.0000	0.0000	0.0000	0.0000	779.7393	1413.1167	2011.8332	(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)	1955.1821	1509.7469	1262.4050	758.2444	394.5798	0.0000	0.0000	0.0000	0.0000	775.4313	1405.3094	2000.7181	(211)
Water heating requirement	302.4683	233.5591	195.2951	117.3011	61.0418	0.0000	0.0000	0.0000	0.0000	119.9599	217.4026	309.5128	(215)
Water heating requirement	224.7224	198.0622	207.9879	186.4182	182.6627	163.1856	156.6936	171.9811	171.6898	193.3064	204.4384	219.3058	(64)
Efficiency of water heater (217)m	89.1529	88.9893	88.6689	87.9799	86.5717	79.8000	79.8000	79.8000	79.8000	87.9531	88.8502	89.2077	(216)
Fuel for water heating, kWh/month	252.0640	222.5685	234.5669	211.8874	210.9960	204.4933	196.3579	215.5152	215.1502	219.7836	230.0934	245.8372	(219)
Water heating fuel used												2659.3136	(219)
Annual totals kWh/year													
Space heating fuel - main system												10061.6171	(211)
Space heating fuel - secondary												1556.5408	(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)												571.3507	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.00 * 1080 * 1.00) =										-863.6197		-863.6197	(233)
Total delivered energy for all uses												14060.2024	(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	10061.6171	0.2160	2173.3093	(261)
Space heating - secondary	1556.5408	0.0190	29.5743	(263)
Water heating (other fuel)	2659.3136	0.2160	574.4117	(264)
Space and water heating			2777.2953	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	571.3507	0.5190	296.5310	(268)
Energy saving/generation technologies				
PV Unit	-863.6197	0.5190	-448.2186	(269)
Total CO2, kg/year			2664.5327	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.9100	(273)

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

DER	13.9100	ZC1
Total Floor Area	191.5000	TFA
Assumed number of occupants	2.9909	N
CO2 emission factor in Table 12 for electricity displaced from grid	0.5190	EF
CO2 emissions from appliances, equation (L14)	11.2294	ZC2
CO2 emissions from cooking, equation (L16)	0.9962	ZC3
Total CO2 emissions	26.1357	ZC4
Residual CO2 emissions offset from biofuel CHP	0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year	0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation	0.0000	ZC7
Net CO2 emissions	26.1357	ZC8

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (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	126.0000 (1b)	x 2.8700 (2b)	= 361.6200 (1b) - (3b)
First floor	65.5000 (1c)	x 3.1400 (2c)	= 205.6700 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	191.5000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 567.2900 (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) =	0.0705 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3205 (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) =		0.3205 (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	0.4087	0.4006	0.3926	0.3526	0.3445	0.3045	0.3045	0.2965	0.3205	0.3445	0.3606	0.3766 (22b)
Effective ac	0.5835	0.5803	0.5771	0.5621	0.5594	0.5464	0.5464	0.5439	0.5514	0.5594	0.5650	0.5709 (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 Semi-glazed door			3.7800	1.2000	4.5360		(26a)
TER Opening Type (Uw = 1.40)			43.7800	1.3258	58.0417		(27)
TER Room Window (Uw = 1.70)			0.3400	1.5918	0.5412		(27a)
Ground Floor			126.0000	0.1300	16.3800		(28a)
EW1 - Facing Brick	173.8600	28.3800	145.4800	0.1800	26.1864		(29a)
EW2 - Facing block	53.2600	9.1500	44.1100	0.1800	7.9398		(29a)
EW3 - Timber frame	22.4700	10.0300	12.4400	0.1800	2.2392		(29a)
R1 - Pitched - Top Floor	90.7500	0.3400	90.4100	0.1300	11.7533		(30)
R2 - Pitched - Ground Floor	46.8500		46.8500	0.1300	6.0905		(30)
R3 - Flat Roof	5.1700		5.1700	0.1300	0.6721		(30)
Total net area of external elements Aum(A, m ²)			518.3600				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		134.3802		(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)							25.8653 (36)
Total fabric heat loss						(33) + (36) =	160.2455 (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	109.2341	108.6271	108.0322	105.2377	104.7148	102.2809	102.2809	101.8302	103.2184	104.7148	105.7725	106.8783 (38)
Heat transfer coeff	269.4796	268.8726	268.2776	265.4831	264.9603	262.5263	262.5263	262.0756	263.4639	264.9603	266.0180	267.1238 (39)
Average = Sum(39)m / 12 =												265.4806 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.4072	1.4040	1.4009	1.3863	1.3836	1.3709	1.3709	1.3685	1.3758	1.3836	1.3891	1.3949 (40)
HLP (average)												1.3863 (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												2.9909 (42)
Average daily hot water use (litres/day)												105.2327 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	115.7560	111.5467	107.3374	103.1281	98.9187	94.7094	94.7094	98.9187	103.1281	107.3374	111.5467	115.7560 (44)
Energy conte	171.6628	150.1374	154.9283	135.0702	129.6031	111.8376	103.6340	118.9215	120.3418	140.2468	153.0904	166.2462 (45)
Energy content (annual)										Total = Sum(45)m =		1655.7203 (45)
Distribution loss (46)m = 0.15 x (45)m												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	25.7494	22.5206	23.2392	20.2605	19.4405	16.7756	15.5451	17.8382	18.0513	21.0370	22.9636	24.9369 (46)
Water storage loss:												
Store volume												250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.8903 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.0208 (55)
Total storage loss												
31.6444	28.5820	31.6444	30.6236	31.6444	30.6236	31.6444	31.6444	30.6236	31.6444	30.6236	31.6444	(56)
If cylinder contains dedicated solar storage												
31.6444	28.5820	31.6444	30.6236	31.6444	30.6236	31.6444	31.6444	30.6236	31.6444	30.6236	31.6444	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month												
226.5696	199.7306	209.8351	188.2059	184.5099	164.9732	158.5408	173.8283	173.4774	195.1536	206.2260	221.1530	(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	(63)
Solar input (sum of months) = Sum(63)m =												0.0000 (63)
Output from w/h												
226.5696	199.7306	209.8351	188.2059	184.5099	164.9732	158.5408	173.8283	173.4774	195.1536	206.2260	221.1530	(64)
Heat gains from water heating, kWh/month												
101.0033	89.5953	95.4391	87.4193	87.0185	79.6945	78.3837	83.4668	82.5221	90.5575	93.4110	99.2023	(65)
Total per year (kWh/year) = Sum(64)m =												2302.2034 (64)

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

Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
149.5425	149.5425	149.5425	149.5425	149.5425	149.5425	149.5425	149.5425	149.5425	149.5425	149.5425	149.5425	149.5425 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
32.3522	28.7350	23.3689	17.6917	13.2248	11.1649	12.0641	15.6813	21.0475	26.7246	31.1915	33.2514	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
362.8937	366.6594	357.1700	336.9681	311.4668	287.4992	271.4874	267.7217	277.2111	297.4130	322.9143	346.8819	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
37.9543	37.9543	37.9543	37.9543	37.9543	37.9543	37.9543	37.9543	37.9543	37.9543	37.9543	37.9543	(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	(70)
Losses e.g. evaporation (negative values) (Table 5)												
-119.6340	-119.6340	-119.6340	-119.6340	-119.6340	-119.6340	-119.6340	-119.6340	-119.6340	-119.6340	-119.6340	-119.6340	(71)
Water heating gains (Table 5)												
135.7571	133.3263	128.2784	121.4158	116.9603	110.6868	105.3545	112.1866	114.6141	121.7171	129.7375	133.3364	(72)
Total internal gains												
601.8659	599.5835	579.6800	546.9383	512.5147	480.2137	459.7687	466.4524	483.7354	516.7174	554.7062	584.3325	(73)

6. Solar gains

[Jan]		Area	Solar flux	g	FF	Access	Gains
		m2	Table 6a	or Table 6b	Specific data	factor	W
			W/m2		or Table 6c	Table 6d	
North		9.0300	10.6334	0.6300	0.7000	0.7700	29.3448 (74)
East		17.7600	19.6403	0.6300	0.7000	0.7700	106.6012 (76)
South		13.5400	46.7521	0.6300	0.7000	0.7700	193.4600 (78)
West		3.4500	19.6403	0.6300	0.7000	0.7700	20.7080 (80)
North		0.3400	16.1759	0.6300	0.7000	1.0000	2.1829 (82)

Solar gains	352.2969	626.0950	916.5444	1221.0466	1434.7784	1451.0230	1388.0764	1226.4693	1022.6663	709.0036	426.9283	298.1643 (83)
Total gains	954.1628	1225.6785	1496.2244	1767.9849	1947.2930	1931.2367	1847.8451	1692.9217	1506.4017	1225.7210	981.6345	882.4968 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
49.3492	49.4606	49.5703	50.0921	50.1910	50.6563	50.6563	50.7434	50.4760	50.1910	49.9914	49.7845	49.7845
alpha	4.2899	4.2974	4.3047	4.3395	4.3461	4.3771	4.3771	4.3829	4.3651	4.3461	4.3328	4.3190
util living area												
0.9990	0.9968	0.9899	0.9649	0.8947	0.7534	0.5925	0.6569	0.8812	0.9834	0.9977	0.9993	(86)
MIT	19.3383	19.5436	19.8702	20.2917	20.6604	20.8938	20.9716	20.9560	20.7690	20.2707	19.7225	19.3071 (87)
Th 2	19.7578	19.7602	19.7626	19.7738	19.7759	19.7857	19.7857	19.7875	19.7819	19.7759	19.7717	19.7672 (88)
util rest of house												
0.9986	0.9957	0.9859	0.9502	0.8491	0.6518	0.4448	0.5092	0.8110	0.9741	0.9966	0.9990	(89)
MIT 2	17.5534	17.8550	18.3319	18.9427	19.4409	19.7149	19.7757	19.7698	19.5921	18.9234	18.1248	17.5141 (90)
Living area fraction									fLA = Living area / (4) =			0.2454 (91)
MIT	17.9915	18.2695	18.7094	19.2738	19.7402	20.0042	20.0692	20.0609	19.8809	19.2541	18.5169	17.9541 (92)
Temperature adjustment												0.0000
adjusted MIT	17.9915	18.2695	18.7094	19.2738	19.7402	20.0042	20.0692	20.0609	19.8809	19.2541	18.5169	17.9541 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.9978	0.9935	0.9811	0.9423	0.8475	0.6722	0.4813	0.5453	0.8181	0.9683	0.9949	0.9984	(94)
Useful gains	952.0234	1217.7234	1467.9101	1665.9241	1650.4042	1298.1620	889.4177	923.2237	1232.3211	1186.8503	976.6435	881.0800 (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												
3689.5684	3594.6806	3275.5212	2754.0661	2130.3327	1418.7499	910.7682	959.4287	1523.0632	2292.9932	3037.1129	3674.0602	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh												
2036.7335	1597.3152	1344.8627	783.4623	357.0668	0.0000	0.0000	0.0000	0.0000	822.9703	1483.5380	2077.9773	(98)
Space heating												10503.9260 (98)
Space heating per m2												(98) / (4) = 54.8508 (99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)														0.0000 (201)
Fraction of space heat from main system(s)														1.0000 (202)
Efficiency of main space heating system 1 (in %)														93.5000 (206)
Efficiency of secondary/supplementary heating system, %														0.0000 (208)
Space heating requirement														11234.1455 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	2036.7335	1597.3152	1344.8627	783.4623	357.0668	0.0000	0.0000	0.0000	0.0000	822.9703	1483.5380	2077.9773	(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)	2178.3246	1708.3585	1438.3558	837.9276	381.8896	0.0000	0.0000	0.0000	0.0000	880.1822	1586.6716	2222.4356	(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	226.5696	199.7306	209.8351	188.2059	184.5099	164.9732	158.5408	173.8283	173.4774	195.1536	206.2260	221.1530	(64)	
Efficiency of water heater (217)m	89.3013	89.1711	88.8913	88.2091	86.5464	79.8000	79.8000	79.8000	79.8000	88.2323	89.0429	89.3476	(216)	
Fuel for water heating, kWh/month	253.7135	223.9858	236.0580	213.3633	213.1918	206.7334	198.6727	217.8300	217.3903	221.1816	231.6030	247.5197	(219)	
Water heating fuel used												2681.2432	(219)	
Annual totals kWh/year														
Space heating fuel - main system												11234.1455	(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)													571.3507	(232)
Total delivered energy for all uses													14561.7394	(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	11234.1455	0.2160	2426.5754 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2681.2432	0.2160	579.1485 (264)
Space and water heating			3005.7240 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	571.3507	0.5190	296.5310 (268)
Total CO2, kg/m2/year			3341.1800 (272)
Emissions per m2 for space and water heating			15.6957 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			1.5485 (272b)
Emissions per m2 for pumps and fans			0.2033 (272c)
Target Carbon Dioxide Emission Rate (TER) = (15.6957 * 1.00) + 1.5485 + 0.2033, rounded to 2 d.p.			17.4500 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (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	126.0000 (1b)	x 2.8700 (2b)	= 361.6200 (1b) - (3b)
First floor	65.5000 (1c)	x 3.1400 (2c)	= 205.6700 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	191.5000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	567.2900 (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) = 0.0705 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3205 (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) =	0.3205 (21)

Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4087	0.4006	0.3926	0.3526	0.3445	0.3045	0.3045	0.2965	0.3205	0.3445	0.3606	0.3766 (22b)
Effective ac	0.5835	0.5803	0.5771	0.5621	0.5594	0.5464	0.5464	0.5439	0.5514	0.5594	0.5650	0.5709 (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
Windows (Uw = 1.40)			63.2000	1.3258	83.7879		(27)
Entrance Door			3.7800	1.4000	5.2920		(26a)
Oriel Window (Uw = 1.70)			3.2600	1.5918	5.1891		(27)
Rooflight (Uw = 1.40)			0.5100	1.3258	0.6761		(27a)
Ground Floor			126.0000	0.1100	13.8600		(28a)
EW1 - Facing Brick	173.8600	41.1300	132.7300	0.2100	27.8733		(29a)
EW2 - Facing block	53.2600	13.8900	39.3700	0.2000	7.8740		(29a)
EW3 - Timber frame	22.4700	15.2200	7.2500	0.2200	1.5950		(29a)
R1 - Pitched - Top Floor	90.7500	0.5100	90.2400	0.1600	14.4384		(30)
R2 - Pitched - Ground Floor	46.8500		46.8500	0.1900	8.9015		(30)
R3 - Flat Roof	5.1700		5.1700	0.1800	0.9306		(30)
Total net area of external elements Aum(A, m ²)			518.3600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	170.4180		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							100.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							18.0559 (36)
Total fabric heat loss						(33) + (36) =	188.4739 (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
	109.2341	108.6271	108.0322	105.2377	104.7148	102.2809	102.2809	101.8302	103.2184	104.7148	105.7725	106.8783 (38)
Heat transfer coeff	297.7080	297.1010	296.5061	293.7115	293.1887	290.7548	290.7548	290.3040	291.6923	293.1887	294.2464	295.3522 (39)
Average = Sum(39)m / 12 =												293.7090 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	1.5546	1.5514	1.5483	1.5337	1.5310	1.5183	1.5183	1.5159	1.5232	1.5310	1.5365	1.5423 (40)
HLP (average)												1.5337 (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												2.9909 (42)
Average daily hot water use (litres/day)												105.2327 (43)

Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	115.7560	111.5467	107.3374	103.1281	98.9187	94.7094	94.7094	98.9187	103.1281	107.3374	111.5467	115.7560 (44)
Energy conte	171.6628	150.1374	154.9283	135.0702	129.6031	111.8376	103.6340	118.9215	120.3418	140.2468	153.0904	166.2462 (45)
Energy content (annual)										Total = Sum(45)m =		1655.7203 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	36.4783	31.9042	32.9223	28.7024	27.5407	23.7655	22.0222	25.2708	25.5726	29.8024	32.5317	35.3273 (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	149.5425	149.5425	149.5425	149.5425	149.5425	149.5425	149.5425	149.5425	149.5425	149.5425	149.5425	149.5425	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	32.3522	28.7350	23.3689	17.6917	13.2248	11.1649	12.0641	15.6813	21.0475	26.7246	31.1915	33.2514	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	362.8937	366.6594	357.1700	336.9681	311.4668	287.4992	271.4874	267.7217	277.2111	297.4130	322.9143	346.8819	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.9543	37.9543	37.9543	37.9543	37.9543	37.9543	37.9543	37.9543	37.9543	37.9543	37.9543	37.9543	(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)	-119.6340	-119.6340	-119.6340	-119.6340	-119.6340	-119.6340	-119.6340	-119.6340	-119.6340	-119.6340	-119.6340	-119.6340	(71)
Water heating gains (Table 5)	49.0300	47.4765	44.2504	39.8645	37.0170	33.0076	29.5998	33.9662	35.5176	40.0571	45.1829	47.4830	(72)
Total internal gains	512.1388	510.7337	492.6520	462.3871	429.5714	399.5345	381.0140	385.2319	401.6389	432.0574	467.1515	495.4790	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
North				10.4400	10.6334	0.6300	0.7000	0.7700	33.9269 (74)			
East				26.9600	19.6403	0.6300	0.7000	0.7700	161.8225 (76)			
South				20.5600	46.7521	0.6300	0.7000	0.7700	293.7621 (78)			
West				5.2400	19.6403	0.6300	0.7000	0.7700	31.4522 (80)			
North				3.2600	10.6334	0.6300	0.7000	0.7700	10.5940 (74)			
North				0.5100	16.1759	0.6300	0.7000	1.0000	3.2743 (82)			
Solar gains	534.8320	950.4758	1391.3490	1853.4773	2177.7900	2202.3913	2106.8729	1861.6645	1552.4090	1076.3251	648.1293	452.6533 (83)
Total gains	1046.9708	1461.2094	1884.0010	2315.8644	2607.3614	2601.9258	2487.8869	2246.8964	1954.0479	1508.3825	1115.2809	948.1324 (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	17.8680	17.9045	17.9404	18.1111	18.1434	18.2953	18.2953	18.3237	18.2365	18.1434	18.0782	18.0105	
alpha	2.1912	2.1936	2.1960	2.2074	2.2096	2.2197	2.2197	2.2216	2.2158	2.2096	2.2052	2.2007	
util living area	0.9738	0.9473	0.9012	0.8188	0.7037	0.5686	0.4495	0.5010	0.6992	0.8809	0.9579	0.9787	(86)
MIT	17.7662	18.2161	18.8673	19.6349	20.2650	20.6844	20.8669	20.8263	20.4659	19.5821	18.5139	17.6869	(87)
Th 2	19.6468	19.6491	19.6514	19.6623	19.6643	19.6738	19.6738	19.6756	19.6701	19.6643	19.6602	19.6559	(88)
util rest of house	0.9692	0.9382	0.8840	0.7869	0.6497	0.4839	0.3346	0.3847	0.6235	0.8523	0.9492	0.9749	(89)
MIT 2	16.7387	17.1831	17.8201	18.5600	19.1360	19.4951	19.6231	19.6038	19.3344	18.5336	17.4905	16.6659	(90)
Living area fraction	16.9909	17.4366	18.0771	18.8238	19.4131	19.7870	19.9284	19.9039	19.6121	18.7910	17.7417	16.9165	(92)
MIT	16.9909	17.4366	18.0771	18.8238	19.4131	19.7870	19.9284	19.9039	19.6121	18.7910	17.7417	16.9165	(93)
Temperature adjustment												0.0000	
adjusted MIT	16.9909	17.4366	18.0771	18.8238	19.4131	19.7870	19.9284	19.9039	19.6121	18.7910	17.7417	16.9165	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	1000.7286	1341.1453	1617.1480	1766.9949	1664.0516	1279.7323	891.3771	913.3924	1210.9004	1249.4139	1038.7830	913.4441	(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	3778.1750	3724.6320	3432.6783	2914.7296	2261.3931	1508.1309	967.7367	1017.1902	1607.8387	2401.4963	3131.2698	3755.8421	(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	2066.4201	1601.7031	1350.7545	826.3690	444.4221	0.0000	0.0000	0.0000	0.0000	857.1493	1506.5905	2114.7442	(98)
Space heating												10768.1528	(98)
Space heating per m2												(98) / (4) =	56.2306 (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	

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Calculation Type: New Build (As Designed)

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Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	2733.0947	2151.5852	2206.3106	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7392	0.7977	0.7627	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	2020.3782	1716.3817	1682.7254	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	3174.3242	3038.0801	2760.6239	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	830.8411	983.3436	801.9565	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												2616.1412	(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	207.7103	245.8359	200.4891	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												654.0353	(107)
Space cooling per m2												3.4153	(108)
Energy for space heating												56.2306	(99)
Energy for space cooling												3.4153	(108)
Total												59.6459	(109)
Dwelling Fabric Energy Efficiency (DFEE)												59.6	(109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (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	126.0000 (1b)	x 2.8700 (2b)	= 361.6200 (1b) - (3b)
First floor	65.5000 (1c)	x 3.1400 (2c)	= 205.6700 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	191.5000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 567.2900 (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) = 0.0705 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3205 (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) =	0.3205 (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	0.4087	0.4006	0.3926	0.3526	0.3445	0.3045	0.3045	0.2965	0.3205	0.3445	0.3606	0.3766 (22b)
Effective ac	0.5835	0.5803	0.5771	0.5621	0.5594	0.5464	0.5464	0.5439	0.5514	0.5594	0.5650	0.5709 (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 Semi-glazed door			3.7800	1.2000	4.5360		(26a)
TER Opening Type (Uw = 1.40)			43.7800	1.3258	58.0417		(27)
TER Room Window (Uw = 1.70)			0.3400	1.5918	0.5412		(27a)
Ground Floor			126.0000	0.1300	16.3800		(28a)
EW1 - Facing Brick	173.8600	28.3800	145.4800	0.1800	26.1864		(29a)
EW2 - Facing block	53.2600	9.1500	44.1100	0.1800	7.9398		(29a)
EW3 - Timber frame	22.4700	10.0300	12.4400	0.1800	2.2392		(29a)
R1 - Pitched - Top Floor	90.7500	0.3400	90.4100	0.1300	11.7533		(30)
R2 - Pitched - Ground Floor	46.8500		46.8500	0.1300	6.0905		(30)
R3 - Flat Roof	5.1700		5.1700	0.1300	0.6721		(30)
Total net area of external elements Aum(A, m ²)			518.3600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	134.3802		(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)							25.8653 (36)
Total fabric heat loss						(33) + (36) =	160.2455 (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	109.2341	108.6271	108.0322	105.2377	104.7148	102.2809	102.2809	101.8302	103.2184	104.7148	105.7725	106.8783 (38)
Heat transfer coeff	269.4796	268.8726	268.2776	265.4831	264.9603	262.5263	262.5263	262.0756	263.4639	264.9603	266.0180	267.1238 (39)
Average = Sum(39)m / 12 =												265.4806 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.4072	1.4040	1.4009	1.3863	1.3836	1.3709	1.3709	1.3685	1.3758	1.3836	1.3891	1.3949 (40)
HLP (average)												1.3863 (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												2.9909 (42)
Average daily hot water use (litres/day)												105.2327 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	115.7560	111.5467	107.3374	103.1281	98.9187	94.7094	94.7094	98.9187	103.1281	107.3374	111.5467	115.7560 (44)
Energy conte	171.6628	150.1374	154.9283	135.0702	129.6031	111.8376	103.6340	118.9215	120.3418	140.2468	153.0904	166.2462 (45)
Energy content (annual)												Total = Sum(45)m = 1655.7203 (45)
Distribution loss (46)m = 0.15 x (45)m												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Water storage loss:	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	36.4783	31.9042	32.9223	28.7024	27.5407	23.7655	22.0222	25.2708	25.5726	29.8024	32.5317	35.3273 (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	149.5425	149.5425	149.5425	149.5425	149.5425	149.5425	149.5425	149.5425	149.5425	149.5425	149.5425	149.5425	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	32.3522	28.7350	23.3689	17.6917	13.2248	11.1649	12.0641	15.6813	21.0475	26.7246	31.1915	33.2514	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	362.8937	366.6594	357.1700	336.9681	311.4668	287.4992	271.4874	267.7217	277.2111	297.4130	322.9143	346.8819	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.9543	37.9543	37.9543	37.9543	37.9543	37.9543	37.9543	37.9543	37.9543	37.9543	37.9543	37.9543	(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)	-119.6340	-119.6340	-119.6340	-119.6340	-119.6340	-119.6340	-119.6340	-119.6340	-119.6340	-119.6340	-119.6340	-119.6340	(71)
Water heating gains (Table 5)	49.0300	47.4765	44.2504	39.8645	37.0170	33.0076	29.5998	33.9662	35.5176	40.0571	45.1829	47.4830	(72)
Total internal gains	512.1388	510.7337	492.6520	462.3871	429.5714	399.5345	381.0140	385.2319	401.6389	432.0574	467.1515	495.4790	(73)

6. Solar gains

[Jan]	Area m2				Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W	
North	9.0300				10.6334		0.6300		0.7000		0.7700		29.3448 (74)	
East	17.7600				19.6403		0.6300		0.7000		0.7700		106.6012 (76)	
South	13.5400				46.7521		0.6300		0.7000		0.7700		193.4600 (78)	
West	3.4500				19.6403		0.6300		0.7000		0.7700		20.7080 (80)	
North	0.3400				16.1759		0.6300		0.7000		1.0000		2.1829 (82)	
Solar gains	352.2969	626.0950	916.5444	1221.0466	1434.7784	1451.0230	1388.0764	1226.4693	1022.6663	709.0036	426.9283	298.1643	(83)	
Total gains	864.4357	1136.8287	1409.1964	1683.4337	1864.3497	1850.5575	1769.0904	1611.7013	1424.3052	1141.0610	894.0799	793.6434	(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	49.3492	49.4606	49.5703	50.0921	50.1910	50.6563	50.6563	50.7434	50.4760	50.1910	49.9914	49.7845	
alpha	4.2899	4.2974	4.3047	4.3395	4.3461	4.3771	4.3771	4.3829	4.3651	4.3461	4.3328	4.3190	
util living area	0.9993	0.9976	0.9919	0.9702	0.9065	0.7727	0.6139	0.6812	0.8978	0.9872	0.9984	0.9995	(86)
MIT	19.2964	19.5025	19.8312	20.2576	20.6359	20.8820	20.9675	20.9492	20.7460	20.2336	19.6818	19.2655	(87)
Th 2	19.7578	19.7602	19.7626	19.7738	19.7759	19.7857	19.7857	19.7875	19.7819	19.7759	19.7717	19.7672	(88)
util rest of house	0.9991	0.9968	0.9887	0.9575	0.8643	0.6729	0.4632	0.5319	0.8333	0.9798	0.9977	0.9994	(89)
MIT 2	18.2109	18.4186	18.7474	19.1744	19.5274	19.7309	19.7777	19.7732	19.6358	19.1582	18.6067	18.1873	(90)
Living area fraction									fLA = Living area / (4) =			0.2454	(91)
MIT	18.4773	18.6846	19.0134	19.4402	19.7994	20.0135	20.0697	20.0618	19.9083	19.4221	18.8706	18.4520	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.4773	18.6846	19.0134	19.4402	19.7994	20.0135	20.0697	20.0618	19.9083	19.4221	18.8706	18.4520	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	863.2960	1131.9103	1389.5118	1604.2502	1613.2362	1284.2256	886.0158	917.0384	1198.6649	1114.6135	891.2780	792.9237	(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	3820.5047	3706.3006	3357.0561	2798.2470	2146.0284	1421.1756	910.8981	959.6721	1530.2802	2337.5143	3131.1807	3807.0363	(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	2200.1633	1729.9903	1463.8529	859.6777	396.3974	0.0000	0.0000	0.0000	0.0000	909.8382	1612.7299	2242.4998	(98)
Space heating												11415.1494	(98)
Space heating per m2												(98) / (4) =	59.6091 (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	2467.7477	1942.6950	1991.7747	0.0000	0.0000	0.0000	0.0000	(100)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7839	0.8608	0.8198	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1934.4973	1672.2898	1632.8661	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	2297.9934	2199.6672	2019.4729	0.0000	0.0000	0.0000	0.0000 (103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling kWh												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	261.7172	392.3688	287.6355	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												941.7215 (104)
Cooled fraction									FC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)												
Intermittency factor	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	65.4293	98.0922	71.9089	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												235.4304 (107)
Space cooling per m2												1.2294 (108)
Energy for space heating												59.6091 (99)
Energy for space cooling												1.2294 (108)
Total												60.8385 (109)
Target Fabric Energy Efficiency (TFEE)												70.0 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (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	126.0000 (1b)	x 2.8700 (2b)	= 361.6200 (1b) - (3b)
First floor	65.5000 (1c)	x 3.1400 (2c)	= 205.6700 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	191.5000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 567.2900 (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) = 0.0881 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3381 (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) =	0.3381 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.4000	4.2000	4.2000	3.9000	3.9000	3.4000	3.5000	3.3000	3.5000	3.9000	3.7000	4.1000 (22)
Wind factor	1.1000	1.0500	1.0500	0.9750	0.9750	0.8500	0.8750	0.8250	0.8750	0.9750	0.9250	1.0250 (22a)
Adj infilt rate	0.3720	0.3550	0.3550	0.3297	0.3297	0.2874	0.2959	0.2790	0.2959	0.3297	0.3128	0.3466 (22b)
Effective ac	0.5692	0.5630	0.5630	0.5543	0.5543	0.5413	0.5438	0.5389	0.5438	0.5543	0.5489	0.5601 (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
Windows (Uw = 1.40)			63.2000	1.3258	83.7879		(27)
Entrance Door			3.7800	1.4000	5.2920		(26a)
Oriel Window (Uw = 1.70)			3.2600	1.5918	5.1891		(27)
Rooflight (Uw = 1.40)			0.5100	1.3258	0.6761		(27a)
Ground Floor			126.0000	0.1100	13.8600		(28a)
EW1 - Facing Brick	173.8600	41.1300	132.7300	0.2100	27.8733		(29a)
EW2 - Facing block	53.2600	13.8900	39.3700	0.2000	7.8740		(29a)
EW3 - Timber frame	22.4700	15.2200	7.2500	0.2200	1.5950		(29a)
R1 - Pitched - Top Floor	90.7500	0.5100	90.2400	0.1600	14.4384		(30)
R2 - Pitched - Ground Floor	46.8500		46.8500	0.1900	8.9015		(30)
R3 - Flat Roof	5.1700		5.1700	0.1800	0.9306		(30)
Total net area of external elements Aum(A, m ²)			518.3600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	170.4180		(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 100.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 18.0559 (36)
Total fabric heat loss (33) + (36) = 188.4739 (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	106.5527	105.4022	105.4022	103.7767	103.7767	101.3353	101.7968	100.8871	101.7968	103.7767	102.7600	104.8470 (38)
Average = Sum(39)m / 12 =	295.0265	293.8760	293.8760	292.2506	292.2506	289.8091	290.2707	289.3610	290.2707	292.2506	291.2339	293.3208 (39)
												291.9831 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.5406	1.5346	1.5346	1.5261	1.5261	1.5134	1.5158	1.5110	1.5158	1.5261	1.5208	1.5317 (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												2.9909 (42)
Average daily hot water use (litres/day)												105.2327 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	115.7560	111.5467	107.3374	103.1281	98.9187	94.7094	94.7094	98.9187	103.1281	107.3374	111.5467	115.7560 (44)
Energy content (annual)	171.6628	150.1374	154.9283	135.0702	129.6031	111.8376	103.6340	118.9215	120.3418	140.2468	153.0904	166.2462 (45)
										Total = Sum(45)m =		1655.7203 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	25.7494	22.5206	23.2392	20.2605	19.4405	16.7756	15.5451	17.8382	18.0513	21.0370	22.9636	24.9369 (46)
Water storage loss:												
Store volume												250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.7800 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.9612 (55)
Total storage loss												
29.7972 26.9136 29.7972 28.8360 29.7972 28.8360 29.7972 29.7972 28.8360 29.7972 28.8360 29.7972 (56)												
If cylinder contains dedicated solar storage												
29.7972 26.9136 29.7972 28.8360 29.7972 28.8360 29.7972 29.7972 28.8360 29.7972 28.8360 29.7972 (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												
224.7224 198.0622 207.9879 186.4182 182.6627 163.1856 156.6936 171.9811 171.6898 193.3064 204.4384 219.3058 (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	224.7224	198.0622	207.9879	186.4182	182.6627	163.1856	156.6936	171.9811	171.6898	193.3064	204.4384	219.3058 (64)
Total per year (kWh/year) = Sum(64)m =												2280.4543 (64)
RHI water heating demand												2280 (64)
Heat gains from water heating, kWh/month	99.5256	86.2605	93.9613	85.9893	85.5407	78.2644	76.9060	81.9891	81.0921	89.0797	91.9809	97.7246 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	179.4511	179.4511	179.4511	179.4511	179.4511	179.4511	179.4511	179.4511	179.4511	179.4511	179.4511	179.4511 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	80.8806	71.8374	58.4221	44.2293	33.0619	27.9123	30.1602	39.2034	52.6187	66.8115	77.9789	83.1285 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	541.6325	547.2529	533.0895	502.9375	464.8758	429.1033	405.2050	399.5846	413.7479	443.9000	481.9616	517.7342 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.9360	55.9360	55.9360	55.9360	55.9360	55.9360	55.9360	55.9360	55.9360	55.9360	55.9360	55.9360 (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)	-119.6340	-119.6340	-119.6340	-119.6340	-119.6340	-119.6340	-119.6340	-119.6340	-119.6340	-119.6340	-119.6340	-119.6340 (71)
Water heating gains (Table 5)	133.7709	131.3400	126.2921	119.4295	114.9741	108.7006	103.3683	110.2004	112.6279	119.7308	127.7513	131.3502 (72)
Total internal gains	875.0369	869.1834	836.5568	785.3493	731.6648	684.4691	657.4865	667.7413	697.7474	749.1953	806.4448	850.9659 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W
North					10.4400	12.7650		0.6300	0.7000	0.7700		40.7281 (74)
East					26.9600	23.8018		0.6300	0.7000	0.7700		196.1105 (76)
South					20.5600	54.2217		0.6300	0.7000	0.7700		340.6969 (78)
West					5.2400	23.8018		0.6300	0.7000	0.7700		38.1164 (80)
North					3.2600	12.7650		0.6300	0.7000	0.7700		12.7178 (74)
North					0.5100	19.2832		0.6300	0.7000	1.0000		3.9033 (82)

Solar gains	632.2730	983.0869	1432.8372	1946.2518	2235.6176	2394.9049	2267.0840	2036.7185	1707.0456	1195.9584	755.0200	538.0906 (83)
Total gains	1507.3100	1852.2702	2269.3940	2731.6010	2967.2824	3079.3741	2924.5704	2704.4598	2404.7930	1945.1537	1561.4648	1389.0565 (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	18.0304	18.1010	18.1010	18.2017	18.2017	18.3550	18.3258	18.3834	18.3258	18.2017	18.2652	18.1352
alpha	2.2020	2.2067	2.2067	2.2134	2.2134	2.2237	2.2217	2.2256	2.2217	2.2134	2.2177	2.2090
util living area	0.9441	0.9147	0.8552	0.7513	0.6215	0.4457	0.3250	0.3639	0.5913	0.8057	0.9148	0.9518 (86)
MIT	18.8284	19.0945	19.5733	20.1054	20.5013	20.7602	20.8392	20.8262	20.6273	20.0947	19.3817	18.7778 (87)
Th 2	19.6572	19.6616	19.6616	19.6680	19.6680	19.6775	19.6757	19.6792	19.6757	19.6680	19.6719	19.6638 (88)
util rest of house	0.9346	0.9007	0.8314	0.7107	0.5582	0.3543	0.2103	0.2454	0.5048	0.7633	0.8980	0.9434 (89)
MIT 2	16.8260	17.2069	17.8817	18.6116	19.1209	19.4194	19.4849	19.4812	19.2906	18.6217	17.6318	16.7577 (90)
Living area fraction									fLA = Living area / (4) =			0.2454 (91)
MIT	17.3175	17.6702	18.2968	18.9782	19.4597	19.7485	19.8172	19.8113	19.6186	18.9832	18.0613	17.2535 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.1675	17.5202	18.1468	18.8282	19.3097	19.5985	19.6672	19.6613	19.4686	18.8332	17.9113	17.1035 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9097	0.8707	0.7975	0.6806	0.5391	0.3484	0.2095	0.2437	0.4895	0.7303	0.8678	0.9206 (94)
Useful gains	1371.2604	1612.8279	1809.7567	1859.1852	1599.6009	1072.8652	612.7220	659.0886	1177.0462	1420.4932	1355.0211	1278.7429 (95)
Ext temp.	4.9000	5.4000	7.2000	9.7000	12.6000	15.6000	17.5000	17.3000	14.7000	11.3000	7.8000	4.9000 (96)
Heat loss rate W	3619.2246	3561.8264	3217.0164	2667.7334	1960.9175	1158.7933	629.0880	683.2735	1384.1939	2201.5822	2944.7417	3579.5361 (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												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF HEAT DEMAND 09 Jan 2014

	1672.4853	1309.7270	1047.0012	582.1547	268.8195	0.0000	0.0000	0.0000	0.0000	581.1302	1144.5989	1711.7901 (98)
Space heating												8317.7069 (98)
RHI space heating demand												8318 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (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	126.0000 (1b)	x 2.8700 (2b)	= 361.6200 (1b) - (3b)
First floor	65.5000 (1c)	x 3.1400 (2c)	= 205.6700 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	191.5000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 567.2900 (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) = 0.0881 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3381 (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) =	0.3381 (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	0.4311	0.4227	0.4142	0.3720	0.3635	0.3212	0.3212	0.3128	0.3381	0.3635	0.3804	0.3973 (22b)
Effective ac	0.5929	0.5893	0.5858	0.5692	0.5661	0.5516	0.5516	0.5489	0.5572	0.5661	0.5724	0.5789 (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
Windows (Uw = 1.40)			63.2000	1.3258	83.7879		(27)
Entrance Door			3.7800	1.4000	5.2920		(26a)
Oriel Window (Uw = 1.70)			3.2600	1.5918	5.1891		(27)
Rooflight (Uw = 1.40)			0.5100	1.3258	0.6761		(27a)
Ground Floor			126.0000	0.1100	13.8600		(28a)
EW1 - Facing Brick	173.8600	41.1300	132.7300	0.2100	27.8733		(29a)
EW2 - Facing block	53.2600	13.8900	39.3700	0.2000	7.8740		(29a)
EW3 - Timber frame	22.4700	15.2200	7.2500	0.2200	1.5950		(29a)
R1 - Pitched - Top Floor	90.7500	0.5100	90.2400	0.1600	14.4384		(30)
R2 - Pitched - Ground Floor	46.8500		46.8500	0.1900	8.9015		(30)
R3 - Flat Roof	5.1700		5.1700	0.1800	0.9306		(30)
Total net area of external elements Aum(A, m ²)			518.3600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	170.4180		(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 100.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 18.0559 (36)
Total fabric heat loss (33) + (36) = 188.4739 (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	111.0008	110.3252	109.6630	106.5527	105.9707	103.2617	103.2617	102.7600	104.3052	105.9707	107.1480	108.3787 (38)
Heat transfer coeff	299.4747	298.7991	298.1369	295.0265	294.4446	291.7356	291.7356	291.2339	292.7790	294.4446	295.6218	296.8526 (39)
Average = Sum(39)m / 12 =												295.0237 (39)
HLP	1.5638	1.5603	1.5569	1.5406	1.5376	1.5234	1.5234	1.5208	1.5289	1.5376	1.5437	1.5501 (40)
HLP (average)												1.5406 (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												2.9909 (42)
Average daily hot water use (litres/day)												105.2327 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	115.7560	111.5467	107.3374	103.1281	98.9187	94.7094	94.7094	98.9187	103.1281	107.3374	111.5467	115.7560 (44)
Energy content (annual)	171.6628	150.1374	154.9283	135.0702	129.6031	111.8376	103.6340	118.9215	120.3418	140.2468	153.0904	166.2462 (45)
										Total = Sum(45)m =		1655.7203 (45)

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Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	25.7494	22.5206	23.2392	20.2605	19.4405	16.7756	15.5451	17.8382	18.0513	21.0370	22.9636	24.9369 (46)
Water storage loss:												
Store volume												250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.7800 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.9612 (55)
Total storage loss												
29.7972 26.9136 29.7972 28.8360 29.7972 28.8360 29.7972 29.7972 28.8360 29.7972 28.8360 29.7972 (56)												
If cylinder contains dedicated solar storage												
29.7972 26.9136 29.7972 28.8360 29.7972 28.8360 29.7972 29.7972 28.8360 29.7972 28.8360 29.7972 (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												
224.7224 198.0622 207.9879 186.4182 182.6627 163.1856 156.6936 171.9811 171.6898 193.3064 204.4384 219.3058 (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												
224.7224 198.0622 207.9879 186.4182 182.6627 163.1856 156.6936 171.9811 171.6898 193.3064 204.4384 219.3058 (64)												
Total per year (kWh/year) = Sum(64)m =												2280.4543 (64)
Heat gains from water heating, kWh/month												
99.5256 88.2605 93.9613 85.9893 85.5407 78.2644 76.9060 81.9891 81.0921 89.0797 91.9809 97.7246 (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	179.4511	179.4511	179.4511	179.4511	179.4511	179.4511	179.4511	179.4511	179.4511	179.4511	179.4511	179.4511	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	80.8806	71.8374	58.4221	44.2293	33.0619	27.9123	30.1602	39.2034	52.6187	66.8115	77.9789	83.1285	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	541.6325	547.2529	533.0895	502.9375	464.8758	429.1033	405.2050	399.5846	413.7479	443.9000	481.9616	517.7342	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	55.9360	55.9360	55.9360	55.9360	55.9360	55.9360	55.9360	55.9360	55.9360	55.9360	55.9360	55.9360	(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)													
	-119.6340	-119.6340	-119.6340	-119.6340	-119.6340	-119.6340	-119.6340	-119.6340	-119.6340	-119.6340	-119.6340	-119.6340	(71)
Water heating gains (Table 5)													
	133.7709	131.3400	126.2921	119.4295	114.9741	108.7006	103.3683	110.2004	112.6279	119.7308	127.7513	131.3502	(72)
Total internal gains													
	875.0369	869.1834	836.5568	785.3493	731.6648	684.4691	657.4865	667.7413	697.7474	749.1953	806.4448	850.9659	(73)

6. Solar gains

[Jan]				Area m2		Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c		Access factor Table 6d		Gains W
North				10.4400		10.6334	0.6300	0.7000		0.7700		33.9269 (74)
East				26.9600		19.6403	0.6300	0.7000		0.7700		161.8225 (76)
South				20.5600		46.7521	0.6300	0.7000		0.7700		293.7621 (78)
West				5.2400		19.6403	0.6300	0.7000		0.7700		31.4522 (80)
North				3.2600		10.6334	0.6300	0.7000		0.7700		10.5940 (74)
North				0.5100		16.1759	0.6300	0.7000		1.0000		3.2743 (82)
Solar gains	534.8320	950.4758	1391.3490	1853.4773	2177.7900	2202.3913	2106.8729	1861.6645	1552.4090	1076.3251	648.1293	452.6533 (83)
Total gains	1409.8689	1819.6591	2227.9058	2638.8266	2909.4548	2886.8604	2764.3594	2529.4058	2250.1565	1825.5204	1454.5741	1303.6192 (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	17.7626	17.8027	17.8423	18.0304	18.0660	18.2338	18.2338	18.2652	18.1688	18.0660	17.9941	17.9195
alpha	2.1842	2.1868	2.1895	2.2020	2.2044	2.2156	2.2156	2.2177	2.2113	2.2044	2.1996	2.1946
util living area	0.9540	0.9223	0.8709	0.7838	0.6668	0.5313	0.4147	0.4597	0.6507	0.8405	0.9317	0.9606 (86)
MIT	18.6404	18.9590	19.4169	19.9534	20.3865	20.6731	20.7944	20.7700	20.5355	19.9364	19.1831	18.5833 (87)
Th 2	19.6400	19.6426	19.6451	19.6572	19.6594	19.6700	19.6700	19.6719	19.6659	19.6594	19.6549	19.6501 (88)
util rest of house	0.9462	0.9097	0.8499	0.7484	0.6110	0.4481	0.3055	0.3486	0.5725	0.8055	0.9185	0.9539 (89)
MIT 2	16.5459	17.0021	17.6513	18.3998	18.9718	19.3256	19.4473	19.4312	19.1807	18.4026	17.3389	16.4692 (90)
Living area fraction	17.0599	17.4824	18.0846	18.7811	19.3190	19.6563	19.7779	19.7598	19.5132	fLA = Living area / (4) =		0.2454 (91)
MIT	17.0599	17.4824	18.0846	18.7811	19.3190	19.6563	19.7779	19.7598	19.5132	18.7791	17.7915	16.9881 (92)
Temperature adjustment												-0.1500
adjusted MIT	16.9099	17.3324	17.9346	18.6311	19.1690	19.5063	19.6279	19.6098	19.3632	18.6291	17.6415	16.8381 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9238	0.8806	0.8161	0.7162	0.5877	0.4368	0.3017	0.3429	0.5520	0.7713	0.8907	0.9336 (94)
Useful gains	1302.4984	1602.3727	1818.2798	1889.8168	1709.9867	1260.9920	834.1075	867.2467	1242.0731	1407.9375	1295.5400	1217.0538 (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	3776.3596	3714.7984	3409.0901	2870.9260	2199.2210	1431.3489	883.3603	934.8048	1540.9435	2364.1111	3116.3093	3751.6492 (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	1840.5527	1419.5501	1183.5629	706.3986	363.9903	0.0000	0.0000	0.0000	0.0000	711.3931	1310.9539	1885.7389 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Space heating
Space heating per m2 (98) / (4) = 9422.1406 (98)
49.2018 (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)												0.1000	(201)
Fraction of space heat from main system(s)												0.9000	(202)
Efficiency of main space heating system 1 (in %)												90.5000	(206)
Efficiency of secondary/supplementary heating system, %												65.0000	(208)
Space heating requirement												9370.0845	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1840.5527	1419.5501	1183.5629	706.3986	363.9903	0.0000	0.0000	0.0000	0.0000	711.3931	1310.9539	1885.7389	(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)	1830.3839	1411.7073	1177.0239	702.4959	361.9793	0.0000	0.0000	0.0000	0.0000	707.4628	1303.7111	1875.3205	(211)
Water heating requirement	283.1620	218.3923	182.0866	108.6767	55.9985	0.0000	0.0000	0.0000	0.0000	109.4451	201.6852	290.1137	(215)
Water heating requirement	224.7224	198.0622	207.9879	186.4182	182.6627	163.1856	156.6936	171.9811	171.6898	193.3064	204.4384	219.3058	(64)
Efficiency of water heater (217)m	89.0733	88.9001	88.5602	87.8298	86.3549	79.8000	79.8000	79.8000	79.8000	87.7708	88.7427	89.1324	(216)
Fuel for water heating, kWh/month	252.2893	222.7919	234.8549	212.2495	211.5255	204.4933	196.3579	215.5152	215.1502	220.2401	230.3720	246.0451	(219)
Water heating fuel used												2661.8848	(219)
Annual totals kWh/year													
Space heating fuel - main system												9370.0845	(211)
Space heating fuel - secondary												1449.5601	(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)												571.3507	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.00 * 1080 * 1.00) =										-863.6197		-863.6197	(233)
Total delivered energy for all uses												13264.2605	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	9370.0845	3.4800	326.0789 (240)
Space heating - secondary	1449.5601	4.2300	61.3164 (242)
Water heating (other fuel)	2661.8848	3.4800	92.6336 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	571.3507	13.1900	75.3612 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-863.6197	13.1900	-113.9114 (252)
Total energy cost			571.3711 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.4200 (256) 1.0147 (257)
SAP value		85.8450
SAP rating (Section 12)		86 (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	9370.0845	0.2160	2023.9383 (261)
Space heating - secondary	1449.5601	0.0190	27.5416 (263)
Water heating (other fuel)	2661.8848	0.2160	574.9671 (264)
Space and water heating			2626.4470 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	571.3507	0.5190	296.5310 (268)
Energy saving/generation technologies			
PV Unit	-863.6197	0.5190	-448.2186 (269)
Total kg/year			2513.6844 (272)
CO2 emissions per m2			13.1300 (273)
EI value			85.7576
EI rating			86 (274)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

EI band B

Calculation of stars for heating and DHW	

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.25) / 0.9050 = 4.124$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.25) / 0.9050 = 0.2560$, stars = 4
Water heating energy efficiency	$3.48 / 0.8546 = 4.072$, stars = 4
Water heating environmental impact	$0.216 / 0.8546 = 0.2527$, stars = 4

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

SAP 2012 WORKSHEET FOR New Build (As Designed) (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	126.0000 (1b)	x 2.8700 (2b)	= 361.6200 (1b) - (3b)
First floor	65.5000 (1c)	x 3.1400 (2c)	= 205.6700 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	191.5000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 567.2900 (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) = 0.0881 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3381 (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) =	0.3381 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.4000	4.2000	4.2000	3.9000	3.9000	3.4000	3.5000	3.3000	3.5000	3.9000	3.7000	4.1000 (22)
Wind factor	1.1000	1.0500	1.0500	0.9750	0.9750	0.8500	0.8750	0.8250	0.8750	0.9750	0.9250	1.0250 (22a)
Adj infilt rate												
Effective ac	0.3720	0.3550	0.3550	0.3297	0.3297	0.2874	0.2959	0.2790	0.2959	0.3297	0.3128	0.3466 (22b)
	0.5692	0.5630	0.5630	0.5543	0.5543	0.5413	0.5438	0.5389	0.5438	0.5543	0.5489	0.5601 (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
Windows (Uw = 1.40)			63.2000	1.3258	83.7879		(27)
Entrance Door			3.7800	1.4000	5.2920		(26a)
Oriel Window (Uw = 1.70)			3.2600	1.5918	5.1891		(27)
Rooflight (Uw = 1.40)			0.5100	1.3258	0.6761		(27a)
Ground Floor			126.0000	0.1100	13.8600		(28a)
EW1 - Facing Brick	173.8600	41.1300	132.7300	0.2100	27.8733		(29a)
EW2 - Facing block	53.2600	13.8900	39.3700	0.2000	7.8740		(29a)
EW3 - Timber frame	22.4700	15.2200	7.2500	0.2200	1.5950		(29a)
R1 - Pitched - Top Floor	90.7500	0.5100	90.2400	0.1600	14.4384		(30)
R2 - Pitched - Ground Floor	46.8500		46.8500	0.1900	8.9015		(30)
R3 - Flat Roof	5.1700		5.1700	0.1800	0.9306		(30)
Total net area of external elements Aum(A, m ²)			518.3600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	170.4180		(33)

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

100.0000 (35)
18.0559 (36)
(33) + (36) = 188.4739 (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	106.5527	105.4022	105.4022	103.7767	103.7767	101.3353	101.7968	100.8871	101.7968	103.7767	102.7600	104.8470 (38)
Heat transfer coeff	295.0265	293.8760	293.8760	292.2506	292.2506	289.8091	290.2707	289.3610	290.2707	292.2506	291.2339	293.3208 (39)
Average = Sum(39)m / 12 =												291.9831 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.5406	1.5346	1.5346	1.5261	1.5261	1.5134	1.5158	1.5110	1.5158	1.5261	1.5208	1.5317 (40)
HLP (average)												1.5247 (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												2.9909 (42)
Average daily hot water use (litres/day)												105.2327 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	115.7560	111.5467	107.3374	103.1281	98.9187	94.7094	94.7094	98.9187	103.1281	107.3374	111.5467	115.7560 (44)
Energy conte	171.6628	150.1374	154.9283	135.0702	129.6031	111.8376	103.6340	118.9215	120.3418	140.2468	153.0904	166.2462 (45)
Energy content (annual)										Total = Sum(45)m =		1655.7203 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Distribution loss (46)m = 0.15 x (45)m	25.7494	22.5206	23.2392	20.2605	19.4405	16.7756	15.5451	17.8382	18.0513	21.0370	22.9636	24.9369 (46)
Water storage loss:												
Store volume												250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.7800 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.9612 (55)
Total storage loss												
29.7972 26.9136 29.7972 28.8360 29.7972 28.8360 29.7972 29.7972 28.8360 29.7972 28.8360 29.7972 (56)												
If cylinder contains dedicated solar storage												
29.7972 26.9136 29.7972 28.8360 29.7972 28.8360 29.7972 29.7972 28.8360 29.7972 28.8360 29.7972 (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												
224.7224 198.0622 207.9879 186.4182 182.6627 163.1856 156.6936 171.9811 171.6898 193.3064 204.4384 219.3058 (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	224.7224	198.0622	207.9879	186.4182	182.6627	163.1856	156.6936	171.9811	171.6898	193.3064	204.4384	219.3058 (64)
Total per year (kWh/year) = Sum(64)m =												2280.4543 (64)
Heat gains from water heating, kWh/month												
99.5256 88.2605 93.9613 85.9893 85.5407 78.2644 76.9060 81.9891 81.0921 89.0797 91.9809 97.7246 (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	179.4511	179.4511	179.4511	179.4511	179.4511	179.4511	179.4511	179.4511	179.4511	179.4511	179.4511	179.4511	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
80.8806 71.8374 58.4221 44.2293 33.0619 27.9123 30.1602 39.2034 52.6187 66.8115 77.9789 83.1285 (67)													
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
541.6325 547.2529 533.0895 502.9375 464.8758 429.1033 405.2050 399.5846 413.7479 443.9000 481.9616 517.7342 (68)													
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
55.9360 55.9360 55.9360 55.9360 55.9360 55.9360 55.9360 55.9360 55.9360 55.9360 55.9360 55.9360 (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)													
-119.6340 -119.6340 -119.6340 -119.6340 -119.6340 -119.6340 -119.6340 -119.6340 -119.6340 -119.6340 -119.6340 -119.6340 (71)													
Water heating gains (Table 5)													
133.7709 131.3400 126.2921 119.4295 114.9741 108.7006 103.3683 110.2004 112.6279 119.7308 127.7513 131.3502 (72)													
Total internal gains	875.0369	869.1834	836.5568	785.3493	731.6648	684.4691	657.4865	667.7413	697.7474	749.1953	806.4448	850.9659	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g	Specific data or Table 6b	FF	Specific data or Table 6c	Access factor Table 6d	Gains W	
North				10.4400	12.7650	0.6300		0.7000		0.7700	40.7281 (74)	
East				26.9600	23.8018	0.6300		0.7000		0.7700	196.1105 (76)	
South				20.5600	54.2217	0.6300		0.7000		0.7700	340.6969 (78)	
West				5.2400	23.8018	0.6300		0.7000		0.7700	38.1164 (80)	
North				3.2600	12.7650	0.6300		0.7000		0.7700	12.7178 (74)	
North				0.5100	19.2832	0.6300		0.7000		1.0000	3.9033 (82)	
Solar gains	632.2730	983.0869	1432.8372	1946.2518	2235.6176	2394.9049	2267.0840	2036.7185	1707.0456	1195.9584	755.0200	538.0906 (83)
Total gains	1507.3100	1852.2702	2269.3940	2731.6010	2967.2824	3079.3741	2924.5704	2704.4598	2404.7930	1945.1537	1561.4648	1389.0565 (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	18.0304	18.1010	18.1010	18.2017	18.2017	18.3550	18.3258	18.3834	18.3258	18.2017	18.2652	18.1352	
alpha	2.2020	2.2067	2.2067	2.2134	2.2134	2.2237	2.2217	2.2256	2.2217	2.2134	2.2177	2.2090	
util living area	0.9441	0.9147	0.8552	0.7513	0.6215	0.4457	0.3250	0.3639	0.5913	0.8057	0.9148	0.9518 (86)	
MIT	18.8284	19.0945	19.5733	20.1054	20.5013	20.7602	20.8392	20.8262	20.6273	20.0947	19.3817	18.7778 (87)	
Th 2	19.6572	19.6616	19.6616	19.6680	19.6680	19.6775	19.6757	19.6792	19.6757	19.6680	19.6719	19.6638 (88)	
util rest of house	0.9346	0.9007	0.8314	0.7107	0.5582	0.3543	0.2103	0.2454	0.5048	0.7633	0.8980	0.9434 (89)	
MIT 2	16.8260	17.2069	17.8817	18.6116	19.1209	19.4194	19.4849	19.4812	19.2906	18.6217	17.6318	16.7577 (90)	
Living area fraction	17.3175	17.6702	18.2968	18.9782	19.4597	19.7485	19.8172	19.8113	19.6186	18.9832	18.0613	17.2535 (92)	
MIT	17.3175	17.6702	18.2968	18.9782	19.4597	19.7485	19.8172	19.8113	19.6186	18.9832	18.0613	17.2535 (92)	
Temperature adjustment												-0.1500	
adjusted MIT	17.1675	17.5202	18.1468	18.8282	19.3097	19.5985	19.6672	19.6613	19.4686	18.8332	17.9113	17.1035 (93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
0.9097 0.8707 0.7975 0.6806 0.5391 0.3484 0.2095 0.2437 0.4895 0.7303 0.8678 0.9206 (94)													
Useful gains	1371.2604	1612.8279	1809.7567	1859.1852	1599.6009	1072.8652	612.7220	659.0886	1177.0462	1420.4932	1355.0211	1278.7429 (95)	
Ext temp.	4.9000	5.4000	7.2000	9.7000	12.6000	15.6000	17.5000	17.3000	14.7000	11.3000	7.8000	4.9000 (96)	
Heat loss rate W	3619.2246	3561.8264	3217.0164	2667.7334	1960.9175	1158.7933	629.0880	683.2735	1384.1939	2201.5822	2944.7417	3579.5361 (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	1672.4853	1309.7270	1047.0012	582.1547	268.8195	0.0000	0.0000	0.0000	0.0000	581.1302	1144.5989	1711.7901 (98)	

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Space heating 8317.7069 (98)
Space heating per m2 (98) / (4) = 43.4345 (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)													0.1000 (201)
Fraction of space heat from main system(s)													0.9000 (202)
Efficiency of main space heating system 1 (in %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													65.0000 (208)
Space heating requirement													8271.7528 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1672.4853	1309.7270	1047.0012	582.1547	268.8195	0.0000	0.0000	0.0000	0.0000	581.1302	1144.5989	1711.7901	(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)	1663.2451	1302.4910	1041.2166	578.9384	267.3343	0.0000	0.0000	0.0000	0.0000	577.9195	1138.2751	1702.3327	(211)
Water heating requirement	257.3054	201.4965	161.0771	89.5623	41.3568	0.0000	0.0000	0.0000	0.0000	89.4046	176.0921	263.3523	(215)
Water heating requirement	224.7224	198.0622	207.9879	186.4182	182.6627	163.1856	156.6936	171.9811	171.6898	193.3064	204.4384	219.3058	(64)
Efficiency of water heater	88.9507	88.7874	88.3578	87.4237	85.5644	79.8000	79.8000	79.8000	79.8000	87.3397	88.5342	79.8000	(216)
(217)m												89.0127	(217)
Fuel for water heating, kWh/month	252.6370	223.0746	235.3928	213.2352	213.4799	204.4933	196.3579	215.5152	215.1502	221.3271	230.9145	246.3758	(219)
Water heating fuel used												2667.9537	(219)
Annual totals kWh/year													
Space heating fuel - main system												8271.7528	(211)
Space heating fuel - secondary												1279.6472	(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)												571.3507	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.00 * 1169 * 1.00) =										-935.0412		-935.0412	(233)
Total delivered energy for all uses												11930.6631	(238)

10a. Fuel costs - using BEDF prices (493)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	8271.7528	3.6300	300.2646	(240)
Space heating - secondary	1279.6472	5.1600	66.0298	(242)
Water heating (other fuel)	2667.9537	3.6300	96.8467	(247)
Pumps and fans for heating	75.0000	19.4400	14.5800	(249)
Energy for lighting	571.3507	19.4400	111.0706	(250)
Additional standing charges			95.0000	(251)
Energy saving/generation technologies				
PV Unit	-935.0412	19.4400	-181.7720	(252)
Total energy cost			502.0197	(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	8271.7528	0.2160	1786.6986	(261)
Space heating - secondary	1279.6472	0.0190	24.3133	(263)
Water heating (other fuel)	2667.9537	0.2160	576.2780	(264)
Space and water heating			2387.2899	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	571.3507	0.5190	296.5310	(268)
Energy saving/generation technologies				
PV Unit	-935.0412	0.5190	-485.2864	(269)
Total kg/year			2237.4595	(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	8271.7528	1.2200	10091.5384	(261)
Space heating - secondary	1279.6472	1.0400	1330.8331	(263)
Water heating (other fuel)	2667.9537	1.2200	3254.9035	(264)
Space and water heating			14677.2749	(265)
Pumps and fans	75.0000	3.0700	230.2500	(267)
Energy for lighting	571.3507	3.0700	1754.0466	(268)

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Energy saving/generation technologies			
PV Unit	-935.0412	3.0700	-2870.5765 (269)
Primary energy kWh/year			13790.9951 (272)
Primary energy kWh/m ² /year			72.0156 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating:	B 86
Current environmental impact rating:	B 86

(For testing purposes):

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

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.0	-£ 39	-268 kg (12.0%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£39	1.40 kg/m ²	B 87
Total Savings	£39	1.40 kg/m ²	

Potential energy efficiency rating:	B 87
Potential environmental impact rating:	B 87

Fuel prices for cost data on this page from database revision number 493 TEST (31 Mar 2022)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Thames Valley):

	Current	Potential	Saving
Electricity	£126	£135	-£10
Mains gas	£492	£443	£49
Wood	£66	£66	-£0
Space heating	£476	£477	-£1
Water heating	£97	£56	£41
Lighting	£111	£111	£0
Generated (PV)	-£182	-£182	£0
Total cost of fuels	£502	£462	£39
Total cost of uses	£502	£462	£40
Delivered energy	62 kWh/m ²	55 kWh/m ²	7 kWh/m ²
Carbon dioxide emissions	2.2 tonnes	2.0 tonnes	0.3 tonnes
CO2 emissions per m ²	12 kg/m ²	10 kg/m ²	1 kg/m ²
Primary energy	72 kWh/m ²	64 kWh/m ²	8 kWh/m ²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (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	126.0000 (1b)	x 2.8700 (2b)	= 361.6200 (1b) - (3b)
First floor	65.5000 (1c)	x 3.1400 (2c)	= 205.6700 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	191.5000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 567.2900 (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) = 0.0881 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3381 (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) =	0.3381 (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	0.4311	0.4227	0.4142	0.3720	0.3635	0.3212	0.3212	0.3128	0.3381	0.3635	0.3804	0.3973 (22b)
Effective ac	0.5929	0.5893	0.5858	0.5692	0.5661	0.5516	0.5516	0.5489	0.5572	0.5661	0.5724	0.5789 (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
Windows (Uw = 1.40)			63.2000	1.3258	83.7879		(27)
Entrance Door			3.7800	1.4000	5.2920		(26a)
Oriel Window (Uw = 1.70)			3.2600	1.5918	5.1891		(27)
Rooflight (Uw = 1.40)			0.5100	1.3258	0.6761		(27a)
Ground Floor			126.0000	0.1100	13.8600		(28a)
EW1 - Facing Brick	173.8600	41.1300	132.7300	0.2100	27.8733		(29a)
EW2 - Facing block	53.2600	13.8900	39.3700	0.2000	7.8740		(29a)
EW3 - Timber frame	22.4700	15.2200	7.2500	0.2200	1.5950		(29a)
R1 - Pitched - Top Floor	90.7500	0.5100	90.2400	0.1600	14.4384		(30)
R2 - Pitched - Ground Floor	46.8500		46.8500	0.1900	8.9015		(30)
R3 - Flat Roof	5.1700		5.1700	0.1800	0.9306		(30)
Total net area of external elements Aum(A, m ²)			518.3600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	170.4180		(33)

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

100.0000 (35)
18.0559 (36)
(33) + (36) = 188.4739 (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	111.0008	110.3252	109.6630	106.5527	105.9707	103.2617	103.2617	102.7600	104.3052	105.9707	107.1480	108.3787 (38)
Heat transfer coeff	299.4747	298.7991	298.1369	295.0265	294.4446	291.7356	291.7356	291.2339	292.7790	294.4446	295.6218	296.8526 (39)
Average = Sum(39)m / 12 =												295.0237 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.5638	1.5603	1.5569	1.5406	1.5376	1.5234	1.5234	1.5208	1.5289	1.5376	1.5437	1.5501 (40)
HLP (average)												1.5406 (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												2.9909 (42)
Average daily hot water use (litres/day)												105.2327 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	115.7560	111.5467	107.3374	103.1281	98.9187	94.7094	94.7094	98.9187	103.1281	107.3374	111.5467	115.7560 (44)
Energy conte	171.6628	150.1374	154.9283	135.0702	129.6031	111.8376	103.6340	118.9215	120.3418	140.2468	153.0904	166.2462 (45)
Energy content (annual)										Total = Sum(45)m =		1655.7203 (45)

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Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	25.7494	22.5206	23.2392	20.2605	19.4405	16.7756	15.5451	17.8382	18.0513	21.0370	22.9636	24.9369 (46)
Water storage loss:												
Store volume												250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.7800 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.9612 (55)
Total storage loss												
29.7972 26.9136 29.7972 28.8360 29.7972 28.8360 29.7972 29.7972 28.8360 29.7972 28.8360 29.7972 (56)												
If cylinder contains dedicated solar storage												
20.8580 18.8395 20.8580 20.1852 20.8580 20.1852 20.8580 20.1852 20.8580 20.1852 20.8580 20.1852 (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												
215.7832 189.9881 197.6530 171.0138 160.9292 141.9281 134.7275 150.9455 157.6362 182.9715 195.7876 210.3667 (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												1.0954 (H8)
Utilisation factor												0.5987 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												127.5000 (H13)
Daily hot water demand												105.2327 (H14)
Volume ratio Veff/V												1.2116 (H15)
Solar storage volume factor												1.0000 (H16)
Solar input												-954.6756 (H17)
Solar input	-27.6837	-46.1961	-78.6773	-105.4431	-130.2660	-128.0722	-126.3797	-110.4186	-86.4799	-59.0556	-32.8368	-23.1665 (63)
Solar input (sum of months) = Sum (63)m =												-954.6756 (63)
Output from w/h												
188.0995 143.7920 118.9757 65.5708 30.6632 13.8559 8.3478 40.5269 71.1563 123.9159 162.9507 187.2001 (64)												
Total per year (kWh/year) = Sum (64)m =												1155.0548 (64)
Heat gains from water heating, kWh/month												
92.3742 81.8012 85.6934 73.6657 68.1539 61.2584 59.3331 65.1606 69.8491 80.8118 85.0603 90.5732 (65)												

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

Metabolic gains (Table 5), Watts												
(66)m	179.4511	179.4511	179.4511	179.4511	179.4511	179.4511	179.4511	179.4511	179.4511	179.4511	179.4511	179.4511 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
80.8806 71.8374 58.4221 44.2293 33.0619 27.9123 30.1602 39.2034 52.6187 66.8115 77.9789 83.1285 (67)												
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
541.6325 547.2529 533.0895 502.9375 464.8758 429.1033 405.2050 399.5846 413.7479 443.9000 481.9616 517.7342 (68)												
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
55.9360 55.9360 55.9360 55.9360 55.9360 55.9360 55.9360 55.9360 55.9360 55.9360 55.9360 55.9360 (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)												
-119.6340 -119.6340 -119.6340 -119.6340 -119.6340 -119.6340 -119.6340 -119.6340 -119.6340 -119.6340 -119.6340 -119.6340 (71)												
Water heating gains (Table 5)												
124.1589 121.7280 115.1793 102.3135 91.6047 85.0811 79.7488 87.5815 97.0127 108.6180 118.1393 121.7382 (72)												
Total internal gains												
865.4249 859.5714 825.4440 768.2333 708.2955 660.8496 633.8670 645.1224 682.1322 738.0825 796.8328 841.3539 (73)												

6. Solar gains

[Jan]													
				Area	Solar flux		g		FF		Access		Gains
				m2	Table 6a		Specific data		Specific data		factor		W
					W/m2		or Table 6b		or Table 6c		Table 6d		
North				10.4400	10.6334		0.6300		0.7000		0.7700		33.9269 (74)
East				26.9600	19.6403		0.6300		0.7000		0.7700		161.8225 (76)
South				20.5600	46.7521		0.6300		0.7000		0.7700		293.7621 (78)
West				5.2400	19.6403		0.6300		0.7000		0.7700		31.4522 (80)
North				3.2600	10.6334		0.6300		0.7000		0.7700		10.5940 (74)
North				0.5100	16.1759		0.6300		0.7000		1.0000		3.2743 (82)
Solar gains	534.8320	950.4758	1391.3490	1853.4773	2177.7900	2202.3913	2106.8729	1861.6645	1552.4090	1076.3251	648.1293	452.6533	(83)
Total gains	1400.2569	1810.0471	2216.7930	2621.7106	2886.0855	2863.2410	2740.7399	2506.7868	2234.5413	1814.4076	1444.9621	1294.0072	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	17.7626	17.8027	17.8423	18.0304	18.0660	18.2338	18.2338	18.2652	18.1688	18.0660	17.9941	17.9195
alpha	2.1842	2.1868	2.1895	2.2020	2.2044	2.2156	2.2156	2.2177	2.2113	2.2044	2.1996	2.1946
util living area												
0.9546 0.9230 0.8719 0.7856 0.6697 0.5343 0.4175 0.4629 0.6532 0.8419 0.9325 0.9611 (86)												
MIT	18.6353	18.9544	19.4123	19.9481	20.3820	20.6706	20.7932	20.7684	20.5326	19.9322	19.1783	18.5780 (87)
Th 2	19.6400	19.6426	19.6451	19.6572	19.6594	19.6700	19.6700	19.6719	19.6659	19.6594	19.6549	19.6501 (88)
util rest of house												
0.9469 0.9105 0.8511 0.7505 0.6139 0.4509 0.3078 0.3513 0.5751 0.8072 0.9194 0.9545 (89)												
MIT 2	16.5386	16.9956	17.6451	18.3930	18.9666	19.3234	19.4466	19.4302	19.1777	18.3972	17.3322	16.4617 (90)
Living area fraction												
												fLA = Living area / (4) = 0.2454 (91)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

MIT	17.0532	17.4764	18.0788	18.7747	19.3140	19.6541	19.7771	19.7587	19.5103	18.7740	17.7853	16.9811 (92)
Temperature adjustment												-0.1500
adjusted MIT	16.9032	17.3264	17.9288	18.6247	19.1640	19.5041	19.6271	19.6087	19.3603	18.6240	17.6353	16.8311 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9247	0.8815	0.8173	0.7181	0.5904	0.4395	0.3040	0.3454	0.5543	0.7729	0.8917	0.9344 (94)	
Useful gains	1294.7780	1595.5581	1811.7849	1882.6283	1704.0635	1258.2762	833.1207	865.8982	1238.7156	1402.3125	1288.5276	1209.1196 (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	3774.3335	3712.9860	3407.3541	2869.0433	2197.7278	1430.6885	883.1127	934.4680	1540.0950	2362.6147	3114.4569	3749.5863 (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	1844.7893	1422.9115	1187.1035	710.2188	367.2862	0.0000	0.0000	0.0000	0.0000	714.4649	1314.6691	1890.1072 (98)	
Space heating												9451.5506 (98)	
Space heating per m2										(98) / (4) =		49.3554 (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)													0.1000 (201)
Fraction of space heat from main system(s)													0.9000 (202)
Efficiency of main space heating system 1 (in %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													65.0000 (208)
Space heating requirement													9399.3321 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1844.7893	1422.9115	1187.1035	710.2188	367.2862	0.0000	0.0000	0.0000	0.0000	714.4649	1314.6691	1890.1072 (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)	1834.5971	1415.0502	1180.5449	706.2950	365.2570	0.0000	0.0000	0.0000	0.0000	710.5176	1307.4058	1879.6646 (211)	
Water heating requirement	283.8137	218.9095	182.6313	109.2644	56.5056	0.0000	0.0000	0.0000	0.0000	109.9177	202.2568	290.7857 (215)	
Water heating													
Water heating requirement	188.0995	143.7920	118.9757	65.5708	30.6632	13.8559	8.3478	40.5269	71.1563	123.9159	162.9507	187.2001 (64)	
Efficiency of water heater (217)m	89.2818	89.2914	89.3002	89.3849	89.4815	79.8000	79.8000	79.8000	79.8000	88.5809	89.0546	89.3128 (217)	
Fuel for water heating, kWh/month	210.6808	161.0368	133.2312	73.3578	34.2677	17.3632	10.4609	50.7856	89.1682	139.8901	182.9785	209.6006 (219)	
Water heating fuel used												1312.8214 (219)	
Annual totals kWh/year													
Space heating fuel - main system												9399.3321 (211)	
Space heating fuel - secondary												1454.0847 (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)													571.3507 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.00 * 1080 * 1.00) =										-863.6197		-863.6197 (233)	
Total delivered energy for all uses												11998.9692 (238)	

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	9399.3321	3.4800	327.0968 (240)	
Space heating - secondary	1454.0847	4.2300	61.5078 (242)	
Water heating (other fuel)	1312.8214	3.4800	45.6862 (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	571.3507	13.1900	75.3612 (250)	
Additional standing charges			120.0000 (251)	
Energy saving/generation technologies				
PV Unit	-863.6197	13.1900	-113.9114 (252)	
Total energy cost			532.2279 (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] =	0.9452 (257)
SAP value		86.8147
SAP rating (Section 12)		87 (258)
SAP band		B

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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	9399.3321	0.2160	2030.2557 (261)
Space heating - secondary	1454.0847	0.0190	27.6276 (263)
Water heating (other fuel)	1312.8214	0.2160	283.5694 (264)
Space and water heating			2341.4528 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	571.3507	0.5190	296.5310 (268)
Energy saving/generation technologies			
PV Unit	-863.6197	0.5190	-448.2186 (269)
Total kg/year			2254.6402 (272)
CO2 emissions per m2			11.7700 (273)
EI value			87.2253
EI rating			87 (274)
EI band			B

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

SAP 2012 WORKSHEET FOR New Build (As Designed) (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	126.0000 (1b)	x 2.8700 (2b)	= 361.6200 (1b) - (3b)
First floor	65.5000 (1c)	x 3.1400 (2c)	= 205.6700 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	191.5000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	567.2900 (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) = 0.0881 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3381 (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) =	0.3381 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.4000	4.2000	4.2000	3.9000	3.9000	3.4000	3.5000	3.3000	3.5000	3.9000	3.7000	4.1000 (22)
Wind factor	1.1000	1.0500	1.0500	0.9750	0.9750	0.8500	0.8750	0.8250	0.8750	0.9750	0.9250	1.0250 (22a)
Adj infilt rate												
Effective ac	0.3720	0.3550	0.3550	0.3297	0.3297	0.2874	0.2959	0.2790	0.2959	0.3297	0.3128	0.3466 (22b)
	0.5692	0.5630	0.5630	0.5543	0.5543	0.5413	0.5438	0.5389	0.5438	0.5543	0.5489	0.5601 (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
Windows (Uw = 1.40)			63.2000	1.3258	83.7879		(27)
Entrance Door			3.7800	1.4000	5.2920		(26a)
Oriel Window (Uw = 1.70)			3.2600	1.5918	5.1891		(27)
Rooflight (Uw = 1.40)			0.5100	1.3258	0.6761		(27a)
Ground Floor			126.0000	0.1100	13.8600		(28a)
EW1 - Facing Brick	173.8600	41.1300	132.7300	0.2100	27.8733		(29a)
EW2 - Facing block	53.2600	13.8900	39.3700	0.2000	7.8740		(29a)
EW3 - Timber frame	22.4700	15.2200	7.2500	0.2200	1.5950		(29a)
R1 - Pitched - Top Floor	90.7500	0.5100	90.2400	0.1600	14.4384		(30)
R2 - Pitched - Ground Floor	46.8500		46.8500	0.1900	8.9015		(30)
R3 - Flat Roof	5.1700		5.1700	0.1800	0.9306		(30)
Total net area of external elements Aum(A, m ²)			518.3600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	170.4180		(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 100.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 18.0559 (36)
Total fabric heat loss (33) + (36) = 188.4739 (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	106.5527	105.4022	105.4022	103.7767	103.7767	101.3353	101.7968	100.8871	101.7968	103.7767	102.7600	104.8470 (38)
Average = Sum(39)m / 12 =	295.0265	293.8760	293.8760	292.2506	292.2506	289.8091	290.2707	289.3610	290.2707	292.2506	291.2339	293.3208 (39)
												291.9831 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.5406	1.5346	1.5346	1.5261	1.5261	1.5134	1.5158	1.5110	1.5158	1.5261	1.5208	1.5317 (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												2.9909 (42)
Average daily hot water use (litres/day)												105.2327 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	115.7560	111.5467	107.3374	103.1281	98.9187	94.7094	94.7094	98.9187	103.1281	107.3374	111.5467	115.7560 (44)
Energy content (annual)	171.6628	150.1374	154.9283	135.0702	129.6031	111.8376	103.6340	118.9215	120.3418	140.2468	153.0904	166.2462 (45)
										Total = Sum(45)m =		1655.7203 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Distribution loss (46)m = 0.15 x (45)m	25.7494	22.5206	23.2392	20.2605	19.4405	16.7756	15.5451	17.8382	18.0513	21.0370	22.9636	24.9369 (46)
Water storage loss:												
Store volume												250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.7800 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.9612 (55)
Total storage loss												
29.7972 26.9136 29.7972 28.8360 29.7972 28.8360 29.7972 29.7972 28.8360 29.7972 28.8360 29.7972 (56)												
If cylinder contains dedicated solar storage												
20.8580 18.8395 20.8580 20.1852 20.8580 20.1852 20.8580 20.1852 20.8580 20.1852 20.8580 20.1852 (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												
215.7832 189.9881 197.6530 171.0138 160.9292 141.9281 134.7275 150.9455 157.6362 182.9715 195.7876 210.3667 (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												1168.8015 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												1963.5865 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.1859 (H8)
Utilisation factor												0.5697 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												127.5000 (H13)
Daily hot water demand												105.2327 (H14)
Volume ratio Veff/V												1.2116 (H15)
Solar storage volume factor												1.0000 (H16)
Solar input												-983.5814 (H17)
Solar input	-31.4519	-45.9059	-77.7114	-105.8712	-127.5557	-132.7141	-129.6433	-115.3828	-91.1033	-63.0157	-36.7613	-26.4646 (63)
Solar input (sum of months) = Sum (63)m =												-983.5814 (63)
Output from w/h												
184.3313 144.0821 119.9416 65.1426 33.3736 9.2140 5.0842 35.5627 66.5328 119.9558 159.0263 183.9020 (64)												
Total per year (kWh/year) = Sum (64)m =												1126.1491 (64)
Heat gains from water heating, kWh/month												
92.3742 81.8012 85.6934 73.6657 68.1539 61.2584 59.3331 65.1606 69.8491 80.8118 85.0603 90.5732 (65)												

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

Metabolic gains (Table 5), Watts												
(66)m	179.4511	179.4511	179.4511	179.4511	179.4511	179.4511	179.4511	179.4511	179.4511	179.4511	179.4511	179.4511 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
80.8806 71.8374 58.4221 44.2293 33.0619 27.9123 30.1602 39.2034 52.6187 66.8115 77.9789 83.1285 (67)												
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
541.6325 547.2529 533.0895 502.9375 464.8758 429.1033 405.2050 399.5846 413.7479 443.9000 481.9616 517.7342 (68)												
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
55.9360 55.9360 55.9360 55.9360 55.9360 55.9360 55.9360 55.9360 55.9360 55.9360 55.9360 55.9360 (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)												
-119.6340 -119.6340 -119.6340 -119.6340 -119.6340 -119.6340 -119.6340 -119.6340 -119.6340 -119.6340 -119.6340 -119.6340 (71)												
Water heating gains (Table 5)												
124.1589 121.7280 115.1793 102.3135 91.6047 85.0811 79.7488 87.5815 97.0127 108.6180 118.1393 121.7382 (72)												
Total internal gains												
865.4249 859.5714 825.4440 768.2333 708.2955 660.8496 633.8670 645.1224 682.1322 738.0825 796.8328 841.3539 (73)												

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
North				10.4400	12.7650	0.6300		0.7000		0.7700		40.7281 (74)
East				26.9600	23.8018	0.6300		0.7000		0.7700		196.1105 (76)
South				20.5600	54.2217	0.6300		0.7000		0.7700		340.6969 (78)
West				5.2400	23.8018	0.6300		0.7000		0.7700		38.1164 (80)
North				3.2600	12.7650	0.6300		0.7000		0.7700		12.7178 (74)
North				0.5100	19.2832	0.6300		0.7000		1.0000		3.9033 (82)
Solar gains	632.2730	983.0869	1432.8372	1946.2518	2235.6176	2394.9049	2267.0840	2036.7185	1707.0456	1195.9584	755.0200	538.0906 (83)
Total gains	1497.6980	1842.6582	2258.2812	2714.4850	2943.9131	3055.7546	2900.9510	2681.8408	2389.1778	1934.0409	1551.8528	1379.4445 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	18.0304	18.1010	18.1010	18.2017	18.2017	18.3550	18.3258	18.3834	18.3258	18.2017	18.2652	18.1352
alpha	2.2020	2.2067	2.2067	2.2134	2.2134	2.2237	2.2217	2.2256	2.2217	2.2134	2.2177	2.2090
util living area												
0.9447 0.9154 0.8563 0.7532 0.6243 0.4483 0.3273 0.3664 0.5937 0.8073 0.9157 0.9524 (86)												
MIT	18.8234	19.0900	19.5690	20.1007	20.4975	20.7588	20.8386	20.8254	20.6251	20.0911	19.3771	18.7727 (87)
Th 2	19.6572	19.6616	19.6616	19.6680	19.6680	19.6775	19.6757	19.6792	19.6757	19.6680	19.6719	19.6638 (88)
util rest of house												
0.9353 0.9016 0.8326 0.7128 0.5611 0.3566 0.2119 0.2473 0.5071 0.7650 0.8991 0.9441 (89)												
MIT 2	16.8189	17.2005	17.8758	18.6058	19.1169	19.4183	19.4846	19.4809	19.2885	18.6170	17.6254	16.7504 (90)
Living area fraction												0.2454 (91)
fLA = Living area / (4) =												

FULL SAP CALCULATION PRINTOUT

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

MIT	17.3109	17.6642	18.2913	18.9727	19.4557	19.7473	19.8169	19.8108	19.6166	18.9788	18.0553	17.2467 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.1609	17.5142	18.1413	18.8227	19.3057	19.5973	19.6669	19.6608	19.4666	18.8288	17.9053	17.0967 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9106	0.8717	0.7987	0.6826	0.5418	0.3506	0.2111	0.2456	0.4916	0.7319	0.8689	0.9215 (94)	
Useful gains	1363.8532	1606.2186	1803.6446	1852.8856	1594.8918	1071.4133	612.3705	658.5726	1174.6153	1415.6006	1348.4732	1271.1040 (95)	
Ext temp.	4.9000	5.4000	7.2000	9.7000	12.6000	15.6000	17.5000	17.3000	14.7000	11.3000	7.8000	4.9000 (96)	
Heat loss rate W													
3617.2841	3560.0804	3215.3968	2666.1079	1959.7523	1158.4429	628.9924	683.1373	1383.5917	2200.2942	2943.0165	3577.5496 (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													
1676.5526	1312.9952	1050.3436	585.5201	271.4562	0.0000	0.0000	0.0000	0.0000	583.8120	1148.0712	1715.9955 (98)		
Space heating												8344.7463 (98)	
Space heating per m2												(98) / (4) =	43.5757 (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)													0.1000 (201)
Fraction of space heat from main system(s)													0.9000 (202)
Efficiency of main space heating system 1 (in %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													65.0000 (208)
Space heating requirement													8298.6428 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1676.5526	1312.9952	1050.3436	585.5201	271.4562	0.0000	0.0000	0.0000	0.0000	583.8120	1148.0712	1715.9955 (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)	
Fuel for water heating, kWh/month	1667.2899	1305.7410	1044.5406	582.2851	269.9564	0.0000	0.0000	0.0000	0.0000	580.5865	1141.7282	1706.5149 (211)	
Water heating requirement	257.9312	201.9993	161.5913	90.0800	41.7625	0.0000	0.0000	0.0000	0.0000	89.8172	176.6263	263.9993 (215)	
Water heating requirement	184.3313	144.0821	119.9416	65.1426	33.3736	9.2140	5.0842	35.5627	66.5328	119.9558	159.0263	183.9020 (64)	
Efficiency of water heater (217)m	89.1980	89.2002	89.1540	89.1844	89.0647	79.8000	79.8000	79.8000	79.8000	88.2994	88.9099	89.2270 (217)	
Fuel for water heating, kWh/month	206.6541	161.5267	134.5330	73.0426	37.4712	11.5463	6.3711	44.5648	83.3745	135.8512	178.8622	206.1059 (219)	
Water heating fuel used												1279.9039 (219)	
Annual totals kWh/year													
Space heating fuel - main system												8298.6428 (211)	
Space heating fuel - secondary												1283.8071 (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)													571.3507 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.00 * 1169 * 1.00) =										-935.0412		-935.0412 (233)	
Total delivered energy for all uses												10623.6633 (238)	

10a. Fuel costs - using BEDF prices (493)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	8298.6428	3.6300	301.2407 (240)	
Space heating - secondary	1283.8071	5.1600	66.2444 (242)	
Water heating (other fuel)	1279.9039	3.6300	46.4605 (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	571.3507	19.4400	111.0706 (250)	
Additional standing charges			95.0000 (251)	
Energy saving/generation technologies				
PV Unit	-935.0412	19.4400	-181.7720 (252)	
Total energy cost			462.5443 (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	8298.6428	0.2160	1792.5068 (261)	
Space heating - secondary	1283.8071	0.0190	24.3923 (263)	
Water heating (other fuel)	1279.9039	0.2160	276.4592 (264)	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Space and water heating			2093.3584 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	571.3507	0.5190	296.5310 (268)
Energy saving/generation technologies			
PV Unit	-935.0412	0.5190	-485.2864 (269)
Total kg/year			1969.4780 (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	8298.6428	1.2200	10124.3442 (261)
Space heating - secondary	1283.8071	1.0400	1335.1594 (263)
Water heating (other fuel)	1279.9039	1.2200	1561.4827 (264)
Space and water heating			13020.9863 (265)
Pumps and fans	125.0000	3.0700	383.7500 (267)
Energy for lighting	571.3507	3.0700	1754.0466 (268)
Energy saving/generation technologies			
PV Unit	-935.0412	3.0700	-2870.5765 (269)
Primary energy kWh/year			12288.2065 (272)
Primary energy kWh/m2/year			64.1682 (273)

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Designed) 9.92

Overheating Calculation Input Data

Dwelling type	Detached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Thames Valley
Front of dwelling faces	East
Overshading	Average or unknown
Thermal mass parameter	100.0
Night ventilation	Yes
Ventilation rate during hot weather (ach)	8.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	1497.65 (P1)
Transmission heat loss coefficient	188.47 (37)
Summer heat loss coefficient	1686.12 (P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
North	0.000	1.000	None
East	0.000	1.000	None
South	0.000	1.000	None
West	0.000	1.000	None

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer
North	1.000	0.90	1.000	0.900 (P8)
North	1.000	1.00	1.000	1.000 (P8)
East	1.000	0.90	1.000	0.900 (P8)
South	1.000	0.90	1.000	0.900 (P8)
West	1.000	0.90	1.000	0.900 (P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	Specific data g or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	10.4400	81.1852	0.6300	0.7000	0.9000	302.7616
East	26.9600	117.5071	0.6300	0.7000	0.9000	1131.6379
South	20.5600	112.2060	0.6300	0.7000	0.9000	824.0675
West	5.2400	117.5071	0.6300	0.7000	0.9000	219.9474
North	3.2600	81.1852	0.6300	0.7000	0.9000	94.5405
North	0.5100	168.5675	0.6300	0.7000	1.0000	34.1213
total:						2607.0763

	Jun	Jul	Aug	
Solar gains	2756	2607	2351	(P3)
Internal gains	681	654	665	
Total summer gains	3438	3262	3016	(P5)
Summer gain/loss ratio	2.04	1.93	1.79	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 100.0)	1.30	1.30	1.30	
Threshold temperature	19.34	21.13	20.89	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	
Assessment of likelihood of high internal temperature:	Slight			

BASIC COMPLIANCE REPORT

Calculation Type: New Build (As Designed)

Property Reference	22098 - Plot 2	Issued on Date	08/04/2022
Assessment Reference	As Designed	Prop Type Ref	Plot 2
Property	Plot 2, 71, Oak Tree Road, Reading, RG31 6LA		
SAP Rating	86 B	DER	13.91
Environmental	86 B	TER	17.45
CO ₂ Emissions (t/year)	2.24	% DER<TER	20.27
General Requirements Compliance	Pass	DFEE	59.65
		TFEE	69.96
		% DFEE<TFEE	14.75
Assessor Details	Mr. Carlos Val Escudero, Carlos Val, Tel: , cd.val@live.com		Assessor ID
Client	The Keen Partnership, 22098		

SUMMARY FOR INPUT DATA FOR New Build (As Designed)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	17.45	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	13.91	kgCO ₂ /m ²	Pass
	-3.54 (-20.3%)	kgCO ₂ /m ²	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	69.96	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DFEE)	59.65	kWh/m ² /yr	
	-10.4 (-14.9%)	kWh/m ² /yr	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.22 (max. 0.70)	Pass
Floor	0.11 (max. 0.25)	0.11 (max. 0.70)	Pass
Roof	0.17 (max. 0.20)	0.19 (max. 0.35)	Pass
Openings	1.41 (max. 2.00)	1.70 (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	5.00 (design value)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Worcester Greenstar 8000 Style GR8700iW 30 S NG Efficiency: 89.5% SEDBUK2009 Minimum: 88.0%	Pass
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BASIC COMPLIANCE REPORT

Calculation Type: New Build (As Designed)

Secondary heating system

Room heaters - Wood Logs
Closed room heater
Efficiency: 65%
Minimum: 65%

Pass

5 Cylinder insulation

Hot water storage

Measured cylinder loss: 1.78 kWh/day
Permitted by DBSCG 2.56

Pass

Primary pipework insulated

Yes

Pass

6 Controls

Space heating controls

Time and temperature zone control

Pass

Hot water controls

Cylinderstat

Pass

Independent timer for DHW

Pass

Boiler interlock

Yes

Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings

100

%

Minimum

75

%

Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Thames Valley)

Slight

Pass

Based on:

Overshading

Average

Windows facing North

13.70 m², No overhang

Windows facing East

26.96 m², No overhang

Windows facing South

20.56 m², No overhang

Windows facing West

5.24 m², No overhang

Air change rate

8.00 ach

Blinds/curtains

None

Criterion 4 – Building performance consistent with DER and DFEE rate

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals

5.00 (design value)

Maximum

10.0

Pass

10 Key features

Floor U-value

0.11

W/m²K

Thermal bridging y-value

0.035

W/m²K

Secondary heating (wood logs)

N/A

Secondary heating fuel:

wood logs

Photovoltaic array

1.00

kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

Property Reference	22098 - Plot 2	Issued on Date	08/04/2022
Assessment Reference	As Designed	Prop Type Ref	Plot 2
Property	Plot 2, 71, Oak Tree Road, Reading, RG31 6LA		
SAP Rating	86 B	DER	13.91
Environmental	86 B	TER	17.45
CO ₂ Emissions (t/year)	2.24	% DER<TER	20.27
General Requirements Compliance	Pass	DFEE	59.65
		TFEE	69.96
		% DFEE<TFEE	14.75
Assessor Details	Mr. Carlos Val Escudero, Carlos Val, Tel: , cd.val@live.com		Assessor ID
Client	The Keen Partnership, 22098		

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

Orientation	East
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Suburban
1.0 Property Type	House, Detached
2.0 Number of Storeys	2
3.0 Date Built	2022
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:	57.88 m	126.00 m ²	2.87 m
1st Storey:	35.90 m	65.50 m ²	3.14 m

7.0 Living Area	47.00	m ²
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8.0 Thermal Mass Parameter	Simple calculation - Low	
Thermal Mass	100.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m ² K)	Gross Area (m ²)	Nett Area (m ²)
EW1 - Facing Brick	Cavity Wall	0.21	173.86	132.73
EW2 - Facing block	Cavity Wall	0.20	53.26	39.37
EW3 - Timber frame	Timber Frame	0.22	22.47	7.25

10.0 External Roofs

Description	Type	U-Value (W/m ² K)	Gross Area (m ²)	Nett Area (m ²)
R1 - Pitched - Top Floor	External Slope Roof	0.16	90.75	90.24
R2 - Pitched - Ground Floor	External Slope Roof	0.19	46.85	46.85
R3 - Flat Roof	External Flat Roof	0.18	5.17	5.17

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m ² K)	Area (m ²)
Ground Floor	Ground Floor - Solid		0.11	126.00

12.0 Opening Types

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Windows	Manufacturer	Window	Double Low-E Soft 0.05			0.63		0.70	1.40
Entrance Door	Manufacturer	Half Glazed Door	Double Low-E Soft 0.05			0.63		0.70	1.40
Oriel Window	Manufacturer	Window	Double Low-E Soft 0.05			0.63		0.70	1.70
Rooflight	Manufacturer	Roof Window	Double Low-E Soft 0.05			0.63		0.70	1.40

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
Entrance Door	Half Glazed Door	[1] EW1 - Facing Brick	East							1.89	
E Windows 1	Window	[1] EW1 - Facing Brick	East	None	0.00					9.08	
E Windows 2	Window	[2] EW2 - Facing block	East	None	0.00					9.88	
E Windows 3	Window	[3] EW3 - Timber frame	East	None	0.00					8.00	
W Windows 1	Window	[1] EW1 - Facing Brick	West	None	0.00					3.87	
Rear Door	Half Glazed Door	[1] EW1 - Facing Brick	West							1.89	
S Windows 1	Window	[1] EW1 - Facing Brick	South	None	0.00					15.76	
S Windows 2	Window	[2] EW2 - Facing block	South	None	0.00					2.64	
N Windows 1	Window	[1] EW1 - Facing Brick	North	None	0.00					8.64	
N Windows 3	Window	[3] EW3 - Timber frame	North	None	0.00					1.80	
W Windows 2	Window	[2] EW2 - Facing block	West	None	0.00					1.37	
S Windows 3	Window	[3] EW3 - Timber frame	South	None	0.00					2.16	
Oriel Window	Window	[3] EW3 - Timber frame	North	None	0.00					3.26	
Rooflight	Roof Window	[1] R1 - Pitched - Top Floor	North	None						0.51	

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)	40.52	0.050	No	catnic
Independently assessed	E3 Sill	21.20	0.034	No	CD0027
Independently assessed	E4 Jamb	83.14	0.040	No	CD0028
Independently assessed	E5 Ground floor (normal)	57.88	0.060	No	CD0022
Table K1 - Default	E20 Exposed floor (normal)	2.54	0.320	No	
Table K1 - Default	E21 Exposed floor (inverted)	1.86	0.320	No	
Independently assessed	E6 Intermediate floor within a dwelling	26.79	0.000	No	CD0029
Table K1 - Approved	E8 Balcony within a dwelling, wall insulation continuous	3.54	0.000	No	
Independently assessed	E11 Eaves (insulation at rafter level)	35.23	0.037	No	CD0034
Independently assessed	E13 Gable (insulation at rafter level)	27.00	0.080	No	CD0032
Table K1 - Default	E14 Flat roof	8.55	0.080	No	
Independently assessed	E16 Corner (normal)	38.66	0.058	No	CD0035
Independently assessed	E17 Corner (inverted – internal area greater than external area)	23.43	-0.069	No	CD0036
Table K1 - Default	R1 Head of roof window	0.85	0.080	No	
Table K1 - Default	R2 Sill of roof window	0.85	0.060	No	
Table K1 - Default	R3 Jamb of roof window	1.20	0.080	No	
Table K1 - Default	R4 Ridge (vaulted ceiling)	18.62	0.080	No	
Table K1 - Default	R5 Ridge (inverted)	3.04	0.040	No	
Table K1 - Default	R7 Flat ceiling (inverted)	1.86	0.040	No	
Table K1 - Default	R8 Roof to wall (rafter)	7.15	0.060	No	

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

Y-value	0.035	W/m ² K
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18.0 Pressure Testing	Yes	
Designed AP ₅₀	5.00	m ³ /(h.m ²) @ 50 Pa
Property Tested ?		
As Built AP ₅₀		m ³ /(h.m ²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	Yes
Air change rate	8.00

Mechanical Ventilation

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

	MHS	SHS	Other	Total
Number of Chimneys	0	0	0	0
Number of open flues	0	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	18	
Total number of L.E.L. fittings	18	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	No
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23.0 Electricity Tariff

Standard

24.0 Main Heating 1

Database	
Percentage of Heat	100 %
Database Ref. No.	18452
Fuel Type	Mains gas
Main Heating	BGB
SAP Code	102
In Winter	90.5
In Summer	79.8
Controls	CBI Time and temperature zone control
PCDF Controls	0
Delayed Start Stat	Yes
Sap Code	2110
Flue Type	Balanced
Fan Assisted Flue	Yes
Is MHS Pumped	Pump in heated space
Heat Emitter	Radiators and Underfloor
Underfloor Heating	Yes - Pipes in thin screed

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

Flow Temperature	Normal (> 45°C)			
25.0 Main Heating 2	None			
Community Heating	None			
27.0 Secondary Heating	RWM			
Secondary Heating	SAP table			
Description	Wood Logs RWM Closed room heater			
SHS efficiency	65.00	%		
SAP Code	633			
HETAS Approved System	Yes			
Smoke Control Area	Unknown			
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	250.00	L		
Loss	1.78	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
1.00	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	£39	B 87	