



SAP Report Submission for Building Regulations Compliance

Client: The Keen Partnership

Project: Plot 1, 71, Oak Tree Road
Reading, RG31 6LA

Contact: JosTec
01923 518 923
Carlos@jostec.co.uk

Report Issue Date: 08/04/2022

EXCELLENCE
IN ENERGY
ASSESSMENT

PREDICTED ENERGY ASSESSMENT

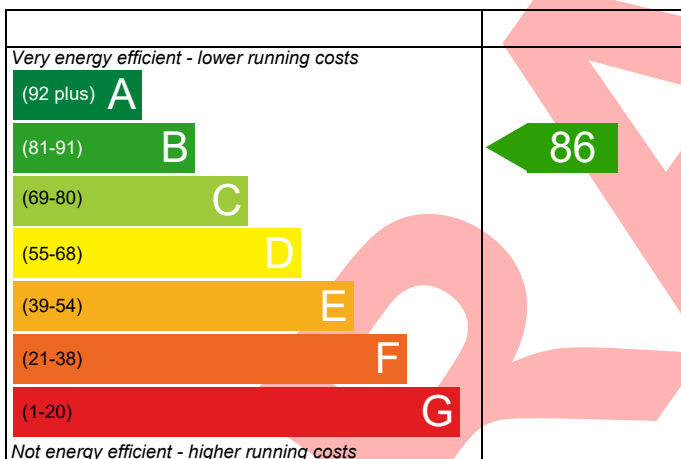
Plot 1, 71, Oak Tree Road,
Reading,
RG31 6LA

Dwelling type: House, Detached
Date of assessment: 08/04/2022
Produced by: Carlos Val
Total floor area: 192.3 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

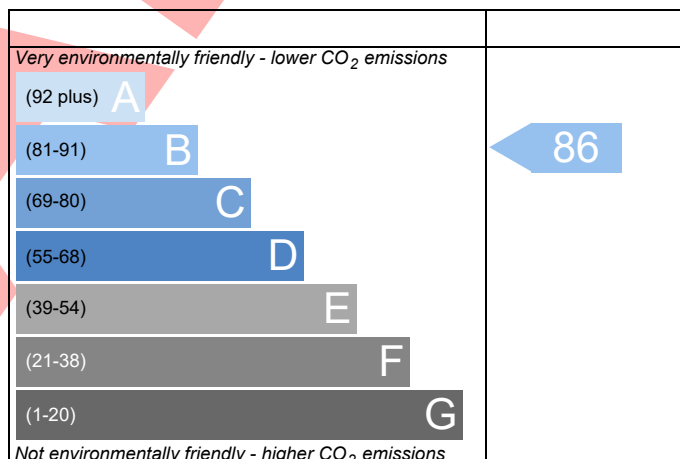


England

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 1	Issued on Date	08/04/2022
Assessment Reference	As Designed	Prop Type Ref	Plot 1
Property	Plot 1, 71, Oak Tree Road, Reading, RG31 6LA		
SAP Rating	86 B	DER	13.88
Environmental	86 B	TER	17.48
CO ₂ Emissions (t/year)	2.24	% DER<TER	20.60
General Requirements Compliance	Pass	DFEE	59.32
		TREE	70.22
		% DFEE<TFEE	15.52
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)	17.48	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	13.88	kgCO ₂ /m ²	Pass
	-3.60 (-20.6%)	kgCO ₂ /m ²	

1b TFE and DFEE

Target Fabric Energy Efficiency (TFEE)	70.22	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DFEE)	59.32	kWh/m ² /yr	
	-10.9 (-15.5%)	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	0.18 (max. 0.20)	0.19 (max. 0.35)	Pass
Openings	1.40 (max. 2.00)	1.40 (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

10.23 m², No overhang

Windows facing East

31.05 m², No overhang

Windows facing South

17.66 m², No overhang

Windows facing West

3.01 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

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)

10 Key features

Floor U-value	0.11	W/m ² K
Thermal bridging y-value	0.031	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)

Property Reference	22098 - Plot 1				Issued on Date	08/04/2022
Assessment Reference	As Designed		Prop Type Ref	Plot 1		
Property	Plot 1, 71, Oak Tree Road, Reading, RG31 6LA					
SAP Rating	86 B	DER	13.88	TER	17.48	
Environmental	86 B	% DER<TER	20.60			
CO ₂ Emissions (t/year)	2.24	DFEE	59.32	TFEE	70.22	
General Requirements Compliance	Pass	% DFEE<TFEE	15.52			
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) 17.48 kgCO₂/m²

Dwelling Carbon Dioxide Emission Rate (DER) 13.88 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)70.2 kWh/m²/yr

Dwelling Fabric Energy Efficiency (DFEE)59.3 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	0.18 (max. 0.20)	0.19 (max. 0.35)	OK
Openings	1.40 (max. 2.00)	1.40 (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:	10.23 m ² , No overhang
Windows facing East:	31.05 m ² , No overhang
Windows facing South:	17.66 m ² , No overhang
Windows facing West:	3.01 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 0.031 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	140.0000 (1b)	x 2.8300 (2b)	= 396.2000 (1b) - (3b)
First floor	52.3000 (1c)	x 3.2000 (2c)	= 167.3600 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	192.3000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 563.5600 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																5 * 10 =	50.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =				50.0000	/ (5) =	0.0887 (8)	
Pressure test										Yes							
Measured/design AP50										5.0000							
Infiltration rate										0.3387 (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) =				0.3387	(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	0.4319	0.4234	0.4149	0.3726	0.3641	0.3218	0.3218	0.3133	0.3387	0.3641	0.3811	0.3980	(22b)				
Effective ac	0.5933	0.5896	0.5861	0.5694	0.5663	0.5518	0.5518	0.5491	0.5574	0.5663	0.5726	0.5792	(25)				

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K						
Windows (Uw = 1.40)			61.9500	1.3258	82.1307			(27)					
Entrance Door			5.5600	1.4000	7.7840			(26a)					
Ground Floor			140.0000	0.1100	15.4000			(28a)					
EW1 - Facing Brick	120.3500	25.0000	95.3500	0.2100	20.0235			(29a)					
EW2 - Facing block	107.1900	30.0600	77.1300	0.2000	15.4260			(29a)					
EW3 - Timber frame	17.6400	12.4500	5.1900	0.2200	1.1418			(29a)					
R1 - Pitched - Top Floor	62.9500		62.9500	0.1600	10.0720			(30)					
R2 - Pitched - Ground Floor	86.0600		86.0600	0.1900	16.3514			(30)					
R3 - Flat Roof	4.4700		4.4700	0.1800	0.8046			(30)					
Total net area of external elements Aum(A, m2)			538.6600					(31)					
Fabric heat loss, W/K = Sum (A x U)				(26) ... (30) + (32) =	169.1340			(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								100.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)								16.6217 (36)					
Total fabric heat loss						(33) + (36) =		185.7557 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 110.3307	Feb 109.6572	Mar 108.9971	Apr 105.8965	May 105.3164	Jun 102.6159	Jul 102.6159	Aug 102.1158	Sep 103.6561	Oct 105.3164	Nov 106.4899	Dec 107.7168	(38)
Heat transfer coeff	296.0864	295.4129	294.7528	291.6522	291.0721	288.3716	288.3716	287.8715	289.4118	291.0721	292.2456	293.4725	(39)
Average = Sum(39)m / 12 =												291.6494	(39)
HLP	Jan 1.5397	Feb 1.5362	Mar 1.5328	Apr 1.5167	May 1.5136	Jun 1.4996	Jul 1.4996	Aug 1.4970	Sep 1.5050	Oct 1.5136	Nov 1.5197	Dec 1.5261	(40)
HLP (average)												1.5166	(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												2.9919 (42)
Average daily hot water use (litres/day)												105.2575 (43)
Daily hot water use	Jan 115.7832	Feb 111.5729	Mar 107.3626	Apr 103.1523	May 98.9420	Jun 94.7317	Jul 94.7317	Aug 98.9420	Sep 103.1523	Oct 107.3626	Nov 111.5729	Dec 115.7832 (44)
Energy conte	171.7032	150.1727	154.9648	135.1020	129.6336	111.8640	103.6584	118.9495	120.3702	140.2798	153.1264	166.2854 (45)
Energy content (annual)												Total = Sum(45)m = 1656.1099 (45)
Distribution loss (46)m = 0.15 x (45)m	25.7555	22.5259	23.2447	20.2653	19.4450	16.7796	15.5488	17.8424	18.0555	21.0420	22.9690	24.9428 (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												
	224.7628	198.0975	208.0244	186.4500	182.6932	163.2120	156.7180	172.0091	171.7182	193.3394	204.4744	219.3450 (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												
	224.7628	198.0975	208.0244	186.4500	182.6932	163.2120	156.7180	172.0091	171.7182	193.3394	204.4744	219.3450 (64)
	Total per year (kWh/year) = Sum (64)m =											2280.8439 (64)
Heat gains from water heating, kWh/month												
	99.5390	88.2723	93.9735	85.9998	85.5509	78.2732	76.9141	81.9984	81.1015	89.0907	91.9929	97.7376 (65)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9504	0.9129	0.8534	0.7574	0.6303	0.4769	0.3342	0.3802	0.6014	0.8176	0.9242	0.9581 (94)
Useful gains	1036.6431	1346.6169	1597.1570	1722.9182	1602.3443	1206.8381	809.4168	837.0872	1159.5453	1235.6315	1061.4194	955.3043 (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	3667.6642	3608.9856	3315.6416	2798.3881	2149.9676	1403.4182	867.6669	917.2504	1504.1027	2293.9558	3022.2749	3644.6058 (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	1957.4797	1520.3117	1278.5525	774.3383	407.4317	0.0000	0.0000	0.0000	0.0000	787.3933	1411.8159	2000.8403 (98)
Space heating												10138.1636 (99)
Space heating per m2										(98) / (4) =		52.7206 (99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)	0.1000 (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	10082.1516 (211)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	1957.4797	1520.3117	1278.5525	774.3383	407.4317	0.0000	0.0000	0.0000	0.0000	787.3933	1411.8159	2000.8403 (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)	1946.6649	1511.9122	1271.4887	770.0602	405.1807	0.0000	0.0000	0.0000	0.0000	783.0431	1404.0159	1989.7859 (211)
Water heating requirement	301.1507	233.8941	196.7004	119.1290	62.6818	0.0000	0.0000	0.0000	0.0000	121.1374	217.2025	307.8216 (215)
Water heating requirement	224.7628	198.0975	208.0244	186.4500	182.6932	163.2120	156.7180	172.0091	171.7182	193.3394	204.4744	219.3450 (64)
Efficiency of water heater (217)m	89.1475	88.9909	88.6795	88.0092	86.6369	79.8000	79.8000	79.8000	79.8000	87.9716	88.8486	79.8000 (216)
Fuel for water heating, kWh/month	252.1245	222.6041	234.5800	211.8529	210.8722	204.5263	196.3885	215.5503	215.1857	219.7747	230.1379	245.8988 (219)
Water heating fuel used												2659.4959 (219)
Annual totals kWh/year												
Space heating fuel - main system												10082.1516 (211)
Space heating fuel - secondary												1559.7175 (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)												572.5687 (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												14085.3140 (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	10082.1516	0.2160	2177.7448 (261)
Space heating - secondary	1559.7175	0.0190	29.6346 (263)
Water heating (other fuel)	2659.4959	0.2160	574.4511 (264)
Space and water heating			2781.8305 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	572.5687	0.5190	297.1632 (268)
Energy saving/generation technologies			
PV Unit	-863.6197	0.5190	-448.2186 (269)
Total CO2, kg/year			2669.7000 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.8800 (273)

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

DER		13.8800 ZC1
Total Floor Area	TFA	192.3000
Assumed number of occupants	N	2.9919
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190
CO2 emissions from appliances, equation (L14)		11.2065 ZC2
CO2 emissions from cooking, equation (L16)		0.9922 ZC3
Total CO2 emissions		26.0788 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		26.0788 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	140.0000 (1b)	x 2.8300 (2b)	= 396.2000 (1b) - (3b)
First floor	52.3000 (1c)	x 3.2000 (2c)	= 167.3600 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	192.3000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 563.5600 (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) = 0.0710 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3210 (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) =	0.3210 (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	0.4092	0.4012	0.3932	0.3531	0.3451	0.3049	0.3049	0.2969	0.3210	0.3451	0.3611	0.3771 (22b)
Effective ac	0.5837	0.5805	0.5773	0.5623	0.5595	0.5465	0.5465	0.5441	0.5515	0.5595	0.5652	0.5711 (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			5.5600	1.2000	6.6720		(26a)
TER Opening Type (Uw = 1.40)			42.5300	1.3258	56.3845		(27)
Ground Floor			140.0000	0.1300	18.2000		(28a)
EW1 - Facing Brick	120.3500	17.1600	103.1900	0.1800	18.5742		(29a)
EW2 - Facing block	107.1900	22.3800	84.8100	0.1800	15.2658		(29a)
EW3 - Timber frame	17.6400	8.5500	9.0900	0.1800	1.6362		(29a)
R1 - Pitched - Top Floor	62.9500		62.9500	0.1300	8.1835		(30)
R2 - Pitched - Ground Floor	86.0600		86.0600	0.1300	11.1878		(30)
R3 - Flat Roof	4.4700		4.4700	0.1300	0.5811		(30)
Total net area of external elements Aum(A, m ²)			538.6600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	136.6851		(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)							24.5554 (36)
Total fabric heat loss						(33) + (36) =	161.2405 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	108.5612	107.9564	107.3636	104.5794	104.0585	101.6335	101.6335	101.1844	102.5676	104.0585	105.1123	106.2140 (38)
Heat transfer coeff	269.8016	269.1969	268.6041	265.8199	265.2989	262.8740	262.8740	262.4249	263.8080	265.2989	266.3528	267.4545 (39)
Average = Sum(39)m / 12 =												265.8174 (39)
HLP	1.4030	1.3999	1.3968	1.3823	1.3796	1.3670	1.3670	1.3647	1.3719	1.3796	1.3851	1.3908 (40)
HLP (average)												1.3823 (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												2.9919 (42)
Average daily hot water use (litres/day)												105.2575 (43)
Daily hot water use	115.7832	111.5729	107.3626	103.1523	98.9420	94.7317	94.7317	98.9420	103.1523	107.3626	111.5729	115.7832 (44)
Energy conte	171.7032	150.1727	154.9648	135.1020	129.6336	111.8640	103.6584	118.9495	120.3702	140.2798	153.1264	166.2854 (45)
Energy content (annual)												1656.1099 (45)
Distribution loss (46)m = 0.15 x (45)m	25.7555	22.5259	23.2447	20.2653	19.4450	16.7796	15.5488	17.8424	18.0555	21.0420	22.9690	24.9428 (46)

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													11326.3308	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	2044.4272	1608.6907	1359.3426	797.6141	368.4545	0.0000	0.0000	0.0000	0.0000	834.4848	1492.3888	2084.7166	(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)	2186.5531	1720.5248	1453.8424	853.0632	394.0690	0.0000	0.0000	0.0000	0.0000	892.4971	1596.1378	2229.6435	(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	226.6100	199.7659	209.8716	188.2376	184.5404	164.9996	158.5652	173.8563	173.5058	195.1866	206.2620	221.1921	(64)	
Efficiency of water heater (217)m	89.3052	89.1791	88.9057	88.2408	86.6240	79.8000	79.8000	79.8000	79.8000	88.2567	89.0501	89.3508	(216)	
Fuel for water heating, kWh/month	253.7479	224.0052	236.0610	213.3226	213.0362	206.7664	198.7032	217.8651	217.4258	221.1577	231.6246	247.5548	(219)	
Water heating fuel used												2681.2705	(219)	
Annual totals kWh/year														
Space heating fuel - main system												11326.3308	(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)													572.6768	(232)
Total delivered energy for all uses													14655.2781	(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	11326.3308	0.2160	2446.4874 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2681.2705	0.2160	579.1544 (264)
Space and water heating			3025.6419 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	572.6768	0.5190	297.2193 (268)
Total CO2, kg/m2/year			3361.7861 (272)
Emissions per m2 for space and water heating			15.7340 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			1.5456 (272b)
Emissions per m2 for pumps and fans			0.2024 (272c)
Target Carbon Dioxide Emission Rate (TER) = (15.7340 * 1.00) + 1.5456 + 0.2024, rounded to 2 d.p.			17.4800 (273)

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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	140.0000 (1b)	x 2.8300 (2b)	= 396.2000 (1b) - (3b)
First floor	52.3000 (1c)	x 3.2000 (2c)	= 167.3600 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	192.3000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 563.5600 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																4 * 10 =	40.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) =	0.0710 (8)	
Pressure test										Yes							
Measured/design AP50										5.0000							
Infiltration rate										0.3210 (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) =					0.3210 (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	0.4092	0.4012	0.3932	0.3531	0.3451	0.3049	0.3049	0.2969	0.3210	0.3451	0.3611	0.3771	(22b)				
Effective ac	0.5837	0.5805	0.5773	0.5623	0.5595	0.5465	0.5465	0.5441	0.5515	0.5595	0.5652	0.5711	(25)				

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K						
Windows (Uw = 1.40)			61.9500	1.3258	82.1307			(27)					
Entrance Door			5.5600	1.4000	7.7840			(26a)					
Ground Floor			140.0000	0.1100	15.4000			(28a)					
EW1 - Facing Brick	120.3500	25.0000	95.3500	0.2100	20.0235			(29a)					
EW2 - Facing block	107.1900	30.0600	77.1300	0.2000	15.4260			(29a)					
EW3 - Timber frame	17.6400	12.4500	5.1900	0.2200	1.1418			(29a)					
R1 - Pitched - Top Floor	62.9500		62.9500	0.1600	10.0720			(30)					
R2 - Pitched - Ground Floor	86.0600		86.0600	0.1900	16.3514			(30)					
R3 - Flat Roof	4.4700		4.4700	0.1800	0.8046			(30)					
Total net area of external elements Aum(A, m2)			538.6600					(31)					
Fabric heat loss, W/K = Sum (A x U)				(26) ... (30) + (32) =	169.1340			(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								100.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)								16.6217 (36)					
Total fabric heat loss						(33) + (36) =		185.7557 (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	108.5612	107.9564	107.3636	104.5794	104.0585	101.6335	101.6335	101.1844	102.5676	104.0585	105.1123	106.2140	(38)
	294.3169	293.7121	293.1193	290.3351	289.8142	287.3892	287.3892	286.9401	288.3233	289.8142	290.8680	291.9697	(39)
Average = Sum(39)m / 12 =												290.3326	(39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.5305	1.5274	1.5243	1.5098	1.5071	1.4945	1.4945	1.4921	1.4993	1.5071	1.5126	1.5183	(40)
HLP (average)												1.5098	(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												2.9919 (42)
Average daily hot water use (litres/day)												105.2575 (43)
Daily hot water use	Jan 115.7832	Feb 111.5729	Mar 107.3626	Apr 103.1523	May 98.9420	Jun 94.7317	Jul 94.7317	Aug 98.9420	Sep 103.1523	Oct 107.3626	Nov 111.5729	Dec 115.7832 (44)
Energy conte	171.7032	150.1727	154.9648	135.1020	129.6336	111.8640	103.6584	118.9495	120.3702	140.2798	153.1264	166.2854 (45)
Energy content (annual)												Total = Sum(45)m = 1656.1099 (45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)

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CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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	(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	(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	(59)
Heat gains from water heating, kWh/month	36.4869	31.9117	32.9300	28.7092	27.5471	23.7711	22.0274	25.2768	25.5787	29.8095	32.5394	35.3356 (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	149.5947	149.5947	149.5947	149.5947	149.5947	149.5947	149.5947	149.5947	149.5947	149.5947	149.5947	149.5947	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	32.4212	28.7962	23.4187	17.7294	13.2530	11.1887	12.0898	15.7148	21.0923	26.7816	31.2580	33.3223	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	363.6674	367.4411	357.9314	337.6864	312.1308	288.1121	272.0661	268.2924	277.8021	298.0470	323.6027	347.6214	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.9595	37.9595	37.9595	37.9595	37.9595	37.9595	37.9595	37.9595	37.9595	37.9595	37.9595	37.9595	(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)	-119.6757	-119.6757	-119.6757	-119.6757	-119.6757	-119.6757	-119.6757	-119.6757	-119.6757	-119.6757	-119.6757	-119.6757	(71)
Water heating gains (Table 5)	49.0416	47.4876	44.2608	39.8739	37.0257	33.0154	29.6067	33.9742	35.5259	40.0665	45.1936	47.4941	(72)
Total internal gains	513.0085	511.6034	493.4893	463.1681	430.2879	400.1946	381.6411	385.8597	402.2987	432.7735	467.9327	496.3162	(73)

6. Solar gains

[Jan]	Area m ²	Solar flux Table 6a W/m ²	Specific data or Table 6b	Specific data or Table 6c	FF	Access factor Table 6d	Gains W
North	10.2300	10.6334	0.6300		0.7000	0.7700	33.2445 (74)
East	31.0500	19.6403	0.6300		0.7000	0.7700	186.3720 (76)
South	17.6600	46.7521	0.6300		0.7000	0.7700	252.3268 (78)
West	3.0100	19.6403	0.6300		0.7000	0.7700	18.0670 (80)

Solar gains	490.0102	876.7042	1292.9799	1728.9142	2030.7686	2051.7842	1963.7057	1736.8557	1445.6916	995.8972	595.0160	413.8685	(83)
Total gains	1003.0188	1388.3075	1786.4691	2192.0823	2461.0565	2451.9788	2345.3468	2122.7155	1847.9903	1428.6707	1062.9487	910.1847	(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	18.1494	18.1867	18.2235	18.3983	18.4314	18.5869	18.5869	18.6160	18.5267	18.4314	18.3646	18.2953	
alpha	2.2100	2.2124	2.2149	2.2266	2.2288	2.2391	2.2391	2.2411	2.2351	2.2288	2.2243	2.2197	
util living area	0.9761	0.9521	0.9094	0.8317	0.7210	0.5876	0.4671	0.5186	0.7160	0.8905	0.9617	0.9805	(86)
MIT	17.7692	18.2008	18.8407	19.6040	20.2387	20.6693	20.8597	20.8180	20.4478	19.5600	18.5067	17.6940	(87)
Th 2	19.6647	19.6670	19.6693	19.6802	19.6822	19.6916	19.6916	19.6934	19.6880	19.6822	19.6781	19.6738	(88)
util rest of house	0.9719	0.9439	0.8936	0.8015	0.6687	0.5035	0.3509	0.4018	0.6423	0.8640	0.9538	0.9771	(89)
MIT 2	16.7530	17.1801	17.8075	18.5461	19.1301	19.5018	19.6372	19.6168	19.3365	18.5265	17.4952	16.6842	(90)
Living area fraction									fLA = Living area / (4) =			0.2288	(91)
MIT	16.9855	17.4136	18.0439	18.7881	19.3838	19.7690	19.9169	19.8917	19.5908	18.7630	17.7266	16.9152	(92)
Temperature adjustment												0.0000	
adjusted MIT	16.9855	17.4136	18.0439	18.7881	19.3838	19.7690	19.9169	19.8917	19.5908	18.7630	17.7266	16.9152	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9593	0.9245	0.8684	0.7769	0.6551	0.5090	0.3725	0.4212	0.6360	0.8399	0.9369	0.9663	(94)
Useful gains	962.2433	1283.4835	1551.4057	1702.9993	1612.3138	1248.0161	873.5655	894.1021	1175.3177	1199.8822	995.8868	879.5288	(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	3733.5494	3675.4031	3383.7468	2870.8707	2226.8718	1485.5030	953.2426	1001.8999	1583.1224	2365.7447	3090.9467	3712.4598	(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	2061.8517	1607.3700	1363.2618	840.8674	457.2311	0.0000	0.0000	0.0000	0.0000	867.4017	1508.4431	2107.7007	(98)
Space heating												10814.1276	(98)
Space heating per m ²										(98) / (4) =		56.2357	(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	2701.4585	2126.6801	2180.7450	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7272	0.7876	0.7521	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1964.4817	1675.0196	1640.0754	0.0000	0.0000	0.0000	0.0000	(102)

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Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	3004.9757	2876.9216	2619.5698	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	749.1557	894.2151	728.7438	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												2372.1146 (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	187.2889	223.5538	182.1859	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												593.0286 (107)
Space cooling per m2												3.0839 (108)
Energy for space heating												56.2357 (99)
Energy for space cooling												3.0839 (108)
Total												59.3196 (109)
Dwelling Fabric Energy Efficiency (DFEE)												59.3 (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	140.0000 (1b)	x 2.8300 (2b)	= 396.2000 (1b) - (3b)
First floor	52.3000 (1c)	x 3.2000 (2c)	= 167.3600 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	192.3000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 563.5600 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																4 * 10 =	40.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) =	0.0710 (8)	
Pressure test										Yes							
Measured/design AP50										5.0000							
Infiltration rate										0.3210 (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) =					0.3210 (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	0.4092	0.4012	0.3932	0.3531	0.3451	0.3049	0.3049	0.2969	0.3210	0.3451	0.3611	0.3771	(22b)				
Effective ac	0.5837	0.5805	0.5773	0.5623	0.5595	0.5465	0.5465	0.5441	0.5515	0.5595	0.5652	0.5711	(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			5.5600	1.2000	6.6720		(26a)
TER Opening Type (Uw = 1.40)			42.5300	1.3258	56.3845		(27)
Ground Floor			140.0000	0.1300	18.2000		(28a)
EW1 - Facing Brick	120.3500	17.1600	103.1900	0.1800	18.5742		(29a)
EW2 - Facing block	107.1900	22.3800	84.8100	0.1800	15.2658		(29a)
EW3 - Timber frame	17.6400	8.5500	9.0900	0.1800	1.6362		(29a)
R1 - Pitched - Top Floor	62.9500		62.9500	0.1300	8.1835		(30)
R2 - Pitched - Ground Floor	86.0600		86.0600	0.1300	11.1878		(30)
R3 - Flat Roof	4.4700		4.4700	0.1300	0.5811		(30)
Total net area of external elements Aum(A, m ²)			538.6600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	136.6851		(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)							24.5554 (36)
Total fabric heat loss						(33) + (36) =	161.2405 (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	108.5612	107.9564	107.3636	104.5794	104.0585	101.6335	101.6335	101.1844	102.5676	104.0585	105.1123	106.2140 (38)
Heat transfer coeff	269.8016	269.1969	268.6041	265.8199	265.2989	262.8740	262.8740	262.4249	263.8080	265.2989	266.3528	267.4545 (39)
Average = Sum(39)m / 12 =												265.8174 (39)
HLP	Jan 1.4030	Feb 1.3999	Mar 1.3968	Apr 1.3823	May 1.3796	Jun 1.3670	Jul 1.3670	Aug 1.3647	Sep 1.3719	Oct 1.3796	Nov 1.3851	Dec 1.3908 (40)
HLP (average)												1.3823 (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												2.9919 (42)
Average daily hot water use (litres/day)												105.2575 (43)
Daily hot water use	Jan 115.7832	Feb 111.5729	Mar 107.3626	Apr 103.1523	May 98.9420	Jun 94.7317	Jul 94.7317	Aug 98.9420	Sep 103.1523	Oct 107.3626	Nov 111.5729	Dec 115.7832 (44)
Energy conte	171.7032	150.1727	154.9648	135.1020	129.6336	111.8640	103.6584	118.9495	120.3702	140.2798	153.1264	166.2854 (45)
Energy content (annual)												Total = Sum(45)m = 1656.1099 (45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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	(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	(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	(59)
Heat gains from water heating, kWh/month	36.4869	31.9117	32.9300	28.7092	27.5471	23.7711	22.0274	25.2768	25.5787	29.8095	32.5394	35.3356 (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	149.5947	149.5947	149.5947	149.5947	149.5947	149.5947	149.5947	149.5947	149.5947	149.5947	149.5947	149.5947	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	32.4273	28.8017	23.4231	17.7328	13.2555	11.1908	12.0921	15.7177	21.0963	26.7866	31.2639	33.3286	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	363.6674	367.4411	357.9314	337.6864	312.1308	288.1121	272.0661	268.2924	277.8021	298.0470	323.6027	347.6214	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.9595	37.9595	37.9595	37.9595	37.9595	37.9595	37.9595	37.9595	37.9595	37.9595	37.9595	37.9595	(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)	-119.6757	-119.6757	-119.6757	-119.6757	-119.6757	-119.6757	-119.6757	-119.6757	-119.6757	-119.6757	-119.6757	-119.6757	(71)
Water heating gains (Table 5)	49.0416	47.4876	44.2608	39.8739	37.0257	33.0154	29.6067	33.9742	35.5259	40.0665	45.1936	47.4941	(72)
Total internal gains	513.0147	511.6088	493.4937	463.1715	430.2904	400.1967	381.6433	385.8627	402.3027	432.7786	467.9386	496.3225	(73)

6. Solar gains

[Jan]	Area m ²	Solar flux Table 6a W/m ²	Specific data or Table 6b	Specific data or Table 6c	FF	Access factor Table 6d	Gains W	
North	7.0300	10.6334	0.6300		0.7000	0.7700	22.8454	(74)
East	21.3100	19.6403	0.6300		0.7000	0.7700	127.9094	(76)
South	12.1200	46.7521	0.6300		0.7000	0.7700	173.1710	(78)
West	2.0700	19.6403	0.6300		0.7000	0.7700	12.4248	(80)

Solar gains	336.3507	601.7918	887.5563	1186.8373	1394.0832	1408.5248	1348.0539	1192.3017	992.3964	683.6148	408.4298	284.0848	(83)
Total gains	849.3653	1113.4006	1381.0500	1650.0088	1824.3736	1808.7215	1729.6972	1578.1644	1394.6991	1116.3934	876.3684	780.4073	(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	49.4962	49.6074	49.7169	50.2377	50.3363	50.8006	50.8006	50.8876	50.6208	50.3363	50.1371	49.9306	
alpha	4.2997	4.3072	4.3145	4.3492	4.3558	4.3867	4.3867	4.3925	4.3747	4.3558	4.3425	4.3287	
util living area	0.9994	0.9979	0.9926	0.9725	0.9127	0.7837	0.6259	0.6924	0.9042	0.9883	0.9985	0.9996	(86)
MIT	19.2927	19.4944	19.8204	20.2448	20.6240	20.8756	20.9652	20.9462	20.7375	20.2238	19.6759	19.2628	(87)
Th 2	19.7610	19.7634	19.7658	19.7769	19.7790	19.7887	19.7887	19.7905	19.7850	19.7790	19.7748	19.7704	(88)
util rest of house	0.9992	0.9971	0.9897	0.9606	0.8724	0.6853	0.4740	0.5430	0.8422	0.9816	0.9979	0.9994	(89)
MIT 2	18.2097	18.4130	18.7392	19.1648	19.5203	19.7302	19.7801	19.7751	19.6324	19.1511	18.6033	18.1869	(90)
Living area fraction									fLA = Living area / (4) =			0.2288	(91)
MIT	18.4575	18.6604	18.9866	19.4119	19.7729	19.9923	20.0513	20.0431	19.8852	19.3966	18.8487	18.4331	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.4575	18.6604	18.9866	19.4119	19.7729	19.9923	20.0513	20.0431	19.8852	19.3966	18.8487	18.4331	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9988	0.9960	0.9871	0.9559	0.8722	0.7041	0.5093	0.5775	0.8487	0.9786	0.9971	0.9992	(94)
Ext temp.	848.3360	1108.9994	1363.2222	1577.3195	1591.1341	1273.5008	880.9939	911.3466	1183.6188	1092.4727	873.8558	779.7563	(95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Month fracti	3819.7246	3704.2590	3353.9531	2794.2839	2141.7220	1417.4977	907.2455	956.0323	1526.1929	2333.7256	3129.3019	3806.7065	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating	2210.7131	1744.0145	1481.1038	876.2144	409.6374	0.0000	0.0000	0.0000	0.0000	923.4922	1623.9212	2252.0510	(98)
Space heating per m ²										(98) / (4) =		11521.1476	(98)
												59.9124	(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	2471.0153	1945.2674	1994.4292	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7749	0.8539	0.8122	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1914.8870	1661.0329	1619.9290	0.0000	0.0000	0.0000	0.0000	(102)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	2253.1193	2157.3343	1983.0854	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	243.5273	369.2482	270.1884	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												882.9639 (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	60.8818	92.3121	67.5471	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												220.7410 (107)
Space cooling per m2												1.1479 (108)
Energy for space heating												59.9124 (99)
Energy for space cooling												1.1479 (108)
Total												61.0603 (109)
Target Fabric Energy Efficiency (TFEE)												70.2 (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	140.0000 (1b)	x 2.8300 (2b)	= 396.2000 (1b) - (3b)
First floor	52.3000 (1c)	x 3.2000 (2c)	= 167.3600 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	192.3000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 563.5600 (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) = 0.0887 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3387 (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) =	0.3387 (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	0.3726	0.3557	0.3557	0.3303	0.3303	0.2879	0.2964	0.2794	0.2964	0.3303	0.3133	0.3472 (22b)
	0.5694	0.5632	0.5632	0.5545	0.5545	0.5414	0.5439	0.5390	0.5439	0.5545	0.5491	0.5603 (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)			61.9500	1.3258	82.1307		(27)
Entrance Door			5.5600	1.4000	7.7840		(26a)
Ground Floor			140.0000	0.1100	15.4000		(28a)
EW1 - Facing Brick	120.3500	25.0000	95.3500	0.2100	20.0235		(29a)
EW2 - Facing block	107.1900	30.0600	77.1300	0.2000	15.4260		(29a)
EW3 - Timber frame	17.6400	12.4500	5.1900	0.2200	1.1418		(29a)
R1 - Pitched - Top Floor	62.9500		62.9500	0.1600	10.0720		(30)
R2 - Pitched - Ground Floor	86.0600		86.0600	0.1900	16.3514		(30)
R3 - Flat Roof	4.4700		4.4700	0.1800	0.8046		(30)
Total net area of external elements Aum(A, m ²)			538.6600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	169.1340		(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)							16.6217 (36)
Total fabric heat loss						(33) + (36) =	185.7557 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	105.8965	104.7496	104.7496	103.1293	103.1293	100.6955	101.1556	100.2488	101.1556	103.1293	102.1158	104.1962 (38)
Heat transfer coeff	291.6522	290.5053	290.5053	288.8850	288.8850	286.4512	286.9113	286.0045	286.9113	288.8850	287.8715	289.9519 (39)
Average = Sum(39)m / 12 =												288.6183 (39)
HLP	1.5167	1.5107	1.5107	1.5023	1.5023	1.4896	1.4920	1.4873	1.4920	1.5023	1.4970	1.5078 (40)
HLP (average)												1.5009 (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												2.9919 (42)
Average daily hot water use (litres/day)												105.2575 (43)
Daily hot water use	115.7832	111.5729	107.3626	103.1523	98.9420	94.7317	94.7317	98.9420	103.1523	107.3626	111.5729	115.7832 (44)
Energy conte	171.7032	150.1727	154.9648	135.1020	129.6336	111.8640	103.6584	118.9495	120.3702	140.2798	153.1264	166.2854 (45)
Energy content (annual)												1656.1099 (45)
Distribution loss (46)m = 0.15 x (45)m	25.7555	22.5259	23.2447	20.2653	19.4450	16.7796	15.5488	17.8424	18.0555	21.0420	22.9690	24.9428 (46)

[illegible]

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	179.5136	179.5136	179.5136	179.5136	179.5136	179.5136	179.5136	179.5136	179.5136	179.5136	179.5136	179.5136 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	81.0530	71.9906	58.5467	44.3236	33.1324	27.9718	30.2245	39.2869	52.7308	66.9539	78.1451	83.3057 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	542.7871	548.4195	534.2260	504.0096	465.8669	430.0180	406.0688	400.4364	414.6300	444.8463	482.9891	518.8379 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.9433	55.9433	55.9433	55.9433	55.9433	55.9433	55.9433	55.9433	55.9433	55.9433	55.9433	55.9433 (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)	-119.6757	-119.6757	-119.6757	-119.6757	-119.6757	-119.6757	-119.6757	-119.6757	-119.6757	-119.6757	-119.6757	-119.6757 (71)
Water heating gains (Table 5)	133.7890	131.3575	126.3084	119.4442	114.9877	108.7127	103.3792	110.2129	112.6409	119.7456	127.7680	131.3677 (72)
Total internal gains	876.4102	870.5488	837.8622	786.5585	732.7681	685.4837	658.4536	668.7174	698.7829	750.3270	807.6833	852.2924 (73)

[Jan					Area	Solar flux	g	FF			Access	Gains
					m2	Table 6a	Specific data	Specific data			factor	W
						W/m2	or Table 6b	or Table 6c			Table 6d	
North					10.2300	12.7650	0.6300	0.7000			0.7700	39.9089
East					31.0500	23.8018	0.6300	0.7000			0.7700	225.8617
South					17.6600	54.2217	0.6300	0.7000			0.7700	292.6414
West					3.0100	23.8018	0.6300	0.7000			0.7700	21.8951
Solar gains	580.3071	908.2075	1332.8513	1815.7358	2083.8858	2229.8986	2111.9977	1899.9734	1590.7444	1108.1325	694.3440	492.8644
Total gains	1456.7173	1778.7562	2170.7135	2602.2943	2816.6539	2915.3823	2770.4513	2568.6908	2289.5273	1858.4594	1502.0272	1345.1569

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	18.3152	18.3875	18.3875	18.4906	18.4906	18.6477	18.6178	18.6769	18.6178	18.4906	18.5557	18.4226
alpha	2.2210	2.2258	2.2258	2.2327	2.2327	2.2432	2.2412	2.2451	2.2412	2.2327	2.2370	2.2282
util living area	0.9475	0.9203	0.8642	0.7646	0.6378	0.4617	0.3378	0.3769	0.6067	0.8168	0.9202	0.9547 (86)
MIT	18.8301	19.0870	19.5589	20.0888	20.4891	20.7557	20.8382	20.8249	20.6201	20.0829	19.3768	18.7823 (87)
Th 2	19.6750	19.6795	19.6795	19.6858	19.6858	19.6953	19.6935	19.6971	19.6935	19.6858	19.6898	19.6816 (88)
util rest of house	0.9386	0.9072	0.8416	0.7254	0.5755	0.3695	0.2208	0.2567	0.5209	0.7761	0.9045	0.9469 (89)
MIT 2	16.8385	17.2073	17.8743	18.6049	19.1236	19.4335	19.5030	19.4990	19.3003	18.6202	17.6362	16.7741 (90)
Living area fraction									fLA = Living area / (4) =			0.2288 (91)
MIT	17.2942	17.6374	18.2597	18.9444	19.4361	19.7360	19.8085	19.8024	19.6023	18.9549	18.0345	17.2336 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.1442	17.4874	18.1097	18.7944	19.2861	19.5860	19.6585	19.6524	19.4523	18.8049	17.8845	17.0836 (93)

[illegible]

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

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	140.0000 (1b)	x 2.8300 (2b)	= 396.2000 (1b) - (3b)
First floor	52.3000 (1c)	x 3.2000 (2c)	= 167.3600 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	192.3000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 563.5600 (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) = 0.0887 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3387 (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) =	0.3387 (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	0.4319	0.4234	0.4149	0.3726	0.3641	0.3218	0.3218	0.3133	0.3387	0.3641	0.3811	0.3980 (22b)
Effective ac	0.5933	0.5896	0.5861	0.5694	0.5663	0.5518	0.5518	0.5491	0.5574	0.5663	0.5726	0.5792 (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)			61.9500	1.3258	82.1307		(27)
Entrance Door			5.5600	1.4000	7.7840		(26a)
Ground Floor			140.0000	0.1100	15.4000		(28a)
EW1 - Facing Brick	120.3500	25.0000	95.3500	0.2100	20.0235		(29a)
EW2 - Facing block	107.1900	30.0600	77.1300	0.2000	15.4260		(29a)
EW3 - Timber frame	17.6400	12.4500	5.1900	0.2200	1.1418		(29a)
R1 - Pitched - Top Floor	62.9500		62.9500	0.1600	10.0720		(30)
R2 - Pitched - Ground Floor	86.0600		86.0600	0.1900	16.3514		(30)
R3 - Flat Roof	4.4700		4.4700	0.1800	0.8046		(30)
Total net area of external elements Aum(A, m ²)			538.6600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	169.1340		(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)							16.6217 (36)
Total fabric heat loss						(33) + (36) =	185.7557 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	110.3307	109.6572	108.9971	105.8965	105.3164	102.6159	102.6159	102.1158	103.6561	105.3164	106.4899	107.7168 (38)
Heat transfer coeff	296.0864	295.4129	294.7528	291.6522	291.0721	288.3716	288.3716	287.8715	289.4118	291.0721	292.2456	293.4725 (39)
Average = Sum(39)m / 12 =												291.6494 (39)
HLP	1.5397	1.5362	1.5328	1.5167	1.5136	1.4996	1.4996	1.4970	1.5050	1.5136	1.5197	1.5261 (40)
HLP (average)												1.5166 (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												2.9919 (42)
Average daily hot water use (litres/day)												105.2575 (43)
Daily hot water use	115.7832	111.5729	107.3626	103.1523	98.9420	94.7317	94.7317	98.9420	103.1523	107.3626	111.5729	115.7832 (44)
Energy conte	171.7032	150.1727	154.9648	135.1020	129.6336	111.8640	103.6584	118.9495	120.3702	140.2798	153.1264	166.2854 (45)
Energy content (annual)												1656.1099 (45)
Distribution loss (46)m = 0.15 x (45)m	25.7555	22.5259	23.2447	20.2653	19.4450	16.7796	15.5488	17.8424	18.0555	21.0420	22.9690	24.9428 (46)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)																		0.1000 (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																		9373.9342 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec						
Space heating requirement	1830.3305	1419.5849	1190.0460	715.8035	372.5867	0.0000	0.0000	0.0000	0.0000	716.6291	1307.7473	1873.2836	(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)	1820.2182	1411.7419	1183.4712	711.8488	370.5282	0.0000	0.0000	0.0000	0.0000	712.6698	1300.5222	1862.9340	(211)					
Water heating requirement	281.5893	218.3977	183.0840	110.1236	57.3210	0.0000	0.0000	0.0000	0.0000	110.2506	201.1919	288.1975	(215)					
Water heating requirement	224.7628	198.0975	208.0244	186.4500	182.6932	163.2120	156.7180	172.0091	171.7182	193.3394	204.4744	219.3450	(64)					
Efficiency of water heater (217)m	89.0662	88.8999	88.5686	87.8559	86.4136	79.8000	79.8000	79.8000	79.8000	87.7853	88.7388	89.1242	(217)					
Fuel for water heating, kWh/month	252.3548	222.8322	234.8738	212.2226	211.4171	204.5263	196.3885	215.5503	215.1857	220.2412	230.4227	246.1114	(219)					
Water heating fuel used												2662.1266	(219)					
Annual totals kWh/year																		
Space heating fuel - main system													9373.9342	(211)				
Space heating fuel - secondary													1450.1556	(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)													572.5687	(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													13270.1655	(238)				

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	9373.9342	3.4800	326.2129 (240)
Space heating - secondary	1450.1556	4.2300	61.3416 (242)
Water heating (other fuel)	2662.1266	3.4800	92.6420 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	572.5687	13.1900	75.5218 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-863.6197	13.1900	-113.9114 (252)
Total energy cost			571.6994 (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] =	1.0119 (257)
SAP value		85.8846
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	9373.9342	0.2160	2024.7698 (261)
Space heating - secondary	1450.1556	0.0190	27.5530 (263)
Water heating (other fuel)	2662.1266	0.2160	575.0193 (264)
Space and water heating			2627.3421 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	572.5687	0.5190	297.1632 (268)
Energy saving/generation technologies			
PV Unit	-863.6197	0.5190	-448.2186 (269)
Total kg/year			2515.2116 (272)
CO2 emissions per m2			13.0800 (273)
EI value			85.7970
EI rating			86 (274)
EI band			B

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

Calculation of stars for heating and DHW	

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.25) / 0.9050 = 4.124$, 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	$3.48 / 0.8547 = 4.072$, stars = 4
Water heating environmental impact	$0.216 / 0.8547 = 0.2527$, 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	140.0000 (1b)	x 2.8300 (2b)	= 396.2000 (1b) - (3b)
First floor	52.3000 (1c)	x 3.2000 (2c)	= 167.3600 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	192.3000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 563.5600 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																5 * 10 =	50.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =				50.0000	/ (5) =	0.0887 (8)	
Pressure test										Yes							
Measured/design AP50										5.0000							
Infiltration rate										0.3387 (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) =				0.3387	(21)		
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
	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																	
	0.3726	0.3557	0.3557	0.3303	0.3303	0.2879	0.2964	0.2794	0.2964	0.3303	0.3133	0.3472	(22b)				
Effective ac	0.5694	0.5632	0.5632	0.5545	0.5545	0.5414	0.5439	0.5390	0.5439	0.5545	0.5491	0.5603	(25)				

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K						
Windows (Uw = 1.40)			61.9500	1.3258	82.1307			(27)					
Entrance Door			5.5600	1.4000	7.7840			(26a)					
Ground Floor			140.0000	0.1100	15.4000			(28a)					
EW1 - Facing Brick	120.3500	25.0000	95.3500	0.2100	20.0235			(29a)					
EW2 - Facing block	107.1900	30.0600	77.1300	0.2000	15.4260			(29a)					
EW3 - Timber frame	17.6400	12.4500	5.1900	0.2200	1.1418			(29a)					
R1 - Pitched - Top Floor	62.9500		62.9500	0.1600	10.0720			(30)					
R2 - Pitched - Ground Floor	86.0600		86.0600	0.1900	16.3514			(30)					
R3 - Flat Roof	4.4700		4.4700	0.1800	0.8046			(30)					
Total net area of external elements Aum(A, m2)			538.6600					(31)					
Fabric heat loss, W/K = Sum (A x U)				(26) ... (30) + (32) =	169.1340			(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								100.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)								16.6217 (36)					
Total fabric heat loss						(33) + (36) =		185.7557 (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	105.8965	104.7496	104.7496	103.1293	103.1293	100.6955	101.1556	100.2488	101.1556	103.1293	102.1158	104.1962	(38)
	291.6522	290.5053	290.5053	288.8850	288.8850	286.4512	286.9113	286.0045	286.9113	288.8850	287.8715	289.9519	(39)
Average = Sum(39)m / 12 =												288.6183	(39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.5167	1.5107	1.5107	1.5023	1.5023	1.4896	1.4920	1.4873	1.4920	1.5023	1.4970	1.5078	(40)
Days in month												1.5009	(40)
	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.9919 (42)
Average daily hot water use (litres/day)												105.2575 (43)
Daily hot water use	Jan 115.7832	Feb 111.5729	Mar 107.3626	Apr 103.1523	May 98.9420	Jun 94.7317	Jul 94.7317	Aug 98.9420	Sep 103.1523	Oct 107.3626	Nov 111.5729	Dec 115.7832 (44)
Energy conte	171.7032	150.1727	154.9648	135.1020	129.6336	111.8640	103.6584	118.9495	120.3702	140.2798	153.1264	166.2854 (45)
Energy content (annual)												Total = Sum(45)m = 1656.1099 (45)
Distribution loss (46)m = 0.15 x (45)m	25.7555	22.5259	23.2447	20.2653	19.4450	16.7796	15.5488	17.8424	18.0555	21.0420	22.9690	24.9428 (46)

Water storage loss:												250.0000 (47)
Store volume												
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												
	224.7628	198.0975	208.0244	186.4500	182.6932	163.2120	156.7180	172.0091	171.7182	193.3394	204.4744	219.3450 (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												
	224.7628	198.0975	208.0244	186.4500	182.6932	163.2120	156.7180	172.0091	171.7182	193.3394	204.4744	219.3450 (64)
	Total per year (kWh/year) = Sum (64)m =											2280.8439 (64)
Heat gains from water heating, kWh/month												
	99.5390	88.2723	93.9735	85.9998	85.5509	78.2732	76.9141	81.9984	81.1015	89.0907	91.9929	97.7376 (65)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9144	0.8778	0.8075	0.6940	0.5540	0.3611	0.2174	0.2522	0.5029	0.7420	0.8746	0.9246 (94)
Useful gains	1332.0585	1561.3665	1752.9021	1805.8650	1560.4684	1052.7127	602.4266	647.9330	1151.3345	1378.9108	1313.7289	1243.7758 (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	3571.0523	3511.4477	3169.3320	2627.2485	1931.4996	1141.8007	619.2993	672.7838	1363.4799	2168.0535	2903.0361	3532.6634 (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	1665.8114	1310.4546	1053.8238	591.3961	276.0472	0.0000	0.0000	0.0000	0.0000	587.1221	1144.3012	1702.9324 (98)
Space heating												8331.8888 (99)
Space heating per m2										(98) / (4) =		43.3276 (99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.1000 (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													8285.8563 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1665.8114	1310.4546	1053.8238	591.3961	276.0472	0.0000	0.0000	0.0000	0.0000	587.1221	1144.3012	1702.9324	(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)	1656.6081	1303.2145	1048.0016	588.1287	274.5221	0.0000	0.0000	0.0000	0.0000	583.8784	1137.9791	1693.5239	(211)
Water heating requirement	256.2787	201.6084	162.1267	90.9840	42.4688	0.0000	0.0000	0.0000	0.0000	90.3265	176.0463	261.9896	(215)
Water heating requirement	224.7628	198.0975	208.0244	186.4500	182.6932	163.2120	156.7180	172.0091	171.7182	193.3394	204.4744	219.3450	(64)
Efficiency of water heater (217)m	88.9451	88.7879	88.3686	87.4578	85.6344	79.8000	79.8000	79.8000	79.8000	87.3621	88.5335	89.0058	(216)
Fuel for water heating, kWh/month	252.6982	223.1131	235.4052	213.1886	213.3410	204.5263	196.3885	215.5503	215.1857	221.3081	230.9571	246.4388	(219)
Water heating fuel used												2668.1008	(219)
Annual totals kWh/year													
Space heating fuel - main system												8285.8563	(211)
Space heating fuel - secondary												1281.8291	(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)												572.5687	(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												11948.3136	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	8285.8563	3.6300	300.7766 (240)
Space heating - secondary	1281.8291	5.1600	66.1424 (242)
Water heating (other fuel)	2668.1008	3.6300	96.8521 (247)
Pumps and fans for heating	75.0000	19.4400	14.5800 (249)
Energy for lighting	572.5687	19.4400	111.3074 (250)
Additional standing charges			95.0000 (251)
Energy saving/generation technologies			
PV Unit	-935.0412	19.4400	-181.7720 (252)
Total energy cost			502.8864 (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	8285.8563	0.2160	1789.7450 (261)
Space heating - secondary	1281.8291	0.0190	24.3548 (263)
Water heating (other fuel)	2668.1008	0.2160	576.3098 (264)
Space and water heating			2390.4095 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	572.5687	0.5190	297.1632 (268)
Energy saving/generation technologies			
PV Unit	-935.0412	0.5190	-485.2864 (269)
Total kg/year			2241.2113 (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	8285.8563	1.2200	10108.7447 (261)
Space heating - secondary	1281.8291	1.0400	1333.1022 (263)
Water heating (other fuel)	2668.1008	1.2200	3255.0829 (264)
Space and water heating			14696.9299 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	572.5687	3.0700	1757.7859 (268)
Energy saving/generation technologies			
PV Unit	-935.0412	3.0700	-2870.5765 (269)
Primary energy kWh/year			13814.3893 (272)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Primary energy kWh/m²/year

71.8377 (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 (11.9%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£39	1.39 kg/m ²	B 87
Total Savings	£39	1.39 kg/m ²	B 87
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	£136	-£10
Mains gas	£493	£443	£49
Wood	£66	£66	-£0
Space heating	£476	£478	-£1
Water heating	£97	£56	£41
Lighting	£111	£111	£0
Generated (PV)	-£182	-£182	£0
Total cost of fuels	£503	£463	£39
Total cost of uses	£502	£463	£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	140.0000 (1b)	x 2.8300 (2b)	= 396.2000 (1b) - (3b)
First floor	52.3000 (1c)	x 3.2000 (2c)	= 167.3600 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	192.3000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 563.5600 (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) = 0.0887 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3387 (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) =	0.3387 (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	0.4319	0.4234	0.4149	0.3726	0.3641	0.3218	0.3218	0.3133	0.3387	0.3641	0.3811	0.3980 (22b)
Effective ac	0.5933	0.5896	0.5861	0.5694	0.5663	0.5518	0.5518	0.5491	0.5574	0.5663	0.5726	0.5792 (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)			61.9500	1.3258	82.1307		(27)
Entrance Door			5.5600	1.4000	7.7840		(26a)
Ground Floor			140.0000	0.1100	15.4000		(28a)
EW1 - Facing Brick	120.3500	25.0000	95.3500	0.2100	20.0235		(29a)
EW2 - Facing block	107.1900	30.0600	77.1300	0.2000	15.4260		(29a)
EW3 - Timber frame	17.6400	12.4500	5.1900	0.2200	1.1418		(29a)
R1 - Pitched - Top Floor	62.9500		62.9500	0.1600	10.0720		(30)
R2 - Pitched - Ground Floor	86.0600		86.0600	0.1900	16.3514		(30)
R3 - Flat Roof	4.4700		4.4700	0.1800	0.8046		(30)
Total net area of external elements Aum(A, m ²)			538.6600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	169.1340		(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)							16.6217 (36)
Total fabric heat loss						(33) + (36) =	185.7557 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	110.3307	109.6572	108.9971	105.8965	105.3164	102.6159	102.6159	102.1158	103.6561	105.3164	106.4899	107.7168 (38)
Heat transfer coeff	296.0864	295.4129	294.7528	291.6522	291.0721	288.3716	288.3716	287.8715	289.4118	291.0721	292.2456	293.4725 (39)
Average = Sum(39)m / 12 =												291.6494 (39)
HLP	1.5397	1.5362	1.5328	1.5167	1.5136	1.4996	1.4996	1.4970	1.5050	1.5136	1.5197	1.5261 (40)
HLP (average)												1.5166 (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												2.9919 (42)
Average daily hot water use (litres/day)												105.2575 (43)
Daily hot water use	115.7832	111.5729	107.3626	103.1523	98.9420	94.7317	94.7317	98.9420	103.1523	107.3626	111.5729	115.7832 (44)
Energy conte	171.7032	150.1727	154.9648	135.1020	129.6336	111.8640	103.6584	118.9495	120.3702	140.2798	153.1264	166.2854 (45)
Energy content (annual)										Total = Sum(45)m =		1656.1099 (45)
Distribution loss (46)m = 0.15 x (45)m	25.7555	22.5259	23.2447	20.2653	19.4450	16.7796	15.5488	17.8424	18.0555	21.0420	22.9690	24.9428 (46)

												250.0000	(47)
Store volume												1.7800	(48)
a) If manufacturer declared loss factor is known (kWh/day):												0.5400	(49)
Temperature factor from Table 2b												0.9612	(55)
Enter (49) or (54) in (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	20.8580	20.1852	20.8580	20.1852	20.8580	(57)
Primary loss												23.2624	(59)
	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													
	215.8236	190.0234	197.6895	171.0456	160.9597	141.9544	134.7519	150.9735	157.6645	183.0045	195.8236	210.4058	(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												1.0951	(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												105.2575	(H14)
Volume ratio Veff/V												1.2113	(H15)
Solar storage volume factor												1.0000	(H16)
Solar input												-954.8131	(H17)
Solar input												-27.6877	(63)
	-27.6877	-46.2028	-78.6886	-105.4583	-130.2848	-128.0907	-126.3979	-110.4345	-86.4924	-59.0641	-32.8416	-23.1699	(63)
Solar input (sum of months) = Sum(63)m =												-954.8131	(63)
Output from w/h													
	188.1359	143.8206	119.0008	65.5874	30.6750	13.8637	8.3540	40.5390	71.1721	123.9404	162.9820	187.2359	(64)
Total per year (kWh/year) = Sum(64)m =												1155.3070	(64)
Heat gains from water heating, kWh/month													
	92.3877	81.8130	85.7055	73.6763	68.1641	61.2672	59.3412	65.1699	69.8585	80.8228	85.0723	90.5862	(65)

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	179.5136	179.5136	179.5136	179.5136	179.5136	179.5136	179.5136	179.5136	179.5136	179.5136	179.5136	179.5136 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	81.0530	71.9906	58.5467	44.3236	33.1324	27.9718	30.2245	39.2869	52.7308	66.9539	78.1451	83.3057 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	542.7871	548.4195	534.2260	504.0096	465.8669	430.0180	406.0688	400.4364	414.6300	444.8463	482.9891	518.8379 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.9433	55.9433	55.9433	55.9433	55.9433	55.9433	55.9433	55.9433	55.9433	55.9433	55.9433	55.9433 (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)	-119.6757	-119.6757	-119.6757	-119.6757	-119.6757	-119.6757	-119.6757	-119.6757	-119.6757	-119.6757	-119.6757	-119.6757 (71)
Water heating gains (Table 5)	124.1770	121.7455	115.1956	102.3282	91.6184	85.0933	79.7597	87.5940	97.0257	108.6328	118.1560	121.7557 (72)
Total internal gains	866.7982	860.9368	826.7494	769.4425	709.3988	661.8642	634.8342	646.0984	683.1677	739.2142	798.0713	842.6804 (73)

[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					10.2300	10.6334		0.6300	0.7000		0.7700		33.2445 (74)
East					31.0500	19.6403		0.6300	0.7000		0.7700		186.3720 (76)
South					17.6600	46.7521		0.6300	0.7000		0.7700		252.3268 (78)
West					3.0100	19.6403		0.6300	0.7000		0.7700		18.0670 (80)
Solar gains	490.0102	876.7042	1292.9799	1728.9142	2030.7686	2051.7842	1963.7057	1736.8557	1445.6916	995.8972	595.0160	413.8685	(83)
Total gains	1356.8084	1737.6409	2119.7293	2498.3567	2740.1674	2713.6484	2598.5399	2382.9542	2128.8592	1735.1114	1393.0873	1256.5489	(84)

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	18.0409	18.0820	18.1225	18.3152	18.3517	18.5236	18.5236	18.5557	18.4570	18.3517	18.2780	18.2016
alpha	2.2027	2.2055	2.2082	2.2210	2.2234	2.2349	2.2349	2.2370	2.2305	2.2234	2.2185	2.2134
util living area	0.9573	0.9283	0.8802	0.7980	0.6856	0.5511	0.4325	0.4777	0.6681	0.8515	0.9368	0.9634 (86)
MIT	18.6407	18.9473	19.3977	19.9305	20.3673	20.6630	20.7903	20.7651	20.5237	19.9209	19.1767	18.5863 (87)
Th 2	19.6578	19.6605	19.6630	19.6750	19.6773	19.6878	19.6878	19.6898	19.6838	19.6773	19.6727	19.6680 (88)
util rest of house	0.9501	0.9166	0.8605	0.7642	0.6310	0.4679	0.3214	0.3654	0.5913	0.8184	0.9245	0.9572 (89)
MIT 2	16.5559	16.9961	17.6367	18.3838	18.9649	19.3333	19.4628	19.4457	19.1844	18.3952	17.3405	16.4831 (90)
Living area fraction												0.2288 (91)
MIT	17.0330	17.4426	18.0397	18.7377	19.2858	19.6376	19.7666	19.7475	19.4908	18.7443	17.7607	16.9643 (92)
Temperature adjustment												-0.1500
adjusted MIT	16.8830	17.2926	17.8897	18.5877	19.1358	19.4876	19.6166	19.5975	19.3408	18.5943	17.6107	16.8143 (93)

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	9403.9520	0.2160	2031.2536 (261)
Space heating - secondary	1454.7994	0.0190	27.6412 (263)
Water heating (other fuel)	1313.1027	0.2160	283.6302 (264)
Space and water heating			2342.5250 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	572.5687	0.5190	297.1632 (268)
Energy saving/generation technologies			
PV Unit	-863.6197	0.5190	-448.2186 (269)
Total kg/year			2256.3445 (272)
CO2 emissions per m2			11.7300 (273)
EI value			87.2587
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	140.0000 (1b)	x 2.8300 (2b)	= 396.2000 (1b) - (3b)
First floor	52.3000 (1c)	x 3.2000 (2c)	= 167.3600 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	192.3000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 563.5600 (5)

2. Ventilation rate

	main heating	+	secondary heating	+	other	=	total	m3 per hour				
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000 (6a)				
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000 (6b)				
Number of intermittent fans							5 * 10 =	50.0000 (7a)				
Number of passive vents							0 * 10 =	0.0000 (7b)				
Number of flueless gas fires							0 * 40 =	0.0000 (7c)				
								Air changes per hour				
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =						50.0000 / (5) =	0.0887 (8)				
Pressure test							Yes					
Measured/design AP50							5.0000					
Infiltration rate							0.3387	(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) =	0.3387 (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	0.3726	0.3557	0.3557	0.3303	0.3303	0.2879	0.2964	0.2794	0.2964	0.3303	0.3133	0.3472 (22b)
Effective ac	0.5694	0.5632	0.5632	0.5545	0.5545	0.5414	0.5439	0.5390	0.5439	0.5545	0.5491	0.5603 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K						
Windows (Uw = 1.40)			61.9500	1.3258	82.1307			(27)					
Entrance Door			5.5600	1.4000	7.7840			(26a)					
Ground Floor			140.0000	0.1100	15.4000			(28a)					
EW1 - Facing Brick	120.3500	25.0000	95.3500	0.2100	20.0235			(29a)					
EW2 - Facing block	107.1900	30.0600	77.1300	0.2000	15.4260			(29a)					
EW3 - Timber frame	17.6400	12.4500	5.1900	0.2200	1.1418			(29a)					
R1 - Pitched - Top Floor	62.9500		62.9500	0.1600	10.0720			(30)					
R2 - Pitched - Ground Floor	86.0600		86.0600	0.1900	16.3514			(30)					
R3 - Flat Roof	4.4700		4.4700	0.1800	0.8046			(30)					
Total net area of external elements Aum(A, m2)			538.6600					(31)					
Fabric heat loss, W/K = Sum (A x U)				(26) ... (30) + (32) =	169.1340			(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								100.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)								16.6217 (36)					
Total fabric heat loss						(33) + (36) =		185.7557 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 105.8965	Feb 104.7496	Mar 104.7496	Apr 103.1293	May 103.1293	Jun 100.6955	Jul 101.1556	Aug 100.2488	Sep 101.1556	Oct 103.1293	Nov 102.1158	Dec 104.1962	(38)
Heat transfer coeff	291.6522	290.5053	290.5053	288.8850	288.8850	286.4512	286.9113	286.0045	286.9113	288.8850	287.8715	289.9519	(39)
Average = Sum(39)m / 12 =												288.6183	(39)
HLP	Jan 1.5167	Feb 1.5107	Mar 1.5107	Apr 1.5023	May 1.5023	Jun 1.4896	Jul 1.4920	Aug 1.4873	Sep 1.4920	Oct 1.5023	Nov 1.4970	Dec 1.5078	(40)
HLP (average)												1.5009	(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												2.9919 (42)
Average daily hot water use (litres/day)												105.2575 (43)
Daily hot water use	Jan 115.7832	Feb 111.5729	Mar 107.3626	Apr 103.1523	May 98.9420	Jun 94.7317	Jul 94.7317	Aug 98.9420	Sep 103.1523	Oct 107.3626	Nov 111.5729	Dec 115.7832 (44)
Energy conte	171.7032	150.1727	154.9648	135.1020	129.6336	111.8640	103.6584	118.9495	120.3702	140.2798	153.1264	166.2854 (45)
Energy content (annual)												Total = Sum(45)m = 1656.1099 (45)
Distribution loss (46)m = 0.15 x (45)m	25.7555	22.5259	23.2447	20.2653	19.4450	16.7796	15.5488	17.8424	18.0555	21.0420	22.9690	24.9428 (46)

												250.0000	(47)												
Store volume												1.7800	(48)												
a) If manufacturer declared loss factor is known (kWh/day):												0.5400	(49)												
Temperature factor from Table 2b												0.9612	(55)												
Enter (49) or (54) in (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	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	20.8580	20.1852	20.8580	20.1852	20.8580	20.1852	20.8580	(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																									
215.8236	190.0234	197.6895	171.0456	160.9597	141.9544	134.7519	150.9735	157.6645	183.0045	195.8236	210.4058	(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												1.1857	(H8)												
Utilisation factor												0.5698	(H9)												
Collector performance factor												0.8793	(H10)												
Dedicated solar storage volume												75.0000	(H11)												
Effective solar volume												127.5000	(H13)												
Daily hot water demand												105.2575	(H14)												
Volume ratio Veff/V												1.2113	(H15)												
Solar storage volume factor												1.0000	(H16)												
Solar input												-983.7288	(H17)												
Solar input												-31.4566	-45.9128	-77.7230	-105.8871	-127.5748	-132.7340	-129.6628	-115.4001	-91.1170	-63.0251	-36.7668	-26.4686	(63)	
												Solar input (sum of months) = Sum(63)m =						-983.7288	(63)						
Output from w/h																									
184.3670	144.1106	119.9664	65.1585	33.3850	9.2204	5.0891	35.5734	66.5475	119.9794	159.0568	183.9372	(64)													
												Total per year (kWh/year) = Sum(64)m =						1126.3913	(64)						
Heat gains from water heating, kWh/month																									
92.3877	81.8130	85.7055	73.6763	68.1641	61.2672	59.3412	65.1699	69.8585	80.8228	85.0723	90.5862	(65)													

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, n _{l,m} (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	18.3152	18.3875	18.3875	18.4906	18.4906	18.6477	18.6178	18.6769	18.6178	18.4906	18.5557	18.4226
alpha	2.2210	2.2258	2.2258	2.2327	2.2327	2.2432	2.2412	2.2451	2.2412	2.2327	2.2370	2.2282
util living area	0.9482	0.9211	0.8653	0.7666	0.6409	0.4645	0.3403	0.3797	0.6092	0.8184	0.9211	0.9553 (86)
MIT	18.8250	19.0824	19.5544	20.0839	20.4851	20.7540	20.8376	20.8240	20.6177	20.0791	19.3721	18.7771 (87)
Th 2	19.6750	19.6795	19.6795	19.6858	19.6858	19.6953	19.6935	19.6971	19.6935	19.6858	19.6898	19.6816 (88)
util rest of house	0.9393	0.9081	0.8428	0.7276	0.5785	0.3720	0.2226	0.2588	0.5234	0.7779	0.9055	0.9476 (89)
MIT 2	16.8313	17.2007	17.8682	18.5987	19.1192	19.4322	19.5027	19.4986	19.2981	18.6154	17.6297	16.7667 (90)
Living area fraction									f _{LA} = Living area / (4) =			0.2288 (91)
MIT	17.2875	17.6313	18.2540	18.9385	19.4317	19.7347	19.8081	19.8018	19.6000	18.9503	18.0284	17.2267 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.1375	17.4813	18.1040	18.7885	19.2817	19.5847	19.6581	19.6518	19.4500	18.8003	17.8784	17.0767 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9153	0.8787	0.8088	0.6960	0.5568	0.3635	0.2192	0.2543	0.5052	0.7437	0.8758	0.9255 (94)
Useful gains	1324.5582	1554.6280	1746.6071	1799.2713	1555.4402	1051.1281	602.0429	647.3734	1148.7417	1373.8333	1307.0568	1236.0545 (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	3569.0950	3509.6737	3167.6663	2625.5438	1930.2503	1141.4173	619.1951	672.6361	1362.8354	2166.7161	2901.2841	3530.6633 (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	1669.9354	1313.7907	1057.2680	594.9162	278.8587	0.0000	0.0000	0.0000	0.0000	589.9048	1147.8436	1707.1890 (98)
Space heating												8359.7064 (98)
Space heating per m2												43.4722 (99)
										(98) / (4) =		

Not applicable

Fraction of space heat from secondary/supplementary system (Table 11)

[illegible]

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	8313.5202	3.6300	301.7808 (240)
Space heating - secondary	1286.1087	5.1600	66.3632 (242)
Water heating (other fuel)	1280.1387	3.6300	46.4690 (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	572.5687	19.4400	111.3074 (250)
Additional standing charges			95.0000 (251)
Energy saving/generation technologies			
PV Unit	-935.0412	19.4400	-181.7720 (252)
Total energy cost			463.4484 (255)

	Energy	Emission factor	Emissions
	kWh/year	kg CO2/kWh	kg CO2/year
Space heating - main system 1	8313.5202	0.2160	1795.7204 (261)
Space heating - secondary	1286.1087	0.0190	24.4361 (263)
Water heating (other fuel)	1280.1387	0.2160	276.5100 (264)
Space and water heating			2096.6664 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	572.5687	0.5190	297.1632 (268)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Energy saving/generation technologies			
PV Unit	-935.0412	0.5190	-485.2864 (269)
Total kg/year			1973.4182 (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	8313.5202	1.2200	10142.4946 (261)
Space heating - secondary	1286.1087	1.0400	1337.5530 (263)
Water heating (other fuel)	1280.1387	1.2200	1561.7692 (264)
Space and water heating			13041.8169 (265)
Pumps and fans	125.0000	3.0700	383.7500 (267)
Energy for lighting	572.5687	3.0700	1757.7859 (268)
Energy saving/generation technologies			
PV Unit	-935.0412	3.0700	-2870.5765 (269)
Primary energy kWh/year			12312.7763 (272)
Primary energy kWh/m2/year			64.0290 (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	1487.80 (P1)
Transmission heat loss coefficient	185.76 (37)
Summer heat loss coefficient	1673.55 (P2)

Overhangs	Ratio	Z_overhangs	Overhang type
Orientation			
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	Z blinds	Solar access	Z overhangs	Z summer
Orientation				
North	1.000	0.90	1.000	0.900 (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	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	10.2300	81.1852	0.6300	0.7000	0.9000	296.6716
East	31.0500	117.5071	0.6300	0.7000	0.9000	1303.3144
South	17.6600	112.2060	0.6300	0.7000	0.9000	707.8323
West	3.0100	117.5071	0.6300	0.7000	0.9000	126.3438
total:						2434.1622

	Jun	Jul	Aug	
Solar gains	2572	2434	2197	(P3)
Internal gains	682	655	666	
Total summer gains	3255	3090	2863	(P5)
Summer gain/loss ratio	1.94	1.85	1.71	(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	19.24	21.05	20.81	(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 1	Issued on Date	08/04/2022
Assessment Reference	As Designed	Prop Type Ref	Plot 1
Property	Plot 1, 71, Oak Tree Road, Reading, RG31 6LA		
SAP Rating	86 B	DER	13.88
Environmental	86 B	TER	17.48
CO ₂ Emissions (t/year)	2.24	% DER<TER	20.60
General Requirements Compliance	Pass	DFEE	59.32
		TFEE	70.22
		% DFEE<TFEE	15.52
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)	17.48	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	13.88	kgCO ₂ /m ²	Pass
	-3.60 (-20.6%)	kgCO ₂ /m ²	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	70.22	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DFEE)	59.32	kWh/m ² /yr	
	-10.9 (-15.5%)	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	0.18 (max. 0.20)	0.19 (max. 0.35)	Pass
Openings	1.40 (max. 2.00)	1.40 (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

10.23 m², No overhang

Windows facing East

31.05 m², No overhang

Windows facing South

17.66 m², No overhang

Windows facing West

3.01 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

0.031

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 1	Issued on Date	08/04/2022
Assessment Reference	As Designed	Prop Type Ref	Plot 1
Property	Plot 1, 71, Oak Tree Road, Reading, RG31 6LA		
SAP Rating	86 B	DER	13.88
Environmental	86 B	TER	17.48
CO ₂ Emissions (t/year)	2.24	% DER<TER	20.60
General Requirements Compliance	Pass	DFEE	59.32
		TFEE	70.22
		% DFEE<TFEE	15.52
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)

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:	60.10 m	140.00 m ²	2.83 m
1st Storey:	29.96 m	52.30 m ²	3.20 m

7.0 Living Area	44.00	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	120.35	95.35
EW2 - Facing block	Cavity Wall	0.20	107.19	77.13
EW3 - Timber frame	Timber Frame	0.22	17.64	5.19

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	62.95	62.95
R2 - Pitched - Ground Floor	External Slope Roof	0.19	86.06	86.06
R3 - Flat Roof	External Flat Roof	0.18	4.47	4.47

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m ² K)	Area (m ²)
Ground Floor	Ground Floor - Solid		0.11	140.00

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

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	[2] EW2 - Facing block	East							3.57	
E Windows 1	Window	[1] EW1 - Facing Brick	East	None	0.00					6.83	
E Windows 2	Window	[2] EW2 - Facing block	East	None	0.00					16.09	
E Windows 3	Window	[3] EW3 - Timber frame	East	None	0.00					8.13	
W Windows	Window	[2] EW2 - Facing block	West	None	0.00					3.01	
Rear Door	Half Glazed Door	[2] EW2 - Facing block	West							1.99	
S Windows 1	Window	[1] EW1 - Facing Brick	South	None	0.00					13.64	
S Windows 2	Window	[2] EW2 - Facing block	South	None	0.00					1.91	
S Windows 3	Window	[3] EW3 - Timber frame	South	None	0.00					2.11	
N Windows 1	Window	[1] EW1 - Facing Brick	North	None	0.00					4.53	
N Windows 2	Window	[2] EW2 - Facing block	North	None	0.00					3.49	
N Windows 3	Window	[3] EW3 - Timber frame	North	None	0.00					2.21	

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)	39.10	0.050	No	CATNIC
Independently assessed	E3 Sill	18.39	0.034	No	CD0027
Independently assessed	E4 Jamb	79.65	0.040	No	CD0028
Independently assessed	E5 Ground floor (normal)	60.10	0.060	No	CD0022
Independently assessed	E6 Intermediate floor within a dwelling	21.20	0.000	No	CD0029
Table K1 - Approved	E8 Balcony within a dwelling, wall insulation continuous	3.60	0.000	No	
Independently assessed	E11 Eaves (insulation at rafter level)	34.96	0.037	No	CD0034
Independently assessed	E13 Gable (insulation at rafter level)	26.52	0.080	No	CD0032
Table K1 - Default	E14 Flat roof	6.08	0.080	No	
Independently assessed	E16 Corner (normal)	34.58	0.058	No	CD0035
Independently assessed	E17 Corner (inverted – internal area greater than external area)	15.14	-0.065	No	CD0036
Table K1 - Default	R4 Ridge (vaulted ceiling)	19.96	0.080	No	
Table K1 - Default	R8 Roof to wall (rafter)	12.16	0.060	No	

Y-value 0.031 W/m²K

18.0 Pressure Testing

Yes

Designed AP₅₀ 5.00 m³/(h.m²) @ 50 Pa

Property Tested ?

As Built AP₅₀ m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather Windows fully open

Cross ventilation possible Yes

Night Ventilation Yes

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

Air change rate

Mechanical Ventilation

Mechanical Ventilation System Present

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

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

23.0 Electricity Tariff

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	
Flow Temperature	Normal (> 45°C)	

25.0 Main Heating 2

Community Heating

27.0 Secondary Heating

Secondary Heating

Description

SHS efficiency %

SAP Code

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

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				
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	