



SAP Report Submission for Building Regulations Compliance

Client: The Keen Partnership

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

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

EXCELLENCE
IN ENERGY
ASSESSMENT

PREDICTED ENERGY ASSESSMENT

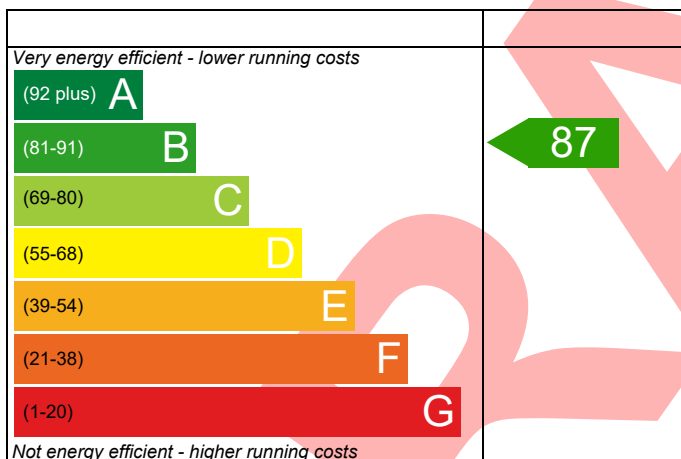
Plot 1, 71, Oak Tree Road,
Reading,
RG31 6LA

Dwelling type: House, Detached
Date of assessment: 08/04/2022
Produced by: Sofia Kymiatzi
Total floor area: 191.81 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

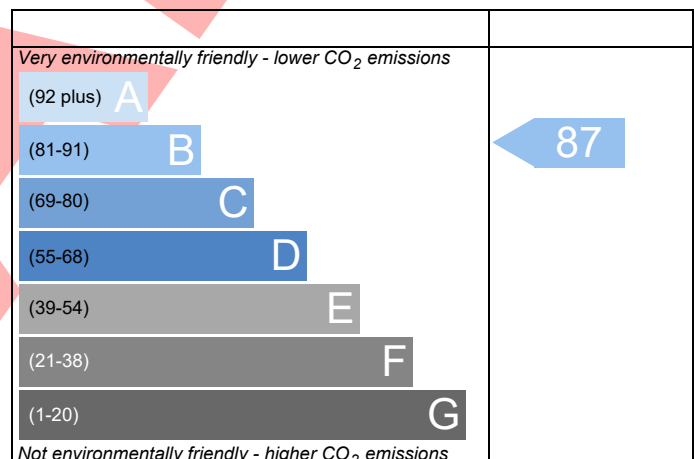


England

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	87 B	DER	12.92
Environmental	87 B	TER	16.16
CO ₂ Emissions (t/year)	2.06	% DER<TER	20.07
General Requirements Compliance	Pass	DFEE	54.29
		TREE	63.44
		% DFEE<TFEE	14.43
Assessor Details	Miss Sofia Kymiatzi, Sofia Kymiatzi, Tel: 07365 923 614, sofia@jostec.co.uk		Assessor ID
Client	The Keen Partnership, 22098		U123-0001

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)	16.16	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	12.92	kgCO ₂ /m ²	Pass
	-3.24 (-20.0%)	kgCO ₂ /m ²	

1b TFE and DFEE

Target Fabric Energy Efficiency (TFEE)	63.44	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DFEE)	54.29	kWh/m ² /yr	
	-9.1 (-14.4%)	kWh/m ² /yr	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	Pass
Floor	0.11 (max. 0.25)	0.11 (max. 0.70)	Pass
Roof	0.17 (max. 0.20)	0.17 (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

4.36 m², No overhang

Windows facing East

22.59 m², No overhang

Windows facing South

19.50 m², No overhang

Windows facing West

6.46 m², No overhang

Air change rate

8.00 ach

Blinds/curtains

None

Criterion 4 – Building performance consistent with DER and DFEE rate

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals

5.00 (design value) m³/(h.m²) @ 50 Pa

Maximum

10.0 m³/(h.m²) @ 50 Pa

Pass

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BUILDING REGULATION COMPLIANCE

Calculation Type: New Build (As Designed)

10 Key features

Floor U-value

0.11

W/m²K

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 88	B 88	Recommended
Photovoltaic			0	0	Already installed
Wind turbine			0	0	Not applicable
Totals	£4,000 - £6,000	£39	B 88	B 88	

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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	87 B	DER	12.92	TER	16.16	
Environmental	87 B	% DER<TER	20.07			
CO ₂ Emissions (t/year)	2.06	DFEE	54.29	TFEE	63.44	
General Requirements Compliance	Pass	% DFEE<TFEE	14.43			
Assessor Details	Miss Sofia Kymiatzi, Sofia Kymiatzi, Tel: 07365 923 614, sofia@jostec.co.uk				Assessor ID	U123-0001
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) 16.16 kgCO₂/m²

Dwelling Carbon Dioxide Emission Rate (DER) 12.92 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)63.4 kWh/m²/yr

Dwelling Fabric Energy Efficiency (DFEE)54.3 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Floor	0.11 (max. 0.25)	0.11 (max. 0.70)	OK
Roof	0.17 (max. 0.20)	0.17 (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:	4.36 m ² , No overhang
Windows facing East:	22.59 m ² , No overhang
Windows facing South:	19.50 m ² , No overhang
Windows facing West:	6.46 m ² , No overhang
Air change rate:	8.00 ach
Blinds/curtains:	None

10 Key features

Floor U-value 0.11 W/m²K

Secondary heating (wood logs)

wood logs

Secondary heating fuel:

1.00 kW

Photovoltaic array

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	139.3400 (1b)	x 2.6800 (2b)	= 373.4312 (1b) - (3b)
First floor	52.4700 (1c)	x 2.4900 (2c)	= 130.6503 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	191.8100		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 504.0815 (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) = 0.0992 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3492 (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) =	0.3492 (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	0.4452	0.4365	0.4278	0.3841	0.3754	0.3317	0.3317	0.3230	0.3492	0.3754	0.3928	0.4103 (22b)
Effective ac	0.5991	0.5953	0.5915	0.5738	0.5705	0.5550	0.5550	0.5522	0.5610	0.5705	0.5772	0.5842 (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)			52.9100	1.3258	70.1458		(27)
Entrance Door			3.7800	1.4000	5.2920		(26a)
Ground Floor			139.3400	0.1100	15.3274		(28a)
EW1 - Facing Brick	230.5300	56.6900	173.8400	0.2100	36.5064		(29a)
R1 - Flat ceiling	131.4500		131.4500	0.1700	22.3465		(30)
R2 - Flat roof (Balcony)	6.5800		6.5800	0.1600	1.0528		(30)
Total net area of external elements Aum, m ²			507.9000				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		150.6709		(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)							21.1722 (36)
Total fabric heat loss						(33) + (36) =	171.8431 (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	99.6600	99.0198	98.3923	95.4449	94.8934	92.3263	92.3263	91.8509	93.3151	94.8934	96.0090	97.1753 (38)
Heat transfer coeff	271.5031	270.8629	270.2354	267.2880	266.7365	264.1694	264.1694	263.6940	265.1582	266.7365	267.8521	269.0184 (39)
Average = Sum(39)m / 12 =												267.2853 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.4155	1.4121	1.4089	1.3935	1.3906	1.3772	1.3772	1.3748	1.3824	1.3906	1.3964	1.4025 (40)
HLP (average)												1.3935 (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												2.9913 (42)
Average daily hot water use (litres/day)												105.2423 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	115.7665	111.5568	107.3472	103.1375	98.9278	94.7181	94.7181	98.9278	103.1375	107.3472	111.5568	115.7665 (44)
Energy conte	171.6784	150.1510	154.9424	135.0826	129.6149	111.8478	103.6435	118.9324	120.3528	140.2596	153.1043	166.2614 (45)
Energy content (annual)												Total = Sum(45)m = 1655.8713 (45)
Distribution loss (46)m = 0.15 x (45)m	25.7518	22.5227	23.2414	20.2624	19.4422	16.7772	15.5465	17.8399	18.0529	21.0389	22.9656	24.9392 (46)
Water storage loss:												250.0000 (47)
Store volume												1.7800 (48)
a) If manufacturer declared loss factor is known (kWh/day):												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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	224.7380	198.0758	208.0020	186.4306	182.6745	163.1958	156.7031	171.9920	171.7008	193.3192	204.4523	219.3210 (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	224.7380	198.0758	208.0020	186.4306	182.6745	163.1958	156.7031	171.9920	171.7008	193.3192	204.4523	219.3210 (64)	
								Total per year (kWh/year) = Sum(64)m =					2280.6053 (64)
Heat gains from water heating, kWh/month	99.5308	88.2651	93.9660	85.9934	85.5446	78.2678	76.9091	81.9927	81.0957	89.0840	91.9856	97.7296 (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	149.5627	149.5627	149.5627	149.5627	149.5627	149.5627	149.5627	149.5627	149.5627	149.5627	149.5627	149.5627	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	32.3790	28.7587	23.3882	17.7063	13.2357	11.1741	12.0740	15.6943	21.0649	26.7467	31.2173	33.2789	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	363.1937	366.9625	357.4652	337.2466	311.7242	287.7368	271.7118	267.9429	277.4402	297.6588	323.1812	347.1686	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.9563	37.9563	37.9563	37.9563	37.9563	37.9563	37.9563	37.9563	37.9563	37.9563	37.9563	37.9563	(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)	-119.6502	-119.6502	-119.6502	-119.6502	-119.6502	-119.6502	-119.6502	-119.6502	-119.6502	-119.6502	-119.6502	-119.6502	(71)
Water heating gains (Table 5)	133.7779	131.3468	126.2984	119.4352	114.9794	108.7053	103.3725	110.2052	112.6329	119.7366	127.7578	131.3570	(72)
Total internal gains	600.2194	597.9369	578.0206	545.2570	510.8081	478.4851	458.0271	464.7113	482.0069	515.0109	553.0251	582.6733	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
North					4.3600	10.6334		0.6300	0.7000	0.7700		14.1687 (74)	
East					22.5900	19.6403		0.6300	0.7000	0.7700		135.5924 (76)	
South					19.5000	46.7521		0.6300	0.7000	0.7700		278.6168 (78)	
West					6.4600	19.6403		0.6300	0.7000	0.7700		38.7750 (80)	

Solar gains	467.1529	824.4792	1189.0015	1550.1097	1788.1691	1793.2000	1721.7204	1544.5958	1315.8320	929.1402	565.1504	395.9535 (83)	
Total gains	1067.3722	1422.4160	1767.0221	2095.3666	2298.9772	2271.6851	2179.7475	2009.3071	1797.8389	1444.1511	1118.1755	978.6268 (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	19.6243	19.6707	19.7164	19.9338	19.9750	20.1691	20.1691	20.2054	20.0939	19.9750	19.8918	19.8055
alpha	2.3083	2.3114	2.3144	2.3289	2.3317	2.3446	2.3446	2.3470	2.3396	2.3317	2.3261	2.3204
util living area	0.9726	0.9482	0.9064	0.8323	0.7260	0.5925	0.4683	0.5139	0.7067	0.8820	0.9566	0.9774 (86)
MIT	18.6478	18.9553	19.3993	19.9252	20.3620	20.6628	20.7943	20.7692	20.5242	19.9179	19.1772	18.5960 (87)
Th 2	19.7515	19.7540	19.7565	19.7683	19.7705	19.7808	19.7808	19.7827	19.7769	19.7705	19.7661	19.7614 (88)
util rest of house	0.9680	0.9396	0.8908	0.8036	0.6765	0.5130	0.3591	0.4046	0.6363	0.8551	0.9480	0.9735 (89)
MIT 2	16.6195	17.0646	17.7017	18.4479	19.0384	19.4211	19.5591	19.5409	19.2673	18.4587	17.3989	16.5504 (90)
Living area fraction									fLA = Living area / (4) =			0.2192 (91)
MIT	17.0641	17.4791	18.0739	18.7718	19.3286	19.6933	19.8299	19.8102	19.5429	18.7786	17.7887	16.9989 (92)
Temperature adjustment												-0.1500
adjusted MIT	16.9141	17.3291	17.9239	18.6218	19.1786	19.5433	19.6799	19.6602	19.3929	18.6286	17.6387	16.8489 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9523	0.9163	0.8605	0.7707	0.6488	0.4957	0.3492	0.3924	0.6101	0.8222	0.9266	0.9598	(94)
Useful gains	1016.4776	1303.4177	1520.5121	1614.8484	1491.6418	1126.0488	761.0857	788.4717	1096.9076	1187.3892	1036.0671	939.3164	(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	3424.7734	3366.5782	3087.1347	2598.5156	1994.8091	1305.8712	813.6194	859.6901	1403.4474	2141.5099	2822.8223	3402.7762	(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	1791.7720	1386.4438	1165.5672	708.2404	374.3564	0.0000	0.0000	0.0000	0.0000	709.8658	1286.4638	1832.8140	(98)
Space heating											9255.5235	(98)	
Space heating per m2											(98) / (4) =	48.2536	(99)

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.1000 (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													9204.3880 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1791.7720	1386.4438	1165.5672	708.2404	374.3564	0.0000	0.0000	0.0000	0.0000	709.8658	1286.4638	1832.8140	(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)	1781.8727	1378.7839	1159.1276	704.3275	372.2882	0.0000	0.0000	0.0000	0.0000	705.9439	1279.3563	1822.6880	(211)
Water heating requirement	275.6572	213.2991	179.3180	108.9601	57.5933	0.0000	0.0000	0.0000	0.0000	109.2101	197.9175	281.9714	(215)
Water heating requirement	224.7380	198.0758	208.0020	186.4306	182.6745	163.1958	156.7031	171.9920	171.7008	193.3192	204.4523	219.3210	(64)
Efficiency of water heater (217)m	89.0397	88.8676	88.5356	87.8349	86.4258	79.8000	79.8000	79.8000	79.8000	87.7663	88.7147	79.8000	(216)
Fuel for water heating, kWh/month	252.4022	222.8887	234.9360	212.2512	211.3656	204.5061	196.3698	215.5288	215.1639	220.2660	230.4604	246.1571	(219)
Water heating fuel used												2662.2957	(219)
Annual totals kWh/year													
Space heating fuel - main system												9204.3880	(211)
Space heating fuel - secondary												1423.9267	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												571.8229	(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												13073.8137	(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	9204.3880	0.2160	1988.1478 (261)
Space heating - secondary	1423.9267	0.0190	27.0546 (263)
Water heating (other fuel)	2662.2957	0.2160	575.0559 (264)
Space and water heating			2590.2583 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	571.8229	0.5190	296.7761 (268)
Energy saving/generation technologies			
PV Unit	-863.6197	0.5190	-448.2186 (269)
Total CO2, kg/year			2477.7408 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			12.9200 (273)

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

DER		12.9200 ZC1
Total Floor Area	TFA	191.8100
Assumed number of occupants	N	2.9913
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190
CO2 emissions from appliances, equation (L14)		11.2205 ZC2
CO2 emissions from cooking, equation (L16)		0.9947 ZC3
Total CO2 emissions		25.1352 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		25.1352 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	139.3400 (1b)	x 2.6800 (2b)	= 373.4312 (1b) - (3b)
First floor	52.4700 (1c)	x 2.4900 (2c)	= 130.6503 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	191.8100		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 504.0815 (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) = 0.0794 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3294 (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) =				0.3294 (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	0.4199	0.4117	0.4035	0.3623	0.3541	0.3129	0.3129	0.3047	0.3294	0.3541	0.3705	0.3870 (22b)
Effective ac	0.5882	0.5847	0.5814	0.5656	0.5627	0.5489	0.5489	0.5464	0.5542	0.5627	0.5686	0.5749 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Semi-glazed door			3.7800	1.2000	4.5360		(26a)
TER Opening Type (Uw = 1.40)			44.1700	1.3258	58.5587		(27)
Ground Floor			139.3400	0.1300	18.1142		(28a)
EW1 - Facing Brick	230.5300	47.9500	182.5800	0.1800	32.8644		(29a)
R1 - Flat ceiling	131.4500		131.4500	0.1300	17.0885		(30)
R2 - Flat roof (Balcony)	6.5800		6.5800	0.1300	0.8554		(30)
Total net area of external elements Aum(A, m ²)			507.9000				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		132.0172		(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)							24.6670 (36)
Total fabric heat loss						(33) + (36) =	156.6842 (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	97.8399	97.2704	96.7122	94.0901	93.5996	91.3159	91.3159	90.8930	92.1955	93.5996	94.5920	95.6295 (38)
Heat transfer coeff	254.5242	253.9546	253.3964	250.7744	250.2838	248.0001	248.0001	247.5772	248.8797	250.2838	251.2762	252.3137 (39)
Average = Sum(39)m / 12 =												250.7720 (39)
HLP	1.3270	1.3240	1.3211	1.3074	1.3049	1.2929	1.2929	1.2907	1.2975	1.3049	1.3100	1.3154 (40)
HLP (average)												1.3074 (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												2.9913 (42)
Average daily hot water use (litres/day)												105.2423 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	115.7665	111.5568	107.3472	103.1375	98.9278	94.7181	94.7181	98.9278	103.1375	107.3472	111.5568	115.7665 (44)
Energy content (annual)	171.6784	150.1510	154.9424	135.0826	129.6149	111.8478	103.6435	118.9324	120.3528	140.2596	153.1043	166.2614 (45)
Distribution loss (46)m = 0.15 x (45)m	25.7518	22.5227	23.2414	20.2624	19.4422	16.7772	15.5465	17.8399	18.0529	21.0389	22.9656	24.9392 (46)
Water storage loss:												250.0000 (47)
Store volume												1.8903 (48)
a) If manufacturer declared loss factor is known (kWh/day):												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.0208 (55)
Total storage loss												
31.6444 28.5820 31.6444 30.6236 31.6444 30.6236 31.6444 31.6444 30.6236 31.6444 30.6236 31.6444 (56)												
If cylinder contains dedicated storage												
31.6444 28.5820 31.6444 30.6236 31.6444 30.6236 31.6444 31.6444 30.6236 31.6444 30.6236 31.6444 (57)												
Primary loss 23.2624 21.0112 23.2624 22.5120 23.2624 22.5120 23.2624 23.2624 22.5120 23.2624 22.5120 23.2624 (59)												
Total heat required for water heating calculated for each month												
226.5852 199.7443 209.8492 188.2182 184.5217 164.9834 158.5503 173.8392 173.4884 195.1664 206.2399 221.1682 (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												
226.5852 199.7443 209.8492 188.2182 184.5217 164.9834 158.5503 173.8392 173.4884 195.1664 206.2399 221.1682 (64)												
Heat gains from water heating, kWh/month												
101.0085 89.5998 95.4438 87.4234 87.0224 79.6979 78.3869 83.4705 82.5258 90.5618 93.4157 99.2073 (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	149.5627	149.5627	149.5627	149.5627	149.5627	149.5627	149.5627	149.5627	149.5627	149.5627	149.5627	149.5627 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	32.3790	28.7587	23.3882	17.7063	13.2357	11.1741	12.0740	15.6943	21.0649	26.7467	31.2173	33.2789 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	363.1937	366.9625	357.4652	337.2466	311.7242	287.7368	271.7118	267.9429	277.4402	297.6588	323.1812	347.1686 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.9563	37.9563	37.9563	37.9563	37.9563	37.9563	37.9563	37.9563	37.9563	37.9563	37.9563	37.9563 (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)	-119.6502	-119.6502	-119.6502	-119.6502	-119.6502	-119.6502	-119.6502	-119.6502	-119.6502	-119.6502	-119.6502	-119.6502 (71)
Water heating gains (Table 5)	135.7641	133.3330	128.2847	121.4214	116.9656	110.6915	105.3587	112.1915	114.6192	121.7228	129.7440	133.3432 (72)
Total internal gains	602.2056	599.9231	580.0069	547.2432	512.7944	480.4713	460.0133	466.6975	483.9931	516.9971	555.0113	584.6595 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
North					3.6400	10.6334	0.6300	0.7000	0.7700		11.8289 (74)	
East					18.8600	19.6403	0.6300	0.7000	0.7700		113.2038 (76)	
South					16.2800	46.7521	0.6300	0.7000	0.7700		232.6093 (78)	
West					5.3900	19.6403	0.6300	0.7000	0.7700		32.3525 (80)	
Solar gains	389.9944	688.2986	992.6049	1294.0568	1492.7864	1496.9840	1437.3130	1289.4512	1098.4825	775.6705	471.8053	330.5554 (83)
Total gains	992.2001	1288.2217	1572.6117	1841.3000	2005.5808	1977.4553	1897.3263	1756.1487	1582.4755	1292.6676	1026.8167	915.2149 (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	52.3335	52.4509	52.5664	53.1160	53.2201	53.7102	53.7102	53.8020	53.5204	53.2201	53.0099	52.7920
alpha	4.4889	4.4967	4.5044	4.5411	4.5480	4.5807	4.5807	4.5868	4.5680	4.5480	4.5340	4.5195
util living area	0.9989	0.9962	0.9874	0.9566	0.8750	0.7208	0.5548	0.6142	0.8522	0.9787	0.9973	0.9992 (86)
MIT	19.4539	19.6686	19.9926	20.3941	20.7273	20.9227	20.9816	20.9712	20.8242	20.3629	19.8255	19.4199 (87)
Th 2	19.8198	19.8221	19.8244	19.8350	19.8370	19.8464	19.8464	19.8481	19.8428	19.8370	19.8330	19.8288 (88)
util rest of house	0.9985	0.9948	0.9826	0.9395	0.8260	0.6213	0.4195	0.4768	0.7763	0.9674	0.9961	0.9990 (89)
MIT 2	17.7637	18.0788	18.5509	19.1293	19.5720	19.7958	19.8399	19.8367	19.7025	19.0968	18.3162	17.7200 (90)
Living area fraction									fLA = Living area / (4) =			0.2192 (91)
MIT	18.1342	18.4273	18.8670	19.4066	19.8253	20.0428	20.0902	20.0854	19.9484	19.3743	18.6471	18.0927 (92)
Temperature adjustment												0.0000
adjusted MIT	18.1342	18.4273	18.8670	19.4066	19.8253	20.0428	20.0902	20.0854	19.9484	19.3743	18.6471	18.0927 (93)

8. Space heating requirement

Utilisation 0.9976 0.9924 0.9772 0.9314 0.8254 0.6398 0.4493 0.5068 0.7845 0.9610 0.9942 0.9983 (94)													
Useful gains 989.7791 1278.3962 1536.7153 1715.0065 1655.4046 1265.2630 852.4829 890.0925 1241.4588 1242.2554 1020.8221 913.6496 (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 3521.1496 3435.3236 3133.7530 2634.7795 2033.6221 1349.8196 865.5729 912.4205 1455.5570 2196.0730 2901.5035 3505.3172 (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 1883.3397 1449.4552 1188.1960 662.2366 281.3938 0.0000 0.0000 0.0000 0.0000 709.6403 1354.0906 1928.2007 (98)													
Space heating													9456.5530 (98)
Space heating per m2													(98) / (4) = 49.3017 (99)

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													10113.9605 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1883.3397	1449.4552	1188.1960	662.2366	281.3938	0.0000	0.0000	0.0000	0.0000	709.6403	1354.0906	1928.2007	(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)	2014.2671	1550.2195	1270.7979	708.2744	300.9559	0.0000	0.0000	0.0000	0.0000	758.9736	1448.2253	2062.2468	(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	226.5852	199.7443	209.8492	188.2182	184.5217	164.9834	158.5503	173.8392	173.4884	195.1664	206.2399	221.1682	(64)
Efficiency of water heater (217)m	89.2153	89.0538	88.7145	87.8918	85.9365	79.8000	79.8000	79.8000	79.8000	87.9561	88.9240	79.8000	(216)
Fuel for water heating, kWh/month	253.9756	224.2962	236.5445	214.1476	214.7187	206.7462	198.6845	217.8436	217.4040	221.8906	231.9283	247.7566	(219)
Water heating fuel used												2685.9364	(219)
Annual totals kWh/year													
Space heating fuel - main system												10113.9605	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												571.8229	(232)
Total delivered energy for all uses												13446.7198	(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	10113.9605	0.2160	2184.6155 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2685.9364	0.2160	580.1623 (264)
Space and water heating			2764.7777 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	571.8229	0.5190	296.7761 (268)
Total CO2, kg/m2/year			3100.4788 (272)
Emissions per m2 for space and water heating			14.4141 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			1.5472 (272b)
Emissions per m2 for pumps and fans			0.2029 (272c)
Target Carbon Dioxide Emission Rate (TER) = (14.4141 * 1.00) + 1.5472 + 0.2029, rounded to 2 d.p.			16.1600 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	139.3400 (1b)	x 2.6800 (2b)	= 373.4312 (1b) - (3b)
First floor	52.4700 (1c)	x 2.4900 (2c)	= 130.6503 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	191.8100		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 504.0815 (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) = 0.0794 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3294 (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) =	0.3294 (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	0.4199	0.4117	0.4035	0.3623	0.3541	0.3129	0.3129	0.3047	0.3294	0.3541	0.3705	0.3870 (22b)
Effective ac	0.5882	0.5847	0.5814	0.5656	0.5627	0.5489	0.5489	0.5464	0.5542	0.5627	0.5686	0.5749 (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)			52.9100	1.3258	70.1458		(27)
Entrance Door			3.7800	1.4000	5.2920		(26a)
Ground Floor			139.3400	0.1100	15.3274		(28a)
EW1 - Facing Brick	230.5300	56.6900	173.8400	0.2100	36.5064		(29a)
R1 - Flat ceiling	131.4500		131.4500	0.1700	22.3465		(30)
R2 - Flat roof (Balcony)	6.5800		6.5800	0.1600	1.0528		(30)
Total net area of external elements Aum, m ²			507.9000				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		150.6709		(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)							21.1722 (36)
Total fabric heat loss						(33) + (36) =	171.8431 (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	97.8399	97.2704	96.7122	94.0901	93.5996	91.3159	91.3159	90.8930	92.1955	93.5996	94.5920	95.6295 (38)
Heat transfer coeff	269.6830	269.1135	268.5553	265.9332	265.4427	263.1590	263.1590	262.7360	264.0386	265.4427	266.4351	267.4726 (39)
Average = Sum(39)m / 12 =												265.9309 (39)
HLP	1.4060	1.4030	1.4001	1.3864	1.3839	1.3720	1.3720	1.3698	1.3766	1.3839	1.3891	1.3945 (40)
HLP (average)												1.3864 (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												2.9913 (42)
Average daily hot water use (litres/day)												105.2423 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	115.7665	111.5568	107.3472	103.1375	98.9278	94.7181	94.7181	98.9278	103.1375	107.3472	111.5568	115.7665 (44)
Energy content (annual)	171.6784	150.1510	154.9424	135.0826	129.6149	111.8478	103.6435	118.9324	120.3528	140.2596	153.1043	166.2614 (45)
Distribution loss (46)m = 0.15 x (45)m												1655.8713 (45)
Water storage loss:	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)

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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	36.4817	31.9071	32.9253	28.7050	27.5432	23.7677	22.0242	25.2731	25.5750	29.8052	32.5347	35.3305 (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	149.5627	149.5627	149.5627	149.5627	149.5627	149.5627	149.5627	149.5627	149.5627	149.5627	149.5627	149.5627	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	32.3790	28.7587	23.3882	17.7063	13.2357	11.1741	12.0740	15.6943	21.0649	26.7467	31.2173	33.2789	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	363.1937	366.9625	357.4652	337.2466	311.7242	287.7368	271.7118	267.9429	277.4402	297.6588	323.1812	347.1686	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.9563	37.9563	37.9563	37.9563	37.9563	37.9563	37.9563	37.9563	37.9563	37.9563	37.9563	37.9563	(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)	-119.6502	-119.6502	-119.6502	-119.6502	-119.6502	-119.6502	-119.6502	-119.6502	-119.6502	-119.6502	-119.6502	-119.6502	(71)
Water heating gains (Table 5)	49.0345	47.4808	44.2544	39.8681	37.0204	33.0106	29.6025	33.9693	35.5208	40.0607	45.1870	47.4873	(72)
Total internal gains	512.4760	511.0708	492.9766	462.6899	429.8492	399.7904	381.2571	385.4753	401.8947	432.3351	467.4544	495.8036	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	4.3600	10.6334	0.6300	0.7000	0.7700	14.1687 (74)
East	22.5900	19.6403	0.6300	0.7000	0.7700	135.5924 (76)
South	19.5000	46.7521	0.6300	0.7000	0.7700	278.6168 (78)
West	6.4600	19.6403	0.6300	0.7000	0.7700	38.7750 (80)

Solar gains	467.1529	824.4792	1189.0015	1550.1097	1788.1691	1793.2000	1721.7204	1544.5958	1315.8320	929.1402	565.1504	395.9535	(83)
Total gains	979.6288	1335.5500	1681.9781	2012.7995	2218.0182	2192.9904	2102.9775	1930.0711	1717.7267	1361.4753	1032.6048	891.7571	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	19.7567	19.7985	19.8397	20.0353	20.0723	20.2465	20.2465	20.2791	20.1791	20.0723	19.9976	19.9200	
alpha	2.3171	2.3199	2.3226	2.3357	2.3382	2.3498	2.3498	2.3519	2.3453	2.3382	2.3332	2.3280	
util living area	0.9770	0.9540	0.9139	0.8417	0.7369	0.6047	0.4802	0.5279	0.7214	0.8928	0.9628	0.9813	(86)
MIT	17.9657	18.3807	18.9798	19.6884	20.2814	20.6904	20.8719	20.8358	20.4968	19.6688	18.6696	17.8929	(87)
Th 2	19.7587	19.7610	19.7632	19.7737	19.7757	19.7849	19.7849	19.7866	19.7813	19.7757	19.7717	19.7676	(88)
util rest of house	0.9731	0.9463	0.8993	0.8141	0.6884	0.5253	0.3696	0.4176	0.6523	0.8678	0.9554	0.9781	(89)
MIT 2	17.0076	17.4185	18.0067	18.6950	19.2443	19.6012	19.7323	19.7140	19.4535	18.6952	17.7162	16.9411	(90)
Living area fraction									fLA = Living area / (4) =			0.2192	(91)
MIT	17.2176	17.6294	18.2200	18.9127	19.4717	19.8400	19.9821	19.9599	19.6822	18.9086	17.9252	17.1497	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.2176	17.6294	18.2200	18.9127	19.4717	19.8400	19.9821	19.9599	19.6822	18.9086	17.9252	17.1497	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	941.8281	1239.7161	1473.2484	1591.6305	1496.4164	1160.7557	817.9178	839.1028	1109.3574	1150.6849	970.2265	863.3212	(94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	3483.6669	3425.6612	3147.4674	2662.7201	2062.9309	1378.9459	890.0324	935.3183	1473.9249	2205.4629	2884.2141	3463.6974	(97a)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	1891.1280	1468.9551	1245.6189	771.1844	421.4868	0.0000	0.0000	0.0000	0.0000	784.7548	1378.0710	1934.6799	(98)
Space heating												9895.8791	(98)
Space heating per m2										(98) / (4) =		51.5921	(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	2473.6942	1947.3763	1996.7939	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7318	0.7941	0.7624	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1810.2210	1546.3437	1522.2860	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	2702.1159	2593.4919	2394.2555	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													

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Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	642.1643	779.0782	648.7453	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction												2069.9878 (104)
Intermittency factor (Table 10b)									fC = cooled area / (4) =			1.0000 (105)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	160.5411	194.7696	162.1863	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling per m2												517.4970 (107)
Energy for space heating												2.6980 (108)
Energy for space cooling												51.5921 (99)
Total												2.6980 (108)
Dwelling Fabric Energy Efficiency (DFEE)												54.2901 (109)
												54.3 (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	139.3400 (1b)	x 2.6800 (2b)	= 373.4312 (1b) - (3b)
First floor	52.4700 (1c)	x 2.4900 (2c)	= 130.6503 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	191.8100		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 504.0815 (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) = 0.0794 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3294 (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) =	0.3294 (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	0.4199	0.4117	0.4035	0.3623	0.3541	0.3129	0.3129	0.3047	0.3294	0.3541	0.3705	0.3870 (22b)
Effective ac	0.5882	0.5847	0.5814	0.5656	0.5627	0.5489	0.5489	0.5464	0.5542	0.5627	0.5686	0.5749 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Semi-glazed door			3.7800	1.2000	4.5360		(26a)
TER Opening Type (Uw = 1.40)			44.1700	1.3258	58.5587		(27)
Ground Floor			139.3400	0.1300	18.1142		(28a)
EW1 - Facing Brick	230.5300	47.9500	182.5800	0.1800	32.8644		(29a)
R1 - Flat ceiling	131.4500		131.4500	0.1300	17.0885		(30)
R2 - Flat roof (Balcony)	6.5800		6.5800	0.1300	0.8554		(30)
Total net area of external elements Aum(A, m ²)			507.9000				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		132.0172		(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)							24.6670 (36)
Total fabric heat loss						(33) + (36) =	156.6842 (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	97.8399	97.2704	96.7122	94.0901	93.5996	91.3159	91.3159	90.8930	92.1955	93.5996	94.5920	95.6295 (38)
Heat transfer coeff	254.5242	253.9546	253.3964	250.7744	250.2838	248.0001	248.0001	247.5772	248.8797	250.2838	251.2762	252.3137 (39)
Average = Sum(39)m / 12 =												250.7720 (39)
HLP	1.3270	1.3240	1.3211	1.3074	1.3049	1.2929	1.2929	1.2907	1.2975	1.3049	1.3100	1.3154 (40)
HLP (average)												1.3074 (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												2.9913 (42)
Average daily hot water use (litres/day)												105.2423 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	115.7665	111.5568	107.3472	103.1375	98.9278	94.7181	94.7181	98.9278	103.1375	107.3472	111.5568	115.7665 (44)
Energy content (annual)	171.6784	150.1510	154.9424	135.0826	129.6149	111.8478	103.6435	118.9324	120.3528	140.2596	153.1043	166.2614 (45)
Distribution loss (46)m = 0.15 x (45)m												1655.8713 (45)
Water storage loss:	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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	36.4817	31.9071	32.9253	28.7050	27.5432	23.7677	22.0242	25.2731	25.5750	29.8052	32.5347	(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	149.5627	149.5627	149.5627	149.5627	149.5627	149.5627	149.5627	149.5627	149.5627	149.5627	149.5627	149.5627	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	32.3790	28.7587	23.3882	17.7063	13.2357	11.1741	12.0740	15.6943	21.0649	26.7467	31.2173	33.2789	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	363.1937	366.9625	357.4652	337.2466	311.7242	287.7368	271.7118	267.9429	277.4402	297.6588	323.1812	347.1686	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.9563	37.9563	37.9563	37.9563	37.9563	37.9563	37.9563	37.9563	37.9563	37.9563	37.9563	37.9563	(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)	-119.6502	-119.6502	-119.6502	-119.6502	-119.6502	-119.6502	-119.6502	-119.6502	-119.6502	-119.6502	-119.6502	-119.6502	(71)
Water heating gains (Table 5)	49.0345	47.4808	44.2544	39.8681	37.0204	33.0106	29.6025	33.9693	35.5208	40.0607	45.1870	47.4873	(72)
Total internal gains	512.4760	511.0708	492.9766	462.6899	429.8492	399.7904	381.2571	385.4753	401.8947	432.3351	467.4544	495.8036	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	3.6400	10.6334	0.6300	0.7000	0.7700	11.8289 (74)
East	18.8600	19.6403	0.6300	0.7000	0.7700	113.2038 (76)
South	16.2800	46.7521	0.6300	0.7000	0.7700	232.6093 (78)
West	5.3900	19.6403	0.6300	0.7000	0.7700	32.3525 (80)

Solar gains	389.9944	688.2986	992.6049	1294.0568	1492.7864	1496.9840	1437.3130	1289.4512	1098.4825	775.6705	471.8053	330.5554 (83)
Total gains	902.4704	1199.3695	1485.5815	1756.7467	1922.6356	1896.7745	1818.5701	1674.9265	1500.3772	1208.0056	939.2597	826.3590 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	52.3335	52.4509	52.5664	53.1160	53.2201	53.7102	53.7102	53.8020	53.5204	53.2201	53.0099	52.7920	
alpha	4.4889	4.4967	4.5044	4.5411	4.5480	4.5807	4.5807	4.5868	4.5680	4.5480	4.5340	4.5195	
util living area	0.9992	0.9972	0.9898	0.9630	0.8884	0.7410	0.5755	0.6380	0.8710	0.9834	0.9981	0.9995	(86)
MIT	19.4115	19.6271	19.9536	20.3609	20.7050	20.9133	20.9787	20.9665	20.8043	20.3262	19.7843	19.3778	(87)
Th 2	19.8198	19.8221	19.8244	19.8350	19.8370	19.8464	19.8464	19.8481	19.8428	19.8370	19.8330	19.8288	(88)
util rest of house	0.9990	0.9961	0.9860	0.9480	0.8425	0.6423	0.4367	0.4981	0.7999	0.9744	0.9973	0.9993	(89)
MIT 2	18.3737	18.5906	18.9167	19.3225	19.6386	19.8069	19.8412	19.8388	19.7335	19.2966	18.7564	18.3470	(90)
Living area fraction									fLA = Living area / (4) =			0.2192	(91)
MIT	18.6012	18.8178	19.1440	19.5502	19.8724	20.0494	20.0906	20.0860	19.9683	19.5223	18.9818	18.5730	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6012	18.8178	19.1440	19.5502	19.8724	20.0494	20.0906	20.0860	19.9683	19.5223	18.9818	18.5730	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	901.1729	1193.2116	1460.2205	1657.2642	1623.0217	1254.6059	850.2812	886.0498	1214.0730	1172.9355	935.8535	825.5609	(94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(95)
Heat loss rate W	3640.0055	3534.5024	3203.9406	2670.7858	2045.4139	1351.4544	865.6587	912.5721	1460.4972	2233.1154	2985.6055	3626.4938	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	2037.6914	1573.3474	1297.3277	729.7356	314.2598	0.0000	0.0000	0.0000	0.0000	788.7738	1475.8214	2083.8940	(98)
Space heating												10300.8512	(98)
Space heating per m2												53.7034	(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	2331.2007	1835.2005	1881.5864	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8251	0.8947	0.8623	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1923.4891	1642.0307	1622.4605	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	2355.8894	2261.0676	2096.0345	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	311.3282	460.5634	352.3390	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												1124.2307 (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	77.8321	115.1409	88.0848	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												281.0577 (107)
Space cooling per m2												1.4653 (108)
Energy for space heating												53.7034 (99)
Energy for space cooling												1.4653 (108)
Total												55.1687 (109)
Target Fabric Energy Efficiency (TFEE)												63.4 (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	139.3400 (1b)	x 2.6800 (2b)	= 373.4312 (1b) - (3b)
First floor	52.4700 (1c)	x 2.4900 (2c)	= 130.6503 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	191.8100		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 504.0815 (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) = 0.0992 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3492 (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) =	0.3492 (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	0.3841	0.3666	0.3666	0.3405	0.3405	0.2968	0.3055	0.2881	0.3055	0.3405	0.3230	0.3579 (22b)
Effective ac	0.5738	0.5672	0.5672	0.5580	0.5580	0.5440	0.5467	0.5415	0.5467	0.5580	0.5522	0.5641 (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)			52.9100	1.3258	70.1458		(27)
Entrance Door			3.7800	1.4000	5.2920		(26a)
Ground Floor			139.3400	0.1100	15.3274		(28a)
EW1 - Facing Brick	230.5300	56.6900	173.8400	0.2100	36.5064		(29a)
R1 - Flat ceiling	131.4500		131.4500	0.1700	22.3465		(30)
R2 - Flat roof (Balcony)	6.5800		6.5800	0.1600	1.0528		(30)
Total net area of external elements Aum, m ²			507.9000				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		150.6709		(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)							21.1722 (36)
Total fabric heat loss						(33) + (36) =	171.8431 (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	95.4449	94.3546	94.3546	92.8144	92.8144	90.5008	90.9382	90.0761	90.9382	92.8144	91.8509	93.8285 (38)
Heat transfer coeff	267.2880	266.1977	266.1977	264.6575	264.6575	262.3439	262.7812	261.9192	262.7812	264.6575	263.6940	265.6716 (39)
Average = Sum(39)m / 12 =												264.4039 (39)
HLP	1.3935	1.3878	1.3878	1.3798	1.3798	1.3677	1.3700	1.3655	1.3700	1.3798	1.3748	1.3851 (40)
HLP (average)												1.3785 (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												2.9913 (42)
Average daily hot water use (litres/day)												105.2423 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	115.7665	111.5568	107.3472	103.1375	98.9278	94.7181	94.7181	98.9278	103.1375	107.3472	111.5568	115.7665 (44)
Energy content (annual)	171.6784	150.1510	154.9424	135.0826	129.6149	111.8478	103.6435	118.9324	120.3528	140.2596	153.1043	166.2614 (45)
Distribution loss (46)m = 0.15 x (45)m	25.7518	22.5227	23.2414	20.2624	19.4422	16.7772	15.5465	17.8399	18.0529	21.0389	22.9656	24.9392 (46)
Water storage loss:												250.0000 (47)
Store volume												1.7800 (48)
a) If manufacturer declared loss factor is known (kWh/day):												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

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	224.7380	198.0758	208.0020	186.4306	182.6745	163.1958	156.7031	171.9920	171.7008	193.3192	204.4523	219.3210 (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	224.7380	198.0758	208.0020	186.4306	182.6745	163.1958	156.7031	171.9920	171.7008	193.3192	204.4523	219.3210 (64)
Total per year (kWh/year) = Sum(64)m =												2280.6053 (64)
RHI water heating demand												2281 (64)
Heat gains from water heating, kWh/month	99.5308	88.2651	93.9660	85.9934	85.5446	78.2678	76.9091	81.9927	81.0957	89.0840	91.9856	97.7296 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	179.4753	179.4753	179.4753	179.4753	179.4753	179.4753	179.4753	179.4753	179.4753	179.4753	179.4753	179.4753	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	80.9475	71.8968	58.4704	44.2659	33.0893	27.9353	30.1851	39.2358	52.6622	66.8667	78.0433	83.1972	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	542.0801	547.7052	533.5302	503.3531	465.2601	429.4579	405.5399	399.9148	414.0899	444.2669	482.3600	518.1621	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.9388	55.9388	55.9388	55.9388	55.9388	55.9388	55.9388	55.9388	55.9388	55.9388	55.9388	55.9388	(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)	-119.6502	-119.6502	-119.6502	-119.6502	-119.6502	-119.6502	-119.6502	-119.6502	-119.6502	-119.6502	-119.6502	-119.6502	(71)
Water heating gains (Table 5)	133.7779	131.3468	126.2984	119.4352	114.9794	108.7053	103.3725	110.2052	112.6329	119.7366	127.7578	131.3570	(72)
Total internal gains	875.5694	869.7127	837.0629	785.8181	732.0926	684.8625	657.8614	668.1197	698.1489	749.6341	806.9250	851.4802	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.3600	12.7650	0.6300	0.7000	0.7700	17.0091	(74)
East	22.5900	23.8018	0.6300	0.7000	0.7700	164.3226	(76)
South	19.5000	54.2217	0.6300	0.7000	0.7700	323.1317	(78)
West	6.4600	23.8018	0.6300	0.7000	0.7700	46.9909	(80)

Solar gains	551.4543	850.8513	1220.3428	1621.0851	1828.3628	1942.7018	1845.5233	1682.9087	1441.4970	1029.6504	657.2492	470.0951	(83)
Total gains	1427.0236	1720.5640	2057.4057	2406.9032	2560.4553	2627.5643	2503.3847	2351.0285	2139.6459	1779.2845	1464.1742	1321.5753	(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	19.9338	20.0154	20.0154	20.1319	20.1319	20.3094	20.2756	20.3424	20.2756	20.1319	20.2054	20.0550
alpha	2.3289	2.3344	2.3344	2.3421	2.3421	2.3540	2.3517	2.3562	2.3517	2.3421	2.3470	2.3370
util living area	0.9475	0.9209	0.8671	0.7725	0.6499	0.4727	0.3445	0.3806	0.6077	0.8159	0.9197	0.9547 (86)
MIT	18.9840	19.2280	19.6659	20.1539	20.5241	20.7731	20.8491	20.8381	20.6557	20.1640	19.5029	18.9376 (87)
Th 2	19.7683	19.7727	19.7727	19.7789	19.7789	19.7882	19.7864	19.7899	19.7864	19.7789	19.7827	19.7748 (88)
util rest of house	0.9390	0.9084	0.8458	0.7359	0.5912	0.3851	0.2336	0.2675	0.5270	0.7771	0.9045	0.9472 (89)
MIT 2	17.1147	17.4658	18.0863	18.7623	19.2457	19.5392	19.6046	19.6015	19.4211	18.7954	17.8736	17.0527 (90)
Living area fraction									fLA = Living area / (4) =			0.2192 (91)
MIT	17.5245	17.8521	18.4326	19.0674	19.5260	19.8097	19.8774	19.8726	19.6917	19.0954	18.2308	17.4659 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.3745	17.7021	18.2826	18.9174	19.3760	19.6597	19.7274	19.7226	19.5417	18.9454	18.0808	17.3159 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	1306.7932	1514.7234	1673.5777	1698.0256	1457.9841	985.6122	570.5069	613.0903	1088.1692	1324.5140	1282.4339	1223.5226	(94)
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	3334.2860	3274.8017	2950.1551	2439.4509	1793.3117	1065.0415	585.3267	634.5197	1272.3140	2023.4201	2710.9812	3298.5620	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	1508.4546	1182.7726	949.7736	533.8262	249.4837	0.0000	0.0000	0.0000	0.0000	519.9861	1028.5540	1543.8293	(98)
Space heating												7516.6802	(98)
RHI space heating demand												7517	(98)

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	139.3400 (1b)	x 2.6800 (2b)	= 373.4312 (1b) - (3b)
First floor	52.4700 (1c)	x 2.4900 (2c)	= 130.6503 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	191.8100		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 504.0815 (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) = 0.0992 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3492 (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) =	0.3492 (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	0.4452	0.4365	0.4278	0.3841	0.3754	0.3317	0.3317	0.3230	0.3492	0.3754	0.3928	0.4103 (22b)
Effective ac	0.5991	0.5953	0.5915	0.5738	0.5705	0.5550	0.5550	0.5522	0.5610	0.5705	0.5772	0.5842 (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)			52.9100	1.3258	70.1458		(27)
Entrance Door			3.7800	1.4000	5.2920		(26a)
Ground Floor			139.3400	0.1100	15.3274		(28a)
EW1 - Facing Brick	230.5300	56.6900	173.8400	0.2100	36.5064		(29a)
R1 - Flat ceiling	131.4500		131.4500	0.1700	22.3465		(30)
R2 - Flat roof (Balcony)	6.5800		6.5800	0.1600	1.0528		(30)
Total net area of external elements Aum, m ²			507.9000				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		150.6709		(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)							21.1722 (36)
Total fabric heat loss						(33) + (36) =	171.8431 (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	99.6600	99.0198	98.3923	95.4449	94.8934	92.3263	92.3263	91.8509	93.3151	94.8934	96.0090	97.1753 (38)
Heat transfer coeff	271.5031	270.8629	270.2354	267.2880	266.7365	264.1694	264.1694	263.6940	265.1582	266.7365	267.8521	269.0184 (39)
Average = Sum(39)m / 12 =												267.2853 (39)
HLP	1.4155	1.4121	1.4089	1.3935	1.3906	1.3772	1.3772	1.3748	1.3824	1.3906	1.3964	1.4025 (40)
HLP (average)												1.3935 (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												2.9913 (42)
Average daily hot water use (litres/day)												105.2423 (43)
Daily hot water use	115.7665	111.5568	107.3472	103.1375	98.9278	94.7181	94.7181	98.9278	103.1375	107.3472	111.5568	115.7665 (44)
Energy conte	171.6784	150.1510	154.9424	135.0826	129.6149	111.8478	103.6435	118.9324	120.3528	140.2596	153.1043	166.2614 (45)
Energy content (annual)												Total = Sum(45)m = 1655.8713 (45)
Distribution loss (46)m = 0.15 x (45)m	25.7518	22.5227	23.2414	20.2624	19.4422	16.7772	15.5465	17.8399	18.0529	21.0389	22.9656	24.9392 (46)
Water storage loss:												250.0000 (47)
Store volume												1.7800 (48)
a) If manufacturer declared loss factor is known (kWh/day):												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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	224.7380	198.0758	208.0020	186.4306	182.6745	163.1958	156.7031	171.9920	171.7008	193.3192	204.4523	219.3210 (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	224.7380	198.0758	208.0020	186.4306	182.6745	163.1958	156.7031	171.9920	171.7008	193.3192	204.4523	219.3210 (64)
Total per year (kWh/year) = Sum(64)m =												2280.6053 (64)
Heat gains from water heating, kWh/month	99.5308	88.2651	93.9660	85.9934	85.5446	78.2678	76.9091	81.9927	81.0957	89.0840	91.9856	97.7296 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	179.4753	179.4753	179.4753	179.4753	179.4753	179.4753	179.4753	179.4753	179.4753	179.4753	179.4753	179.4753	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	80.9475	71.8968	58.4704	44.2659	33.0893	27.9353	30.1851	39.2358	52.6622	66.8667	78.0433	83.1972	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	542.0801	547.7052	533.5302	503.3531	465.2601	429.4579	405.5399	399.9148	414.0899	444.2669	482.3600	518.1621	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.9388	55.9388	55.9388	55.9388	55.9388	55.9388	55.9388	55.9388	55.9388	55.9388	55.9388	55.9388	(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)	-119.6502	-119.6502	-119.6502	-119.6502	-119.6502	-119.6502	-119.6502	-119.6502	-119.6502	-119.6502	-119.6502	-119.6502	(71)
Water heating gains (Table 5)	133.7779	131.3468	126.2984	119.4352	114.9794	108.7053	103.3725	110.2052	112.6329	119.7366	127.7578	131.3570	(72)
Total internal gains	875.5694	869.7127	837.0629	785.8181	732.0926	684.8625	657.8614	668.1197	698.1489	749.6341	806.9250	851.4802	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d	Gains W
North					4.3600	10.6334	0.6300	0.7000			0.7700	14.1687 (74)
East					22.5900	19.6403	0.6300	0.7000			0.7700	135.5924 (76)
South					19.5000	46.7521	0.6300	0.7000			0.7700	278.6168 (78)
West					6.4600	19.6403	0.6300	0.7000			0.7700	38.7750 (80)

Solar gains	467.1529	824.4792	1189.0015	1550.1097	1788.1691	1793.2000	1721.7204	1544.5958	1315.8320	929.1402	565.1504	395.9535 (83)
Total gains	1342.7222	1694.1919	2026.0644	2335.9278	2520.2616	2478.0624	2379.5818	2212.7155	2013.9809	1678.7743	1372.0754	1247.4337 (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	19.6243	19.6707	19.7164	19.9338	19.9750	20.1691	20.1691	20.2054	20.0939	19.9750	19.8918	19.8055
alpha	2.3083	2.3114	2.3144	2.3289	2.3317	2.3446	2.3446	2.3470	2.3396	2.3317	2.3261	2.3204
util living area	0.9568	0.9281	0.8818	0.8032	0.6943	0.5597	0.4372	0.4784	0.6663	0.8493	0.9357	0.9630 (86)
MIT	18.8055	19.0986	19.5178	20.0104	20.4141	20.6893	20.8070	20.7861	20.5704	20.0160	19.3152	18.7532 (87)
Th 2	19.7515	19.7540	19.7565	19.7683	19.7705	19.7808	19.7808	19.7827	19.7769	19.7705	19.7661	19.7614 (88)
util rest of house	0.9498	0.9168	0.8631	0.7715	0.6430	0.4810	0.3326	0.3732	0.5938	0.8175	0.9237	0.9569 (89)
MIT 2	16.8463	17.2679	17.8658	18.5597	19.1001	19.4463	19.5674	19.5529	19.3165	18.5886	17.5944	16.7772 (90)
Living area fraction	17.2758	17.6692	18.2280	18.8777	19.3881	19.7188	19.8392	19.8233	19.5914	18.9015	17.9716	17.2104 (91)
MIT	17.1258	17.5192	18.0780	18.7277	19.2381	19.5688	19.6892	19.6733	19.4414	18.7515	17.8216	17.0604 (93)
Temperature adjustment												-0.1500
adjusted MIT	17.1258	17.5192	18.0780	18.7277	19.2381	19.5688	19.6892	19.6733	19.4414	18.7515	17.8216	17.0604 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	1247.2068	1507.1826	1683.8035	1727.3868	1556.7128	1154.5992	771.2050	802.7750	1149.5504	1316.3392	1231.4746	1170.0258	(94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	3482.2487	3418.0852	3128.7776	2626.8368	2010.6969	1312.6054	816.0696	863.1402	1416.3040	2174.3045	2871.8101	3459.6770	(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	1662.8712	1284.1266	1075.0607	647.6040	337.7642	0.0000	0.0000	0.0000	0.0000	638.3262	1181.0416	1703.5005	(98)
Space heating												8530.2949	(98)
Space heating per m2												(98) / (4) =	44.4726 (99)

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.1000	(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												8483.1662	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1662.8712	1284.1266	1075.0607	647.6040	337.7642	0.0000	0.0000	0.0000	0.0000	638.3262	1181.0416	1703.5005	(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)	1653.6840	1277.0319	1069.1211	644.0261	335.8981	0.0000	0.0000	0.0000	0.0000	634.7995	1174.5165	1694.0889	(211)
Water heating requirement	255.8263	197.5579	165.3940	99.6314	51.9637	0.0000	0.0000	0.0000	0.0000	98.2040	181.6987	262.0770	(215)
Water heating requirement	224.7380	198.0758	208.0020	186.4306	182.6745	163.1958	156.7031	171.9920	171.7008	193.3192	204.4523	219.3210	(64)
Efficiency of water heater (217)m	88.9429	88.7587	88.4027	87.6518	86.1634	79.8000	79.8000	79.8000	79.8000	87.5445	88.5839	79.8000	(216)
Fuel for water heating, kWh/month	252.6766	223.1622	235.2894	212.6946	212.0095	204.5061	196.3698	215.5288	215.1639	220.8239	230.8008	246.4103	(219)
Water heating fuel used												2665.4359	(219)
Annual totals kWh/year													
Space heating fuel - main system												8483.1662	(211)
Space heating fuel - secondary												1312.3531	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												571.8229	(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												12244.1584	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	8483.1662	3.4800	295.2142 (240)
Space heating - secondary	1312.3531	4.2300	55.5125 (242)
Water heating (other fuel)	2665.4359	3.4800	92.7572 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	571.8229	13.1900	75.4234 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-863.6197	13.1900	-113.9114 (252)
Total energy cost			534.8884 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.9487 (257)
SAP value	86.7661	
SAP rating (Section 12)	87	(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	8483.1662	0.2160	1832.3639 (261)
Space heating - secondary	1312.3531	0.0190	24.9347 (263)
Water heating (other fuel)	2665.4359	0.2160	575.7342 (264)
Space and water heating			2433.0328 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	571.8229	0.5190	296.7761 (268)
Energy saving/generation technologies			
PV Unit	-863.6197	0.5190	-448.2186 (269)
Total kg/year			2320.5152 (272)
CO2 emissions per m2			12.1000 (273)
EI value			86.8693
EI rating			87 (274)
EI band			B

Calculation of stars for heating and DHW

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

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	$3.48 / 0.8535 = 4.077$, stars = 4
Water heating environmental impact	$0.216 / 0.8535 = 0.2531$, 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	139.3400 (1b)	x 2.6800 (2b)	= 373.4312 (1b) - (3b)
First floor	52.4700 (1c)	x 2.4900 (2c)	= 130.6503 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	191.8100		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 504.0815 (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) = 0.0992 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3492 (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) =	0.3492 (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	0.3841	0.3666	0.3666	0.3405	0.3405	0.2968	0.3055	0.2881	0.3055	0.3405	0.3230	0.3579 (22b)
Effective ac	0.5738	0.5672	0.5672	0.5580	0.5580	0.5440	0.5467	0.5415	0.5467	0.5580	0.5522	0.5641 (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)			52.9100	1.3258	70.1458		(27)
Entrance Door			3.7800	1.4000	5.2920		(26a)
Ground Floor			139.3400	0.1100	15.3274		(28a)
EW1 - Facing Brick	230.5300	56.6900	173.8400	0.2100	36.5064		(29a)
R1 - Flat ceiling	131.4500		131.4500	0.1700	22.3465		(30)
R2 - Flat roof (Balcony)	6.5800		6.5800	0.1600	1.0528		(30)
Total net area of external elements Aum, m ²			507.9000				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		150.6709		(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)							21.1722 (36)
Total fabric heat loss						(33) + (36) =	171.8431 (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	95.4449	94.3546	94.3546	92.8144	92.8144	90.5008	90.9382	90.0761	90.9382	92.8144	91.8509	93.8285 (38)
Heat transfer coeff	267.2880	266.1977	266.1977	264.6575	264.6575	262.3439	262.7812	261.9192	262.7812	264.6575	263.6940	265.6716 (39)
Average = Sum(39)m / 12 =												264.4039 (39)
HLP	1.3935	1.3878	1.3878	1.3798	1.3798	1.3677	1.3700	1.3655	1.3700	1.3798	1.3748	1.3851 (40)
HLP (average)												1.3785 (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												2.9913 (42)
Average daily hot water use (litres/day)												105.2423 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	115.7665	111.5568	107.3472	103.1375	98.9278	94.7181	94.7181	98.9278	103.1375	107.3472	111.5568	115.7665 (44)
Energy content (annual)	171.6784	150.1510	154.9424	135.0826	129.6149	111.8478	103.6435	118.9324	120.3528	140.2596	153.1043	166.2614 (45)
Distribution loss (46)m = 0.15 x (45)m	25.7518	22.5227	23.2414	20.2624	19.4422	16.7772	15.5465	17.8399	18.0529	21.0389	22.9656	24.9392 (46)
Water storage loss:												250.0000 (47)
Store volume												1.7800 (48)
a) If manufacturer declared loss factor is known (kWh/day):												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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	224.7380	198.0758	208.0020	186.4306	182.6745	163.1958	156.7031	171.9920	171.7008	193.3192	204.4523	219.3210 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	224.7380	198.0758	208.0020	186.4306	182.6745	163.1958	156.7031	171.9920	171.7008	193.3192	204.4523	219.3210 (64)
Heat gains from water heating, kWh/month	99.5308	88.2651	93.9660	85.9934	85.5446	78.2678	76.9091	81.9927	81.0957	89.0840	91.9856	97.7296 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	179.4753	179.4753	179.4753	179.4753	179.4753	179.4753	179.4753	179.4753	179.4753	179.4753	179.4753	179.4753	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	80.9475	71.8968	58.4704	44.2659	33.0893	27.9353	30.1851	39.2358	52.6622	66.8667	78.0433	83.1972	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	542.0801	547.7052	533.5302	503.3531	465.2601	429.4579	405.5399	399.9148	414.0899	444.2669	482.3600	518.1621	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.9388	55.9388	55.9388	55.9388	55.9388	55.9388	55.9388	55.9388	55.9388	55.9388	55.9388	55.9388	(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)	-119.6502	-119.6502	-119.6502	-119.6502	-119.6502	-119.6502	-119.6502	-119.6502	-119.6502	-119.6502	-119.6502	-119.6502	(71)
Water heating gains (Table 5)	133.7779	131.3468	126.2984	119.4352	114.9794	108.7053	103.3725	110.2052	112.6329	119.7366	127.7578	131.3570	(72)
Total internal gains	875.5694	869.7127	837.0629	785.8181	732.0926	684.8625	657.8614	668.1197	698.1489	749.6341	806.9250	851.4802	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W				
North					4.3600	12.7650	0.6300	0.7000	0.7700	17.0091 (74)				
East					22.5900	23.8018	0.6300	0.7000	0.7700	164.3226 (76)				
South					19.5000	54.2217	0.6300	0.7000	0.7700	323.1317 (78)				
West					6.4600	23.8018	0.6300	0.7000	0.7700	46.9909 (80)				
Solar gains	551.4543	850.8513	1220.3428	1621.0851	1828.3628	1942.7018	1845.5233	1682.9087	1441.4970	1029.6504	657.2492	470.0951 (83)		
Total gains	1427.0236	1720.5640	2057.4057	2406.9032	2560.4553	2627.5643	2503.3847	2351.0285	2139.6459	1779.2845	1464.1742	1321.5753 (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	19.9338	20.0154	20.0154	20.1319	20.1319	20.3094	20.2756	20.3424	20.2756	20.1319	20.2054	20.0550
alpha	2.3289	2.3344	2.3344	2.3421	2.3421	2.3540	2.3517	2.3562	2.3517	2.3421	2.3470	2.3370
util living area	0.9475	0.9209	0.8671	0.7725	0.6499	0.4727	0.3445	0.3806	0.6077	0.8159	0.9197	0.9547 (86)
MIT	18.9840	19.2280	19.6659	20.1539	20.5241	20.7731	20.8491	20.8381	20.6557	20.1640	19.5029	18.9376 (87)
Th 2	19.7683	19.7727	19.7727	19.7789	19.7789	19.7882	19.7864	19.7899	19.7864	19.7789	19.7827	19.7748 (88)
util rest of house	0.9390	0.9084	0.8458	0.7359	0.5912	0.3851	0.2336	0.2675	0.5270	0.7771	0.9045	0.9472 (89)
MIT 2	17.1147	17.4658	18.0863	18.7623	19.2457	19.5392	19.6046	19.6015	19.4211	18.7954	17.8736	17.0527 (90)
Living area fraction	17.5245	17.8521	18.4326	19.0674	19.5260	19.8097	19.8774	19.8726	19.6917	19.0954	18.2308	17.4659 (92)
MIT	17.5245	17.8521	18.4326	19.0674	19.5260	19.8097	19.8774	19.8726	19.6917	19.0954	18.2308	17.4659 (92)
Temperature adjustment	17.3745	17.7021	18.2826	18.9174	19.3760	19.6597	19.7274	19.7226	19.5417	18.9454	18.0808	17.3159 (93)
adjusted MIT	17.3745	17.7021	18.2826	18.9174	19.3760	19.6597	19.7274	19.7226	19.5417	18.9454	18.0808	17.3159 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	1306.7932	1514.7234	1673.5777	1698.0256	1457.9841	985.6122	570.5069	613.0903	1088.1692	1324.5140	1282.4339	1223.5226	(94)
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	3334.2860	3274.8017	2950.1551	2439.4509	1793.3117	1065.0415	585.3267	634.5197	1272.3140	2023.4201	2710.9812	3298.5620	(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	1508.4546	1182.7726	949.7736	533.8262	249.4837	0.0000	0.0000	0.0000	0.0000	519.9861	1028.5540	1543.8293	(98)
Space heating												7516.6802	(98)
Space heating per m2												39.1882	(99)

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.1000 (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													7475.1516 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1508.4546	1182.7726	949.7736	533.8262	249.4837	0.0000	0.0000	0.0000	0.0000	519.9861	1028.5540	1543.8293	(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)	1500.1206	1176.2379	944.5263	530.8769	248.1054	0.0000	0.0000	0.0000	0.0000	517.1133	1022.8714	1535.2998	(211)
Water heating requirement	232.0699	181.9650	146.1190	82.1271	38.3821	0.0000	0.0000	0.0000	0.0000	79.9979	158.2391	237.5122	(215)
Water heating requirement	224.7380	198.0758	208.0020	186.4306	182.6745	163.1958	156.7031	171.9920	171.7008	193.3192	204.4523	219.3210	(64)
Efficiency of water heater (217)m	88.8087	88.6355	88.1858	87.2302	85.3652	79.8000	79.8000	79.8000	79.8000	87.0865	88.3567	79.8000	(216)
Fuel for water heating, kWh/month	253.0585	223.4724	235.8679	213.7225	213.9918	204.5061	196.3698	215.5288	215.1639	221.9854	231.3942	246.7736	(219)
Water heating fuel used												2671.8347	(219)
Annual totals kWh/year													
Space heating fuel - main system												7475.1516	(211)
Space heating fuel - secondary												1156.4123	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												571.8229	(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												11015.1803	(238)

10a. Fuel costs - using BEDF prices (500)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	7475.1516	3.6300	271.3480 (240)
Space heating - secondary	1156.4123	5.1600	59.6709 (242)
Water heating (other fuel)	2671.8347	3.6300	96.9876 (247)
Pumps and fans for heating	75.0000	19.4400	14.5800 (249)
Energy for lighting	571.8229	19.4400	111.1624 (250)
Additional standing charges			95.0000 (251)
Energy saving/generation technologies			
PV Unit	-935.0412	19.4400	-181.7720 (252)
Total energy cost			466.9768 (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	7475.1516	0.2160	1614.6327 (261)
Space heating - secondary	1156.4123	0.0190	21.9718 (263)
Water heating (other fuel)	2671.8347	0.2160	577.1163 (264)
Space and water heating			2213.7209 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	571.8229	0.5190	296.7761 (268)
Energy saving/generation technologies			
PV Unit	-935.0412	0.5190	-485.2864 (269)
Total kg/year			2064.1356 (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	7475.1516	1.2200	9119.6849 (261)
Space heating - secondary	1156.4123	1.0400	1202.6688 (263)
Water heating (other fuel)	2671.8347	1.2200	3259.6383 (264)
Space and water heating			13581.9921 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	571.8229	3.0700	1755.4964 (268)
Energy saving/generation technologies			
PV Unit	-935.0412	3.0700	-2870.5765 (269)
Primary energy kWh/year			12697.1620 (272)
Primary energy kWh/m2/year			66.1966 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

SAP 2012 EPC IMPROVEMENTS

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

(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 (13.0%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£39 1.40 kg/m ²	B 88	B 88
Total Savings	£39 1.40 kg/m ²		

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

Fuel prices for cost data on this page from database revision number 500 TEST (30 Jun 2022)
Recommendation texts revision number 4.9c (22 Feb 2014)

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

	Current	Potential	Saving
Electricity	£126	£135	-£10
Mains gas	£463	£414	£49
Wood	£60	£60	-£0
Space heating	£441	£442	-£1
Water heating	£97	£56	£41
Lighting	£111	£111	£0
Generated (PV)	-£182	-£182	£0
Total cost of fuels	£467	£427	£39
Total cost of uses	£467	£427	£40
Delivered energy	57 kWh/m ²	51 kWh/m ²	7 kWh/m ²
Carbon dioxide emissions	2.1 tonnes	1.8 tonnes	0.3 tonnes
CO2 emissions per m ²	11 kg/m ²	9 kg/m ²	1 kg/m ²
Primary energy	66 kWh/m ²	58 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	139.3400 (1b)	x 2.6800 (2b)	= 373.4312 (1b) - (3b)
First floor	52.4700 (1c)	x 2.4900 (2c)	= 130.6503 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	191.8100		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 504.0815 (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) = 0.0992 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3492 (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) =	0.3492 (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	0.4452	0.4365	0.4278	0.3841	0.3754	0.3317	0.3317	0.3230	0.3492	0.3754	0.3928	0.4103 (22b)
Effective ac	0.5991	0.5953	0.5915	0.5738	0.5705	0.5550	0.5550	0.5522	0.5610	0.5705	0.5772	0.5842 (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)			52.9100	1.3258	70.1458		(27)
Entrance Door			3.7800	1.4000	5.2920		(26a)
Ground Floor			139.3400	0.1100	15.3274		(28a)
EW1 - Facing Brick	230.5300	56.6900	173.8400	0.2100	36.5064		(29a)
R1 - Flat ceiling	131.4500		131.4500	0.1700	22.3465		(30)
R2 - Flat roof (Balcony)	6.5800		6.5800	0.1600	1.0528		(30)
Total net area of external elements Aum, m ²			507.9000				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		150.6709		(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)							21.1722 (36)
Total fabric heat loss						(33) + (36) =	171.8431 (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	99.6600	99.0198	98.3923	95.4449	94.8934	92.3263	92.3263	91.8509	93.3151	94.8934	96.0090	97.1753 (38)
Heat transfer coeff	271.5031	270.8629	270.2354	267.2880	266.7365	264.1694	264.1694	263.6940	265.1582	266.7365	267.8521	269.0184 (39)
Average = Sum(39)m / 12 =												267.2853 (39)
HLP	1.4155	1.4121	1.4089	1.3935	1.3906	1.3772	1.3772	1.3748	1.3824	1.3906	1.3964	1.4025 (40)
HLP (average)												1.3935 (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												2.9913 (42)
Average daily hot water use (litres/day)												105.2423 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	115.7665	111.5568	107.3472	103.1375	98.9278	94.7181	94.7181	98.9278	103.1375	107.3472	111.5568	115.7665 (44)
Energy content (annual)	171.6784	150.1510	154.9424	135.0826	129.6149	111.8478	103.6435	118.9324	120.3528	140.2596	153.1043	166.2614 (45)
Distribution loss (46)m = 0.15 x (45)m	25.7518	22.5227	23.2414	20.2624	19.4422	16.7772	15.5465	17.8399	18.0529	21.0389	22.9656	24.9392 (46)
Water storage loss:												250.0000 (47)
Store volume												1.7800 (48)
a) If manufacturer declared loss factor is known (kWh/day):												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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	28.8360	29.7972	28.8360	29.7972	28.8360	29.7972	28.8360	(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	20.1852	20.8580	20.1852	20.8580	20.1852	(57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624	23.2624	23.2624	23.2624	23.2624	23.2624	23.2624	(59)
Total heat required for water heating calculated for each month																			
215.7989	190.0018	197.6671	171.0262	160.9411	141.9383	134.7370	150.9564	157.6471	182.9843	195.8015	210.3818	210.3818	210.3818	210.3818	210.3818	210.3818	210.3818	210.3818	(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																			1.0953 (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																			105.2423 (H14)
Volume ratio Veff/V																			1.2115 (H15)
Solar storage volume factor																			1.0000 (H16)
Solar input																			-954.7289 (H17)
Solar input	-27.6852	-46.1987	-78.6817	-105.4489	-130.2733	-128.0794	-126.3868	-110.4248	-86.4847	-59.0589	-32.8387	-23.1678	-23.1678	-23.1678	-23.1678	-23.1678	-23.1678	-23.1678	(63)
Solar input (sum of months) = Sum (63)m =																			-954.7289 (63)
Output from w/h																			
188.1136	143.8031	118.9855	65.5772	30.6678	13.8589	8.3502	40.5316	71.1624	123.9254	162.9629	187.2140	187.2140	187.2140	187.2140	187.2140	187.2140	187.2140	187.2140	(64)
Total per year (kWh/year) = Sum (64)m =																			1155.1525 (64)
Heat gains from water heating, kWh/month																			
92.3794	81.8058	85.6981	73.6698	68.1579	61.2618	59.3362	65.1642	69.8528	80.8161	85.0649	90.5783	90.5783	90.5783	90.5783	90.5783	90.5783	90.5783	90.5783	(65)

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

Metabolic gains (Table 5), Watts																			
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec								
(66)m	179.4753	179.4753	179.4753	179.4753	179.4753	179.4753	179.4753	179.4753	179.4753	179.4753	179.4753	179.4753	179.4753	179.4753	179.4753	179.4753	179.4753	179.4753	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5																			
80.9475	71.8968	58.4704	44.2659	33.0893	27.9353	30.1851	39.2358	52.6622	66.8667	78.0433	83.1972	83.1972	83.1972	83.1972	83.1972	83.1972	83.1972	83.1972	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5																			
542.0801	547.7052	533.5302	503.3531	465.2601	429.4579	405.5399	399.9148	414.0899	444.2669	482.3600	518.1621	518.1621	518.1621	518.1621	518.1621	518.1621	518.1621	518.1621	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5																			
55.9388	55.9388	55.9388	55.9388	55.9388	55.9388	55.9388	55.9388	55.9388	55.9388	55.9388	55.9388	55.9388	55.9388	55.9388	55.9388	55.9388	55.9388	55.9388	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)																			
-119.6502	-119.6502	-119.6502	-119.6502	-119.6502	-119.6502	-119.6502	-119.6502	-119.6502	-119.6502	-119.6502	-119.6502	-119.6502	-119.6502	-119.6502	-119.6502	-119.6502	-119.6502	-119.6502	(71)
Water heating gains (Table 5)																			
124.1659	121.7348	115.1856	102.3192	91.6100	85.0858	79.7530	87.5863	97.0177	108.6238	118.1458	121.7450	121.7450	121.7450	121.7450	121.7450	121.7450	121.7450	121.7450	(72)
Total internal gains																			
865.9574	860.1007	825.9501	768.7021	708.7232	661.2430	634.2420	645.5008	682.5337	738.5213	797.3130	841.8682	841.8682	841.8682	841.8682	841.8682	841.8682	841.8682	841.8682	(73)

6. Solar gains

[Jan]																			
	Area	Solar flux	g	FF	Access	Gains													
	m2	Table 6a	Specific data	Specific data	factor	W													
		W/m2	or Table 6b	or Table 6c	Table 6d														
North	4.3600	10.6334	0.6300	0.7000	0.7700	14.1687	(74)												
East	22.5900	19.6403	0.6300	0.7000	0.7700	135.5924	(76)												
South	19.5000	46.7521	0.6300	0.7000	0.7700	278.6168	(78)												
West	6.4600	19.6403	0.6300	0.7000	0.7700	38.7750	(80)												

Solar gains	467.1529	824.4792	1189.0015	1550.1097	1788.1691	1793.2000	1721.7204	1544.5958	1315.8320	929.1402	565.1504	395.9535	(83)
Total gains	1333.1102	1684.5799	2014.9516	2318.8118	2496.8923	2454.4430	2355.9624	2190.0966	1998.3657	1667.6615	1362.4634	1237.8217	(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	19.6243	19.6707	19.7164	19.9338	19.9750	20.1691	20.1691	20.2054	20.0939	19.9750	19.8918	19.8055
alpha	2.3083	2.3114	2.3144	2.3289	2.3317	2.3446	2.3446	2.3470	2.3396	2.3317	2.3261	2.3204
util living area												
	0.9574	0.9288	0.8829	0.8053	0.6976	0.5633	0.4407	0.4822	0.6691	0.8509	0.9366	0.9635 (86)
MIT	18.8001	19.0937	19.5129	20.0046	20.4089	20.6864	20.8056	20.7843	20.5673	20.0116	19.3101	18.7478 (87)
Th 2	19.7515	19.7540	19.7565	19.7683	19.7705	19.7808	19.7808	19.7827	19.7769	19.7705	19.7661	19.7614 (88)
util rest of house												
	0.9505	0.9177	0.8643	0.7738	0.6465	0.4845	0.3355	0.3764	0.5967	0.8193	0.9247	0.9576 (89)
MIT 2	16.8386	17.2610	17.8591	18.5522	19.0940	19.4437	19.5666	19.5517	19.3132	18.5828	17.5873	16.7693 (90)
Living area fraction												
MIT	17.2686	17.6628	18.2216	18.8706	19.3822	19.7161	19.8382	19.8220	19.5882	18.8960	17.9650	17.2030 (91)
Temperature adjustment												-0.1500
adjusted MIT	17.1186	17.5128	18.0716	18.7206	19.2322	19.5661	19.6882	19.6720	19.4382	18.7460	17.8150	17.0530 (92)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9297	0.8906	0.8323	0.7417	0.6209	0.4692	0.3269	0.3659	0.5735	0.7859	0.8987	0.9388	(94)
Useful gains	1239.4212	1500.2502	1677.1005	1719.7751	1550.2371	1151.5755	770.1197	801.3384	1146.0557	1310.5859	1224.3823	1162.0345	(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	3480.2976	3416.3265	3127.0678	2624.9281	2009.1243	1311.8955	815.8073	862.7947	1415.4563	2172.8441	2870.0236	3457.6936	(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	1667.2120	1287.6032	1078.7757	651.7101	341.4121	0.0000	0.0000	0.0000	0.0000	641.5201	1184.8617	1707.9704	(98)
Space heating												8561.0652	(98)
Space heating per m2												(98) / (4) =	44.6330 (99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.1000 (201)
Fraction of space heat from main system(s)													0.9000 (202)
Efficiency of main space heating system 1 (in %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													65.0000 (208)
Space heating requirement													8513.7665 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1667.2120	1287.6032	1078.7757	651.7101	341.4121	0.0000	0.0000	0.0000	0.0000	641.5201	1184.8617	1707.9704	(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)	1658.0009	1280.4894	1072.8156	648.1095	339.5258	0.0000	0.0000	0.0000	0.0000	637.9758	1178.3155	1698.5341	(211)
Water heating requirement	256.4942	198.0928	165.9655	100.2631	52.5249	0.0000	0.0000	0.0000	0.0000	98.6954	182.2864	262.7647	(215)
Water heating													
Water heating requirement	188.1136	143.8031	118.9855	65.5772	30.6678	13.8589	8.3502	40.5316	71.1624	123.9254	162.9629	187.2140	(64)
Efficiency of water heater	89.1681	89.1800	89.1943	89.2960	89.4120	79.8000	79.8000	79.8000	79.8000	88.4053	88.9195	89.2015	(216)
(217)m													
Fuel for water heating, kWh/month	210.9652	161.2504	133.4002	73.4381	34.2994	17.3671	10.4639	50.7915	89.1759	140.1787	183.2701	209.8778	(219)
Water heating fuel used												1314.4783	(219)
Annual totals kWh/year													
Space heating fuel - main system												8513.7665	(211)
Space heating fuel - secondary												1317.0870	(215)
Electricity for pumps and fans:													
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
pump for solar water heating													50.0000 (230g)
Total electricity for the above, kWh/year													125.0000 (231)
Electricity for lighting (calculated in Appendix L)													571.8229 (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												10978.5350	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	8513.7665	3.4800	296.2791	(240)
Space heating - secondary	1317.0870	4.2300	55.7128	(242)
Water heating (other fuel)	1314.4783	3.4800	45.7438	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Pump for solar water heating	50.0000	13.1900	6.5950	(249)
Energy for lighting	571.8229	13.1900	75.4234	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-863.6197	13.1900	-113.9114	(252)
Total energy cost			495.7352	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):			0.4200 (256)
Energy cost factor (ECF)		[(255) x (256)] / [(4) + 45.0] =	0.8792 (257)
SAP value			87.7348
SAP rating (Section 12)			88 (258)
SAP band			B

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

Energy	Emission factor	Emissions
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FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

	kWh/year	kg CO2/kWh	kg CO2/year
Space heating - main system 1	8513.7665	0.2160	1838.9736 (261)
Space heating - secondary	1317.0870	0.0190	25.0247 (263)
Water heating (other fuel)	1314.4783	0.2160	283.9273 (264)
Space and water heating			2147.9255 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	571.8229	0.5190	296.7761 (268)
Energy saving/generation technologies			
PV Unit	-863.6197	0.5190	-448.2186 (269)
Total kg/year			2061.3580 (272)
CO2 emissions per m2			10.7500 (273)
EI value			88.3357
EI rating			88 (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	139.3400 (1b)	x 2.6800 (2b)	= 373.4312 (1b) - (3b)
First floor	52.4700 (1c)	x 2.4900 (2c)	= 130.6503 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	191.8100		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 504.0815 (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) = 0.0992 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3492 (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) =	0.3492 (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	0.3841	0.3666	0.3666	0.3405	0.3405	0.2968	0.3055	0.2881	0.3055	0.3405	0.3230	0.3579 (22b)
Effective ac	0.5738	0.5672	0.5672	0.5580	0.5580	0.5440	0.5467	0.5415	0.5467	0.5580	0.5522	0.5641 (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)			52.9100	1.3258	70.1458		(27)
Entrance Door			3.7800	1.4000	5.2920		(26a)
Ground Floor			139.3400	0.1100	15.3274		(28a)
EW1 - Facing Brick	230.5300	56.6900	173.8400	0.2100	36.5064		(29a)
R1 - Flat ceiling	131.4500		131.4500	0.1700	22.3465		(30)
R2 - Flat roof (Balcony)	6.5800		6.5800	0.1600	1.0528		(30)
Total net area of external elements Aum, m ²			507.9000				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		150.6709		(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)							21.1722 (36)
Total fabric heat loss						(33) + (36) =	171.8431 (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	95.4449	94.3546	94.3546	92.8144	92.8144	90.5008	90.9382	90.0761	90.9382	92.8144	91.8509	93.8285 (38)
Heat transfer coeff	267.2880	266.1977	266.1977	264.6575	264.6575	262.3439	262.7812	261.9192	262.7812	264.6575	263.6940	265.6716 (39)
Average = Sum(39)m / 12 =												264.4039 (39)
HLP	1.3935	1.3878	1.3878	1.3798	1.3798	1.3677	1.3700	1.3655	1.3700	1.3798	1.3748	1.3851 (40)
HLP (average)												1.3785 (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												2.9913 (42)
Average daily hot water use (litres/day)												105.2423 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	115.7665	111.5568	107.3472	103.1375	98.9278	94.7181	94.7181	98.9278	103.1375	107.3472	111.5568	115.7665 (44)
Energy content (annual)	171.6784	150.1510	154.9424	135.0826	129.6149	111.8478	103.6435	118.9324	120.3528	140.2596	153.1043	166.2614 (45)
Distribution loss (46)m = 0.15 x (45)m	25.7518	22.5227	23.2414	20.2624	19.4422	16.7772	15.5465	17.8399	18.0529	21.0389	22.9656	24.9392 (46)
Water storage loss:												250.0000 (47)
Store volume												1.7800 (48)
a) If manufacturer declared loss factor is known (kWh/day):												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.9612 (55)
Total storage loss												
	29.7972	26.9136	29.7972	28.8360	29.7972	28.8360	29.7972	29.7972	28.8360	29.7972	28.8360	29.7972 (56)
If cylinder contains dedicated solar storage												
	20.8580	18.8395	20.8580	20.1852	20.8580	20.1852	20.8580	20.8580	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	215.7989	190.0018	197.6671	171.0262	160.9411	141.9383	134.7370	150.9564	157.6471	182.9843	195.8015	210.3818 (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												1.1858 (H8)
Utilisation factor												0.5697 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												127.5000 (H13)
Daily hot water demand												105.2423 (H14)
Volume ratio Veff/V												1.2115 (H15)
Solar storage volume factor												1.0000 (H16)
Solar input												-983.6385 (H17)
Solar input	-31.4538	-45.9086	-77.7159	-105.8774	-127.5631	-132.7218	-129.6509	-115.3895	-91.1086	-63.0193	-36.7634	-26.4662 (63)
												-983.6385 (63)
Solar input (sum of months) = Sum (63)m =												
Output from w/h	184.3451	144.0932	119.9512	65.1488	33.3780	9.2165	5.0861	35.5669	66.5385	119.9650	159.0381	183.9157 (64)
Total per year (kWh/year) = Sum (64)m =												1126.2430 (64)
Heat gains from water heating, kWh/month	92.3794	81.8058	85.6981	73.6698	68.1579	61.2618	59.3362	65.1642	69.8528	80.8161	85.0649	90.5783 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	179.4753	179.4753	179.4753	179.4753	179.4753	179.4753	179.4753	179.4753	179.4753	179.4753	179.4753	179.4753	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	80.9475	71.8968	58.4704	44.2659	33.0893	27.9353	30.1851	39.2358	52.6622	66.8667	78.0433	83.1972	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	542.0801	547.7052	533.5302	503.3531	465.2601	429.4579	405.5399	399.9148	414.0899	444.2669	482.3600	518.1621	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.9388	55.9388	55.9388	55.9388	55.9388	55.9388	55.9388	55.9388	55.9388	55.9388	55.9388	55.9388	(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)	-119.6502	-119.6502	-119.6502	-119.6502	-119.6502	-119.6502	-119.6502	-119.6502	-119.6502	-119.6502	-119.6502	-119.6502	(71)
Water heating gains (Table 5)	124.1659	121.7348	115.1856	102.3192	91.6100	85.0858	79.7530	87.5863	97.0177	108.6238	118.1458	121.7450	(72)
Total internal gains	865.9574	860.1007	825.9501	768.7021	708.7232	661.2430	634.2420	645.5008	682.5337	738.5213	797.3130	841.8682	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	FF factor Table 6d	Gains W	
North	4.3600	12.7650	0.6300	0.7000	0.7700	17.0091	(74)
East	22.5900	23.8018	0.6300	0.7000	0.7700	164.3226	(76)
South	19.5000	54.2217	0.6300	0.7000	0.7700	323.1317	(78)
West	6.4600	23.8018	0.6300	0.7000	0.7700	46.9909	(80)

Solar gains	551.4543	850.8513	1220.3428	1621.0851	1828.3628	1942.7018	1845.5233	1682.9087	1441.4970	1029.6504	657.2492	470.0951	(83)
Total gains	1417.4116	1710.9520	2046.2929	2389.7872	2537.0860	2603.9448	2479.7653	2328.4095	2124.0307	1768.1717	1454.5622	1311.9633	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	19.9338	20.0154	20.0154	20.1319	20.1319	20.3094	20.2756	20.3424	20.2756	20.1319	20.2054	20.0550	
alpha	2.3289	2.3344	2.3344	2.3421	2.3421	2.3540	2.3517	2.3562	2.3517	2.3421	2.3470	2.3370	
util living area	0.9482	0.9217	0.8683	0.7747	0.6533	0.4760	0.3474	0.3837	0.6104	0.8176	0.9206	0.9553	(86)
MIT	18.9788	19.2232	19.6613	20.1487	20.5198	20.7713	20.8485	20.8373	20.6533	20.1601	19.4981	18.9323	(87)
Th 2	19.7683	19.7727	19.7727	19.7789	19.7789	19.7882	19.7864	19.7899	19.7864	19.7789	19.7827	19.7748	(88)
util rest of house	0.9398	0.9093	0.8471	0.7383	0.5947	0.3881	0.2357	0.2699	0.5297	0.7790	0.9056	0.9479	(89)
MIT 2	17.1072	17.4590	18.0799	18.7557	19.2409	19.5379	19.6043	19.6010	19.4188	18.7904	17.8669	17.0450	(90)
Living area fraction												0.2192	(91)
MIT	17.5175	17.8458	18.4266	19.0611	19.5213	19.8083	19.8770	19.8720	19.6894	19.0907	18.2245	17.4587	(92)
Temperature adjustment												-0.1500	
adjusted MIT	17.3675	17.6958	18.2766	18.9111	19.3713	19.6583	19.7270	19.7220	19.5394	18.9407	18.0745	17.3087	(93)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9167	0.8814	0.8148	0.7077	0.5726	0.3779	0.2299	0.2631	0.5111	0.7463	0.8771	0.9267	(94)
Useful gains	1299.3102	1507.9928	1667.2548	1691.3157	1452.7986	983.9834	570.1205	612.5419	1085.6322	1319.4988	1275.7988	1215.8173	(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	3332.4166	3273.1078	2948.5572	2437.7917	1792.0747	1064.6621	585.2262	634.3808	1271.7103	2022.1598	2709.3162	3296.6515	(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	1512.6312	1186.1572	953.2890	537.4627	252.4214	0.0000	0.0000	0.0000	0.0000	522.7798	1032.1325	1548.1407	(98)
Space heating												7545.0145	(98)
Space heating per m2												39.3359	(99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.1000	(201)
Fraction of space heat from main system(s)													0.9000	(202)
Efficiency of main space heating system 1 (in %)													90.5000	(206)
Efficiency of secondary/supplementary heating system, %													65.0000	(208)
Space heating requirement													7503.3294	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	1512.6312	1186.1572	953.2890	537.4627	252.4214	0.0000	0.0000	0.0000	0.0000	522.7798	1032.1325	1548.1407	(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)	1504.2741	1179.6039	948.0222	534.4933	251.0268	0.0000	0.0000	0.0000	0.0000	519.8915	1026.4301	1539.5874	(211)	
Water heating requirement	232.7125	182.4857	146.6598	82.6866	38.8341	0.0000	0.0000	0.0000	0.0000	80.4277	158.7896	238.1755	(215)	
Water heating														
Water heating requirement	184.3451	144.0932	119.9512	65.1488	33.3780	9.2165	5.0861	35.5669	66.5385	119.9650	159.0381	183.9157	(64)	
Efficiency of water heater	89.0756	89.0795	89.0356	89.0822	88.9718	79.8000	79.8000	79.8000	79.8000	88.1000	88.7602	89.1068	(216)	
(217)m														
Fuel for water heating, kWh/month	206.9536	161.7579	134.7227	73.1333	37.5153	11.5495	6.3736	44.5700	83.3816	136.1691	179.1772	206.3991	(219)	
Water heating fuel used												1281.7029	(219)	
Annual totals kWh/year														
Space heating fuel - main system												7503.3294	(211)	
Space heating fuel - secondary												1160.7715	(215)	
Electricity for pumps and fans:														
central heating pump												30.0000	(230c)	
main heating flue fan												45.0000	(230e)	
pump for solar water heating												50.0000	(230g)	
Total electricity for the above, kWh/year												125.0000	(231)	
Electricity for lighting (calculated in Appendix L)												571.8229	(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												9707.5854	(238)	

10a. Fuel costs - using BEDF prices (500)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	7503.3294	3.6300	272.3709	(240)
Space heating - secondary	1160.7715	5.1600	59.8958	(242)
Water heating (other fuel)	1281.7029	3.6300	46.5258	(247)
Pumps and fans for heating	75.0000	19.4400	14.5800	(249)
Pump for solar water heating	50.0000	19.4400	9.7200	(249)
Energy for lighting	571.8229	19.4400	111.1624	(250)
Additional standing charges			95.0000	(251)
Energy saving/generation technologies				
PV Unit	-935.0412	19.4400	-181.7720	(252)
Total energy cost			427.4828	(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	7503.3294	0.2160	1620.7191	(261)
Space heating - secondary	1160.7715	0.0190	22.0547	(263)
Water heating (other fuel)	1281.7029	0.2160	276.8478	(264)
Space and water heating			1919.6216	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	571.8229	0.5190	296.7761	(268)
Energy saving/generation technologies				
PV Unit	-935.0412	0.5190	-485.2864	(269)
Total kg/year			1795.9863	(272)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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	7503.3294	1.2200	9154.0618 (261)
Space heating - secondary	1160.7715	1.0400	1207.2023 (263)
Water heating (other fuel)	1281.7029	1.2200	1563.6775 (264)
Space and water heating			11924.9416 (265)
Pumps and fans	125.0000	3.0700	383.7500 (267)
Energy for lighting	571.8229	3.0700	1755.4964 (268)
Energy saving/generation technologies			
PV Unit	-935.0412	3.0700	-2870.5765 (269)
Primary energy kWh/year			11193.6115 (272)
Primary energy kWh/m2/year			58.3578 (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	1330.78 (P1)
Transmission heat loss coefficient	171.84 (37)
Summer heat loss coefficient	1502.62 (P2)

Overhangs

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

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer
North	1.000	0.90	1.000	0.900 (P8)
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	4.3600	81.1852	0.6300	0.7000	0.9000	126.4407
East	22.5900	117.5071	0.6300	0.7000	0.9000	948.2085
South	19.5000	112.2060	0.6300	0.7000	0.9000	781.5815
West	6.4600	117.5071	0.6300	0.7000	0.9000	271.1566

total: 2127.3873

	Jun	Jul	Aug	
Solar gains	2241	2127	1947	(P3)
Internal gains	682	655	665	
Total summer gains	2923	2782	2612	(P5)

Summer gain/loss ratio	1.95	1.85	1.74	(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	19.25	21.05	20.84	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	
Assessment of likelihood of high internal temperature:	Slight			

U-VALUE CALCULATOR REPORT

Property Reference	22098 - Plot 1	Issued on Date	08/04/2022
Assessment Reference	As Designed	Prop Type Ref	Plot 1
Project	Plot 1, 71, Oak Tree Road, Reading, RG31 6LA		
Calculation Type	New Build (As Designed)		

SAP Rating	87 B	DER	12.92	TER	16.16
Environmental	87 B	% DER<TER	20.07		
CO ₂ Emissions (t/year)	2.06	DFEE	54.29	TFEE	63.44
General Requirements Compliance	Pass	% DFEE<TFEE	14.43		

Assessor Details	Miss Sofia Kymiatzi, Sofia Kymiatzi, Tel: 07365 923 614, sofia@jostec.co.uk	Assessor ID	U123-0001
Client	The Keen Partnership, 22098		

Building Elements

Roof 000004

Roof Type: Pitched Roof, insulated sloping ceiling

Layer	Description	Thickness (mm)	Conductivity (W/m ² K)	Resistance (m ² K/W)	Fraction (%)
Ext surface				0.0400	
Layer 1	Standard cavity				
	Main construction	10	0.0667	0.1500	87.50
	Main construction	10	0.1300	0.0769	12.50
	Corrections - Cavity Unventilated, Emissivity: Normal				
Layer 2	Hybris				
	Main construction	140	0.0330	4.2424	87.50
	Main construction	140	0.1300	1.0769	12.50
	Corrections - Air Gap: Level 1, Fasteners: None or plastic				
Layer 3	Hcontrol Hybrid				
	Main construction	45	0.0237	1.9000	100.00
Layer 4	airspace/timber battens				
	Main construction	22	0.1222	0.1800	89.63
	Main construction	22	0.1375	0.1600	10.37
	Corrections - Cavity Unventilated, Emissivity: Normal				
Layer 5	Plasterboard, standard				
	Main construction	12.5	0.2100	0.0595	100.00
Int surface				0.1000	

Total resistance:	Upper limit = 5.983 m ² K/W	Lower limit = 5.514 m ² K/W	Average = 5.749 m ² K/W
	Total correction = 0.0029 m ² K/W	U-value (unrounded) = 0.17 W/m ² K	

Unheated space: None

Total thickness: 230 mm

U-value: 0.17 W/m² K

Kappa: n/a

U-VALUE CALCULATOR REPORT

Property Reference	22098 - Plot 1	Issued on Date	08/04/2022
Assessment Reference	As Designed	Prop Type Ref	Plot 1
Project	Plot 1, 71, Oak Tree Road, Reading, RG31 6LA		
Calculation Type	New Build (As Designed)		

SAP Rating	87 B	DER	12.92	TER	16.16
Environmental	87 B	% DER<TER	20.07		
CO ₂ Emissions (t/year)	2.06	DFEE	54.29	TFEE	63.44
General Requirements Compliance	Pass	% DFEE<TFEE	14.43		

Assessor Details	Miss Sofia Kymiatzi, Sofia Kymiatzi, Tel: 07365 923 614, sofia@jostec.co.uk	Assessor ID	U123-0001
Client	The Keen Partnership, 22098		

Building Elements

Roof 000008

Roof Type: Flat Roof standard (no precipitation)

Layer	Description	Thickness (mm)	Conductivity (W/m ² K)	Resistance (m ² K/W)	Fraction (%)
Ext surface				0.0400	
Layer 1	ROCKWOOL ROLL				
	Main construction	170	0.0440	3.8636	100.00
	Corrections - Air Gap: Level 0, Fasteners: None or plastic				
Layer 2	Standard cavity				
	Main construction	50	0.3125	0.1600	88.25
	Main construction	50	0.1300	0.3846	11.75
	Corrections - Cavity Unventilated, Emissivity: Normal				
Layer 3	ROCKWOOL ROLL				
	Main construction	100	0.0440	2.2727	88.25
	Main construction	100	0.1300	0.7692	11.75
	Corrections - Air Gap: Level 0, Fasteners: None or plastic				
Layer 4	Plasterboard, standard				
	Main construction	12.5	0.2100	0.0595	100.00
Layer 5	Plaster, standard				
	Main construction	3	0.4000	0.0075	100.00
Int surface				0.1000	

Total resistance:	Upper limit = 6.307 m ² K/W	Lower limit = 6.091 m ² K/W	Average = 6.199 m ² K/W
	Total correction = 0.0000 m ² K/W	U-value (unrounded) = 0.16 W/m ² K	

Unheated space: None

Total thickness: 336 mm

U-value: 0.16 W/m² K

Kappa: n/a

U-VALUE CALCULATOR REPORT

Property Reference	22098 - Plot 1	Issued on Date	08/04/2022
Assessment Reference	As Designed	Prop Type Ref	Plot 1
Project	Plot 1, 71, Oak Tree Road, Reading, RG31 6LA		
Calculation Type	New Build (As Designed)		

SAP Rating	87 B	DER	12.92	TER	16.16
Environmental	87 B	% DER<TER	20.07		
CO ₂ Emissions (t/year)	2.06	DFEE	54.29	TFEE	63.44
General Requirements Compliance	Pass	% DFEE<TFEE	14.43		

Assessor Details	Miss Sofia Kymiatzi, Sofia Kymiatzi, Tel: 07365 923 614, sofia@jostec.co.uk	Assessor ID	U123-0001
Client	The Keen Partnership, 22098		

Building Elements

Wall 000001

Wall Type: Standard Wall

Layer	Description	Thickness (mm)	Conductivity (W/m ² K)	Resistance (m ² K/W)	Fraction (%)
Ext surface				0.0400	
Layer 1	Brick, outer leaf				
	Main construction	102.5	0.7700	0.1331	82.81
	Main construction	102.5	0.9407	0.1090	17.19
Layer 2	Earthwool Dritherm 32 Ultimate				
	Main construction	125	0.0320	3.9063	100.00
	Corrections - Air Gap: Level 1, Fasteners: None or plastic				
Layer 3	Celcon Standard - Normal - Trad joint 10mm				
	Main construction	100	0.1500	0.6667	93.18
	Main construction	100	0.8803	0.1136	6.82
Layer 4	airspace/plaster dabs				
	Main construction	15	0.0882	0.1700	80.00
	Main construction	15	0.0882	0.1700	20.00
	Corrections - Cavity Unventilated, Emissivity: Normal				
Layer 5	Plasterboard, standard				
	Main construction	12.5	0.2100	0.0595	100.00
Layer 6	Plaster, standard				
	Main construction	6	0.4000	0.0150	100.00
Int surface				0.1300	

Total resistance: Upper limit = 5.074 m² K/W Lower limit = 4.950 m² K/W Average = 5.012 m² K/W
Total correction = 0.0061 m² K/W U-value (unrounded) = 0.21 W/m² K

Unheated space: None

Total thickness: 361 mm

U-value: 0.21 W/m² K

Kappa: n/a

U-VALUE CALCULATOR REPORT

Property Reference	22098 - Plot 1	Issued on Date	08/04/2022
Assessment Reference	As Designed	Prop Type Ref	Plot 1
Project	Plot 1, 71, Oak Tree Road, Reading, RG31 6LA		
Calculation Type	New Build (As Designed)		

SAP Rating	87 B	DER	12.92	TER	16.16
Environmental	87 B	% DER<TER	20.07		
CO ₂ Emissions (t/year)	2.06	DFEE	54.29	TFEE	63.44
General Requirements Compliance	Pass	% DFEE<TFEE	14.43		

Assessor Details	Miss Sofia Kymiatzi, Sofia Kymiatzi, Tel: 07365 923 614, sofia@jostec.co.uk	Assessor ID	U123-0001
Client	The Keen Partnership, 22098		

Building Elements

Floor 000007 - Floor - suspended beam-and-block floor

Floor Type: Suspended Floor

Area = 140.00 m², Perimeter = 60.10 m, Wall thickness = 300.00 mm, Soil: Clay

Depth of underfloor space below ground: 0.200 m Floor wind shielding: Average (suburban)

Floor height above ground: h = 0.000 m

U-value of walls above ground: U_w = 1.500 m

Ventilation openings per perimeter length: e = 0.0015 %

Mean wind speed: v = 5.000 m/s

Resistance on solum: R_g = 0.000 m²K/W

Layer	Description	Thickness (mm)	Conductivity (W/m ² K)	Resistance (m ² K/W)	Fraction (%)
Ext surface				0.1700	
Layer 1	AAC (600 kg/m ³)/ concrete				
	Main construction	150	0.1800	0.8333	86.30
	Main construction	150	1.3500	0.1111	13.70
Layer 2	Celotex XR4000				
	Main construction	150	0.0220	6.8182	100.00
	Corrections - Air Gap: Level 1, Fasteners: None or plastic				
Layer 3	Screed				
	Main construction	65	1.1500	0.0565	100.00
Int surface				0.1700	

Total resistance: Upper limit = 7.941 m² K/W Lower limit = 7.655 m² K/W Average = 7.798 m² K/W

Total correction = 0.0076 m² K/W

U-value (unrounded) = 0.11 W/m² K

Unheated space: None

Total thickness: 365 mm

U-value: 0.11 W/m² K

Kappa: n/a

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	87 B	DER	12.92
Environmental	87 B	TER	16.16
CO ₂ Emissions (t/year)	2.06	% DER<TER	20.07
General Requirements Compliance	Pass	DFEE	54.29
		TFEE	63.44
		% DFEE<TFEE	14.43
Assessor Details	Miss Sofia Kymiatzi, Sofia Kymiatzi, Tel: 07365 923 614, sofia@jostec.co.uk		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)	16.16	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	12.92	kgCO ₂ /m ²	Pass
	-3.24 (-20.0%)	kgCO ₂ /m ²	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	63.44	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DFEE)	54.29	kWh/m ² /yr	
	-9.1 (-14.4%)	kWh/m ² /yr	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	Pass
Floor	0.11 (max. 0.25)	0.11 (max. 0.70)	Pass
Roof	0.17 (max. 0.20)	0.17 (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

4.36 m², No overhang

Windows facing East

22.59 m², No overhang

Windows facing South

19.50 m², No overhang

Windows facing West

6.46 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

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	87 B	DER	12.92
Environmental	87 B	TER	16.16
CO ₂ Emissions (t/year)	2.06	% DER<TER	20.07
General Requirements Compliance	Pass	DfEE	54.29
		TFEE	63.44
		% DfEE<TFEE	14.43
Assessor Details	Miss Sofia Kymiatzi, Sofia Kymiatzi, Tel: 07365 923 614, sofia@jostec.co.uk		Assessor ID
Client	The Keen Partnership, 22098		

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

Orientation	East
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Suburban
1.0 Property Type	House, Detached
2.0 Number of Storeys	2
3.0 Date Built	2022
4.0 Sheltered Sides	0
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements		Heat Loss Perimeter	Internal Floor Area	Average Storey Height
	Ground Floor:	58.38 m	139.34 m ²	2.68 m
	1st Storey:	29.87 m	52.47 m ²	2.49 m

7.0 Living Area	42.05	m ²
8.0 Thermal Mass Parameter	Simple calculation - Low	
Thermal Mass	100.00	kJ/m ² K

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	230.53	173.84

10.0 External Roofs				
Description	Type	U-Value (W/m ² K)	Gross Area (m ²)	Nett Area (m ²)
R1 - Flat ceiling	External Plane Roof	0.17	131.45	131.45
R2 - Flat roof (Balcony)	External Flat Roof	0.16	6.58	6.58

11.0 Heat Loss Floors				
Description	Type	Construction	U-Value (W/m ² K)	Area (m ²)
Ground Floor	Ground Floor - Solid		0.11	139.34

12.0 Opening Types									
Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m ² K)
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

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
E Windows 1	Window	[1] EW1 - Facing Brick	East	None	0.00					22.59	
Entrance door	Half Glazed Door	[1] EW1 - Facing Brick	East							1.89	
W Windows	Window	[1] EW1 - Facing Brick	West	None	0.00					6.46	
S Windows	Window	[1] EW1 - Facing Brick	South	None	0.00					19.50	
N Windows	Window	[1] EW1 - Facing Brick	North	None	0.00					4.36	
Rear Door	Half Glazed Door	[1] EW1 - Facing Brick	North							1.89	

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)	32.32	0.050	No	CATNIC
Independently assessed	E3 Sill	14.34	0.034	No	CD0027
Independently assessed	E4 Jamb	65.06	0.040	No	CD0028
Independently assessed	E5 Ground floor (normal)	58.38	0.060	No	CD0022
Independently assessed	E6 Intermediate floor within a dwelling	29.74	0.000	No	CD0029
Table K1 - Approved	E10 Eaves (insulation at ceiling level)	41.65	0.060	No	
Table K1 - Approved	E12 Gable (insulation at ceiling level)	22.00	0.240	No	
Table K1 - Default	E15 Flat roof with parapet	7.25	0.560	No	
Independently assessed	E16 Corner (normal)	31.40	0.058	No	CD0035
Independently assessed	E17 Corner (inverted – internal area greater than external area)	10.72	-0.065	No	CD0036

Y-value 0.042 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

Air change rate 8.00

Mechanical Ventilation

Mechanical Ventilation System Present No

20.0 Fans, Open Fireplaces, Flues

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

21.0 Fixed Cooling System No

22.0 Lighting

Internal

Total number of light fittings 15

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

Total number of L.E.L. fittings	15	
Percentage of L.E.L. fittings	100.00	%
External		
External lights fitted	No	
23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	18452	
Fuel Type	Mains gas	
Main Heating	BGB	
SAP Code	102	
In Winter	90.5	
In Summer	79.8	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	Yes	
Sap Code	2110	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators and Underfloor	
Underfloor Heating	Yes - Pipes in thin screed	
Flow Temperature	Normal (> 45°C)	
25.0 Main Heating 2	None	
Community Heating	None	
27.0 Secondary Heating	RWM	
Secondary Heating	SAP table	
Description	Wood Logs RWM Closed room heater	
SHS efficiency	65.00	%
SAP Code	633	
HETAS Approved System	Yes	
Smoke Control Area	Unknown	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

29.0 Hot Water Cylinder

Hot Water Cylinder	Hot Water Cylinder	
Cylinder Stat	Yes	
Cylinder In Heated Space	Yes	
Independent Time Control	Yes	
Insulation Type	Measured Loss	
Cylinder Volume	250.00	L
Loss	1.78	kWh/day
Pipes insulation	Fully insulated primary pipework	

31.0 Thermal Store

None

32.0 Photovoltaic Unit

One Dwelling

PV Cells kWp

1.00

Orientation

South

Elevation

30°

Overshading

None Or Little

Connected to Dwelling

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 88	