

Energy Calculations Ltd

SAP ♦ CODE ♦ SBEM ♦ DESIGN

01754-761035



SAP Report Submission for Building Regulations Compliance

Client:

Project: Flat 4, 18, Parkside Road
READING, RG30 2DB

Contact: Matthew Carter
Energy Calculations Limited
mcarter@energycalculations.co.uk

Report Issue Date: 16/08/2021

EXCELLENCE
IN ENERGY
ASSESSMENT

PREDICTED ENERGY ASSESSMENT

Energy Calculations Ltd
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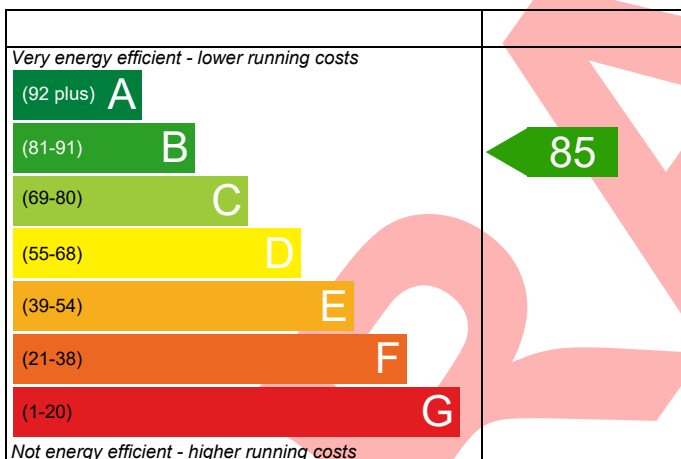
Flat 4, 18, Parkside Road,
READING,
RG30 2DB

Dwelling type: Flat, End-Terrace
Date of assessment: 16/08/2021
Produced by: Energy Calculations Limited
Total floor area: 65 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

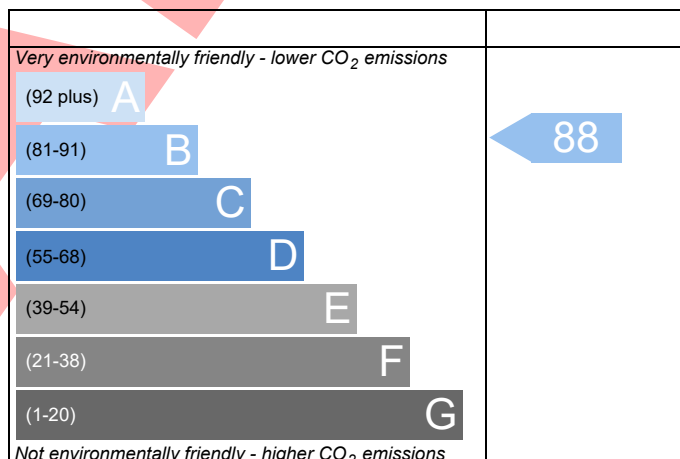


England

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.

THERMAL BRIDGING

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Calculation Type: New Build (As Designed)

Property Reference	015725		Issued on Date	16/08/2021	
Assessment Reference	004	Prop Type Ref			
Property	Flat 4, 18, Parkside Road, READING, RG30 2DB				
SAP Rating	85 B	DER	16.86	TER	25.77
Environmental	88 B	% DER<TER	34.58		
CO ₂ Emissions (t/year)	0.88	DFEE	43.28	TFEE	43.82
General Requirements Compliance	Pass	% DFEE<TFEE	1.21		
Assessor Details	Mr. Matthew Carter, Energy Calculations Limited, Tel: 01754 761035, mcarter@energycalculations.co.uk			Assessor ID	7869-0001
Client					

	Junction detail	Source Type	Psi (W/mK)	Length (m)	Result	Reference
External wall	E2 Other lintels (including other steel lintels)	Table K1 - Approved	0.300	8.20	2.46	
External wall	E3 Sill	Table K1 - Approved	0.040	8.20	0.33	
External wall	E4 Jamb	Table K1 - Approved	0.050	28.00	1.40	
External wall	E7 Party floor between dwellings (in blocks of flats)	Table K1 - Approved	0.070	33.65	2.36	
External wall	E10 Eaves (insulation at ceiling level)	Table K1 - Approved	0.060	11.00	0.66	
External wall	E14 Flat roof	Table K1 - Default	0.080	12.50	1.00	
External wall	E16 Corner (normal)	Table K1 - Approved	0.090	7.20	0.65	
External wall	E17 Corner (inverted – internal area greater than external area)	Table K1 - Approved	-0.090	2.40	-0.22	
Party wall	P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	Table K1 - Default	0.000	3.60	0.00	

Total: **8.64** W/mK:
Y-Value: **0.087** W/m²K:

FULL SAP CALCULATION PRINTOUT

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

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

DWELLING AS DESIGNED

Mid-floor flat, total floor area 65 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:Electricity

Fuel factor:1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER) 25.77 kgCO₂/m²

Dwelling Carbon Dioxide Emission Rate (DER) 16.86 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)43.8 kWh/m²/yr

Dwelling Fabric Energy Efficiency (DFEE)43.3 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.22 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	(no floor)		
Roof	0.15 (max. 0.20)	0.16 (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: Heat pump with radiators or underfloor - Electric
Panasonic WH-MDC05F3E5

Secondary heating system: None

5 Cylinder insulation

Hot water storage	Measured cylinder loss: 1.86 kWh/day	
Permitted by DBSCG 2.30	OK	
Primary pipework insulated:	Yes	OK

6 Controls

Space heating controls:	Time and temperature zone control	OK
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Hot water controls:

Cylinderstat	OK
Independent timer for DHW	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): Not significant OK

Based on:

Overshading:	Average
Windows facing East:	6.02 m ² , No overhang
Windows facing South:	3.24 m ² , No overhang
Windows facing West:	1.56 m ² , No overhang
Air change rate:	6.00 ach
Blinds/curtains:	None

10 Key features

Party wall U-value	0.00 W/m ² K
Photovoltaic array	300.00 kWh/Year

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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	65.0000 (1b)	x 2.4000 (2b)	= 156.0000 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	65.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 156.0000 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					2 * 10 = 20.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
					Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					20.0000 / (5) = 0.1282 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3782 (18)
Number of sides sheltered					1 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.9250 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3498 (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												
	0.4460	0.4373	0.4286	0.3848	0.3761	0.3323	0.3323	0.3236	0.3498	0.3761	0.3936	0.4111 (22b)
Effective ac	0.5995	0.5956	0.5918	0.5740	0.5707	0.5552	0.5552	0.5524	0.5612	0.5707	0.5774	0.5845 (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)			10.8200	1.3258	14.3447		(27)
Door to Stairs			1.8900	1.4000	2.6460		(26)
Main Wall	68.2400	10.8200	57.4200	0.2200	12.6324	60.0000	3445.2000 (29a)
Wall to stairs	12.5200	1.8900	10.6300	0.1864	1.9812	190.0000	2019.7000 (29a)
Flat roof	5.6000		5.6000	0.1400	0.7840	9.0000	50.4000 (30)
Void	13.0600		13.0600	0.1600	2.0896	9.0000	117.5400 (30)
Total net area of external elements Aum(A, m ²)			99.4200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	34.4779		(33)
Party Wall 1			9.4300	0.0000	0.0000	180.0000	1697.4000 (32)
Party Floor 1			65.0000			40.0000	2600.0000 (32d)
Party Ceilings 1			46.3400			40.0000	1853.6000 (32b)
Internal Wall 1			851.1200			100.0000	85112.0000 (32c)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	96895.8400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							1490.7052 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.6355 (36)
Total fabric heat loss						(33) + (36) =	43.1134 (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	30.8611	30.6623	30.4674	29.5518	29.3805	28.5831	28.5831	28.4354	28.8903	29.3805	29.7271	30.0893 (38)
Heat transfer coeff	73.9745	73.7757	73.5808	72.6652	72.4939	71.6965	71.6965	71.5488	72.0037	72.4939	72.8404	73.2027 (39)
Average = Sum(39)m / 12 =												72.6644 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1381	1.1350	1.1320	1.1179	1.1153	1.1030	1.1030	1.1008	1.1077	1.1153	1.1206	1.1262 (40)
HLP (average)												1.1179 (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												2.1189 (42)
Average daily hot water use (litres/day)												84.5243 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	92.9767	89.5957	86.2148	82.8338	79.4528	76.0718	76.0718	79.4528	82.8338	86.2148	89.5957	92.9767 (44)
Energy conte	137.8817	120.5923	124.4404	108.4902	104.0989	89.8294	83.2402	95.5193	96.6601	112.6480	122.9642	133.5311 (45)
Energy content (annual)										Total = Sum(45)m =		1329.8958 (45)
Distribution loss (46)m = 0.15 x (45)m												

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	20.6823	18.0888	18.6661	16.2735	15.6148	13.4744	12.4860	14.3279	14.4990	16.8972	18.4446	20.0297 (46)
Water storage loss:												
Store volume												210.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.8600 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.0044 (55)
Total storage loss												
31.1364	28.1232	31.1364	30.1320	31.1364	30.1320	31.1364	31.1364	30.1320	31.1364	30.1320	31.1364	(56)
If cylinder contains dedicated solar storage												
31.1364	28.1232	31.1364	30.1320	31.1364	30.1320	31.1364	31.1364	30.1320	31.1364	30.1320	31.1364	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month												
192.2805	169.7267	178.8392	161.1342	158.4977	142.4734	137.6390	149.9181	149.3041	167.0468	175.6082	187.9299	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Solar input (sum of months) = Sum(63)m =												0.0000 (63)
Output from w/h												
192.2805	169.7267	178.8392	161.1342	158.4977	142.4734	137.6390	149.9181	149.3041	167.0468	175.6082	187.9299	(64)
Heat gains from water heating, kWh/month												
89.3647	79.4044	84.8955	78.1882	78.1319	71.9835	71.1964	75.2792	74.2547	80.9745	83.0008	87.9181	(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	105.9458	105.9458	105.9458	105.9458	105.9458	105.9458	105.9458	105.9458	105.9458	105.9458	105.9458	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
17.1093	15.1963	12.3584	9.3561	6.9938	5.9045	6.3800	8.2930	11.1308	14.1331	16.4954	17.5848	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
185.3587	187.2821	182.4351	172.1164	159.0908	146.8487	138.6702	136.7467	141.5937	151.9125	164.9380	177.1801	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
33.5946	33.5946	33.5946	33.5946	33.5946	33.5946	33.5946	33.5946	33.5946	33.5946	33.5946	33.5946	(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	(70)
Losses e.g. evaporation (negative values) (Table 5)												
-84.7567	-84.7567	-84.7567	-84.7567	-84.7567	-84.7567	-84.7567	-84.7567	-84.7567	-84.7567	-84.7567	-84.7567	(71)
Water heating gains (Table 5)												
120.1139	118.1614	114.1068	108.5947	105.0160	99.9771	95.6941	101.1817	103.1315	108.8367	115.2789	118.1695	(72)
Total internal gains												
377.3655	375.4235	363.6841	344.8510	325.8844	307.5140	295.5280	301.0052	310.6398	329.6660	351.4960	367.7182	(73)

6. Solar gains

[Jan]												
				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	FF Specific data or Table 6c		Access factor Table 6d	Gains W	
East				6.0200	19.6403		0.6300	0.7000		0.7700	36.1340 (76)	
South				3.2400	46.7521		0.6300	0.7000		0.7700	46.2932 (78)	
West				1.5600	19.6403		0.6300	0.7000		0.7700	9.3636 (80)	
Solar gains	91.7908	164.8193	243.1518	322.9237	375.7283	377.6507	362.2776	323.1861	271.3587	187.3846	111.6034	77.4166 (83)
Total gains	469.1564	540.2428	606.8359	667.7746	701.6127	685.1646	657.8056	624.1913	581.9985	517.0506	463.0994	445.1348 (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	363.8483	364.8291	365.7955	370.4044	371.2796	375.4090	375.4090	376.1838	373.8076	371.2796	369.5133	367.6846
alpha	25.2566	25.3219	25.3864	25.6936	25.7520	26.0273	26.0273	26.0789	25.9205	25.7520	25.6342	25.5123
util living area	1.0000	1.0000	1.0000	0.9998	0.9404	0.6697	0.4796	0.5273	0.8516	1.0000	1.0000	1.0000 (86)
Tweekday	19.7314	19.7721	19.8349	19.9258	19.9722	19.9829	19.9829	19.9848	19.9790	19.9199	19.8149	19.7347
Tweekend	20.8839	20.9008	20.9275	20.9630	20.9911	20.9932	20.9932	20.9932	20.9930	20.9594	20.9148	20.8813
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	0	0	0	0	0	0	0	0	0	0	0	0
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0
MIT	20.8208	20.8466	20.8881	20.9422	20.9862	20.9895	20.9895	20.9895	20.9890	20.9373	20.8670	20.8168 (87)
Th 2	19.9699	19.9723	19.9748	19.9862	19.9884	19.9984	19.9984	20.0002	19.9945	19.9884	19.9840	19.9795 (88)
util rest of house	1.0000	1.0000	1.0000	0.9986	0.8541	0.5649	0.3704	0.4127	0.7292	0.9998	1.0000	1.0000 (89)
Tweekday	19.7314	19.7721	19.8349	19.9258	19.9722	19.9829	19.9829	19.9848	19.9790	19.9199	19.8149	19.7347
Tweekend	19.7314	19.7721	19.8349	19.9258	19.9722	19.9829	19.9829	19.9848	19.9790	19.9199	19.8149	19.7347
MIT 2	19.7314	19.7721	19.8349	19.9258	19.9722	19.9829	19.9829	19.9848	19.9790	19.9199	19.8149	19.7347 (90)
Living area fraction									fLA = Living area / (4) =			0.4692 (91)
MIT	20.2426	20.2763	20.3291	20.4027	20.4480	20.4553	20.4552	20.4562	20.4529	20.3973	20.3086	20.2424 (92)
Temperature adjustment												0.0000
adjusted MIT	20.2426	20.2763	20.3291	20.4027	20.4480	20.4553	20.4552	20.4562	20.4529	20.3973	20.3086	20.2424 (93)

8. Space heating requirement

Utilisation	1.0000	1.0000	1.0000	0.9994	0.8970	0.6127	0.4202	0.4650	0.7856	0.9999	1.0000	1.0000 (94)
Useful gains	469.1564	540.2428	606.8354	667.3539	629.3374	419.8012	276.4070	290.2197	457.2446	517.0110	463.0994	445.1348 (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	1179.3465	1134.3933	1017.5544	835.8466	634.1787	419.8016	276.4070	290.2197	457.4353	710.2452	962.1202	1174.3504 (97)

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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	528.3815	399.2691	305.5749	121.3148	3.6019	0.0000	0.0000	0.0000	0.0000	143.7662	359.2950	542.5364 (98)
Space heating												2403.7398 (98)
Space heating per m2										(98) / (4) =		36.9806 (99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												254.0241 (206)
Efficiency of secondary/supplementary heating system, %												100.0000 (208)
Space heating requirement												946.2646 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	528.3815	399.2691	305.5749	121.3148	3.6019	0.0000	0.0000	0.0000	0.0000	143.7662	359.2950	542.5364 (98)
Space heating efficiency (main heating system 1)	254.0241	254.0241	254.0241	254.0241	254.0241	0.0000	0.0000	0.0000	0.0000	254.0241	254.0241	254.0241 (210)
Space heating fuel (main heating system)	208.0045	157.1777	120.2937	47.7572	1.4179	0.0000	0.0000	0.0000	0.0000	56.5955	141.4413	213.5768 (211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	192.2805	169.7267	178.8392	161.1342	158.4977	142.4734	137.6390	149.9181	149.3041	167.0468	175.6082	187.9299 (64)
Efficiency of water heater	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400 (216)
(217)m	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400 (217)
Fuel for water heating, kWh/month	113.4800	100.1692	105.5472	95.0981	93.5421	84.0849	81.2317	88.4786	88.1162	98.5876	103.6403	110.9124 (219)
Water heating fuel used												1162.8882 (219)
Annual totals kWh/year												
Space heating fuel - main system												946.2646 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
Total electricity for the above, kWh/year												0.0000 (231)
Electricity for lighting (calculated in Appendix L)												302.1547 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
Total delivered energy for all uses												2411.3076 (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	946.2646	0.5190	491.1113 (261)
Space heating - secondary	0.0000	0.5190	0.0000 (263)
Water heating (other fuel)	1162.8882	0.5190	603.5390 (264)
Space and water heating			1094.6503 (265)
Pumps and fans	0.0000	0.0000	0.0000 (267)
Energy for lighting	302.1547	0.5190	156.8183 (268)
Energy saving/generation technologies			
PV Unit	-300.0000	0.5190	-155.7000 (269)
Total CO2, kg/year			1095.7686 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			16.8600 (273)

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

DER			16.8600 ZC1
Total Floor Area		TFA	65.0000
Assumed number of occupants		N	2.1189
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190
CO2 emissions from appliances, equation (L14)			16.8984 ZC2
CO2 emissions from cooking, equation (L16)			2.6131 ZC3
Total CO2 emissions			36.3715 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			36.3715 ZC8

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1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	65.0000 (1b)	x 2.4000 (2b)	= 156.0000 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	65.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 156.0000 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					2 * 10 = 20.0000 (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) =					Air changes per hour
Pressure test					20.0000 / (5) = 0.1282 (8)
Measured/design AP50					Yes
Infiltration rate					5.0000
Number of sides sheltered					0.3782 (18)
					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3498 (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												
Effective ac	0.4460	0.4373	0.4286	0.3848	0.3761	0.3323	0.3323	0.3236	0.3498	0.3761	0.3936	0.4111 (22b)
Effective ac	0.5995	0.5956	0.5918	0.5740	0.5707	0.5552	0.5552	0.5524	0.5612	0.5707	0.5774	0.5845 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K						
TER Opaque door			1.8900	1.0000	1.8900			(26)					
TER Opening Type (Uw = 1.40)			10.8200	1.3258	14.3447			(27)					
Main Wall	68.2400	10.8200	57.4200	0.1800	10.3356			(29a)					
Wall to stairs	12.5200	1.8900	10.6300	0.1800	1.9134			(29a)					
Flat roof	5.6000		5.6000	0.1300	0.7280			(30)					
Void	13.0600		13.0600	0.1300	1.6978			(30)					
Total net area of external elements Aum(A, m2)			99.4200					(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		30.9095			(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)								6.6675 (36)					
Total fabric heat loss						(33) + (36) =		37.5770 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 30.8611	Feb 30.6623	Mar 30.4674	Apr 29.5518	May 29.3805	Jun 28.5831	Jul 28.5831	Aug 28.4354	Sep 28.8903	Oct 29.3805	Nov 29.7271	Dec 30.0893	(38)
Heat transfer coeff	68.4381	68.2393	68.0444	67.1288	66.9575	66.1601	66.1601	66.0124	66.4673	66.9575	67.3040	67.6663	(39)
Average = Sum(39)m / 12 =												67.1280	(39)
HLP	Jan 1.0529	Feb 1.0498	Mar 1.0468	Apr 1.0328	May 1.0301	Jun 1.0178	Jul 1.0178	Aug 1.0156	Sep 1.0226	Oct 1.0301	Nov 1.0354	Dec 1.0410	(40)
HLP (average)												1.0327	(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												2.1189 (42)
Average daily hot water use (litres/day)												84.5243 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	92.9767	89.5957	86.2148	82.8338	79.4528	76.0718	76.0718	79.4528	82.8338	86.2148	89.5957	92.9767 (44)
Energy conte	137.8817	120.5923	124.4404	108.4902	104.0989	89.8294	83.2402	95.5193	96.6601	112.6480	122.9642	133.5311 (45)
Energy content (annual)											Total = Sum(45)m =	1329.8958 (45)
Distribution loss (46)m = 0.15 x (45)m												
	20.6823	18.0888	18.6661	16.2735	15.6148	13.4744	12.4860	14.3279	14.4990	16.8972	18.4446	20.0297 (46)
Water storage loss:												
Store volume												210.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.7016 (48)
Temperature factor from Table 2b												0.5400 (49)

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Enter (49) or (54) in (55)													0.9188 (55)
Total storage loss	28.4842	25.7277	28.4842	27.5653	28.4842	27.5653	28.4842	28.4842	27.5653	28.4842	27.5653	28.4842	(56)
If cylinder contains dedicated solar storage	28.4842	25.7277	28.4842	27.5653	28.4842	27.5653	28.4842	28.4842	27.5653	28.4842	27.5653	28.4842	(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	189.6283	167.3311	176.1870	158.5675	155.8455	139.9068	134.9868	147.2659	146.7375	164.3946	173.0415	185.2777	(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	189.6283	167.3311	176.1870	158.5675	155.8455	139.9068	134.9868	147.2659	146.7375	164.3946	173.0415	185.2777	(64)
Heat gains from water heating, kWh/month	87.2430	77.4880	82.7737	76.1349	76.0102	69.9302	69.0746	73.1574	72.2014	78.8527	80.9475	85.7964	(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	105.9458	105.9458	105.9458	105.9458	105.9458	105.9458	105.9458	105.9458	105.9458	105.9458	105.9458	105.9458	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	17.1093	15.1963	12.3584	9.3561	6.9938	5.9045	6.3800	8.2930	11.1308	14.1331	16.4954	17.5848	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	185.3587	187.2821	182.4351	172.1164	159.0908	146.8487	138.6702	136.7467	141.5937	151.9125	164.9380	177.1801	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.5946	33.5946	33.5946	33.5946	33.5946	33.5946	33.5946	33.5946	33.5946	33.5946	33.5946	33.5946	(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)	-84.7567	-84.7567	-84.7567	-84.7567	-84.7567	-84.7567	-84.7567	-84.7567	-84.7567	-84.7567	-84.7567	-84.7567	(71)
Water heating gains (Table 5)	117.2620	115.3095	111.2550	105.7429	102.1642	97.1252	92.8422	98.3299	100.2797	105.9849	112.4270	115.3177	(72)
Total internal gains	377.5137	375.5717	363.8323	344.9991	326.0326	307.6621	295.6762	301.1533	310.7880	329.8142	351.6442	367.8664	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
East					6.0200	19.6403	0.6300	0.7000	0.7700		36.1340 (76)	
South					3.2400	46.7521	0.6300	0.7000	0.7700		46.2932 (78)	
West					1.5600	19.6403	0.6300	0.7000	0.7700		9.3636 (80)	
Solar gains	91.7908	164.8193	243.1518	322.9237	375.7283	377.6507	362.2776	323.1861	271.3587	187.3846	111.6034	77.4166 (83)
Total gains	469.3045	540.3910	606.9841	667.9228	701.7609	685.3128	657.9538	624.3394	582.1466	517.1988	463.2476	445.2830 (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	65.9557	66.1480	66.3374	67.2422	67.4142	68.2267	68.2267	68.3794	67.9115	67.4142	67.0671	66.7081	
alpha	5.3970	5.4099	5.4225	5.4828	5.4943	5.5484	5.5484	5.5586	5.5274	5.4943	5.4711	5.4472	
util living area	0.9952	0.9889	0.9711	0.9154	0.7913	0.6008	0.4398	0.4818	0.7311	0.9413	0.9891	0.9963	(86)
MIT	20.0059	20.1696	20.4151	20.7035	20.9005	20.9827	20.9974	20.9958	20.9512	20.6905	20.2956	19.9782	(87)
Th 2	20.0395	20.0420	20.0445	20.0561	20.0583	20.0685	20.0685	20.0704	20.0646	20.0583	20.0539	20.0493	(88)
util rest of house	0.9936	0.9855	0.9619	0.8898	0.7370	0.5206	0.3481	0.3868	0.6527	0.9176	0.9850	0.9951	(89)
MIT 2	18.7235	18.9626	19.3161	19.7218	19.9665	20.0576	20.0675	20.0687	20.0289	19.7150	19.1558	18.6905	(90)
Living area fraction	19.3252	19.5290	19.8318	20.1825	20.4047	20.4917	20.5039	20.5037	20.4617	20.1727	19.6906	19.2947	(92)
MIT	19.3252	19.5290	19.8318	20.1825	20.4047	20.4917	20.5039	20.5037	20.4617	20.1727	19.6906	19.2947	(93)
Temperature adjustment												0.0000	
adjusted MIT	19.3252	19.5290	19.8318	20.1825	20.4047	20.4917	20.5039	20.5037	20.4617	20.1727	19.6906	19.2947	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	465.5802	531.2531	582.3905	596.8576	532.0150	382.2652	257.4018	269.4102	400.2793	476.3284	455.3755	442.5416	(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	1028.2966	998.2715	907.1517	757.3776	582.8466	389.7952	258.2794	270.8956	422.8421	640.9657	847.4005	1021.4037	(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	418.6610	313.8363	241.6223	115.5744	37.8187	0.0000	0.0000	0.0000	0.0000	122.4902	282.2580	430.6733	(98)
Space heating												1962.9343	(98)
Space heating per m2												30.1990	(99)

8c. Space cooling requirement

Not applicable

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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													2099.3949 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	418.6610	313.8363	241.6223	115.5744	37.8187	0.0000	0.0000	0.0000	0.0000	122.4902	282.2580	430.6733	(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)	447.7658	335.6538	258.4196	123.6090	40.4478	0.0000	0.0000	0.0000	0.0000	131.0055	301.8802	460.6132	(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	189.6283	167.3311	176.1870	158.5675	155.8455	139.9068	134.9868	147.2659	146.7375	164.3946	173.0415	185.2777	(64)
Efficiency of water heater (217)m	86.8689	86.4680	85.6567	83.9863	81.6860	79.8000	79.8000	79.8000	79.8000	84.0426	86.1117	79.8000	(216)
Fuel for water heating, kWh/month	218.2926	193.5179	205.6896	188.8016	190.7861	175.3218	169.1563	184.5437	183.8815	195.6088	200.9500	212.9839	(219)
Water heating fuel used												2319.5339	(219)
Annual totals kWh/year													
Space heating fuel - main system												2099.3949	(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)												302.1547	(232)
Total delivered energy for all uses												4796.0836	(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	2099.3949	0.2160	453.4693 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2319.5339	0.2160	501.0193 (264)
Space and water heating			954.4886 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	302.1547	0.5190	156.8183 (268)
Total CO2, kg/m2/year			1150.2319 (272)
Emissions per m2 for space and water heating			14.6844 (272a)
Fuel factor (electricity)			1.5500
Emissions per m2 for lighting			2.4126 (272b)
Emissions per m2 for pumps and fans			0.5988 (272c)
Target Carbon Dioxide Emission Rate (TER) = (14.6844 * 1.55) + 2.4126 + 0.5988, rounded to 2 d.p.			25.7700 (273)

FULL SAP CALCULATION PRINTOUT

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CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	65.0000 (1b)	x 2.4000 (2b)	= 156.0000 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	65.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 156.0000 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					2 * 10 = 20.0000 (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) =				Air changes per hour
Pressure test					20.0000 / (5) = 0.1282 (8)
Measured/design AP50					Yes
Infiltration rate					5.0000
Number of sides sheltered					0.3782 (18)
					1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3498 (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												
Effective ac	0.4460	0.4373	0.4286	0.3848	0.3761	0.3323	0.3323	0.3236	0.3498	0.3761	0.3936	0.4111 (22b)
	0.5995	0.5956	0.5918	0.5740	0.5707	0.5552	0.5552	0.5524	0.5612	0.5707	0.5774	0.5845 (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)			10.8200	1.3258	14.3447		(27)
Door to Stairs			1.8900	1.4000	2.6460		(26)
Main Wall	68.2400	10.8200	57.4200	0.2200	12.6324	60.0000	3445.2000 (29a)
Wall to stairs	12.5200	1.8900	10.6300	0.1864	1.9812	190.0000	2019.7000 (29a)
Flat roof	5.6000		5.6000	0.1400	0.7840	9.0000	50.4000 (30)
Void	13.0600		13.0600	0.1600	2.0896	9.0000	117.5400 (30)
Total net area of external elements Aum(A, m ²)			99.4200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	34.4779		(33)
Party Wall 1			9.4300	0.0000	0.0000	180.0000	1697.4000 (32)
Party Floor 1			65.0000			40.0000	2600.0000 (32d)
Party Ceilings 1			46.3400			30.0000	1390.2000 (32b)
Internal Wall 1			851.1200			100.0000	85112.0000 (32c)
Heat capacity Cm = Sum(A x k)				(28)...(30) + (32) + (32a)...(32e) =			96432.4400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							1483.5760 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.6355 (36)
Total fabric heat loss						(33) + (36) =	43.1134 (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	30.8611	30.6623	30.4674	29.5518	29.3805	28.5831	28.5831	28.4354	28.8903	29.3805	29.7271	30.0893 (38)
Heat transfer coeff	73.9745	73.7757	73.5808	72.6652	72.4939	71.6965	71.6965	71.5488	72.0037	72.4939	72.8404	73.2027 (39)
Average = Sum(39)m / 12 =												72.6644 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1381	1.1350	1.1320	1.1179	1.1153	1.1030	1.1030	1.1008	1.1077	1.1153	1.1206	1.1262 (40)
HLP (average)												1.1179 (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												2.1189 (42)
Average daily hot water use (litres/day)												84.5243 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	92.9767	89.5957	86.2148	82.8338	79.4528	76.0718	76.0718	79.4528	82.8338	86.2148	89.5957	92.9767 (44)
Energy conte	137.8817	120.5923	124.4404	108.4902	104.0989	89.8294	83.2402	95.5193	96.6601	112.6480	122.9642	133.5311 (45)
Energy content (annual)										Total = Sum(45)m =		1329.8958 (45)
Distribution loss (46)m = 0.15 x (45)m												

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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	29.2999	25.6259	26.4436	23.0542	22.1210	19.0888	17.6885	20.2979	20.5403	23.9377	26.1299	28.3754 (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	105.9458	105.9458	105.9458	105.9458	105.9458	105.9458	105.9458	105.9458	105.9458	105.9458	105.9458	105.9458	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	17.1093	15.1963	12.3584	9.3561	6.9938	5.9045	6.3800	8.2930	11.1308	14.1331	16.4954	17.5848	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	185.3587	187.2821	182.4351	172.1164	159.0908	146.8487	138.6702	136.7467	141.5937	151.9125	164.9380	177.1801	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.5946	33.5946	33.5946	33.5946	33.5946	33.5946	33.5946	33.5946	33.5946	33.5946	33.5946	33.5946	(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)	-84.7567	-84.7567	-84.7567	-84.7567	-84.7567	-84.7567	-84.7567	-84.7567	-84.7567	-84.7567	-84.7567	-84.7567	(71)
Water heating gains (Table 5)	39.3815	38.1337	35.5425	32.0197	29.7325	26.5122	23.7749	27.2821	28.5282	32.1743	36.2915	38.1389	(72)
Total internal gains	296.6332	295.3958	285.1197	268.2759	250.6010	234.0491	223.6088	227.1055	236.0364	253.0037	272.5087	287.6876	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	6.0200	19.6403	0.6300	0.7000	0.7700	36.1340	(76)
South	3.2400	46.7521	0.6300	0.7000	0.7700	46.2932	(78)
West	1.5600	19.6403	0.6300	0.7000	0.7700	9.3636	(80)

Solar gains	91.7908	164.8193	243.1518	322.9237	375.7283	377.6507	362.2776	323.1861	271.3587	187.3846	111.6034	77.4166	(83)
Total gains	388.4240	460.2152	528.2715	591.1996	626.3292	611.6997	585.8864	550.2916	507.3951	440.3882	384.1121	365.1042	(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	362.1082	363.0843	364.0461	368.6329	369.5040	373.6136	373.6136	374.3847	372.0199	369.5040	367.7461	365.9261	
alpha	25.1405	25.2056	25.2697	25.5755	25.6336	25.9076	25.9076	25.9590	25.8013	25.6336	25.5164	25.3951	
util living area	1.0000	1.0000	1.0000	1.0000	0.9875	0.7500	0.5384	0.5981	0.9517	1.0000	1.0000	1.0000	(86)
MIT	20.7502	20.7854	20.8411	20.9150	20.9836	21.0000	21.0000	21.0000	20.9959	20.9074	20.8145	20.7448	(87)
Th 2	19.9699	19.9723	19.9748	19.9862	19.9884	19.9984	19.9984	20.0002	19.9945	19.9884	19.9840	19.9795	(88)
util rest of house	1.0000	1.0000	1.0000	0.9999	0.9392	0.6327	0.4159	0.4681	0.8351	1.0000	1.0000	1.0000	(89)
MIT 2	19.7425	19.7801	19.8381	19.9229	19.9846	19.9984	19.9984	20.0002	19.9943	19.9175	19.8204	19.7464	(90)
Living area fraction									fLA = Living area / (4) =			0.4692	(91)
MIT	20.2154	20.2518	20.3087	20.3884	20.4534	20.4684	20.4684	20.4693	20.4643	20.3820	20.2869	20.2149	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.2154	20.2518	20.3087	20.3884	20.4534	20.4684	20.4684	20.4693	20.4643	20.3820	20.2869	20.2149	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	1.0000	1.0000	1.0000	1.0000	0.9684	0.6878	0.4734	0.5291	0.8964	1.0000	1.0000	1.0000	(94)
Useful gains	388.4240	460.2152	528.2715	591.1743	606.5383	420.7323	277.3481	291.1571	454.8235	440.3874	384.1121	365.1042	(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	1177.3309	1132.5892	1016.0576	834.8086	634.5657	420.7404	277.3481	291.1571	458.2511	709.1344	960.5385	1172.3334	(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	586.9467	451.8353	362.9129	175.4168	20.8524	0.0000	0.0000	0.0000	0.0000	199.9477	415.0270	600.5785	(98)
Space heating												2813.5173	(98)
Space heating per m2												(98) / (4) =	43.2849 (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	673.9471	530.5541	543.7711	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9978	1.0000	0.9998	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	672.4741	530.5407	543.6858	0.0000	0.0000	0.0000	0.0000	(102)

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Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	794.0711	762.3474	722.0748	0.0000	0.0000	0.0000	0.0000 (103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling kWh												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	87.5498	172.4642	132.7214	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												392.7354 (104)
Cooled fraction									fC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)												
Intermittency factor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												0.0000 (107)
Space cooling per m2												0.0000 (108)
Energy for space heating												43.2849 (99)
Energy for space cooling												0.0000 (108)
Total												43.2849 (109)
Dwelling Fabric Energy Efficiency (DFEE)												43.3 (109)

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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	65.0000 (1b)	x 2.4000 (2b)	= 156.0000 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	65.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 156.0000 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					2 * 10 = 20.0000 (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) =					20.0000 / (5) = 0.1282 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3782 (18)
Number of sides sheltered					1 (19)
Shelter factor					(20) = 1 - [0.075 x (19)] = 0.9250 (20)
Infiltration rate adjusted to include shelter factor					(21) = (18) x (20) = 0.3498 (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												
Effective ac	0.4460	0.4373	0.4286	0.3848	0.3761	0.3323	0.3323	0.3236	0.3498	0.3761	0.3936	0.4111 (22b)
Effective ac	0.5995	0.5956	0.5918	0.5740	0.5707	0.5552	0.5552	0.5524	0.5612	0.5707	0.5774	0.5845 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K						
TER Opaque door			1.8900	1.0000	1.8900			(26)					
TER Opening Type (Uw = 1.40)			10.8200	1.3258	14.3447			(27)					
Main Wall	68.2400	10.8200	57.4200	0.1800	10.3356			(29a)					
Wall to stairs	12.5200	1.8900	10.6300	0.1800	1.9134			(29a)					
Flat roof	5.6000		5.6000	0.1300	0.7280			(30)					
Void	13.0600		13.0600	0.1300	1.6978			(30)					
Total net area of external elements Aum(A, m2)			99.4200					(31)					
Fabric heat loss, W/K = Sum (A x U)			(26) ... (30) + (32) =		30.9095			(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)								6.6675 (36)					
Total fabric heat loss						(33) + (36) =	37.5770	(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 30.8611	Feb 30.6623	Mar 30.4674	Apr 29.5518	May 29.3805	Jun 28.5831	Jul 28.5831	Aug 28.4354	Sep 28.8903	Oct 29.3805	Nov 29.7271	Dec 30.0893	(38)
Heat transfer coeff	68.4381	68.2393	68.0444	67.1288	66.9575	66.1601	66.1601	66.0124	66.4673	66.9575	67.3040	67.6663	(39)
Average = Sum(39)m / 12 =												67.1280	(39)
HLP	Jan 1.0529	Feb 1.0498	Mar 1.0468	Apr 1.0328	May 1.0301	Jun 1.0178	Jul 1.0178	Aug 1.0156	Sep 1.0226	Oct 1.0301	Nov 1.0354	Dec 1.0410	(40)
HLP (average)												1.0327	(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												2.1189 (42)
Average daily hot water use (litres/day)												84.5243 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	92.9767	89.5957	86.2148	82.8338	79.4528	76.0718	76.0718	79.4528	82.8338	86.2148	89.5957	92.9767 (44)
Energy conte	137.8817	120.5923	124.4404	108.4902	104.0989	89.8294	83.2402	95.5193	96.6601	112.6480	122.9642	133.5311 (45)
Energy content (annual)										Total = Sum(45)m =		1329.8958 (45)
Distribution loss (46)m = 0.15 x (45)m												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage												

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Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Heat gains from water heating, kWh/month	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
	29.2999	25.6259	26.4436	23.0542	22.1210	19.0888	17.6885	20.2979	20.5403	23.9377	26.1299	28.3754 (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	105.9458	105.9458	105.9458	105.9458	105.9458	105.9458	105.9458	105.9458	105.9458	105.9458	105.9458	105.9458	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	17.1093	15.1963	12.3584	9.3561	6.9938	5.9045	6.3800	8.2930	11.1308	14.1331	16.4954	17.5848	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	185.3587	187.2821	182.4351	172.1164	159.0908	146.8487	138.6702	136.7467	141.5937	151.9125	164.9380	177.1801	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.5946	33.5946	33.5946	33.5946	33.5946	33.5946	33.5946	33.5946	33.5946	33.5946	33.5946	33.5946	(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)	-84.7567	-84.7567	-84.7567	-84.7567	-84.7567	-84.7567	-84.7567	-84.7567	-84.7567	-84.7567	-84.7567	-84.7567	(71)
Water heating gains (Table 5)	39.3815	38.1337	35.5425	32.0197	29.7325	26.5122	23.7749	27.2821	28.5282	32.1743	36.2915	38.1389	(72)
Total internal gains	296.6332	295.3958	285.1197	268.2759	250.6010	234.0491	223.6088	227.1055	236.0364	253.0037	272.5087	287.6876	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	FF	Access factor Table 6d	Gains W	
East	6.0200	19.6403	0.6300		0.7000	0.7700	36.1340	(76)
South	3.2400	46.7521	0.6300		0.7000	0.7700	46.2932	(78)
West	1.5600	19.6403	0.6300		0.7000	0.7700	9.3636	(80)

Solar gains	91.7908	164.8193	243.1518	322.9237	375.7283	377.6507	362.2776	323.1861	271.3587	187.3846	111.6034	77.4166	(83)
Total gains	388.4240	460.2152	528.2715	591.1996	626.3292	611.6997	585.8864	550.2916	507.3951	440.3882	384.1121	365.1042	(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, nilm (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	65.9557	66.1480	66.3374	67.2422	67.4142	68.2267	68.2267	68.3794	67.9115	67.4142	67.0671	66.7081	
alpha	5.3970	5.4099	5.4225	5.4828	5.4943	5.5484	5.5484	5.5586	5.5274	5.4943	5.4711	5.4472	
util living area	0.9980	0.9947	0.9840	0.9453	0.8436	0.6618	0.4916	0.5425	0.8010	0.9688	0.9955	0.9986	(86)
MIT	19.8891	20.0568	20.3126	20.6259	20.8606	20.9725	20.9955	20.9924	20.9228	20.6016	20.1837	19.8617	(87)
Th 2	20.0395	20.0420	20.0445	20.0561	20.0583	20.0685	20.0685	20.0704	20.0646	20.0583	20.0539	20.0493	(88)
util rest of house	0.9974	0.9930	0.9785	0.9265	0.7947	0.5779	0.3904	0.4377	0.7268	0.9543	0.9937	0.9981	(89)
MIT 2	19.0249	19.1939	19.4486	19.7592	19.9669	20.0562	20.0673	20.0683	20.0236	19.7436	19.3306	19.0056	(90)
Living area fraction									fLA = Living area / (4) =			0.4692	(91)
MIT	19.4304	19.5988	19.8540	20.1659	20.3862	20.4861	20.5029	20.5019	20.4455	20.1462	19.7309	19.4073	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.4304	19.5988	19.8540	20.1659	20.3862	20.4861	20.5029	20.5019	20.4455	20.1462	19.7309	19.4073	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9968	0.9919	0.9772	0.9290	0.8130	0.6167	0.4381	0.4872	0.7592	0.9559	0.9929	0.9977	(94)
Useful gains	387.2005	456.5101	516.2217	549.2498	509.2258	377.2428	256.6740	268.0821	385.2033	420.9726	381.3688	364.2698	(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	1035.4986	1003.0357	908.6636	756.2657	581.6095	389.4282	258.2133	270.7777	421.7691	639.1899	850.1109	1029.0205	(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	482.3338	367.2652	291.9768	149.0515	53.8535	0.0000	0.0000	0.0000	0.0000	162.3537	337.4943	494.5745	(98)
Space heating												2338.9032	(98)
Space heating per m2										(98) / (4) =		35.9831	(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	621.9050	489.5848	501.6946	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9300	0.9676	0.9556	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	578.3710	473.7017	479.4211	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	794.0711	762.3474	722.0748	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	155.3040	214.7524	180.5344	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												550.5908	(104)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Energy Calculations Ltd
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CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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	38.8260	53.6881	45.1336	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												137.6477 (107)
Space cooling per m2												2.1177 (108)
Energy for space heating												35.9831 (99)
Energy for space cooling												2.1177 (108)
Total												38.1008 (109)
Target Fabric Energy Efficiency (TFEE)												43.8 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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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 (m2)	Storey height (m)	Volume (m3)
Ground floor	65.0000 (1b)	x 2.4000 (2b)	= 156.0000 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	65.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 156.0000 (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					2 * 10 = 20.0000 (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) =				Air changes per hour 20.0000 / (5) = 0.1282 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3782 (18)
Number of sides sheltered					1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3498 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.4000	4.1000	4.1000	3.9000	3.9000	3.4000	3.4000	3.3000	3.4000	3.8000	3.7000	4.0000 (22)
Wind factor	1.1000	1.0250	1.0250	0.9750	0.9750	0.8500	0.8500	0.8250	0.8500	0.9500	0.9250	1.0000 (22a)
Adj infilt rate	0.3848	0.3586	0.3586	0.3411	0.3411	0.2974	0.2974	0.2886	0.2974	0.3323	0.3236	0.3498 (22b)
Effective ac	0.5740	0.5643	0.5643	0.5582	0.5582	0.5442	0.5442	0.5417	0.5442	0.5552	0.5524	0.5612 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Windows (Uw = 1.40)			10.8200	1.3258	14.3447		(27)
Door to Stairs			1.8900	1.4000	2.6460		(26)
Main Wall	68.2400	10.8200	57.4200	0.2200	12.6324	60.0000	3445.2000 (29a)
Wall to stairs	12.5200	1.8900	10.6300	0.1864	1.9812	190.0000	2019.7000 (29a)
Flat roof	5.6000		5.6000	0.1400	0.7840	9.0000	50.4000 (30)
Void	13.0600		13.0600	0.1600	2.0896	9.0000	117.5400 (30)
Total net area of external elements Aum(A, m2)			99.4200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	34.4779		(33)
Party Wall 1			9.4300	0.0000	0.0000	180.0000	1697.4000 (32)
Party Floor 1			65.0000			40.0000	2600.0000 (32d)
Party Ceilings 1			46.3400			40.0000	1853.6000 (32b)
Internal Wall 1			851.1200			100.0000	85112.0000 (32c)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	96895.8400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							1490.7052 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.6355 (36)
Total fabric heat loss						(33) + (36) =	43.1134 (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	29.5518	29.0497	29.0497	28.7347	28.7347	28.0161	28.0161	27.8841	28.0161	28.5831	28.4354	28.8903 (38)
Heat transfer coeff	72.6652	72.1631	72.1631	71.8481	71.8481	71.1295	71.1295	70.9975	71.1295	71.6965	71.5488	72.0037 (39)
Average = Sum(39)m / 12 =												71.6935 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1179	1.1102	1.1102	1.1054	1.1054	1.0943	1.0943	1.0923	1.0943	1.1030	1.1008	1.1077 (40)
HLP (average)												1.1030 (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	2.1189 (42)
Average daily hot water use (litres/day)	84.5243 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	92.9767	89.5957	86.2148	82.8338	79.4528	76.0718	76.0718	79.4528	82.8338	86.2148	89.5957	92.9767 (44)
Energy conte	137.8817	120.5923	124.4404	108.4902	104.0989	89.8294	83.2402	95.5193	96.6601	112.6480	122.9642	133.5311 (45)
Energy content (annual)										Total = Sum(45)m =		1329.8958 (45)
Distribution loss (46)m = 0.15 x (45)m												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Energy Calculations Ltd
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CALCULATION OF HEAT DEMAND 09 Jan 2014

	20.6823	18.0888	18.6661	16.2735	15.6148	13.4744	12.4860	14.3279	14.4990	16.8972	18.4446	20.0297 (46)
Water storage loss:												
Store volume												210.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.8600 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.0044 (55)
Total storage loss												
31.1364	28.1232	31.1364	30.1320	31.1364	30.1320	31.1364	31.1364	30.1320	31.1364	30.1320	31.1364	(56)
If cylinder contains dedicated solar storage												
31.1364	28.1232	31.1364	30.1320	31.1364	30.1320	31.1364	31.1364	30.1320	31.1364	30.1320	31.1364	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month												
192.2805	169.7267	178.8392	161.1342	158.4977	142.4734	137.6390	149.9181	149.3041	167.0468	175.6082	187.9299	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Output from w/h												
192.2805	169.7267	178.8392	161.1342	158.4977	142.4734	137.6390	149.9181	149.3041	167.0468	175.6082	187.9299	(64)
RHI water heating demand												
Heat gains from water heating, kWh/month												
89.3647	79.4044	84.8955	78.1882	78.1319	71.9835	71.1964	75.2792	74.2547	80.9745	83.0008	87.9181	(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	127.1350	127.1350	127.1350	127.1350	127.1350	127.1350	127.1350	127.1350	127.1350	127.1350	127.1350	127.1350 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
42.7731	37.9907	30.8961	23.3904	17.4846	14.7612	15.9500	20.7324	27.8270	35.3328	41.2386	43.9619	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
276.6547	279.5255	272.2912	256.8901	237.4490	219.1771	206.9704	204.0996	211.3339	226.7350	246.1761	264.4480	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
49.8324	49.8324	49.8324	49.8324	49.8324	49.8324	49.8324	49.8324	49.8324	49.8324	49.8324	49.8324	(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	(70)
Losses e.g. evaporation (negative values) (Table 5)												
-84.7567	-84.7567	-84.7567	-84.7567	-84.7567	-84.7567	-84.7567	-84.7567	-84.7567	-84.7567	-84.7567	-84.7567	(71)
Water heating gains (Table 5)												
120.1139	118.1614	114.1068	108.5947	105.0160	99.9771	95.6941	101.1817	103.1315	108.8367	115.2789	118.1695	(72)
Total internal gains	531.7525	527.8884	509.5049	481.0859	452.1604	426.1261	410.8252	418.2245	434.5032	463.1152	494.9043	518.7902 (73)

6. Solar gains

[Jan]												
	Area m2			Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
East	6.0200			23.7835		0.6300		0.7000		0.7700		43.7566 (76)
South	3.2400			54.0600		0.6300		0.7000		0.7700		53.5295 (78)
West	1.5600			23.7835		0.6300		0.7000		0.7700		11.3389 (80)
Solar gains	108.6250	170.5274	250.1077	338.1234	384.3149	409.1471	388.3932	352.4230	297.8250	208.1732	130.1198	92.1359 (83)
Total gains	640.3775	698.4158	759.6126	819.2093	836.4752	835.2732	799.2184	770.6475	732.3282	671.2885	625.0241	610.9261 (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	370.4044	372.9815	372.9815	374.6168	374.6168	378.4018	378.4018	379.1049	378.4018	375.4090	376.1838	373.8076
alpha	25.6936	25.8654	25.8654	25.9745	25.9745	26.2268	26.2268	26.2737	26.2268	26.0273	26.0789	25.9205
util living area	1.0000	1.0000	0.9997	0.9584	0.7129	0.4598	0.3026	0.3317	0.6022	0.9738	1.0000	1.0000 (86)
Tweekday	19.8234	19.8648	19.9262	19.9792	19.9810	19.9902	19.9902	19.9919	19.9902	19.9810	19.9047	19.8253
Tweekend	20.9177	20.9333	20.9605	20.9894	20.9932	20.9932	20.9932	20.9933	20.9932	20.9883	20.9477	20.9150
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	0	0	0	0	0	0	0	0	0	0	0	0
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0
MIT	20.8729	20.8968	20.9390	20.9834	20.9895	20.9896	20.9896	20.9896	20.9894	20.9819	20.9183	20.8688 (87)
Th 2	19.9862	19.9925	19.9925	19.9965	19.9965	20.0055	20.0055	20.0072	20.0055	19.9984	20.0002	19.9945 (88)
util rest of house	1.0000	1.0000	0.9986	0.8964	0.6267	0.3752	0.2141	0.2402	0.5056	0.9093	1.0000	1.0000 (89)
Tweekday	19.8234	19.8648	19.9262	19.9792	19.9810	19.9902	19.9902	19.9919	19.9902	19.9810	19.9047	19.8253
Tweekend	19.8234	19.8648	19.9262	19.9792	19.9810	19.9902	19.9902	19.9919	19.9902	19.9810	19.9047	19.8253
MIT 2	19.8234	19.8648	19.9262	19.9792	19.9810	19.9902	19.9902	19.9919	19.9902	19.9810	19.9047	19.8253 (90)
Living area fraction									fLA = Living area / (4) =			0.4692 (91)
MIT	20.3159	20.3490	20.4014	20.4504	20.4542	20.4591	20.4591	20.4600	20.4591	20.4506	20.3803	20.3150 (92)
Temperature adjustment												0.0000
adjusted MIT	20.3159	20.3490	20.4014	20.4504	20.4542	20.4591	20.4591	20.4600	20.4591	20.4506	20.3803	20.3150 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	1.0000	1.0000	0.9993	0.9282	0.6660	0.4138	0.2545	0.2819	0.5497	0.9444	1.0000	1.0000 (94)
Ext temp.	640.3773	698.4120	759.0914	760.3635	557.1195	345.6281	203.3675	217.2541	402.5259	633.9850	625.0100	610.9260 (95)
Heat loss rate W	4.9000	5.5000	7.3000	9.7000	12.7000	15.6000	17.6000	17.4000	14.8000	11.4000	7.8000	4.9000 (96)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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CALCULATION OF HEAT DEMAND 09 Jan 2014

Month fracti	1120.1992	1071.5539	945.4402	772.3975	557.1244	345.6281	203.3675	217.2541	402.5259	648.8978	900.1079	1109.9350	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating	356.9875	250.7513	138.6435	8.6645	0.0036	0.0000	0.0000	0.0000	0.0000	11.0952	198.0705	371.2627	(98)
RHI space heating demand												1335	(98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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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	65.0000 (1b)	x 2.4000 (2b)	= 156.0000 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	65.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 156.0000 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					2 * 10 = 20.0000 (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) =					20.0000 / (5) = 0.1282 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3782 (18)
Number of sides sheltered					1 (19)
Shelter factor					(20) = 1 - [0.075 x (19)] = 0.9250 (20)
Infiltration rate adjusted to include shelter factor					(21) = (18) x (20) = 0.3498 (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												
Effective ac	0.4460	0.4373	0.4286	0.3848	0.3761	0.3323	0.3323	0.3236	0.3498	0.3761	0.3936	0.4111 (22b)
Effective ac	0.5995	0.5956	0.5918	0.5740	0.5707	0.5552	0.5552	0.5524	0.5612	0.5707	0.5774	0.5845 (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)			10.8200	1.3258	14.3447		(27)
Door to Stairs			1.8900	1.4000	2.6460		(26)
Main Wall	68.2400	10.8200	57.4200	0.2200	12.6324	60.0000	3445.2000 (29a)
Wall to stairs	12.5200	1.8900	10.6300	0.1864	1.9812	190.0000	2019.7000 (29a)
Flat roof	5.6000		5.6000	0.1400	0.7840	9.0000	50.4000 (30)
Void	13.0600		13.0600	0.1600	2.0896	9.0000	117.5400 (30)
Total net area of external elements Aum(A, m ²)			99.4200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	34.4779		(33)
Party Wall 1			9.4300	0.0000	0.0000	180.0000	1697.4000 (32)
Party Floor 1			65.0000			40.0000	2600.0000 (32d)
Party Ceilings 1			46.3400			40.0000	1853.6000 (32b)
Internal Wall 1			851.1200			100.0000	85112.0000 (32c)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 96895.8400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							1490.7052 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.6355 (36)
Total fabric heat loss							(33) + (36) = 43.1134 (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	30.8611	30.6623	30.4674	29.5518	29.3805	28.5831	28.5831	28.4354	28.8903	29.3805	29.7271	30.0893 (38)
Heat transfer coeff	73.9745	73.7757	73.5808	72.6652	72.4939	71.6965	71.6965	71.5488	72.0037	72.4939	72.8404	73.2027 (39)
Average = Sum(39)m / 12 =												72.6644 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1381	1.1350	1.1320	1.1179	1.1153	1.1030	1.1030	1.1008	1.1077	1.1153	1.1206	1.1262 (40)
HLP (average)												1.1179 (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												2.1189 (42)
Average daily hot water use (litres/day)												84.5243 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	92.9767	89.5957	86.2148	82.8338	79.4528	76.0718	76.0718	79.4528	82.8338	86.2148	89.5957	92.9767 (44)
Energy content (annual)	137.8817	120.5923	124.4404	108.4902	104.0989	89.8294	83.2402	95.5193	96.6601	112.6480	122.9642	133.5311 (45)
Distribution loss (46)m = 0.15 x (45)m												Total = Sum(45)m = 1329.8958 (45)

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	20.6823	18.0888	18.6661	16.2735	15.6148	13.4744	12.4860	14.3279	14.4990	16.8972	18.4446	20.0297 (46)
Water storage loss:												
Store volume												210.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.8600 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.0044 (55)
Total storage loss												
31.1364	28.1232	31.1364	30.1320	31.1364	30.1320	31.1364	31.1364	30.1320	31.1364	30.1320	31.1364	(56)
If cylinder contains dedicated solar storage												
31.1364	28.1232	31.1364	30.1320	31.1364	30.1320	31.1364	31.1364	30.1320	31.1364	30.1320	31.1364	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month												
192.2805	169.7267	178.8392	161.1342	158.4977	142.4734	137.6390	149.9181	149.3041	167.0468	175.6082	187.9299	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Solar input (sum of months) = Sum(63)m =												0.0000 (63)
Output from w/h												
192.2805	169.7267	178.8392	161.1342	158.4977	142.4734	137.6390	149.9181	149.3041	167.0468	175.6082	187.9299	(64)
Heat gains from water heating, kWh/month												
89.3647	79.4044	84.8955	78.1882	78.1319	71.9835	71.1964	75.2792	74.2547	80.9745	83.0008	87.9181	(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	127.1350	127.1350	127.1350	127.1350	127.1350	127.1350	127.1350	127.1350	127.1350	127.1350	127.1350	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
42.7731	37.9907	30.8961	23.3904	17.4846	14.7612	15.9500	20.7324	27.8270	35.3328	41.2386	43.9619	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
276.6547	279.5255	272.2912	256.8901	237.4490	219.1771	206.9704	204.0996	211.3339	226.7350	246.1761	264.4480	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
49.8324	49.8324	49.8324	49.8324	49.8324	49.8324	49.8324	49.8324	49.8324	49.8324	49.8324	49.8324	(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	(70)
Losses e.g. evaporation (negative values) (Table 5)												
-84.7567	-84.7567	-84.7567	-84.7567	-84.7567	-84.7567	-84.7567	-84.7567	-84.7567	-84.7567	-84.7567	-84.7567	(71)
Water heating gains (Table 5)												
120.1139	118.1614	114.1068	108.5947	105.0160	99.9771	95.6941	101.1817	103.1315	108.8367	115.2789	118.1695	(72)
Total internal gains												
531.7525	527.8884	509.5049	481.0859	452.1604	426.1261	410.8252	418.2245	434.5032	463.1152	494.9043	518.7902	(73)

6. Solar gains

[Jan]												

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	363.8483	364.8291	365.7955	370.4044	371.2796	375.4090	375.4090	376.1838	373.8076	371.2796	369.5133	367.6846
alpha	25.2566	25.3219	25.3864	25.6936	25.7520	26.0273	26.0273	26.0789	25.9205	25.7520	25.6342	25.5123
util living area	1.0000	1.0000	1.0000	0.9905	0.8136	0.5709	0.4081	0.4439	0.7038	0.9969	1.0000	1.0000 (86)
Tweekday	19.7812	19.8212	19.8819	19.9606	19.9728	19.9829	19.9829	19.9848	19.9790	19.9589	19.8612	19.7834
Tweekend	20.9059	20.9225	20.9483	20.9813	20.9930	20.9932	20.9932	20.9932	20.9932	20.9781	20.9353	20.9028
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	0	0	0	0	0	0	0	0	0	0	0	0
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0
MIT	20.8547	20.8801	20.9202	20.9708	20.9892	20.9895	20.9895	20.9895	20.9893	20.9662	20.8989	20.8500 (87)
Th 2	19.9699	19.9723	19.9748	19.9862	19.9884	19.9984	19.9984	20.0002	19.9945	19.9884	19.9840	19.9795 (88)
util rest of house	1.0000	1.0000	0.9998	0.9635	0.7257	0.4815	0.3152	0.3474	0.6013	0.9803	1.0000	1.0000 (89)
Tweekday	19.7812	19.8212	19.8819	19.9606	19.9728	19.9829	19.9829	19.9848	19.9790	19.9589	19.8612	19.7834
Tweekend	19.7812	19.8212	19.8819	19.9606	19.9728	19.9829	19.9829	19.9848	19.9790	19.9589	19.8612	19.7834
MIT 2	19.7812	19.8212	19.8819	19.9606	19.9728	19.9829	19.9829	19.9848	19.9790	19.9589	19.8612	19.7834 (90)
Living area fraction									fLA = Living area / (4) =			0.4692 (91)
MIT	20.2849	20.3181	20.3691	20.4346	20.4497	20.4553	20.4552	20.4562	20.4531	20.4316	20.3481	20.2839 (92)
Temperature adjustment												0.0000
adjusted MIT	20.2849	20.3181	20.3691	20.4346	20.4497	20.4553	20.4552	20.4562	20.4531	20.4316	20.3481	20.2839 (93)

8. Space heating requirement

Utilisation	1.0000	1.0000	0.9999	0.9791	0.7660	0.5223	0.3575	0.3914	0.6481	0.9909	1.0000	1.0000 (94)
Useful gains	623.5433	692.7067	752.5697	787.2343	634.1453	419.8017	276.4070	290.2197	457.4426	644.5843	606.5062	596.2068 (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	1182.4789	1137.4814	1020.4956	838.1651	634.3011	419.8017	276.4070	290.2197	457.4447	712.7281	964.9997	1177.3849 (97)

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Month fracti	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	415.8481	298.8886	199.3369	36.6702	0.1159	0.0000	0.0000	0.0000	0.0000	50.6991	258.1154	432.3965 (98)
Space heating												1692.0706 (98)
Space heating per m2										(98) / (4) =		26.0319 (99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												254.0241 (206)
Efficiency of secondary/supplementary heating system, %												100.0000 (208)
Space heating requirement												666.1064 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	415.8481	298.8886	199.3369	36.6702	0.1159	0.0000	0.0000	0.0000	0.0000	50.6991	258.1154	432.3965 (98)
Space heating efficiency (main heating system 1)	254.0241	254.0241	254.0241	254.0241	254.0241	0.0000	0.0000	0.0000	0.0000	254.0241	254.0241	254.0241 (210)
Space heating fuel (main heating system)	163.7042	117.6615	78.4717	14.4357	0.0456	0.0000	0.0000	0.0000	0.0000	19.9584	101.6106	170.2187 (211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	192.2805	169.7267	178.8392	161.1342	158.4977	142.4734	137.6390	149.9181	149.3041	167.0468	175.6082	187.9299 (64)
Efficiency of water heater	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400 (216)
(217)m	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400 (217)
Fuel for water heating, kWh/month	113.4800	100.1692	105.5472	95.0981	93.5421	84.0849	81.2317	88.4786	88.1162	98.5876	103.6403	110.9124 (219)
Water heating fuel used												1162.8882 (219)
Annual totals kWh/year												
Space heating fuel - main system												666.1064 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
Total electricity for the above, kWh/year												0.0000 (231)
Electricity for lighting (calculated in Appendix L)												302.1547 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
Total delivered energy for all uses												2131.1494 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	666.1064	13.1900	87.8594 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1162.8882	13.1900	153.3850 (247)
Pumps and fans for heating	0.0000	0.0000	0.0000 (249)
Energy for lighting	302.1547	13.1900	39.8542 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit	0.0000	13.1900	0.0000 (252)
Total energy cost			281.0986 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.4200 (256)
SAP value		1.0733 (257)
SAP rating (Section 12)		85.0277
SAP band		85 (258)
		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	666.1064	0.5190	345.7092 (261)
Space heating - secondary	0.0000	0.5190	0.0000 (263)
Water heating (other fuel)	1162.8882	0.5190	603.5390 (264)
Space and water heating			949.2482 (265)
Pumps and fans	0.0000	0.0000	0.0000 (267)
Energy for lighting	302.1547	0.5190	156.8183 (268)
Energy saving/generation technologies			
PV Unit	-300.0000	0.5190	-155.7000 (269)
Total kg/year			950.3665 (272)
CO2 emissions per m2			14.6200 (273)
EI value			88.4228
EI rating			88 (274)

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EI band

B

Calculation of stars for heating and DHW

Main heating energy efficiency	$13.19 \times (1 + 0.29 \times 0.25) / 2.5402 = 5.569$, stars = 3
Main heating environmental impact	$0.519 \times (1 + 0.29 \times 0.25) / 2.5402 = 0.2191$, stars = 5
Water heating energy efficiency	$13.19 / 1.6944 = 7.784$, stars = 2
Water heating environmental impact	$0.519 / 1.6944 = 0.3063$, stars = 4

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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	65.0000 (1b)	x 2.4000 (2b)	= 156.0000 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	65.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 156.0000 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					2 * 10 = 20.0000 (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) =				20.0000 / (5) = 0.1282 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3782 (18)
Number of sides sheltered					1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3498 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.4000	4.1000	4.1000	3.9000	3.9000	3.4000	3.4000	3.3000	3.4000	3.8000	3.7000	4.0000 (22)
Wind factor	1.1000	1.0250	1.0250	0.9750	0.9750	0.8500	0.8500	0.8250	0.8500	0.9500	0.9250	1.0000 (22a)
Adj infilt rate	0.3848	0.3586	0.3586	0.3411	0.3411	0.2974	0.2974	0.2886	0.2974	0.3323	0.3236	0.3498 (22b)
Effective ac	0.5740	0.5643	0.5643	0.5582	0.5582	0.5442	0.5442	0.5417	0.5442	0.5552	0.5524	0.5612 (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)			10.8200	1.3258	14.3447		(27)
Door to Stairs			1.8900	1.4000	2.6460		(26)
Main Wall	68.2400	10.8200	57.4200	0.2200	12.6324	60.0000	3445.2000 (29a)
Wall to stairs	12.5200	1.8900	10.6300	0.1864	1.9812	190.0000	2019.7000 (29a)
Flat roof	5.6000		5.6000	0.1400	0.7840	9.0000	50.4000 (30)
Void	13.0600		13.0600	0.1600	2.0896	9.0000	117.5400 (30)
Total net area of external elements Aum(A, m ²)			99.4200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	34.4779		(33)
Party Wall 1			9.4300	0.0000	0.0000	180.0000	1697.4000 (32)
Party Floor 1			65.0000			40.0000	2600.0000 (32d)
Party Ceilings 1			46.3400			40.0000	1853.6000 (32b)
Internal Wall 1			851.1200			100.0000	85112.0000 (32c)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		96895.8400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							1490.7052 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.6355 (36)
Total fabric heat loss						(33) + (36) =	43.1134 (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	29.5518	29.0497	29.0497	28.7347	28.7347	28.0161	28.0161	27.8841	28.0161	28.5831	28.4354	28.8903 (38)
Heat transfer coeff	72.6652	72.1631	72.1631	71.8481	71.8481	71.1295	71.1295	70.9975	71.1295	71.6965	71.5488	72.0037 (39)
Average = Sum(39)m / 12 =												71.6935 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1179	1.1102	1.1102	1.1054	1.1054	1.0943	1.0943	1.0923	1.0943	1.1030	1.1008	1.1077 (40)
HLP (average)												1.1030 (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	2.1189 (42)
Average daily hot water use (litres/day)	84.5243 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	92.9767	89.5957	86.2148	82.8338	79.4528	76.0718	76.0718	79.4528	82.8338	86.2148	89.5957	92.9767 (44)
Energy conte	137.8817	120.5923	124.4404	108.4902	104.0989	89.8294	83.2402	95.5193	96.6601	112.6480	122.9642	133.5311 (45)
Energy content (annual)										Total = Sum(45)m =		1329.8958 (45)
Distribution loss (46)m = 0.15 x (45)m												

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	20.6823	18.0888	18.6661	16.2735	15.6148	13.4744	12.4860	14.3279	14.4990	16.8972	18.4446	20.0297 (46)
Water storage loss:												
Store volume												210.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.8600 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.0044 (55)
Total storage loss												
31.1364	28.1232	31.1364	30.1320	31.1364	30.1320	31.1364	31.1364	30.1320	31.1364	30.1320	31.1364	(56)
If cylinder contains dedicated solar storage												
31.1364	28.1232	31.1364	30.1320	31.1364	30.1320	31.1364	31.1364	30.1320	31.1364	30.1320	31.1364	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month												
192.2805	169.7267	178.8392	161.1342	158.4977	142.4734	137.6390	149.9181	149.3041	167.0468	175.6082	187.9299	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Solar input (sum of months) = Sum(63)m =												0.0000 (63)
Output from w/h												
192.2805	169.7267	178.8392	161.1342	158.4977	142.4734	137.6390	149.9181	149.3041	167.0468	175.6082	187.9299	(64)
Heat gains from water heating, kWh/month												
89.3647	79.4044	84.8955	78.1882	78.1319	71.9835	71.1964	75.2792	74.2547	80.9745	83.0008	87.9181	(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	127.1350	127.1350	127.1350	127.1350	127.1350	127.1350	127.1350	127.1350	127.1350	127.1350	127.1350	127.1350	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	42.7731	37.9907	30.8961	23.3904	17.4846	14.7612	15.9500	20.7324	27.8270	35.3328	41.2386	43.9619	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	276.6547	279.5255	272.2912	256.8901	237.4490	219.1771	206.9704	204.0996	211.3339	226.7350	246.1761	264.4480	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	49.8324	49.8324	49.8324	49.8324	49.8324	49.8324	49.8324	49.8324	49.8324	49.8324	49.8324	49.8324	(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)													
	-84.7567	-84.7567	-84.7567	-84.7567	-84.7567	-84.7567	-84.7567	-84.7567	-84.7567	-84.7567	-84.7567	-84.7567	(71)
Water heating gains (Table 5)													
	120.1139	118.1614	114.1068	108.5947	105.0160	99.9771	95.6941	101.1817	103.1315	108.8367	115.2789	118.1695	(72)
Total internal gains													
	531.7525	527.8884	509.5049	481.0859	452.1604	426.1261	410.8252	418.2245	434.5032	463.1152	494.9043	518.7902	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	FF Specific data or Table 6c		Access factor Table 6d		Gains W	
East				6.0200	23.7835		0.6300	0.7000		0.7700		43.7566 (76)	
South				3.2400	54.0600		0.6300	0.7000		0.7700		53.5295 (78)	
West				1.5600	23.7835		0.6300	0.7000		0.7700		11.3389 (80)	
Solar gains	108.6250	170.5274	250.1077	338.1234	384.3149	409.1471	388.3932	352.4230	297.8250	208.1732	130.1198	92.1359 (83)	
Total gains	640.3775	698.4158	759.6126	819.2093	836.4752	835.2732	799.2184	770.6475	732.3282	671.2885	625.0241	610.9261 (84)	

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)

Utilisation factor for gains for living area, nil,m (see Table 9a)													21.0000 (85)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	370.4044	372.9815	372.9815	374.6168	374.6168	378.4018	378.4018	379.1049	378.4018	375.4090	376.1838	373.8076	
alpha	25.6936	25.8654	25.8654	25.9745	25.9745	26.2268	26.2268	26.2737	26.2268	26.0273	26.0789	25.9205	
util living area	1.0000	1.0000	0.9997	0.9584	0.7129	0.4598	0.3026	0.3317	0.6022	0.9738	1.0000	1.0000	(86)
Tweekday	19.8234	19.8648	19.9262	19.9792	19.9810	19.9902	19.9902	19.9919	19.9902	19.9810	19.9047	19.8253	
Tweekend	20.9177	20.9333	20.9605	20.9894	20.9932	20.9932	20.9932	20.9933	20.9932	20.9883	20.9477	20.9150	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
MIT	20.8729	20.8968	20.9390	20.9834	20.9895	20.9896	20.9896	20.9896	20.9894	20.9819	20.9183	20.8688	(87)
Th 2	19.9862	19.9925	19.9925	19.9965	19.9965	20.0055	20.0055	20.0072	20.0055	19.9984	20.0002	19.9945	(88)
util rest of house													
1.0000	1.0000	0.9986	0.8964	0.6267	0.3752	0.2141	0.2402	0.5056	0.9093	1.0000	1.0000	(89)	
Tweekday	19.8234	19.8648	19.9262	19.9792	19.9810	19.9902	19.9902	19.9919	19.9902	19.9810	19.9047	19.8253	
Tweekend	19.8234	19.8648	19.9262	19.9792	19.9810	19.9902	19.9902	19.9919	19.9902	19.9810	19.9047	19.8253	
MIT 2	19.8234	19.8648	19.9262	19.9792	19.9810	19.9902	19.9902	19.9919	19.9902	19.9810	19.9047	19.8253	(90)
Living area fraction													
MIT	20.3159	20.3490	20.4014	20.4504	20.4542	20.4591	20.4591	20.4600	20.4591	20.4506	20.3803	20.3150	(91)
Temperature adjustment													0.4692 (92)
adjusted MIT	20.3159	20.3490	20.4014	20.4504	20.4542	20.4591	20.4591	20.4600	20.4591	20.4506	20.3803	20.3150	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	1.0000	1.0000	0.9993	0.9282	0.6660	0.4138	0.2545	0.2819	0.5497	0.9444	1.0000	1.0000	(94)
Useful gains	640.3773	698.4120	759.0914	760.3635	557.1195	345.6281	203.3675	217.2541	402.5259	633.9850	625.0100	610.9260	(95)
Ext temp.	4.9000	5.5000	7.3000	9.7000	12.7000	15.6000	17.6000	17.4000	14.8000	11.4000	7.8000	4.9000	(96)
Heat loss rate W													
	1120.1992	1071.5539	945.4402	772.3975	557.1244	345.6281	203.3675	217.2541	402.5259	648.8978	900.1079	1109.9350	(97)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Month fracti	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	356.9875	250.7513	138.6435	8.6645	0.0036	0.0000	0.0000	0.0000	0.0000	11.0952	198.0705	371.2627 (98)
Space heating												1335.4787 (98)
Space heating per m2										(98) / (4) =		20.5458 (99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												251.3703 (206)
Efficiency of secondary/supplementary heating system, %												100.0000 (208)
Space heating requirement												531.2793 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	356.9875	250.7513	138.6435	8.6645	0.0036	0.0000	0.0000	0.0000	0.0000	11.0952	198.0705	371.2627 (98)
Space heating efficiency (main heating system 1)	251.3703	251.3703	251.3703	251.3703	251.3703	0.0000	0.0000	0.0000	0.0000	251.3703	251.3703	251.3703 (210)
Space heating fuel (main heating system)	142.0165	99.7538	55.1551	3.4469	0.0014	0.0000	0.0000	0.0000	0.0000	4.4139	78.7963	147.6955 (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	192.2805	169.7267	178.8392	161.1342	158.4977	142.4734	137.6390	149.9181	149.3041	167.0468	175.6082	187.9299 (64)
Efficiency of water heater	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400 (216)
Fuel for water heating, kWh/month	113.4800	100.1692	105.5472	95.0981	93.5421	84.0849	81.2317	88.4786	88.1162	98.5876	103.6403	110.9124 (219)
Water heating fuel used												1162.8882 (219)
Annual totals kWh/year												
Space heating fuel - main system												531.2793 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
Total electricity for the above, kWh/year												0.0000 (231)
Electricity for lighting (calculated in Appendix L)												302.1547 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
Total delivered energy for all uses												1996.3223 (238)

10a. Fuel costs - using BEDF prices (480)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	531.2793	19.1200	101.5806 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1162.8882	19.1200	222.3442 (247)
Pumps and fans for heating	0.0000	0.0000	0.0000 (249)
Energy for lighting	302.1547	19.1200	57.7720 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit	0.0000	19.1200	0.0000 (252)
Total energy cost			381.6968 (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	531.2793	0.5190	275.7340 (261)
Space heating - secondary	0.0000	0.5190	0.0000 (263)
Water heating (other fuel)	1162.8882	0.5190	603.5390 (264)
Space and water heating			879.2730 (265)
Pumps and fans	0.0000	0.0000	0.0000 (267)
Energy for lighting	302.1547	0.5190	156.8183 (268)
Energy saving/generation technologies			
PV Unit	-300.0000	0.5190	-155.7000 (269)
Total kg/year			880.3913 (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	531.2793	3.0700	1631.0276 (261)
Space heating - secondary	0.0000	3.0700	0.0000 (263)
Water heating (other fuel)	1162.8882	3.0700	3570.0669 (264)
Space and water heating			5201.0945 (265)
Pumps and fans	0.0000	0.0000	0.0000 (267)
Energy for lighting	302.1547	3.0700	927.6150 (268)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Energy saving/generation technologies			
PV Unit	-300.0000	3.0700	-921.0000 (269)
Primary energy kWh/year			5207.7095 (272)
Primary energy kWh/m2/year			80.1186 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating:	B 85
Current environmental impact rating:	B 88

(For testing purposes):

A	Not considered
B	Not considered
C	Not considered
D	Not considered
E Low energy lighting	Already installed
F	Not considered
G	Not considered
H	Not considered
I	Not considered
J	Not considered
K	Not considered
M	Not considered
N Solar water heating	Not applicable
O	Not considered
P	Not considered
R	Not considered
S	Not considered
T	Not considered
U Solar photovoltaic panels	Not applicable
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
(none)			

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
(none)			
Total Savings	£0		0.00 kg/m²

Potential energy efficiency rating:	B 85
Potential environmental impact rating:	B 88

Fuel prices for cost data on this page from database revision number 480 TEST (28 Jul 2021)
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	£382	£382	£0
Space heating	£102	£102	£0
Water heating	£222	£222	£0
Lighting	£58	£58	£0
Total cost of fuels	£382	£382	£0
Total cost of uses	£382	£382	£0
Delivered energy	31 kWh/m²	31 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.9 tonnes	0.9 tonnes	0.0 tonnes
CO2 emissions per m²	14 kg/m²	14 kg/m²	0 kg/m²
Primary energy	80 kWh/m²	80 kWh/m²	0 kWh/m²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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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

No improvements selected / applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Energy Calculations Ltd
SAP ♦ CODE ♦ SBEM ♦ DESIGN

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

No improvements selected / applicable

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

Overheating Calculation Input Data

Dwelling type	EndTerrace Flat
Number of storeys	1
Cross ventilation possible	Yes
SAP Region	Thames Valley
Front of dwelling faces	West
Overshading	Average or unknown
Thermal mass parameter	1490.7 (calculated from construction elements)
Night ventilation	No
Ventilation rate during hot weather (ach)	6.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	308.88 (P1)
Transmission heat loss coefficient	43.11 (37)
Summer heat loss coefficient	351.99 (P2)

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

Solar shading	Z blinds	Solar access	Z overhangs	Z summer
Orientation				
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
East	6.0200	117.5071	0.6300	0.7000	0.9000	252.6877
South	3.2400	112.2060	0.6300	0.7000	0.9000	129.8628
West	1.5600	117.5071	0.6300	0.7000	0.9000	65.4805
total:						448.0310

	Jun	Jul	Aug	
Solar gains	472	448	408	(P3)
Internal gains	426	411	418	
Total summer gains	898	859	826	(P5)

Summer gain/loss ratio	2.55	2.44	2.35	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 1490.7)	0.00	0.00	0.00	
Threshold temperature	18.55	20.34	20.15	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	

Assessment of likelihood of high internal temperature: Not significant

BASIC COMPLIANCE REPORT

Energy Calculations Ltd
SAP • CODE • SBEM • DESIGN

Calculation Type: New Build (As Designed)

Property Reference	015725	Issued on Date	16/08/2021
Assessment Reference	004	Prop Type Ref	
Property	Flat 4, 18, Parkside Road, READING, RG30 2DB		
SAP Rating	85 B	DER	16.86
Environmental	88 B	TER	25.77
CO ₂ Emissions (t/year)	0.88	% DER<TER	34.58
General Requirements Compliance	Pass	DFEE	43.28
		TFEE	43.82
		% DFEE<TFEE	1.21
Assessor Details	Mr. Matthew Carter, Energy Calculations Limited, Tel: 01754 761035, mcarter@energycalculations.co.uk		Assessor ID
Client	7869-0001		

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	Electricity		
Fuel factor	1.55 (electricity)		
Target Carbon Dioxide Emission Rate (TER)	25.77	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	16.86	kgCO ₂ /m ²	Pass
	-8.91 (-34.6%)	kgCO ₂ /m ²	

1b TFE and DFEE

Target Fabric Energy Efficiency (TFEE)	43.82	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DFEE)	43.28	kWh/m ² /yr	
	-0.5 (-1.1%)	kWh/m ² /yr	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.22 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Roof	0.15 (max. 0.20)	0.16 (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	Heat pump with radiators or underfloor - Electric Panasonic WH-MDC05F3E5	
Secondary heating system	None	

5 Cylinder insulation

BASIC COMPLIANCE REPORT

Energy Calculations Ltd
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Calculation Type: New Build (As Designed)

Hot water storage	Measured cylinder loss: 1.86 kWh/day Permitted by DBSCG 2.30	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

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)	Not significant	Pass
Based on:		
Overshading	Average	
Windows facing East	6.02 m ² , No overhang	
Windows facing South	3.24 m ² , No overhang	
Windows facing West	1.56 m ² , No overhang	
Air change rate	6.00 ach	
Blinds/curtains	None	

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Solid Wall	0.00	W/m ² K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	Pass

10 Key features

Party wall U-value	0.00	W/m ² K
Photovoltaic array	300.00	kWh/Year

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

Energy Calculations Ltd
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Calculation Type: New Build (As Designed)

Property Reference	015725	Issued on Date	16/08/2021
Assessment Reference	004	Prop Type Ref	
Property	Flat 4, 18, Parkside Road, READING, RG30 2DB		
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Environmental	88 B	TER	25.77
CO ₂ Emissions (t/year)	0.88	% DER<TER	34.58
General Requirements Compliance	Pass	DFEE	43.28
		TFEE	43.82
		% DFEE<TFEE	1.21
Assessor Details	Mr. Matthew Carter, Energy Calculations Limited, Tel: 01754 761035, mcarter@energycalculations.co.uk		Assessor ID
			7869-0001
Client			

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

Orientation	West					
Property Tenure	Unknown					
Transaction Type	New dwelling					
Terrain Type	Urban					
1.0 Property Type	Flat, End-Terrace					
2.0 Number of Storeys	1					
3.0 Date Built	2020					
4.0 Sheltered Sides	1					
5.0 Sunlight/Shade	Average or unknown					
6.0 Measurements						
Ground Floor:		Heat Loss Perimeter	Internal Floor Area		Average Storey Height	
		33.65 m	65.00 m ²		2.40 m	
7.0 Living Area	30.50		m ²			
8.0 Thermal Mass Parameter	Precise calculation					
Thermal Mass	1490.71		kJ/m ² K			
9.0 External Walls						
Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area (m ²)	Nett Area (m ²)
Main Wall	Cavity Wall	Cavity wall : plasterboard on dabs, AAC block, filled cavity, any outside structure	0.22	60.00	68.24	57.42
Wall to stairs	Cavity Wall	Cavity wall : dense plaster, dense block, filled cavity, any outside structure	0.22	190.00	12.52	10.63
9.1 Party Walls						
Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Area (m ²)	
Party Wall 1	Solid Wall	Dense plaster both sides, dense blocks, cavity or cavity fill	0.00	180.00	9.43	
9.2 Internal Walls						
Description	Construction				Kappa (kJ/m ² K)	Area (m ²)
Internal Wall 1	Dense block, dense plaster				100.00	851.12
10.0 External Roofs						
Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area (m ²)	Nett Area (m ²)
Flat roof	External Flat Roof	Plasterboard, insulated flat roof	0.14	9.00	5.60	5.60
Void	External Plane Roof	Plasterboard, insulated at ceiling level	0.16	9.00	13.06	13.06

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

10.1 Party Ceilings

Description	Construction	Kappa (kJ/m²K)	Area (m²)
Party Ceilings 1	Precast concrete planks floor, screed, carpeted	30.00	46.34

11.1 Party Floors

Description	Construction	Kappa (kJ/m²K)	Area (m²)
Party Floor 1	Precast concrete planks floor, screed, carpeted	40.00	65.00

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
External Door	Manufacturer	Half Glazed Door	Double Low-E Soft 0.05			0.63		0.70	1.40
Windows	Manufacturer	Window	Double Low-E Soft 0.05			0.63		0.70	1.40
Door to Stairs	SAP table	Door to Corridor							1.40

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
Door	Door to Corridor	[2] Wall to stairs	North							1.89	
Windows	Window	[1] Main Wall	South	None	0.00					3.24	
Windows	Window	[1] Main Wall	East	None	0.00					6.02	
Windows	Window	[1] Main Wall	West	None	0.00					1.56	

14.0 Conservatory

None

15.0 Draught Proofing

100 %

16.0 Draught Lobby

Yes

17.0 Thermal Bridging

Calculate Bridges

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Table K1 - Approved	E2 Other lintels (including other steel lintels)	8.20	0.300	No
Table K1 - Approved	E3 Sill	8.20	0.040	No
Table K1 - Approved	E4 Jamb	28.00	0.050	No
Table K1 - Approved	E7 Party floor between dwellings (in blocks of flats)	33.65	0.070	No
Table K1 - Approved	E10 Eaves (insulation at ceiling level)	11.00	0.060	No
Table K1 - Default	E14 Flat roof	12.50	0.080	No
Table K1 - Approved	E16 Corner (normal)	7.20	0.090	No
Table K1 - Approved	E17 Corner (inverted – internal area greater than external area)	2.40	-0.090	No
Table K1 - Default	P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	3.60	0.000	No

Y-value 0.087 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 No

Air change rate 6.00

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

Mechanical Ventilation

Mechanical Ventilation System Present

No

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				2
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	9	
Total number of L.E.L. fittings	9	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	Yes
Light and motion sensor	Yes

23.0 Electricity Tariff

Standard

24.0 Main Heating 1

	Database	
Percentage of Heat	100	%
Database Ref. No.	102968	
Fuel Type	Electricity	
Main Heating	PET	
SAP Code	224	
In Winter	0.0	
In Summer	0.0	
Controls	CHD Time and temperature zone control	
PCDF Controls	0	
Sap Code	2207	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Underfloor	
Underfloor Heating	Yes - Pipes in thin screed	
Flow Temperature	<= 35°C	

25.0 Main Heating 2

None

Community Heating	None
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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

SUMMARY FOR INPUT DATA

Energy Calculations Ltd
SAP ♦ CODE ♦ SBEM ♦ DESIGN

Calculation Type: New Build (As Designed)

Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	
Immersion Only Heating Hot Water	Yes	
29.0 Hot Water Cylinder	Hot Water Cylinder	
Cylinder Stat	Yes	
Cylinder In Heated Space	Yes	
Independent Time Control	Yes	
Insulation Type	Measured Loss	
Cylinder Volume	210.00	L
Loss	1.86	kWh/day
Pipes insulation	Fully insulated primary pipework	
31.0 Thermal Store	None	
32.0 Photovoltaic Unit	More Dwellings, One Block	
Apportioned	300.00	kWh/Year

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

None

BLOCK COMPLIANCE

Energy Calculations Ltd
SAP • CODE • SBEM • DESIGN

Calculation Type: New Build (As Designed)

Block Reference	000516	Issued on Date	16/08/2021
Block Name	Parkside Road		
Assessor Details	Mr. Matthew Carter, Energy Calculations Limited, Tel: 01754 761035, mcarter@energycalculations.co.uk		Assessor ID 7869-0001
Client			

Block Compliance Report - DER

Block Reference: 000516		Block Name: Parkside Road			
Property-Assessment Reference	Multiplier	Floor Area (m ²)	DER (kgCO ₂ /m ²)	TER (kgCO ₂ /m ²)	% DER/TER
015722-004	1	70	17.89	29.47	39.29 %
015723-004	1	50	21.33	31.34	31.93 %
015724-004	1	42.9	22.37	33.10	32.41 %
015725-004	1	65	16.86	25.77	34.58 %
015726-004	1	77.6	15.49	25.88	40.14 %
015727-004	1	73	16.64	24.80	32.90 %
015728-004	1	77	15.36	26.08	41.11 %
015729-004	1	70.3	17.18	27.75	38.08 %
015730-004	1	63.68	16.67	26.03	35.95 %
015731-004	1	50.64	18.50	26.84	31.08 %
015732-004	1	77	16.15	28.08	42.48 %
Totals:	11	717.12	194.44	305.12	
Average DER = 17.32 kgCO ₂ /m ²		% DER/TER	PASS		
Average TER = 27.44 kgCO ₂ /m ²		36.88 %			

Block Compliance Report - DFEE

Block Reference: 000516		Block Name: Parkside Road			
Property-Assessment Reference	Multiplier	Floor Area (m ²)	DFEE (kWh/m ² /yr)	TFEE (kWh/m ² /yr)	% DFEE/TFEE
015722-004	1	70	58.41	58.58	0.29 %
015723-004	1	50	54.32	54.44	0.22 %
015724-004	1	42.9	55.45	55.97	0.94 %
015725-004	1	65	43.28	43.82	1.21 %
015726-004	1	77.6	45.82	48.35	5.22 %
015727-004	1	73	38.64	40.24	3.99 %
015728-004	1	77	47.54	49.93	4.79 %
015729-004	1	70.3	46.03	51.12	9.95 %
015730-004	1	63.68	41.89	44.39	5.61 %
015731-004	1	50.64	36.75	39.96	8.04 %
015732-004	1	77	52.10	56.40	7.62 %
Totals:	11	717.12	520.23	543.19	
Average DFEE = 47.15 kWh/m ² /yr		% DFEE/TFEE	PASS		
Average TFEE = 49.35 kWh/m ² /yr		4.46 %			