

Energy Calculations Ltd

SAP ♦ CODE ♦ SBEM ♦ DESIGN

01754-761035



SAP Report Submission for Building Regulations Compliance

Client:

Project: Flat 5, 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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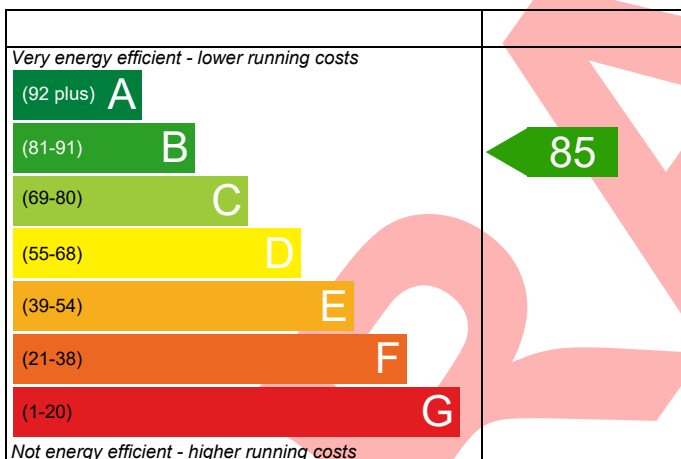
Flat 5, 18, Parkside Road,
READING,
RG30 2DB

Dwelling type: Flat, End-Terrace
Date of assessment: 16/08/2021
Produced by: Energy Calculations Limited
Total floor area: 77.6 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

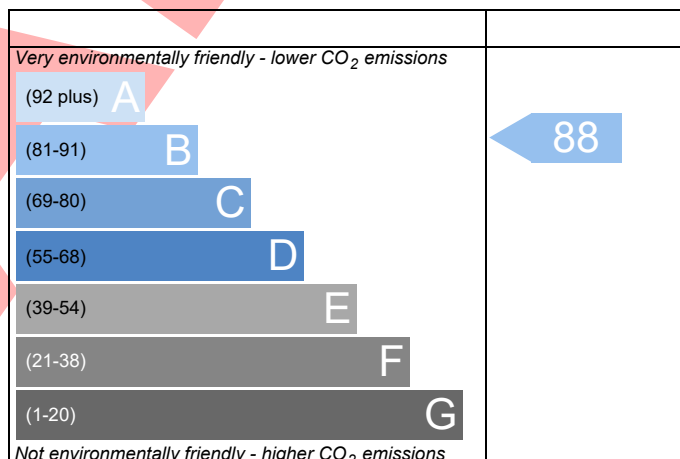


England

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	015726	Issued on Date	16/08/2021
Assessment Reference	004	Prop Type Ref	
Property	Flat 5, 18, Parkside Road, READING, RG30 2DB		

SAP Rating	85 B	DER	15.49	TER	25.88
Environmental	88 B	% DER<TER	40.14		
CO ₂ Emissions (t/year)	1.03	DFEE	45.82	TFEE	48.35
General Requirements Compliance	Pass	% DFEE<TFEE	5.22		

Assessor Details	Mr. Matthew Carter, Energy Calculations Limited, Tel: 01754 761035, mcarter@energycalculations.co.uk	Assessor ID	7869-0001
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Client	
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	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	19.62	0.98	
External wall	E7 Party floor between dwellings (in blocks of flats)	Table K1 - Approved	0.070	31.17	2.18	
External wall	E14 Flat roof	Table K1 - Default	0.080	16.67	1.33	
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	12.00	-1.08	
External wall	E18 Party wall between dwellings	Table K1 - Approved	0.060	12.00	0.72	
Party wall	P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	Table K1 - Default	0.000	16.83	0.00	

Total: **7.57** W/mK:
Y-Value: **0.047** 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 78 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) 25.88 kgCO₂/m²

Dwelling Carbon Dioxide Emission Rate (DER) 15.49 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)48.3 kWh/m²/yr

Dwelling Fabric Energy Efficiency (DFEE)45.8 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.22 (max. 0.30)	0.22 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.14 (max. 0.25)	0.14 (max. 0.70)	OK
Roof	0.14 (max. 0.20)	0.14 (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): Slight OK

Based on:

Overshading:	Average
Windows facing North:	6.27 m², No overhang
Windows facing South:	3.90 m², No overhang
Windows facing West:	3.21 m², No overhang
Air change rate:	6.00 ach
Blinds/curtains:	None

10 Key features

Party wall U-value	0.00 W/m²K
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	77.6000 (1b)	x 2.4000 (2b)	= 186.2400 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	77.6000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	186.2400 (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 20.0000 / (5) = 0.1074 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3574 (18)
Number of sides sheltered					2 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.8500 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3038 (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	0.3873	0.3797	0.3721	0.3342	0.3266	0.2886	0.2886	0.2810	0.3038	0.3266	0.3418	0.3569 (22b)
Effective ac	0.5750	0.5721	0.5692	0.5558	0.5533	0.5416	0.5416	0.5395	0.5461	0.5533	0.5584	0.5637 (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)			13.3800	1.3258	17.7386		(27)
Door to Stairs			1.8900	1.4000	2.6460		(26)
Heat Loss Floor 1			77.6000	0.1400	10.8640		(28b)
Main Wall	62.6700	13.3800	49.2900	0.2200	10.8438	60.0000	2957.4000 (29a)
Wall to stairs	9.2600	1.8900	7.3700	0.1864	1.3736	190.0000	1400.3000 (29a)
Wall to Hall	2.8800		2.8800	0.2060	0.5931	14.0000	40.3200 (29a)
Flat roof	8.0000		8.0000	0.1400	1.1200	9.0000	72.0000 (30)
Total net area of external elements Aum(A, m ²)			160.4100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	45.1792		(33)
Party Wall 1			40.3900	0.0000	0.0000	180.0000	7270.2000 (32)
Party Ceilings 1			69.6000			40.0000	2784.0000 (32b)
Internal Wall 1			73.5800			9.0000	662.2200 (32c)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 15186.4400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							195.7015 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.5725 (36)
Total fabric heat loss						(33) + (36) =	52.7517 (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	35.3395	35.1605	34.9851	34.1609	34.0067	33.2889	33.2889	33.1560	33.5654	34.0067	34.3187	34.6448 (38)
Heat transfer coeff	88.0912	87.9122	87.7368	86.9126	86.7584	86.0406	86.0406	85.9077	86.3171	86.7584	87.0703	87.3965 (39)
Average = Sum(39)m / 12 =												86.9119 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1352	1.1329	1.1306	1.1200	1.1180	1.1088	1.1088	1.1071	1.1123	1.1180	1.1220	1.1262 (40)
HLP (average)												1.1200 (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	2.4157 (42)
Average daily hot water use (litres/day)	91.5740 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	100.7313	97.0684	93.4054	89.7425	86.0795	82.4166	82.4166	86.0795	89.7425	93.4054	97.0684	100.7313 (44)
Energy conte	149.3817	130.6502	134.8193	117.5387	112.7812	97.3216	90.1828	103.4860	104.7220	122.0434	133.2199	144.6682 (45)
Energy content (annual)										Total = Sum(45)m =		1440.8149 (45)
Distribution loss (46)m = 0.15 x (45)m												

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	22.4073	19.5975	20.2229	17.6308	16.9172	14.5982	13.5274	15.5229	15.7083	18.3065	19.9830	21.7002 (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												
203.7805	179.7846	189.2181	170.1827	167.1800	149.9656	144.5816	157.8848	157.3660	176.4422	185.8639	199.0670	(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												
203.7805	179.7846	189.2181	170.1827	167.1800	149.9656	144.5816	157.8848	157.3660	176.4422	185.8639	199.0670	(64)
Heat gains from water heating, kWh/month												
93.1884	82.7487	88.3464	81.1968	81.0188	74.4746	73.5048	77.9281	76.9353	84.0985	86.4108	91.6212	(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	120.7873	120.7873	120.7873	120.7873	120.7873	120.7873	120.7873	120.7873	120.7873	120.7873	120.7873	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
19.6593	17.4612	14.2004	10.7506	8.0362	6.7845	7.3309	9.5290	12.7898	16.2396	18.9540	20.2057	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
214.3515	216.5758	210.9707	199.0380	183.9750	169.8180	160.3603	158.1360	163.7411	175.6738	190.7368	204.8938	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
35.0787	35.0787	35.0787	35.0787	35.0787	35.0787	35.0787	35.0787	35.0787	35.0787	35.0787	35.0787	(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)												
-96.6298	-96.6298	-96.6298	-96.6298	-96.6298	-96.6298	-96.6298	-96.6298	-96.6298	-96.6298	-96.6298	-96.6298	(71)
Water heating gains (Table 5)												
125.2533	123.1379	118.7452	112.7734	108.8962	103.4370	98.7968	104.7421	106.8545	113.0356	120.0150	123.1468	(72)
Total internal gains												
418.5003	416.4112	403.1525	381.7981	360.1437	339.2757	325.7241	331.6433	342.6216	364.1852	388.9420	407.4825	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
North				6.2700	10.6334	0.6300	0.7000	0.7700	20.3756 (74)			
South				3.9000	46.7521	0.6300	0.7000	0.7700	55.7234 (78)			
West				3.2100	19.6403	0.6300	0.7000	0.7700	19.2674 (80)			
Solar gains	95.3664	167.8906	244.4884	328.1964	391.0295	398.6013	379.9592	331.4290	273.1827	189.5085	115.2114	80.9809 (83)
Total gains	513.8668	584.3018	647.6409	709.9946	751.1732	737.8770	705.6834	663.0722	615.8043	553.6936	504.1534	488.4633 (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	47.8873	47.9849	48.0808	48.5368	48.6230	49.0287	49.0287	49.1045	48.8716	48.6230	48.4488	48.2680
alpha	4.1925	4.1990	4.2054	4.2358	4.2415	4.2686	4.2686	4.2736	4.2581	4.2415	4.2299	4.2179
util living area												
0.9921	0.9856	0.9704	0.9295	0.8370	0.6772	0.5184	0.5678	0.7961	0.9472	0.9855	0.9935	(86)
Tweekday	18.4737	18.6688	18.9805	19.3777	19.6911	19.8586	19.8943	19.8919	19.7977	19.4071	18.8763	18.4421
Tweekend	20.2750	20.3613	20.5004	20.6793	20.8316	20.9226	20.9499	20.9457	20.8836	20.6892	20.4501	20.2585
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	19.8811	20.0121	20.2290	20.4993	20.7402	20.8811	20.9226	20.9161	20.8183	20.5203	20.1413	19.8556 (87)
Th 2	19.9722	19.9741	19.9759	19.9845	19.9861	19.9937	19.9937	19.9951	19.9908	19.9861	19.9829	19.9795 (88)
util rest of house												
0.9900	0.9818	0.9624	0.9095	0.7910	0.5936	0.4081	0.4561	0.7254	0.9282	0.9810	0.9919	(89)
Tweekday	18.4737	18.6688	18.9805	19.3777	19.6911	19.8586	19.8943	19.8919	19.7977	19.4071	18.8763	18.4421
Tweekend	18.4737	18.6688	18.9805	19.3777	19.6911	19.8586	19.8943	19.8919	19.7977	19.4071	18.8763	18.4421
MIT 2	18.4737	18.6688	18.9805	19.3777	19.6911	19.8586	19.8943	19.8919	19.7977	19.4071	18.8763	18.4421 (90)
Living area fraction												
fLA = Living area / (4) =												0.4768 (91)
MIT	19.1447	19.3093	19.5758	19.9125	20.1913	20.3461	20.3846	20.3803	20.2843	19.9379	19.4795	19.1161 (92)
Temperature adjustment												0.0000
adjusted MIT	19.1447	19.3093	19.5758	19.9125	20.1913	20.3461	20.3846	20.3803	20.2843	19.9379	19.4795	19.1161 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9878	0.9787	0.9586	0.9078	0.8013	0.6245	0.4521	0.5005	0.7479	0.9271	0.9782	0.9900 (94)
Useful gains	507.6038	571.8632	620.8022	644.5631	601.8837	460.7958	319.0581	331.8575	460.5887	513.3177	493.1627	483.5726 (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												
1307.6903	1266.7534	1147.2251	957.1216	736.6920	494.3975	325.6294	341.9342	533.8104	810.1385	1077.8857	1303.6103	(97)

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Month fraction	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	595.2644	466.9662	391.6587	225.0421	100.2974	0.0000	0.0000	0.0000	0.0000	220.8346	421.0006	610.1081 (98)
Space heating												3031.1721 (98)
Space heating per m2										(98) / (4) =		39.0615 (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 %)												291.2454 (206)
Efficiency of secondary/supplementary heating system, %												100.0000 (208)
Space heating requirement												1040.7623 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	595.2644	466.9662	391.6587	225.0421	100.2974	0.0000	0.0000	0.0000	0.0000	220.8346	421.0006	610.1081 (98)
Space heating efficiency (main heating system 1)	291.2454	291.2454	291.2454	291.2454	291.2454	0.0000	0.0000	0.0000	0.0000	291.2454	291.2454	291.2454 (210)
Space heating fuel (main heating system)	204.3859	160.3343	134.4772	77.2689	34.4374	0.0000	0.0000	0.0000	0.0000	75.8243	144.5518	209.4825 (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	203.7805	179.7846	189.2181	170.1827	167.1800	149.9656	144.5816	157.8848	157.3660	176.4422	185.8639	199.0670 (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	120.2670	106.1052	111.6726	100.4383	98.6662	88.5066	85.3291	93.1804	92.8742	104.1325	109.6930	117.4852 (219)
Water heating fuel used												1228.3504 (219)
Annual totals kWh/year												
Space heating fuel - main system												1040.7623 (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)												347.1896 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
Total delivered energy for all uses												2616.3022 (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	1040.7623	0.5190	540.1556 (261)
Space heating - secondary	0.0000	0.5190	0.0000 (263)
Water heating (other fuel)	1228.3504	0.5190	637.5138 (264)
Space and water heating			1177.6695 (265)
Pumps and fans	0.0000	0.0000	0.0000 (267)
Energy for lighting	347.1896	0.5190	180.1914 (268)
Energy saving/generation technologies			
PV Unit	-300.0000	0.5190	-155.7000 (269)
Total CO2, kg/year			1202.1609 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			15.4900 (273)

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

DER		15.4900 ZC1
Total Floor Area	TFA	77.6000
Assumed number of occupants	N	2.4157
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190
CO2 emissions from appliances, equation (L14)		16.3686 ZC2
CO2 emissions from cooking, equation (L16)		2.2806 ZC3
Total CO2 emissions		34.1392 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		34.1392 ZC8

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Energy Calculations Ltd
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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	77.6000 (1b)	x 2.4000 (2b)	= 186.2400 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	77.6000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 186.2400 (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					3 * 10 = 30.0000 (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 30.0000 / (5) = 0.1611 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4111 (18)
Number of sides sheltered					2 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.8500 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3494 (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	0.4455	0.4368	0.4280	0.3844	0.3756	0.3319	0.3319	0.3232	0.3494	0.3756	0.3931	0.4106 (22b)
Effective ac	0.5992	0.5954	0.5916	0.5739	0.5705	0.5551	0.5551	0.5522	0.5610	0.5705	0.5773	0.5843 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			1.8900	1.0000	1.8900		(26)
TER Opening Type (Uw = 1.40)			13.3800	1.3258	17.7386		(27)
Heat Loss Floor 1			77.6000	0.1300	10.0880		(28b)
Main Wall	62.6700	13.3800	49.2900	0.1800	8.8722		(29a)
Wall to stairs	9.2600	1.8900	7.3700	0.1800	1.3266		(29a)
Wall to Hall	2.8800		2.8800	0.1800	0.5184		(29a)
Flat roof	8.0000		8.0000	0.1300	1.0400		(30)
Total net area of external elements Aum(A, m ²)			160.4100				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		41.4738		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.6045 (36)
Total fabric heat loss						(33) + (36) =	47.0783 (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	36.8288	36.5920	36.3598	35.2694	35.0654	34.1157	34.1157	33.9398	34.4815	35.0654	35.4781	35.9096 (38)
Heat transfer coeff	83.9071	83.6703	83.4381	82.3478	82.1437	81.1940	81.1940	81.0182	81.5598	82.1437	82.5565	82.9879 (39)
Average = Sum(39)m / 12 =												82.3468 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0813	1.0782	1.0752	1.0612	1.0586	1.0463	1.0463	1.0440	1.0510	1.0586	1.0639	1.0694 (40)
HLP (average)												1.0612 (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												2.4157 (42)
Average daily hot water use (litres/day)												91.5740 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	100.7313	97.0684	93.4054	89.7425	86.0795	82.4166	82.4166	86.0795	89.7425	93.4054	97.0684	100.7313 (44)
Energy content (annual)	149.3817	130.6502	134.8193	117.5387	112.7812	97.3216	90.1828	103.4860	104.7220	122.0434	133.2199	144.6682 (45)
Distribution loss (46)m = 0.15 x (45)m	22.4073	19.5975	20.2229	17.6308	16.9172	14.5982	13.5274	15.5229	15.7083	18.3065	19.9830	21.7002 (46)
Water storage loss:												210.0000 (47)
Store volume												1.7016 (48)
a) If manufacturer declared loss factor is known (kWh/day):												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Energy Calculations Ltd
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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Temperature factor from Table 2b												0.5400 (49)
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	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month												
201.1283	177.3890	186.5659	167.6161	164.5278	147.3989	141.9294	155.2326	154.7993	173.7900	183.2972	196.4148	(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												
201.1283	177.3890	186.5659	167.6161	164.5278	147.3989	141.9294	155.2326	154.7993	173.7900	183.2972	196.4148	(64)
Heat gains from water heating, kWh/month												
91.0667	80.8323	86.2247	79.1435	78.8970	72.4213	71.3830	75.8064	74.8819	81.9767	84.3575	89.4994	(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	120.7873	120.7873	120.7873	120.7873	120.7873	120.7873	120.7873	120.7873	120.7873	120.7873	120.7873	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
19.6593	17.4612	14.2004	10.7506	8.0362	6.7845	7.3309	9.5290	12.7898	16.2396	18.9540	20.2057	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
214.3515	216.5758	210.9707	199.0380	183.9750	169.8180	160.3603	158.1360	163.7411	175.6738	190.7368	204.8938	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
35.0787	35.0787	35.0787	35.0787	35.0787	35.0787	35.0787	35.0787	35.0787	35.0787	35.0787	35.0787	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)												
-96.6298	-96.6298	-96.6298	-96.6298	-96.6298	-96.6298	-96.6298	-96.6298	-96.6298	-96.6298	-96.6298	-96.6298	(71)
Water heating gains (Table 5)												
122.4015	120.2861	115.8934	109.9215	106.0444	100.5851	95.9449	101.8903	104.0027	110.1837	117.1632	120.2949	(72)
Total internal gains												
418.6485	416.5594	403.3007	381.9463	360.2918	339.4239	325.8723	331.7914	342.7698	364.3333	389.0901	407.6306	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
North					6.2700	10.6334	0.6300	0.7000	0.7700		20.3756 (74)	
South					3.9000	46.7521	0.6300	0.7000	0.7700		55.7234 (78)	
West					3.2100	19.6403	0.6300	0.7000	0.7700		19.2674 (80)	
Solar gains	95.3664	167.8906	244.4884	328.1964	391.0295	398.6013	379.9592	331.4290	273.1827	189.5085	115.2114	80.9809 (83)
Total gains	514.0149	584.4499	647.7891	710.1427	751.3213	738.0252	705.8315	663.2204	615.9525	553.8418	504.3015	488.6115 (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	64.2244	64.4062	64.5854	65.4406	65.6032	66.3705	66.3705	66.5146	66.0728	65.6032	65.2752	64.9358
alpha	5.2816	5.2937	5.3057	5.3627	5.3735	5.4247	5.4247	5.4343	5.4049	5.3735	5.3517	5.3291
util living area												
0.9968	0.9932	0.9828	0.9472	0.8500	0.6694	0.4998	0.5509	0.8034	0.9634	0.9931	0.9976	(86)
MIT	19.9106	20.0599	20.2967	20.6017	20.8458	20.9684	20.9945	20.9910	20.9163	20.6053	20.2048	19.8862 (87)
Th 2	20.0162	20.0187	20.0211	20.0327	20.0348	20.0449	20.0449	20.0468	20.0410	20.0348	20.0304	20.0259 (88)
util rest of house												
0.9958	0.9909	0.9769	0.9286	0.8014	0.5835	0.3947	0.4424	0.7282	0.9468	0.9904	0.9968	(89)
MIT 2	18.5678	18.7868	19.1309	19.5691	19.8861	20.0243	20.0429	20.0431	19.9760	19.5831	19.0075	18.5393 (90)
Living area fraction												
19.2081	19.3938	19.6867	20.0614	20.3437	20.4744	20.4966	20.4951	20.4244	20.0705	19.5784	19.1815	(92)
Temperature adjustment												0.0000
adjusted MIT	19.2081	19.3938	19.6867	20.0614	20.3437	20.4744	20.4966	20.4951	20.4244	20.0705	19.5784	19.1815 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9946	0.9890	0.9743	0.9293	0.8183	0.6235	0.4450	0.4944	0.7606	0.9476	0.9887	0.9958 (94)
Ext temp.	511.2430	578.0321	631.1731	659.9283	614.8247	460.1485	314.1238	327.8846	468.4771	524.8109	498.6112	486.5611 (95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Month fracti	1250.8921	1212.7018	1100.2774	919.1200	710.0248	476.9696	316.3835	331.7745	515.8139	777.9396	1030.1711	1243.2856 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000 (97a)
Space heating per m2	550.2989	426.4980	349.0136	186.6180	70.8289	0.0000	0.0000	0.0000	0.0000	188.3277	382.7232	563.0030 (98)
												2717.3114 (98)
												35.0169 (99)

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Energy Calculations Ltd
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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000	(201)
Fraction of space heat from main system(s)													1.0000	(202)
Efficiency of main space heating system 1 (in %)													93.5000	(206)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement													2906.2154	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	550.2989	426.4980	349.0136	186.6180	70.8289	0.0000	0.0000	0.0000	0.0000	188.3277	382.7232	563.0030	(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)	588.5550	456.1476	373.2766	199.5915	75.7528	0.0000	0.0000	0.0000	0.0000	201.4200	409.3296	602.1423	(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	201.1283	177.3890	186.5659	167.6161	164.5278	147.3989	141.9294	155.2326	154.7993	173.7900	183.2972	196.4148	(64)	
Efficiency of water heater (217)m	87.3645	87.0706	86.4616	85.1007	82.7441	79.8000	79.8000	79.8000	79.8000	85.0283	86.7339	87.4667	(217)	
Fuel for water heating, kWh/month	230.2173	203.7302	215.7789	196.9621	198.8392	184.7104	177.8563	194.5271	193.9841	204.3907	211.3329	224.5595	(219)	
Water heating fuel used												2436.8888	(219)	
Annual totals kWh/year														
Space heating fuel - main system												2906.2154	(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)													347.1896	(232)
Total delivered energy for all uses													5765.2938	(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	2906.2154	0.2160	627.7425 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2436.8888	0.2160	526.3680 (264)
Space and water heating			1154.1105 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	347.1896	0.5190	180.1914 (268)
Total CO2, kg/m2/year			1373.2269 (272)
Emissions per m2 for space and water heating			14.8726 (272a)
Fuel factor (electricity)			1.5500
Emissions per m2 for lighting			2.3221 (272b)
Emissions per m2 for pumps and fans			0.5016 (272c)
Target Carbon Dioxide Emission Rate (TER) = (14.8726 * 1.55) + 2.3221 + 0.5016, rounded to 2 d.p.			25.8800 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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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	77.6000 (1b)	x 2.4000 (2b)	= 186.2400 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	77.6000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 186.2400 (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					3 * 10 = 30.0000 (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 30.0000 / (5) = 0.1611 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4111 (18)
Number of sides sheltered					2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3494 (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	0.4455	0.4368	0.4280	0.3844	0.3756	0.3319	0.3319	0.3232	0.3494	0.3756	0.3931	0.4106 (22b)
Effective ac	0.5992	0.5954	0.5916	0.5739	0.5705	0.5551	0.5551	0.5522	0.5610	0.5705	0.5773	0.5843 (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)			13.3800	1.3258	17.7386		(27)
Door to Stairs			1.8900	1.4000	2.6460		(26)
Heat Loss Floor 1			77.6000	0.1400	10.8640		(28b)
Main Wall	62.6700	13.3800	49.2900	0.2200	10.8438	60.0000	2957.4000 (29a)
Wall to stairs	9.2600	1.8900	7.3700	0.1864	1.3736	190.0000	1400.3000 (29a)
Wall to Hall	2.8800		2.8800	0.2060	0.5931	14.0000	40.3200 (29a)
Flat roof	8.0000		8.0000	0.1400	1.1200	9.0000	72.0000 (30)
Total net area of external elements Aum(A, m ²)			160.4100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	45.1792		(33)
Party Wall 1			40.3900	0.0000	0.0000	180.0000	7270.2000 (32)
Party Ceilings 1			69.6000			30.0000	2088.0000 (32b)
Internal Wall 1			73.5800			9.0000	662.2200 (32c)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	14490.4400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							186.7325 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.5725 (36)
Total fabric heat loss						(33) + (36) =	52.7517 (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	36.8288	36.5920	36.3598	35.2694	35.0654	34.1157	34.1157	33.9398	34.4815	35.0654	35.4781	35.9096 (38)
Heat transfer coeff	89.5805	89.3436	89.1115	88.0211	87.8171	86.8674	86.8674	86.6915	87.2332	87.8171	88.2298	88.6613 (39)
Average = Sum(39)m / 12 =												88.0201 (39)
HLP	1.1544	1.1513	1.1483	1.1343	1.1317	1.1194	1.1194	1.1172	1.1241	1.1317	1.1370	1.1425 (40)
HLP (average)												1.1343 (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												2.4157 (42)
Average daily hot water use (litres/day)												91.5740 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	100.7313	97.0684	93.4054	89.7425	86.0795	82.4166	82.4166	86.0795	89.7425	93.4054	97.0684	100.7313 (44)
Energy content (annual)	149.3817	130.6502	134.8193	117.5387	112.7812	97.3216	90.1828	103.4860	104.7220	122.0434	133.2199	144.6682 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		1440.8149 (45)

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Calculation Type: New Build (As Designed)

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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	31.7436	27.7632	28.6491	24.9770	23.9660	20.6808	19.1638	21.9908	22.2534	25.9342	28.3092	30.7420 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	120.7873	120.7873	120.7873	120.7873	120.7873	120.7873	120.7873	120.7873	120.7873	120.7873	120.7873	120.7873 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	19.6593	17.4612	14.2004	10.7506	8.0362	6.7845	7.3309	9.5290	12.7898	16.2396	18.9540	20.2057 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	214.3515	216.5758	210.9707	199.0380	183.9750	169.8180	160.3603	158.1360	163.7411	175.6738	190.7368	204.8938 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.0787	35.0787	35.0787	35.0787	35.0787	35.0787	35.0787	35.0787	35.0787	35.0787	35.0787	35.0787 (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)	-96.6298	-96.6298	-96.6298	-96.6298	-96.6298	-96.6298	-96.6298	-96.6298	-96.6298	-96.6298	-96.6298	-96.6298 (71)
Water heating gains (Table 5)	42.6661	41.3142	38.5068	34.6902	32.2124	28.7234	25.7578	29.5575	30.9075	34.8578	39.3184	41.3199 (72)
Total internal gains	335.9132	334.5875	322.9141	303.7150	283.4598	264.5621	252.6852	256.4586	266.6746	286.0074	308.2453	325.6555 (73)

6. Solar gains

[Jan]		Area m2		Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
North		6.2700		10.6334		0.6300		0.7000		0.7700		20.3756 (74)
South		3.9000		46.7521		0.6300		0.7000		0.7700		55.7234 (78)
West		3.2100		19.6403		0.6300		0.7000		0.7700		19.2674 (80)
Solar gains	95.3664	167.8906	244.4884	328.1964	391.0295	398.6013	379.9592	331.4290	273.1827	189.5085	115.2114	80.9809 (83)
Total gains	431.2796	502.4781	567.4025	631.9114	674.4893	663.1634	632.6444	587.8876	539.8573	475.5159	423.4567	406.6364 (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	44.9330	45.0521	45.1695	45.7291	45.8353	46.3364	46.3364	46.4304	46.1421	45.8353	45.6209	45.3989
alpha	3.9955	4.0035	4.0113	4.0486	4.0557	4.0891	4.0891	4.0954	4.0761	4.0557	4.0414	4.0266
util living area	0.9950	0.9903	0.9790	0.9471	0.8707	0.7271	0.5712	0.6267	0.8441	0.9647	0.9911	0.9961 (86)
MIT	19.3875	19.5770	19.8851	20.2915	20.6514	20.8876	20.9682	20.9537	20.7775	20.3094	19.7758	19.3565 (87)
Th 2	19.9567	19.9591	19.9615	19.9729	19.9751	19.9850	19.9850	19.9868	19.9812	19.9751	19.9707	19.9662 (88)
util rest of house	0.9938	0.9878	0.9732	0.9315	0.8309	0.6453	0.4537	0.5098	0.7820	0.9514	0.9883	0.9951 (89)
MIT 2	18.4846	18.6749	18.9817	19.3868	19.7225	19.9243	19.9743	19.9697	19.8429	19.4116	18.8826	18.4610 (90)
Living area fraction									fLA = Living area / (4) =			0.4768 (91)
MIT	18.9151	19.1050	19.4125	19.8182	20.1654	20.3836	20.4482	20.4389	20.2885	19.8397	19.3085	18.8880 (92)
Temperature adjustment												0.0000
adjusted MIT	18.9151	19.1050	19.4125	19.8182	20.1654	20.3836	20.4482	20.4389	20.2885	19.8397	19.3085	18.8880 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9920	0.9851	0.9694	0.9287	0.8392	0.6796	0.5093	0.5645	0.8030	0.9492	0.9859	0.9936 (94)
Useful gains	427.8438	494.9707	550.0297	586.8473	566.0177	450.6745	322.2036	331.8768	433.4997	451.3567	417.4975	404.0513 (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	1309.2304	1269.1280	1150.6492	961.0293	743.4081	502.4087	334.2838	350.1376	539.8431	811.3998	1077.1540	1302.2543 (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	655.7517	520.2337	446.8610	269.4111	131.9785	0.0000	0.0000	0.0000	0.0000	267.8720	474.9527	668.2630 (98)
Space heating												3435.3237 (98)
Space heating per m2										(98) / (4) =		44.2696 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b												
Ext. temp.	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	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	816.5534	642.8187	658.8555	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8261	0.8902	0.8639	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	674.5234	572.2657	569.1733	0.0000	0.0000	0.0000	0.0000 (102)

FULL SAP CALCULATION PRINTOUT

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CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	865.2672	827.7621	777.0134	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	137.3355	190.0894	154.6330	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												482.0579 (104)
Cooled fraction									fC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	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	34.3339	47.5223	38.6583	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												120.5145 (107)
Space cooling per m2												1.5530 (108)
Energy for space heating												44.2696 (99)
Energy for space cooling												1.5530 (108)
Total												45.8227 (109)
Dwelling Fabric Energy Efficiency (DFEE)												45.8 (109)

FULL SAP CALCULATION PRINTOUT

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CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	77.6000 (1b)	x 2.4000 (2b)	= 186.2400 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	77.6000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 186.2400 (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					3 * 10 = 30.0000 (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 30.0000 / (5) = 0.1611 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4111 (18)
Number of sides sheltered					2 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.8500 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3494 (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	0.4455	0.4368	0.4280	0.3844	0.3756	0.3319	0.3319	0.3232	0.3494	0.3756	0.3931	0.4106 (22b)
Effective ac	0.5992	0.5954	0.5916	0.5739	0.5705	0.5551	0.5551	0.5522	0.5610	0.5705	0.5773	0.5843 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			1.8900	1.0000	1.8900		(26)
TER Opening Type (Uw = 1.40)			13.3800	1.3258	17.7386		(27)
Heat Loss Floor 1			77.6000	0.1300	10.0880		(28b)
Main Wall	62.6700	13.3800	49.2900	0.1800	8.8722		(29a)
Wall to stairs	9.2600	1.8900	7.3700	0.1800	1.3266		(29a)
Wall to Hall	2.8800		2.8800	0.1800	0.5184		(29a)
Flat roof	8.0000		8.0000	0.1300	1.0400		(30)
Total net area of external elements Aum(A, m ²)			160.4100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	41.4738		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.6045 (36)
Total fabric heat loss						(33) + (36) =	47.0783 (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	36.8288	36.5920	36.3598	35.2694	35.0654	34.1157	34.1157	33.9398	34.4815	35.0654	35.4781	35.9096 (38)
Heat transfer coeff	83.9071	83.6703	83.4381	82.3478	82.1437	81.1940	81.1940	81.0182	81.5598	82.1437	82.5565	82.9879 (39)
Average = Sum(39)m / 12 =												82.3468 (39)
HLP	1.0813	1.0782	1.0752	1.0612	1.0586	1.0463	1.0463	1.0440	1.0510	1.0586	1.0639	1.0694 (40)
HLP (average)												1.0612 (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												2.4157 (42)
Average daily hot water use (litres/day)												91.5740 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	100.7313	97.0684	93.4054	89.7425	86.0795	82.4166	82.4166	86.0795	89.7425	93.4054	97.0684	100.7313 (44)
Energy content (annual)	149.3817	130.6502	134.8193	117.5387	112.7812	97.3216	90.1828	103.4860	104.7220	122.0434	133.2199	144.6682 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		1440.8149 (45)
Water storage loss:	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)

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Calculation Type: New Build (As Designed)

Energy Calculations Ltd
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If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month	31.7436	27.7632	28.6491	24.9770	23.9660	20.6808	19.1638	21.9908	22.2534	25.9342	28.3092	30.7420 (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	120.7873	120.7873	120.7873	120.7873	120.7873	120.7873	120.7873	120.7873	120.7873	120.7873	120.7873	120.7873	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	19.6593	17.4612	14.2004	10.7506	8.0362	6.7845	7.3309	9.5290	12.7898	16.2396	18.9540	20.2057	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	214.3515	216.5758	210.9707	199.0380	183.9750	169.8180	160.3603	158.1360	163.7411	175.6738	190.7368	204.8938	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.0787	35.0787	35.0787	35.0787	35.0787	35.0787	35.0787	35.0787	35.0787	35.0787	35.0787	35.0787	(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)	-96.6298	-96.6298	-96.6298	-96.6298	-96.6298	-96.6298	-96.6298	-96.6298	-96.6298	-96.6298	-96.6298	-96.6298	(71)
Water heating gains (Table 5)	42.6661	41.3142	38.5068	34.6902	32.2124	28.7234	25.7578	29.5575	30.9075	34.8578	39.3184	41.3199	(72)
Total internal gains	335.9132	334.5875	322.9141	303.7150	283.4598	264.5621	252.6852	256.4586	266.6746	286.0074	308.2453	325.6555	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	6.2700	10.6334	0.6300	0.7000	0.7700	20.3756	(74)
South	3.9000	46.7521	0.6300	0.7000	0.7700	55.7234	(78)
West	3.2100	19.6403	0.6300	0.7000	0.7700	19.2674	(80)

Solar gains	95.3664	167.8906	244.4884	328.1964	391.0295	398.6013	379.9592	331.4290	273.1827	189.5085	115.2114	80.9809	(83)
Total gains	431.2796	502.4781	567.4025	631.9114	674.4893	663.1634	632.6444	587.8876	539.8573	475.5159	423.4567	406.6364	(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	64.2244	64.4062	64.5854	65.4406	65.6032	66.3705	66.3705	66.5146	66.0728	65.6032	65.2752	64.9358	
alpha	5.2816	5.2937	5.3057	5.3627	5.3735	5.4247	5.4247	5.4343	5.4049	5.3735	5.3517	5.3291	
util living area	0.9986	0.9966	0.9904	0.9663	0.8905	0.7265	0.5533	0.6133	0.8609	0.9805	0.9970	0.9990	(86)
MIT	19.8105	19.9622	20.2050	20.5254	20.7990	20.9533	20.9911	20.9851	20.8792	20.5224	20.1081	19.7865	(87)
Th 2	20.0162	20.0187	20.0211	20.0327	20.0348	20.0449	20.0449	20.0468	20.0410	20.0348	20.0304	20.0259	(88)
util rest of house	0.9982	0.9954	0.9869	0.9534	0.8493	0.6400	0.4392	0.4966	0.7949	0.9707	0.9957	0.9987	(89)
MIT 2	18.9276	19.0808	19.3239	19.6460	19.8972	20.0232	20.0426	20.0424	19.9727	19.6491	19.2363	18.9115	(90)
Living area fraction	19.3485	19.5010	19.7440	20.0653	20.3272	20.4667	20.4949	20.4919	20.4049	20.0655	19.6520	19.3287	(91)
MIT	19.3485	19.5010	19.7440	20.0653	20.3272	20.4667	20.4949	20.4919	20.4049	20.0655	19.6520	19.3287	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.3485	19.5010	19.7440	20.0653	20.3272	20.4667	20.4949	20.4919	20.4049	20.0655	19.6520	19.3287	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	430.3030	499.7859	559.2445	602.7834	582.1989	451.0239	312.5198	324.9230	444.1075	461.7667	421.3665	405.9597	(94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(95)
Heat loss rate W	1262.6800	1221.6731	1105.0574	919.4402	708.6727	476.3376	316.2400	331.5164	514.2298	777.5298	1036.2495	1255.4996	(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	619.2885	485.1082	406.0848	227.9929	94.0965	0.0000	0.0000	0.0000	0.0000	234.9278	442.7158	632.0577	(98)
Space heating												3142.2722	(98)
Space heating per m2												40.4932	(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	763.2240	600.8359	615.7381	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8921	0.9447	0.9245	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	680.8923	567.6314	569.2288	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	865.2672	827.7621	777.0134	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	132.7499	193.5373	154.5918	0.0000	0.0000	0.0000	0.0000	(104)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling												480.8789 (104)
Cooled fraction												1.0000 (105)
Intermittency factor (Table 10b)												
	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	33.1875	48.3843	38.6479	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												120.2197 (107)
Space cooling per m2												1.5492 (108)
Energy for space heating												40.4932 (99)
Energy for space cooling												1.5492 (108)
Total												42.0424 (109)
Target Fabric Energy Efficiency (TFEE)												48.3 (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 (m ²)	Storey height (m)	Volume (m ³)
Ground floor	77.6000 (1b)	x 2.4000 (2b)	= 186.2400 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	77.6000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 186.2400 (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) = 0.1074 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3574 (18)
Number of sides sheltered					2 (19)
Shelter factor					(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor					(21) = (18) x (20) = 0.3038 (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	0.3342	0.3114	0.3114	0.2962	0.2962	0.2582	0.2582	0.2506	0.2582	0.2886	0.2810	0.3038 (22b)
Effective ac	0.5558	0.5485	0.5485	0.5439	0.5439	0.5333	0.5333	0.5314	0.5333	0.5416	0.5395	0.5461 (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)			13.3800	1.3258	17.7386		(27)
Door to Stairs			1.8900	1.4000	2.6460		(26)
Heat Loss Floor 1			77.6000	0.1400	10.8640		(28b)
Main Wall	62.6700	13.3800	49.2900	0.2200	10.8438	60.0000	2957.4000 (29a)
Wall to stairs	9.2600	1.8900	7.3700	0.1864	1.3736	190.0000	1400.3000 (29a)
Wall to Hall	2.8800		2.8800	0.2060	0.5931	14.0000	40.3200 (29a)
Flat roof	8.0000		8.0000	0.1400	1.1200	9.0000	72.0000 (30)
Total net area of external elements Aum(A, m ²)			160.4100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	45.1792		(33)
Party Wall 1			40.3900	0.0000	0.0000	180.0000	7270.2000 (32)
Party Ceilings 1			69.6000			40.0000	2784.0000 (32b)
Internal Wall 1			73.5800			9.0000	662.2200 (32c)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 15186.4400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							195.7015 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.5725 (36)
Total fabric heat loss							(33) + (36) = 52.7517 (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	34.1609	33.7090	33.7090	33.4254	33.4254	32.7785	32.7785	32.6597	32.7785	33.2889	33.1560	33.5654 (38)
Heat transfer coeff	86.9126	86.4606	86.4606	86.1771	86.1771	85.5302	85.5302	85.4114	85.5302	86.0406	85.9077	86.3171 (39)
Average = Sum(39)m / 12 =												86.0379 (39)
HLP	1.1200	1.1142	1.1142	1.1105	1.1105	1.1022	1.1022	1.1007	1.1022	1.1088	1.1071	1.1123 (40)
HLP (average)												1.1087 (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												2.4157 (42)
Average daily hot water use (litres/day)												91.5740 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	100.7313	97.0684	93.4054	89.7425	86.0795	82.4166	82.4166	86.0795	89.7425	93.4054	97.0684	100.7313 (44)
Energy conte	149.3817	130.6502	134.8193	117.5387	112.7812	97.3216	90.1828	103.4860	104.7220	122.0434	133.2199	144.6682 (45)
Energy content (annual)										Total = Sum(45)m =		1440.8149 (45)
Distribution loss (46)m = 0.15 x (45)m												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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CALCULATION OF HEAT DEMAND 09 Jan 2014

22.4073	19.5975	20.2229	17.6308	16.9172	14.5982	13.5274	15.5229	15.7083	18.3065	19.9830	21.7002 (46)
Water storage loss:											210.0000 (47)
Store volume											1.8600 (48)
a) If manufacturer declared loss factor is known (kWh/day):											0.5400 (49)
Temperature factor from Table 2b											1.0044 (55)
Enter (49) or (54) in (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											
203.7805	179.7846	189.2181	170.1827	167.1800	149.9656	144.5816	157.8848	157.3660	176.4422	185.8639	199.0670 (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											
203.7805	179.7846	189.2181	170.1827	167.1800	149.9656	144.5816	157.8848	157.3660	176.4422	185.8639	199.0670 (64)
Total per year (kWh/year) = Sum(64)m =											2081.3169 (64)
RHI water heating demand											2081 (64)
Heat gains from water heating, kWh/month											
93.1884	82.7487	88.3464	81.1968	81.0188	74.4746	73.5048	77.9281	76.9353	84.0985	86.4108	91.6212 (65)

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

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	144.9447	144.9447	144.9447	144.9447	144.9447	144.9447	144.9447	144.9447	144.9447	144.9447	144.9447	144.9447 (66)
Lighting gains	(calculated in Appendix L, equation L9 or L9a), also see Table 5											
	49.1483	43.6531	35.5011	26.8766	20.0906	16.9613	18.3273	23.8225	31.9745	40.5990	47.3850	50.5143 (67)
Appliances gains	(calculated in Appendix L, equation L13 or L13a), also see Table 5											
	319.9277	323.2475	314.8816	297.0716	274.5896	253.4597	239.3437	236.0238	244.3897	262.1998	284.6817	305.8116 (68)
Cooking gains	(calculated in Appendix L, equation L15 or L15a), also see Table 5											
	51.9102	51.9102	51.9102	51.9102	51.9102	51.9102	51.9102	51.9102	51.9102	51.9102	51.9102	51.9102 (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)											
	-96.6298	-96.6298	-96.6298	-96.6298	-96.6298	-96.6298	-96.6298	-96.6298	-96.6298	-96.6298	-96.6298	-96.6298 (71)
Water heating gains	(Table 5)											
	125.2533	123.1379	118.7452	112.7734	108.8962	103.4370	98.7968	104.7421	106.8545	113.0356	120.0150	123.1468 (72)
Total internal gains												
	594.5544	590.2637	569.3530	536.9466	503.8015	474.0831	456.6929	464.8136	483.4439	516.0594	552.3069	579.6978 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
North				6.2700	12.7500	0.6300	0.7000	0.7700	24.4314 (74)			
South				3.9000	54.0600	0.6300	0.7000	0.7700	64.4336 (78)			
West				3.2100	23.7835	0.6300	0.7000	0.7700	23.3320 (80)			
Solar gains	112.1971	173.0124	251.4845	345.2127	402.6747	434.9295	410.2163	363.4850	300.4104	209.9736	133.6007	95.7801 (83)
Total gains	706.7514	763.2761	820.8375	882.1594	906.4762	909.0127	866.9092	828.2985	783.8543	726.0330	685.9076	675.4779 (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	48.5368	48.7905	48.7905	48.9510	48.9510	49.3213	49.3213	49.3898	49.3213	49.0287	49.1045	48.8716
alpha	4.2358	4.2527	4.2527	4.2634	4.2634	4.2881	4.2881	4.2927	4.2881	4.2686	4.2736	4.2581
util living area												
	0.9718	0.9586	0.9245	0.8478	0.7040	0.4940	0.3334	0.3679	0.6296	0.8585	0.9504	0.9756 (86)
Tweekday												
	18.8746	19.0408	19.3246	19.6232	19.8226	19.8983	19.9060	19.9070	19.8777	19.6645	19.2458	18.8495
Tweekend												
	20.4506	20.5243	20.6549	20.7975	20.9038	20.9500	20.9579	20.9572	20.9329	20.8141	20.6143	20.4369
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												
	20.1521	20.2642	20.4674	20.6838	20.8516	20.9232	20.9350	20.9340	20.8952	20.7131	20.3977	20.1310 (87)
Th 2												
	19.9845	19.9893	19.9893	19.9922	19.9922	19.9990	19.9990	20.0003	19.9990	19.9937	19.9951	19.9908 (88)
util rest of house												
	0.9650	0.9487	0.9062	0.8122	0.6411	0.4083	0.2363	0.2674	0.5446	0.8175	0.9367	0.9697 (89)
Tweekday												
	18.8746	19.0408	19.3246	19.6232	19.8226	19.8983	19.9060	19.9070	19.8777	19.6645	19.2458	18.8495
Tweekend												
	18.8746	19.0408	19.3246	19.6232	19.8226	19.8983	19.9060	19.9070	19.8777	19.6645	19.2458	18.8495
MIT 2												
	18.8746	19.0408	19.3246	19.6232	19.8226	19.8983	19.9060	19.9070	19.8777	19.6645	19.2458	18.8495 (90)
Living area fraction												
	19.4837	19.6241	19.8695	20.1289	20.3132	20.3870	20.3967	20.3967	20.3628	20.1645	19.7950	19.4605 (91)
MIT												
	19.4837	19.6241	19.8695	20.1289	20.3132	20.3870	20.3967	20.3967	20.3628	20.1645	19.7950	19.4605 (92)
Temperature adjustment												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (93)
adjusted MIT												
	19.4837	19.6241	19.8695	20.1289	20.3132	20.3870	20.3967	20.3967	20.3628	20.1645	19.7950	19.4605 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9609	0.9445	0.9038	0.8175	0.6622	0.4422	0.2751	0.3076	0.5768	0.8252	0.9335	0.9658 (94)
Useful gains	679.1182	720.8973	741.8583	721.1384	600.2239	401.9624	238.5045	254.8036	452.1164	599.1485	640.2995	652.3874 (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												

FULL SAP CALCULATION PRINTOUT

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CALCULATION OF HEAT DEMAND 09 Jan 2014

Month fracti	1267.5066	1221.1815	1086.7630	898.7318	656.0867	409.4324	239.1980	255.9494	475.7876	754.1006	1030.4644	1256.8226 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating	437.7610	336.1910	256.6091	127.8673	41.5620	0.0000	0.0000	0.0000	0.0000	115.2843	280.9187	449.6998 (98)
RHI space heating demand												2045.8931 (98)
												2046 (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	77.6000 (1b)	x 2.4000 (2b)	= 186.2400 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	77.6000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 186.2400 (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) = 0.1074 (8)
Measured/design AP50					Yes
Infiltration rate					5.0000
Number of sides sheltered					0.3574 (18)
					2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3038 (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	0.3873	0.3797	0.3721	0.3342	0.3266	0.2886	0.2886	0.2810	0.3038	0.3266	0.3418	0.3569 (22b)
Effective ac	0.5750	0.5721	0.5692	0.5558	0.5533	0.5416	0.5416	0.5395	0.5461	0.5533	0.5584	0.5637 (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)			13.3800	1.3258	17.7386		(27)
Door to Stairs			1.8900	1.4000	2.6460		(26)
Heat Loss Floor 1			77.6000	0.1400	10.8640		(28b)
Main Wall	62.6700	13.3800	49.2900	0.2200	10.8438	60.0000	2957.4000 (29a)
Wall to stairs	9.2600	1.8900	7.3700	0.1864	1.3736	190.0000	1400.3000 (29a)
Wall to Hall	2.8800		2.8800	0.2060	0.5931	14.0000	40.3200 (29a)
Flat roof	8.0000		8.0000	0.1400	1.1200	9.0000	72.0000 (30)
Total net area of external elements Aum(A, m ²)			160.4100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	45.1792		(33)
Party Wall 1			40.3900	0.0000	0.0000	180.0000	7270.2000 (32)
Party Ceilings 1			69.6000			40.0000	2784.0000 (32b)
Internal Wall 1			73.5800			9.0000	662.2200 (32c)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 15186.4400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							195.7015 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.5725 (36)
Total fabric heat loss						(33) + (36) =	52.7517 (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	35.3395	35.1605	34.9851	34.1609	34.0067	33.2889	33.2889	33.1560	33.5654	34.0067	34.3187	34.6448 (38)
Heat transfer coeff	88.0912	87.9122	87.7368	86.9126	86.7584	86.0406	86.0406	85.9077	86.3171	86.7584	87.0703	87.3965 (39)
Average = Sum(39)m / 12 =												86.9119 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1352	1.1329	1.1306	1.1200	1.1180	1.1088	1.1088	1.1071	1.1123	1.1180	1.1220	1.1262 (40)
HLP (average)												1.1200 (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												2.4157 (42)
Average daily hot water use (litres/day)												91.5740 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	100.7313	97.0684	93.4054	89.7425	86.0795	82.4166	82.4166	86.0795	89.7425	93.4054	97.0684	100.7313 (44)
Energy content (annual)	149.3817	130.6502	134.8193	117.5387	112.7812	97.3216	90.1828	103.4860	104.7220	122.0434	133.2199	144.6682 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		1440.8149 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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CALCULATION OF ENERGY RATINGS 09 Jan 2014

	22.4073	19.5975	20.2229	17.6308	16.9172	14.5982	13.5274	15.5229	15.7083	18.3065	19.9830	21.7002 (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												
203.7805	179.7846	189.2181	170.1827	167.1800	149.9656	144.5816	157.8848	157.3660	176.4422	185.8639	199.0670	(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												
203.7805	179.7846	189.2181	170.1827	167.1800	149.9656	144.5816	157.8848	157.3660	176.4422	185.8639	199.0670	(64)
Heat gains from water heating, kWh/month												
93.1884	82.7487	88.3464	81.1968	81.0188	74.4746	73.5048	77.9281	76.9353	84.0985	86.4108	91.6212	(65)

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

Metabolic gains (Table 5), Watts												
(66)m	144.9447	144.9447	144.9447	144.9447	144.9447	144.9447	144.9447	144.9447	144.9447	144.9447	144.9447	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
49.1483	43.6531	35.5011	26.8766	20.0906	16.9613	18.3273	23.8225	31.9745	40.5990	47.3850	50.5143	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
319.9277	323.2475	314.8816	297.0716	274.5896	253.4597	239.3437	236.0238	244.3897	262.1998	284.6817	305.8116	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
51.9102	51.9102	51.9102	51.9102	51.9102	51.9102	51.9102	51.9102	51.9102	51.9102	51.9102	51.9102	(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)												
-96.6298	-96.6298	-96.6298	-96.6298	-96.6298	-96.6298	-96.6298	-96.6298	-96.6298	-96.6298	-96.6298	-96.6298	(71)
Water heating gains (Table 5)												
125.2533	123.1379	118.7452	112.7734	108.8962	103.4370	98.7968	104.7421	106.8545	113.0356	120.0150	123.1468	(72)
Total internal gains												
594.5544	590.2637	569.3530	536.9466	503.8015	474.0831	456.6929	464.8136	483.4439	516.0594	552.3069	579.6978	(73)

6. Solar gains

[Jan]														
	Area m2				Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W	
North	6.2700				10.6334		0.6300		0.7000		0.7700		20.3756 (74)	
South	3.9000				46.7521		0.6300		0.7000		0.7700		55.7234 (78)	
West	3.2100				19.6403		0.6300		0.7000		0.7700		19.2674 (80)	
Solar gains	95.3664	167.8906	244.4884	328.1964	391.0295	398.6013	379.9592	331.4290	273.1827	189.5085	115.2114	80.9809 (83)		
Total gains	689.9208	758.1542	813.8414	865.1431	894.8310	872.6844	836.6521	796.2425	756.6266	705.5679	667.5183	660.6786 (84)		

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	47.8873	47.9849	48.0808	48.5368	48.6230	49.0287	49.0287	49.1045	48.8716	48.6230	48.4488	48.2680
alpha	4.1925	4.1990	4.2054	4.2358	4.2415	4.2686	4.2686	4.2736	4.2581	4.2415	4.2299	4.2179
util living area	0.9774	0.9649	0.9390	0.8788	0.7652	0.5952	0.4440	0.4835	0.7027	0.8940	0.9621	0.9808 (86)
Tweekday	18.7343	18.9131	19.1884	19.5223	19.7604	19.8761	19.8973	19.8969	19.8409	19.5599	19.1036	18.7009
Tweekend	20.3919	20.4720	20.5970	20.7509	20.8716	20.9367	20.9539	20.9517	20.9132	20.7650	20.5537	20.3743
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	20.0615	20.1833	20.3780	20.6111	20.8018	20.9027	20.9288	20.9255	20.8645	20.6373	20.3031	20.0344 (87)
Th 2	19.9722	19.9741	19.9759	19.9845	19.9861	19.9937	19.9937	19.9951	19.9908	19.9861	19.9829	19.9795 (88)
util rest of house	0.9719	0.9566	0.9244	0.8498	0.7119	0.5143	0.3465	0.3837	0.6257	0.8624	0.9517	0.9761 (89)
Tweekday	18.7343	18.9131	19.1884	19.5223	19.7604	19.8761	19.8973	19.8969	19.8409	19.5599	19.1036	18.7009
Tweekend	18.7343	18.9131	19.1884	19.5223	19.7604	19.8761	19.8973	19.8969	19.8409	19.5599	19.1036	18.7009
MIT 2	18.7343	18.9131	19.1884	19.5223	19.7604	19.8761	19.8973	19.8969	19.8409	19.5599	19.1036	18.7009 (90)
Living area fraction									fLA = Living area / (4) =			0.4768 (91)
MIT	19.3671	19.5187	19.7556	20.0414	20.2569	20.3656	20.3892	20.3873	20.3290	20.0736	19.6755	19.3367 (92)
Temperature adjustment												0.0000
adjusted MIT	19.3671	19.5187	19.7556	20.0414	20.2569	20.3656	20.3892	20.3873	20.3290	20.0736	19.6755	19.3367 (93)

8. Space heating requirement

Utilisation	0.9680	0.9522	0.9207	0.8516	0.7271	0.5453	0.3854	0.4235	0.6531	0.8655	0.9480	0.9725 (94)
Useful gains	667.8587	721.9232	749.3353	736.7871	650.6424	475.8377	322.4338	337.1724	494.1155	610.6391	632.7875	642.5073 (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	1327.2811	1285.1638	1163.0050	968.3299	742.3872	496.0771	326.0207	342.5426	537.6685	821.9160	1094.9568	1322.8942 (97)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Energy Calculations Ltd
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CALCULATION OF ENERGY RATINGS 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	490.6103	378.4977	307.7703	166.7108	68.2582	0.0000	0.0000	0.0000	0.0000	157.1900	332.7619	506.2079 (98)
Space heating												2408.0069 (98)
Space heating per m2											(98) / (4) =	31.0310 (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 %)												291.2454 (206)
Efficiency of secondary/supplementary heating system, %												100.0000 (208)
Space heating requirement												826.7966 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	490.6103	378.4977	307.7703	166.7108	68.2582	0.0000	0.0000	0.0000	0.0000	157.1900	332.7619	506.2079 (98)
Space heating efficiency (main heating system 1)	291.2454	291.2454	291.2454	291.2454	291.2454	0.0000	0.0000	0.0000	0.0000	291.2454	291.2454	291.2454 (210)
Space heating fuel (main heating system)	168.4525	129.9583	105.6739	57.2407	23.4367	0.0000	0.0000	0.0000	0.0000	53.9717	114.2548	173.8080 (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	203.7805	179.7846	189.2181	170.1827	167.1800	149.9656	144.5816	157.8848	157.3660	176.4422	185.8639	199.0670 (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	120.2670	106.1052	111.6726	100.4383	98.6662	88.5066	85.3291	93.1804	92.8742	104.1325	109.6930	117.4852 (219)
Water heating fuel used												1228.3504 (219)
Annual totals kWh/year												
Space heating fuel - main system												826.7966 (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)												347.1896 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
Total delivered energy for all uses												2402.3365 (238)

10a. Fuel costs - using Table 12 prices

	Fuel	Fuel price	Fuel cost
	kWh/year	p/kWh	£/year
Space heating - main system 1	826.7966	13.1900	109.0545 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1228.3504	13.1900	162.0194 (247)
Pumps and fans for heating	0.0000	0.0000	0.0000 (249)
Energy for lighting	347.1896	13.1900	45.7943 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit	0.0000	13.1900	0.0000 (252)
Total energy cost			316.8682 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):			0.4200 (256)
Energy cost factor (ECF)		[(255) x (256)] / [(4) + 45.0] =	1.0855 (257)
SAP value			84.8570
SAP rating (Section 12)			85 (258)
SAP band			B

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

	Energy	Emission factor	Emissions
	kWh/year	kg CO2/kWh	kg CO2/year
Space heating - main system 1	826.7966	0.5190	429.1074 (261)
Space heating - secondary	0.0000	0.5190	0.0000 (263)
Water heating (other fuel)	1228.3504	0.5190	637.5138 (264)
Space and water heating			1066.6213 (265)
Pumps and fans	0.0000	0.0000	0.0000 (267)
Energy for lighting	347.1896	0.5190	180.1914 (268)
Energy saving/generation technologies			
PV Unit	-300.0000	0.5190	-155.7000 (269)
Total kg/year			1091.1127 (272)
CO2 emissions per m2			14.0600 (273)
EI value			88.0743
EI rating			88 (274)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Energy Calculations Ltd
SAP ♦ CODE ♦ SBEM ♦ DESIGN

CALCULATION OF ENERGY RATINGS 09 Jan 2014

EI band

B

Calculation of stars for heating and DHW

Main heating energy efficiency	$13.19 \times (1 + 0.29 \times 0.25) / 2.9125 = 4.857$, stars = 4
Main heating environmental impact	$0.519 \times (1 + 0.29 \times 0.25) / 2.9125 = 0.1911$, 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

FULL SAP CALCULATION PRINTOUT

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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	77.6000 (1b)	x 2.4000 (2b)	= 186.2400 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	77.6000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 186.2400 (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) = 0.1074 (8)
Measured/design AP50					Yes
Infiltration rate					5.0000
Number of sides sheltered					0.3574 (18)
					2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3038 (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	0.3342	0.3114	0.3114	0.2962	0.2962	0.2582	0.2582	0.2506	0.2582	0.2886	0.2810	0.3038 (22b)
Effective ac	0.5558	0.5485	0.5485	0.5439	0.5439	0.5333	0.5333	0.5314	0.5333	0.5416	0.5395	0.5461 (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)			13.3800	1.3258	17.7386		(27)
Door to Stairs			1.8900	1.4000	2.6460		(26)
Heat Loss Floor 1			77.6000	0.1400	10.8640		(28b)
Main Wall	62.6700	13.3800	49.2900	0.2200	10.8438	60.0000	2957.4000 (29a)
Wall to stairs	9.2600	1.8900	7.3700	0.1864	1.3736	190.0000	1400.3000 (29a)
Wall to Hall	2.8800		2.8800	0.2060	0.5931	14.0000	40.3200 (29a)
Flat roof	8.0000		8.0000	0.1400	1.1200	9.0000	72.0000 (30)
Total net area of external elements Aum(A, m ²)			160.4100				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		45.1792		(33)
Party Wall 1			40.3900	0.0000	0.0000	180.0000	7270.2000 (32)
Party Ceilings 1			69.6000			40.0000	2784.0000 (32b)
Internal Wall 1			73.5800			9.0000	662.2200 (32c)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 15186.4400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							195.7015 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.5725 (36)
Total fabric heat loss						(33) + (36) =	52.7517 (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	34.1609	33.7090	33.7090	33.4254	33.4254	32.7785	32.7785	32.6597	32.7785	33.2889	33.1560	33.5654 (38)
Heat transfer coeff	86.9126	86.4606	86.4606	86.1771	86.1771	85.5302	85.5302	85.4114	85.5302	86.0406	85.9077	86.3171 (39)
Average = Sum(39)m / 12 =												86.0379 (39)
HLP	1.1200	1.1142	1.1142	1.1105	1.1105	1.1022	1.1022	1.1007	1.1022	1.1088	1.1071	1.1123 (40)
HLP (average)												1.1087 (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												2.4157 (42)
Average daily hot water use (litres/day)												91.5740 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	100.7313	97.0684	93.4054	89.7425	86.0795	82.4166	82.4166	86.0795	89.7425	93.4054	97.0684	100.7313 (44)
Energy content (annual)	149.3817	130.6502	134.8193	117.5387	112.7812	97.3216	90.1828	103.4860	104.7220	122.0434	133.2199	144.6682 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		1440.8149 (45)

FULL SAP CALCULATION PRINTOUT

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

	22.4073	19.5975	20.2229	17.6308	16.9172	14.5982	13.5274	15.5229	15.7083	18.3065	19.9830	21.7002 (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												
203.7805	179.7846	189.2181	170.1827	167.1800	149.9656	144.5816	157.8848	157.3660	176.4422	185.8639	199.0670	(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												
203.7805	179.7846	189.2181	170.1827	167.1800	149.9656	144.5816	157.8848	157.3660	176.4422	185.8639	199.0670	(64)
Heat gains from water heating, kWh/month												
93.1884	82.7487	88.3464	81.1968	81.0188	74.4746	73.5048	77.9281	76.9353	84.0985	86.4108	91.6212	(65)

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

Metabolic gains (Table 5), Watts												
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	144.9447	144.9447	144.9447	144.9447	144.9447	144.9447	144.9447	144.9447	144.9447	144.9447	144.9447	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
49.1483	43.6531	35.5011	26.8766	20.0906	16.9613	18.3273	23.8225	31.9745	40.5990	47.3850	50.5143	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
319.9277	323.2475	314.8816	297.0716	274.5896	253.4597	239.3437	236.0238	244.3897	262.1998	284.6817	305.8116	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
51.9102	51.9102	51.9102	51.9102	51.9102	51.9102	51.9102	51.9102	51.9102	51.9102	51.9102	51.9102	(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)												
-96.6298	-96.6298	-96.6298	-96.6298	-96.6298	-96.6298	-96.6298	-96.6298	-96.6298	-96.6298	-96.6298	-96.6298	(71)
Water heating gains (Table 5)												
125.2533	123.1379	118.7452	112.7734	108.8962	103.4370	98.7968	104.7421	106.8545	113.0356	120.0150	123.1468	(72)
Total internal gains												
594.5544	590.2637	569.3530	536.9466	503.8015	474.0831	456.6929	464.8136	483.4439	516.0594	552.3069	579.6978	(73)

6. Solar gains

[Jan]												
	Area			Solar flux		g		FF		Access		Gains
	m2			Table 6a		Specific data		Specific data		factor		W
				W/m2		or Table 6b		or Table 6c		Table 6d		
North	6.2700			12.7500		0.6300		0.7000		0.7700		24.4314 (74)
South	3.9000			54.0600		0.6300		0.7000		0.7700		64.4336 (78)
West	3.2100			23.7835		0.6300		0.7000		0.7700		23.3320 (80)
Solar gains	112.1971	173.0124	251.4845	345.2127	402.6747	434.9295	410.2163	363.4850	300.4104	209.9736	133.6007	95.7801 (83)
Total gains	706.7514	763.2761	820.8375	882.1594	906.4762	909.0127	866.9092	828.2985	783.8543	726.0330	685.9076	675.4779 (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	48.5368	48.7905	48.7905	48.9510	48.9510	49.3213	49.3213	49.3898	49.3213	49.0287	49.1045	48.8716
alpha	4.2358	4.2527	4.2527	4.2634	4.2634	4.2881	4.2881	4.2927	4.2881	4.2686	4.2736	4.2581
util living area												
0.9718	0.9586	0.9245	0.8478	0.7040	0.4940	0.3334	0.3679	0.6296	0.8585	0.9504	0.9756	(86)
Tweekday	18.8746	19.0408	19.3246	19.6232	19.8226	19.8983	19.9060	19.9070	19.8777	19.6645	19.2458	18.8495
Tweekend	20.4506	20.5243	20.6549	20.7975	20.9038	20.9500	20.9579	20.9572	20.9329	20.8141	20.6143	20.4369
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	20.1521	20.2642	20.4674	20.6838	20.8516	20.9232	20.9350	20.9340	20.8952	20.7131	20.3977	20.1310 (87)
Th 2	19.9845	19.9893	19.9893	19.9922	19.9922	19.9990	19.9990	20.0003	19.9990	19.9937	19.9951	19.9908 (88)
util rest of house												
0.9650	0.9487	0.9062	0.8122	0.6411	0.4083	0.2363	0.2674	0.5446	0.8175	0.9367	0.9697	(89)
Tweekday	18.8746	19.0408	19.3246	19.6232	19.8226	19.8983	19.9060	19.9070	19.8777	19.6645	19.2458	18.8495
Tweekend	18.8746	19.0408	19.3246	19.6232	19.8226	19.8983	19.9060	19.9070	19.8777	19.6645	19.2458	18.8495
MIT 2	18.8746	19.0408	19.3246	19.6232	19.8226	19.8983	19.9060	19.9070	19.8777	19.6645	19.2458	18.8495 (90)
Living area fraction												
fLA = Living area / (4) =												0.4768 (91)
MIT	19.4837	19.6241	19.8695	20.1289	20.3132	20.3870	20.3967	20.3967	20.3628	20.1645	19.7950	19.4605 (92)
Temperature adjustment												0.0000
adjusted MIT	19.4837	19.6241	19.8695	20.1289	20.3132	20.3870	20.3967	20.3967	20.3628	20.1645	19.7950	19.4605 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9609	0.9445	0.9038	0.8175	0.6622	0.4422	0.2751	0.3076	0.5768	0.8252	0.9335	0.9658 (94)
Useful gains	679.1182	720.8973	741.8583	721.1384	600.2239	401.9624	238.5045	254.8036	452.1164	599.1485	640.2995	652.3874 (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												
1267.5066	1221.1815	1086.7630	898.7318	656.0867	409.4324	239.1980	255.9494	475.7876	754.1006	1030.4644	1256.8226	(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	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	437.7610	336.1910	256.6091	127.8673	41.5620	0.0000	0.0000	0.0000	0.0000	115.2843	280.9187	449.6998 (98)
Space heating												2045.8931 (98)
Space heating per m2										(98) / (4) =		26.3646 (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 %)												289.0513 (206)
Efficiency of secondary/supplementary heating system, %												100.0000 (208)
Space heating requirement												707.7959 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	437.7610	336.1910	256.6091	127.8673	41.5620	0.0000	0.0000	0.0000	0.0000	115.2843	280.9187	449.6998 (98)
Space heating efficiency (main heating system 1)	289.0513	289.0513	289.0513	289.0513	289.0513	0.0000	0.0000	0.0000	0.0000	289.0513	289.0513	289.0513 (210)
Space heating fuel (main heating system)	151.4475	116.3084	88.7763	44.2369	14.3788	0.0000	0.0000	0.0000	0.0000	39.8837	97.1865	155.5779 (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	203.7805	179.7846	189.2181	170.1827	167.1800	149.9656	144.5816	157.8848	157.3660	176.4422	185.8639	199.0670 (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	120.2670	106.1052	111.6726	100.4383	98.6662	88.5066	85.3291	93.1804	92.8742	104.1325	109.6930	117.4852 (219)
Water heating fuel used												1228.3504 (219)
Annual totals kWh/year												
Space heating fuel - main system												707.7959 (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)												347.1896 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
Total delivered energy for all uses												2283.3359 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	707.7959	19.1200	135.3306 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1228.3504	19.1200	234.8606 (247)
Pumps and fans for heating	0.0000	0.0000	0.0000 (249)
Energy for lighting	347.1896	19.1200	66.3826 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit	0.0000	19.1200	0.0000 (252)
Total energy cost			436.5738 (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	707.7959	0.5190	367.3461 (261)
Space heating - secondary	0.0000	0.5190	0.0000 (263)
Water heating (other fuel)	1228.3504	0.5190	637.5138 (264)
Space and water heating			1004.8599 (265)
Pumps and fans	0.0000	0.0000	0.0000 (267)
Energy for lighting	347.1896	0.5190	180.1914 (268)
Energy saving/generation technologies			
PV Unit	-300.0000	0.5190	-155.7000 (269)
Total kg/year			1029.3513 (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	707.7959	3.0700	2172.9336 (261)
Space heating - secondary	0.0000	3.0700	0.0000 (263)
Water heating (other fuel)	1228.3504	3.0700	3771.0356 (264)
Space and water heating			5943.9692 (265)
Pumps and fans	0.0000	0.0000	0.0000 (267)
Energy for lighting	347.1896	3.0700	1065.8720 (268)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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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			6088.8412 (272)
Primary energy kWh/m ² /year			78.4644 (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/m ²

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	£437	£437	£0
Space heating	£135	£135	£0
Water heating	£235	£235	£0
Lighting	£66	£66	£0
Total cost of fuels	£437	£437	£0
Total cost of uses	£436	£436	£0
Delivered energy	29 kWh/m ²	29 kWh/m ²	0 kWh/m ²
Carbon dioxide emissions	1.0 tonnes	1.0 tonnes	0.0 tonnes
CO2 emissions per m ²	13 kg/m ²	13 kg/m ²	0 kg/m ²
Primary energy	78 kWh/m ²	78 kWh/m ²	0 kWh/m ²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Energy Calculations Ltd
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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	195.7 (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	368.76 (P1)
Transmission heat loss coefficient	52.75 (37)
Summer heat loss coefficient	421.51 (P2)

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

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

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	6.2700	81.1852	0.6300	0.7000	0.9000	181.8310
South	3.9000	112.2060	0.6300	0.7000	0.9000	156.3163
West	3.2100	117.5071	0.6300	0.7000	0.9000	134.7388
total:						472.8861

	Jun	Jul	Aug	
Solar gains	502	473	421	(P3)
Internal gains	474	457	465	
Total summer gains	976	930	885	(P5)

	2.32	2.21	2.10	
Summer gain/loss ratio	2.32	2.21	2.10	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 195.7)	0.63	0.63	0.63	
Threshold temperature	18.95	20.74	20.53	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	

Assessment of likelihood of high internal temperature: Slight

BASIC COMPLIANCE REPORT

Energy Calculations Ltd
SAP • CODE • SBEM • DESIGN

Calculation Type: New Build (As Designed)

Property Reference	015726	Issued on Date	16/08/2021
Assessment Reference	004	Prop Type Ref	
Property	Flat 5, 18, Parkside Road, READING, RG30 2DB		
SAP Rating	85 B	DER	15.49
Environmental	88 B	TER	25.88
CO ₂ Emissions (t/year)	1.03	% DER<TER	40.14
General Requirements Compliance	Pass	DFEE	45.82
		TFEE	48.35
		% DFEE<TFEE	5.22
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)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Electricity		
Fuel factor	1.55 (electricity)		
Target Carbon Dioxide Emission Rate (TER)	25.88	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	15.49	kgCO ₂ /m ²	Pass
	-10.39 (-40.1%)	kgCO ₂ /m ²	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	48.35	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DFEE)	45.82	kWh/m ² /yr	
	-2.5 (-5.2%)	kWh/m ² /yr	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.22 (max. 0.30)	0.22 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.14 (max. 0.25)	0.14 (max. 0.70)	Pass
Roof	0.14 (max. 0.20)	0.14 (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	

BASIC COMPLIANCE REPORT

Energy Calculations Ltd
SAP • CODE • SBEM • DESIGN

Calculation Type: New Build (As Designed)

5 Cylinder insulation

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)

Slight

Pass

Based on:

Overshading

Average

Windows facing North

6.27 m², No overhang

Windows facing South

3.90 m², No overhang

Windows facing West

3.21 m², 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/m²K

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/m²K

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	015726	Issued on Date	16/08/2021
Assessment Reference	004	Prop Type Ref	
Property	Flat 5, 18, Parkside Road, READING, RG30 2DB		
SAP Rating	85 B	DER	15.49
Environmental	88 B	TER	25.88
CO ₂ Emissions (t/year)	1.03	% DER<TER	40.14
General Requirements Compliance	Pass	DFEE	45.82
		TFEE	48.35
		% DFEE<TFEE	5.22
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	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements			
	Ground Floor:	Heat Loss Perimeter 31.17 m	Internal Floor Area 77.60 m ²
			Average Storey Height 2.40 m

7.0 Living Area	37.00	m ²
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8.0 Thermal Mass Parameter	Precise calculation	
Thermal Mass	195.7	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	62.67	49.29
Wall to stairs	Cavity Wall	Cavity wall : dense plaster, dense block, filled cavity, any outside structure	0.22	190.00	9.26	7.37
Wall to Hall	Steel Frame	Steel frame wall (warm frame or hybrid construction)	0.22	14.00	2.88	2.88

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	40.39

9.2 Internal Walls					
Description	Construction		Kappa (kJ/m ² K)	Area (m ²)	
Internal Wall 1	Plasterboard on timber frame		9.00	73.58	

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	8.00	8.00

SUMMARY FOR INPUT DATA

Energy Calculations Ltd
SAP • CODE • SBEM • DESIGN

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	69.60

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Area (m²)
Heat Loss Floor 1	Exposed Floor - Solid	Other	0.14	0.00	77.60

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	Manufacture r	Half Glazed Door	Double Low-E Soft 0.05			0.63		0.70	1.40
Windows	Manufacture r	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	West							1.89	
Windows	Window	[1] Main Wall	West	None	0.00					3.21	
Windows	Window	[1] Main Wall	North	None	0.00					6.27	
Windows	Window	[1] Main Wall	South	None	0.00					3.90	

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	19.62	0.050	No
Table K1 - Approved	E7 Party floor between dwellings (in blocks of flats)	31.17	0.070	No
Table K1 - Default	E14 Flat roof	16.67	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)	12.00	-0.090	No
Table K1 - Approved	E18 Party wall between dwellings	12.00	0.060	No
Table K1 - Default	P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	16.83	0.000	No

Y-value 0.047 W/m²K

18.0 Pressure Testing

Designed AP ₅₀	Yes	
Property Tested ?	5.00	m³/(h.m²) @ 50 Pa
As Built AP ₅₀		
		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

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 %			