

Energy Calculations Ltd

SAP ♦ CODE ♦ SBEM ♦ DESIGN

01754-761035



SAP Report Submission for Building Regulations Compliance

Client:

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

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

Report Issue Date: 01/03/2021

EXCELLENCE
IN ENERGY
ASSESSMENT

PREDICTED ENERGY ASSESSMENT

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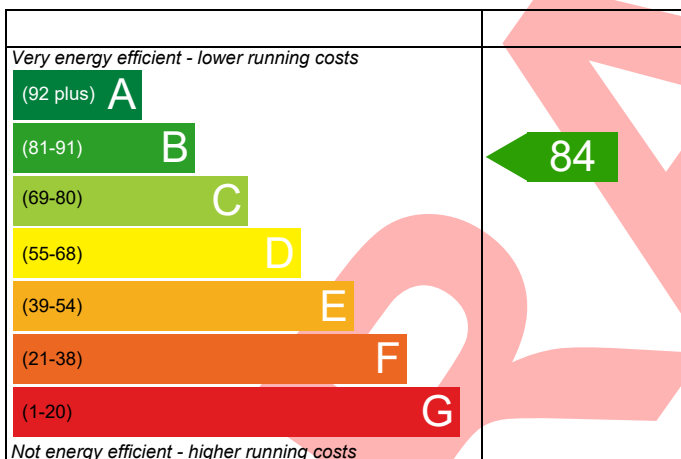
Flat 4, 18, Parkside Road,
READING,
RG30 2DB

Dwelling type: Flat, End-Terrace
Date of assessment: 01/03/2021
Produced by: Energy Calculations Limited
Total floor area: 62.62 m²

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

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

Energy Efficiency Rating

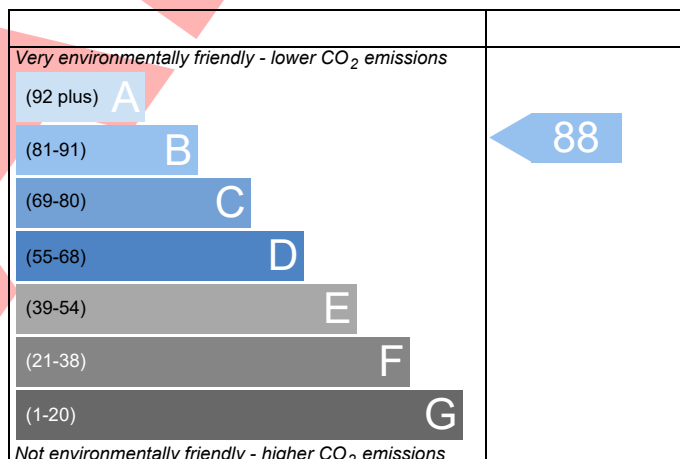


England

EU Directive
2002/91/EC

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

Environmental Impact (CO₂) Rating



England

EU Directive
2002/91/EC

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

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

THERMAL BRIDGING

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Calculation Type: New Build (As Designed)

Property Reference	015725	Issued on Date	01/03/2021
Assessment Reference	003	Prop Type Ref	
Property	Flat 4, 18, Parkside Road, READING, RG30 2DB		
SAP Rating	84 B	DER	17.20
Environmental	88 B	TER	27.70
CO ₂ Emissions (t/year)	0.91	% DER<TER	37.90
General Requirements Compliance	Pass	DFEE	49.26
		TFEE	49.72
		% DFEE<TFEE	0.92
Assessor Details	Mr. Matthew Carter, Energy Calculations Limited, Tel: 01754 761035, mcarter@energycalculations.co.uk		Assessor ID
			7869-0001
Client			

	Junction detail	Source Type	Psi (W/mK)	Length (m)	Result	Reference
External wall	E2 Other lintels (including other steel lintels)	Table K1 - Approved	0.300	8.58	2.57	
External wall	E3 Sill	Table K1 - Approved	0.040	8.58	0.34	
External wall	E4 Jamb	Table K1 - Approved	0.050	45.75	2.29	
External wall	E19 Ground floor (inverted)	Table K1 - Default	0.070	8.61	0.60	
External wall	E7 Party floor between dwellings (in blocks of flats)	Table K1 - Approved	0.070	33.70	2.36	
External wall	E14 Flat roof	Table K1 - Default	0.080	17.28	1.38	
External wall	E16 Corner (normal)	Table K1 - Approved	0.090	12.00	1.08	
External wall	E17 Corner (inverted – internal area greater than external area)	Table K1 - Approved	-0.090	7.20	-0.65	
External wall	E18 Party wall between dwellings	Table K1 - Approved	0.060	4.80	0.29	
Party wall	P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	Table K1 - Default	0.000	3.60	0.00	

Total: **10.27** W/mK:
Y-Value: **0.105** 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 63 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) 27.70 kgCO₂/m²

Dwelling Carbon Dioxide Emission Rate (DER) 17.20 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)49.7 kWh/m²/yr

Dwelling Fabric Energy Efficiency (DFEE)49.3 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.22 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	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
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Based on:

Overshading:	Average
Windows facing North:	8.11 m ² , No overhang
Windows facing East:	4.87 m ² , No overhang
Windows facing South:	4.87 m ² , No overhang
Air change rate:	6.00 ach
Blinds/curtains:	None

10 Key features

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

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	62.6200 (1b)	x 2.4000 (2b)	= 150.2880 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	62.6200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 150.2880 (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) = 0.1331 (8)
Measured/design AP50					Yes
Infiltration rate					5.0000
Number of sides sheltered					0.3831 (18)
					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3543 (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	0.4518	0.4429	0.4341	0.3898	0.3809	0.3366	0.3366	0.3278	0.3543	0.3809	0.3986	0.4164 (22b)
Effective ac	0.6021	0.5981	0.5942	0.5760	0.5726	0.5567	0.5567	0.5537	0.5628	0.5726	0.5795	0.5867 (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)			17.8500	1.3258	23.6648		(27)
Door to Stairs			1.8900	1.4000	2.6460		(26)
Exposed Floor			4.1700	0.1400	0.5838		(28b)
Main Wall	61.2000	17.8500	43.3500	0.2200	9.5370	60.0000	2601.0000 (29a)
Wall to stairs	19.6800	1.8900	17.7900	0.1864	3.3157	190.0000	3380.1000 (29a)
Flat roof	12.5200		12.5200	0.1400	1.7528	9.0000	112.6800 (30)
Total net area of external elements Aum(A, m ²)			97.5700				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	41.5000		(33)
Party Wall 1			8.6400	0.0000	0.0000	180.0000	1555.2000 (32)
Party Floor 1			58.4500			40.0000	2338.0000 (32d)
Party Ceilings 1			50.0100			40.0000	2000.4000 (32b)
Internal Wall 1			58.9900			100.0000	5899.0000 (32c)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	17886.3800 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							285.6337 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.2688 (36)
Total fabric heat loss						(33) + (36) =	51.7688 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	29.8591	29.6626	29.4699	28.5650	28.3957	27.6076	27.6076	27.4616	27.9111	28.3957	28.7382	29.0963 (38)
Heat transfer coeff	81.6279	81.4314	81.2387	80.3338	80.1645	79.3764	79.3764	79.2304	79.6800	80.1645	80.5070	80.8651 (39)
Average = Sum(39)m / 12 =												80.3330 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.3035	1.3004	1.2973	1.2829	1.2802	1.2676	1.2676	1.2653	1.2724	1.2802	1.2856	1.2914 (40)
HLP (average)												1.2829 (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												2.0547 (42)
Average daily hot water use (litres/day)												82.9982 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	91.2980	87.9781	84.6581	81.3382	78.0183	74.6984	74.6984	78.0183	81.3382	84.6581	87.9781	91.2980 (44)
Energy content (annual)	135.3923	118.4150	122.1936	106.5314	102.2194	88.2076	81.7373	93.7947	94.9149	110.6142	120.7440	131.1202 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		1305.8846 (45)

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	20.3088	17.7622	18.3290	15.9797	15.3329	13.2311	12.2606	14.0692	14.2372	16.5921	18.1116	19.6680 (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												
189.7911	167.5494	176.5924	159.1754	156.6182	140.8516	136.1361	148.1935	147.5589	165.0130	173.3880	185.5190	(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												
189.7911	167.5494	176.5924	159.1754	156.6182	140.8516	136.1361	148.1935	147.5589	165.0130	173.3880	185.5190	(64)
Heat gains from water heating, kWh/month												
88.5370	78.6805	84.1484	77.5369	77.5070	71.4442	70.6967	74.7058	73.6744	80.2983	82.2626	87.1165	(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	102.7330	102.7330	102.7330	102.7330	102.7330	102.7330	102.7330	102.7330	102.7330	102.7330	102.7330	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
16.0028	14.2136	11.5592	8.7511	6.5415	5.5226	5.9674	7.7567	10.4110	13.2191	15.4287	16.4476	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
179.5030	181.3657	176.6718	166.6790	154.0650	142.2096	134.2894	132.4267	137.1206	147.1134	159.7274	171.5828	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
33.2733	33.2733	33.2733	33.2733	33.2733	33.2733	33.2733	33.2733	33.2733	33.2733	33.2733	33.2733	(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)												
-82.1864	-82.1864	-82.1864	-82.1864	-82.1864	-82.1864	-82.1864	-82.1864	-82.1864	-82.1864	-82.1864	-82.1864	(71)
Water heating gains (Table 5)												
119.0013	117.0841	113.1027	107.6901	104.1761	99.2281	95.0224	100.4110	102.3256	107.9278	114.2536	117.0921	(72)
Total internal gains												
368.3270	366.4832	355.1536	336.9401	318.6025	300.7802	289.0992	294.4143	303.6771	322.0802	343.2296	358.9424	(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			8.1100			10.6334	0.6300		0.7000		0.7700		26.3551 (74)
East			4.8700			19.6403	0.6300		0.7000		0.7700		29.2313 (76)
South			4.8700			46.7521	0.6300		0.7000		0.7700		69.5827 (78)
Solar gains	125.1691	221.5072	324.9187	438.8794	524.4711	535.0830	509.8872	443.8710	364.0652	250.7211	151.4397	106.1352	(83)
Total gains	493.4961	587.9904	680.0723	775.8195	843.0736	835.8632	798.9863	738.2853	667.7423	572.8013	494.6693	465.0776	(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	60.8669	61.0138	61.1585	61.8474	61.9780	62.5934	62.5934	62.7087	62.3549	61.9780	61.7144	61.4411
alpha	5.0578	5.0676	5.0772	5.1232	5.1319	5.1729	5.1729	5.1806	5.1570	5.1319	5.1143	5.0961
util living area												
0.9963	0.9904	0.9731	0.9151	0.7815	0.5887	0.4337	0.4871	0.7469	0.9493	0.9914	0.9972	(86)
Tweekday	18.6366	18.8425	19.1442	19.4959	19.7058	19.7809	19.7887	19.7899	19.7519	19.4705	18.9948	18.6089
Tweekend	20.4097	20.5006	20.6360	20.7981	20.9103	20.9559	20.9643	20.9630	20.9332	20.7803	20.5638	20.3940
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	20.0890	20.2275	20.4383	20.6847	20.8616	20.9322	20.9449	20.9429	20.8958	20.6609	20.3188	20.0648 (87)
Th 2	19.8381	19.8405	19.8429	19.8543	19.8564	19.8663	19.8663	19.8681	19.8625	19.8564	19.8521	19.8476 (88)
util rest of house												
0.9948	0.9869	0.9629	0.8845	0.7157	0.4931	0.3238	0.3708	0.6530	0.9241	0.9875	0.9961	(89)
Tweekday	18.6366	18.8425	19.1442	19.4959	19.7058	19.7809	19.7887	19.7899	19.7519	19.4705	18.9948	18.6089
Tweekend	18.6366	18.8425	19.1442	19.4959	19.7058	19.7809	19.7887	19.7899	19.7519	19.4705	18.9948	18.6089
MIT 2	18.6366	18.8425	19.1442	19.4959	19.7058	19.7809	19.7887	19.7899	19.7519	19.4705	18.9948	18.6089 (90)
Living area fraction									fLA = Living area / (4) =			0.5133 (91)
MIT	19.3820	19.5534	19.8084	20.1061	20.2990	20.3718	20.3821	20.3817	20.3390	20.0815	19.6744	19.3561 (92)
Temperature adjustment												0.0000
adjusted MIT	19.3820	19.5534	19.8084	20.1061	20.2990	20.3718	20.3821	20.3817	20.3390	20.0815	19.6744	19.3561 (93)

8. Space heating requirement

Utilisation	0.9941	0.9858	0.9625	0.8921	0.7428	0.5368	0.3743	0.4243	0.6949	0.9299	0.9867	0.9955 (94)
Useful gains	490.5820	579.6155	654.5776	692.1001	626.2434	448.6846	299.0240	313.2524	464.0020	532.6704	488.0935	463.0031 (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	1231.1162	1193.2430	1081.1557	900.2260	689.3374	458.1465	300.2119	315.4714	497.1211	760.0781	1012.3269	1225.6024 (97)

FULL SAP CALCULATION PRINTOUT

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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	550.9574	412.3577	317.3741	149.8506	46.9420	0.0000	0.0000	0.0000	0.0000	169.1914	377.4480	567.3739 (98)
Space heating												2591.4952 (98)
Space heating per m2										(98) / (4) =		41.3845 (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 %)												274.4489 (206)
Efficiency of secondary/supplementary heating system, %												100.0000 (208)
Space heating requirement												944.2541 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	550.9574	412.3577	317.3741	149.8506	46.9420	0.0000	0.0000	0.0000	0.0000	169.1914	377.4480	567.3739 (98)
Space heating efficiency (main heating system 1)	274.4489	274.4489	274.4489	274.4489	274.4489	0.0000	0.0000	0.0000	0.0000	274.4489	274.4489	274.4489 (210)
Space heating fuel (main heating system)	200.7504	150.2494	115.6405	54.6005	17.1041	0.0000	0.0000	0.0000	0.0000	61.6477	137.5294	206.7321 (211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating requirement	189.7911	167.5494	176.5924	159.1754	156.6182	140.8516	136.1361	148.1935	147.5589	165.0130	173.3880	185.5190 (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	112.0108	98.8842	104.2212	93.9420	92.4328	83.1277	80.3447	87.4608	87.0862	97.3873	102.3301	109.4895 (219)
Water heating fuel used												1148.7173 (219)
Annual totals kWh/year												
Space heating fuel - main system												944.2541 (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)												282.6148 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
Total delivered energy for all uses												2375.5862 (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	944.2541	0.5190	490.0679 (261)
Space heating - secondary	0.0000	0.5190	0.0000 (263)
Water heating (other fuel)	1148.7173	0.5190	596.1843 (264)
Space and water heating			1086.2521 (265)
Pumps and fans	0.0000	0.0000	0.0000 (267)
Energy for lighting	282.6148	0.5190	146.6771 (268)
Energy saving/generation technologies			
PV Unit	-300.0000	0.5190	-155.7000 (269)
Total CO2, kg/year			1077.2292 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			17.2000 (273)

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

DER			17.2000 ZC1
Total Floor Area		TFA	62.6200
Assumed number of occupants		N	2.0547
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190
CO2 emissions from appliances, equation (L14)			16.9865 ZC2
CO2 emissions from cooking, equation (L16)			2.6878 ZC3
Total CO2 emissions			36.8744 ZC4
Residual CO2 emissions offset from biofuel CHP			0.0000 ZC5
Additional allowable electricity generation, kWh/m²/year			0.0000 ZC6
Resulting CO2 emissions offset from additional allowable electricity generation			0.0000 ZC7
Net CO2 emissions			36.8744 ZC8

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1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	62.6200 (1b)	x 2.4000 (2b)	= 150.2880 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	62.6200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 150.2880 (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) = 0.1331 (8)
Measured/design AP50					Yes
Infiltration rate					5.0000
Number of sides sheltered					0.3831 (18)
					1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3543 (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	0.4518	0.4429	0.4341	0.3898	0.3809	0.3366	0.3366	0.3278	0.3543	0.3809	0.3986	0.4164 (22b)
Effective ac	0.6021	0.5981	0.5942	0.5760	0.5726	0.5567	0.5567	0.5537	0.5628	0.5726	0.5795	0.5867 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opaque door			1.8900	1.0000	1.8900			(26)				
TER Opening Type (Uw = 1.40)			13.7700	1.3258	18.2557			(27)				
Exposed Floor			4.1700	0.1300	0.5421			(28b)				
Main Wall	61.2000	13.7700	47.4300	0.1800	8.5374			(29a)				
Wall to stairs	19.6800	1.8900	17.7900	0.1800	3.2022			(29a)				
Flat roof	12.5200		12.5200	0.1300	1.6276			(30)				
Total net area of external elements Aum(A, m2)			97.5700					(31)				
Fabric heat loss, W/K = Sum (A x U)			(26) ... (30) + (32) =			34.0550		(33)				
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								250.0000 (35)				
Thermal bridges (Sum(L x Psi) calculated using Appendix K)								8.2096 (36)				
Total fabric heat loss						(33) + (36) =		42.2646 (37)				
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 29.8591	Feb 29.6626	Mar 29.4699	Apr 28.5650	May 28.3957	Jun 27.6076	Jul 27.6076	Aug 27.4616	Sep 27.9111	Oct 28.3957	Nov 28.7382	Dec 29.0963 (38)
Heat transfer coeff	72.1237	71.9271	71.7345	70.8296	70.6603	69.8721	69.8721	69.7262	70.1757	70.6603	71.0028	71.3608 (39)
Average = Sum(39)m / 12 =												70.8288 (39)
HLP	Jan 1.1518	Feb 1.1486	Mar 1.1456	Apr 1.1311	May 1.1284	Jun 1.1158	Jul 1.1158	Aug 1.1135	Sep 1.1207	Oct 1.1284	Nov 1.1339	Dec 1.1396 (40)
HLP (average)												1.1311 (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												2.0547 (42)
Average daily hot water use (litres/day)												82.9982 (43)
Daily hot water use	91.2980	87.9781	84.6581	81.3382	78.0183	74.6984	74.6984	78.0183	81.3382	84.6581	87.9781	91.2980 (44)
Energy conte	135.3923	118.4150	122.1936	106.5314	102.2194	88.2076	81.7373	93.7947	94.9149	110.6142	120.7440	131.1202 (45)
Energy content (annual)										Total = Sum(45)m =		1305.8846 (45)
Distribution loss (46)m = 0.15 x (45)m												
20.3088	17.7622	18.3290	15.9797	15.3329	13.2311	12.2606	14.0692	14.2372	16.5921	18.1116	19.6680 (46)	
Water storage loss:												
Store volume												210.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.7016 (48)
Temperature factor from Table 2b												0.5400 (49)

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Enter (49) or (54) in (55)												0.9188 (55)
Total storage loss	28.4842	25.7277	28.4842	27.5653	28.4842	27.5653	28.4842	28.4842	27.5653	28.4842	27.5653	28.4842 (56)
If cylinder contains dedicated solar storage	28.4842	25.7277	28.4842	27.5653	28.4842	27.5653	28.4842	28.4842	27.5653	28.4842	27.5653	28.4842 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	187.1389	165.1538	173.9402	156.6087	153.9660	138.2849	133.4839	145.5413	144.9923	162.3608	170.8214	182.8668 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	187.1389	165.1538	173.9402	156.6087	153.9660	138.2849	133.4839	145.5413	144.9923	162.3608	170.8214	182.8668 (64)
Heat gains from water heating, kWh/month	86.4152	76.7641	82.0267	75.4836	75.3852	69.3909	68.5749	72.5840	71.6211	78.1765	80.2093	84.9947 (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	102.7330	102.7330	102.7330	102.7330	102.7330	102.7330	102.7330	102.7330	102.7330	102.7330	102.7330	102.7330	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	16.0086	14.2187	11.5634	8.7542	6.5439	5.5246	5.9696	7.7595	10.4147	13.2239	15.4342	16.4535	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	179.5030	181.3657	176.6718	166.6790	154.0650	142.2096	134.2894	132.4267	137.1206	147.1134	159.7274	171.5828	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.2733	33.2733	33.2733	33.2733	33.2733	33.2733	33.2733	33.2733	33.2733	33.2733	33.2733	33.2733	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-82.1864	-82.1864	-82.1864	-82.1864	-82.1864	-82.1864	-82.1864	-82.1864	-82.1864	-82.1864	-82.1864	-82.1864	(71)
Water heating gains (Table 5)	116.1495	114.2322	110.2509	104.8383	101.3242	96.3762	92.1706	97.5592	99.4737	105.0759	111.4018	114.2402	(72)
Total internal gains	368.4809	366.6365	355.3059	337.0914	318.7530	300.9303	289.2495	294.5653	303.8290	322.2331	343.3833	359.0965	(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				6.2500	10.6334	0.6300		0.7000	0.7700		20.3106 (74)	
East				3.7600	19.6403	0.6300		0.7000	0.7700		22.5687 (76)	
South				3.7600	46.7521	0.6300		0.7000	0.7700		53.7230 (78)	

Solar gains	96.6024	170.9484	250.7397	338.6520	404.6674	412.8421	393.4077	342.4926	280.9391	193.4901	116.8764	81.9130 (83)
Total gains	465.0833	537.5848	606.0456	675.7435	723.4204	713.7724	682.6572	637.0579	584.7681	515.7232	460.2598	441.0095 (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	60.2938	60.4586	60.6209	61.3954	61.5425	62.2367	62.2367	62.3670	61.9675	61.5425	61.2456	60.9383
alpha	5.0196	5.0306	5.0414	5.0930	5.1028	5.1491	5.1491	5.1578	5.1312	5.1028	5.0830	5.0626
util living area	0.9948	0.9886	0.9715	0.9176	0.7935	0.6042	0.4463	0.4961	0.7492	0.9447	0.9888	0.9960 (86)
MIT	19.8878	20.0601	20.3225	20.6433	20.8749	20.9760	20.9958	20.9929	20.9305	20.6271	20.2000	19.8586 (87)
Th 2	19.9588	19.9613	19.9638	19.9755	19.9777	19.9879	19.9879	19.9898	19.9840	19.9777	19.9733	19.9686 (88)
util rest of house	0.9931	0.9849	0.9622	0.8914	0.7365	0.5180	0.3458	0.3910	0.6666	0.9212	0.9846	0.9947 (89)
MIT 2	18.4930	18.7445	19.1225	19.5741	19.8628	19.9731	19.9865	19.9871	19.9330	19.5641	18.9579	18.4576 (90)
Living area fraction												
MIT	19.2089	19.4197	19.7384	20.1229	20.3823	20.4878	20.5045	20.5033	20.4450	20.1097	19.5954	19.1766 (92)
Temperature adjustment												0.0000
adjusted MIT	19.2089	19.4197	19.7384	20.1229	20.3823	20.4878	20.5045	20.5033	20.4450	20.1097	19.5954	19.1766 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	461.1279	528.1753	581.6432	605.2385	550.1078	400.8257	271.3546	283.5541	412.9524	476.9333	452.2308	438.0637	(94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1075.2859	1044.3597	949.6496	794.9139	613.4908	411.3932	272.8160	286.1108	445.2617	671.9581	887.2111	1068.7452	(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	456.9335	346.8760	273.7967	136.5663	47.1569	0.0000	0.0000	0.0000	0.0000	145.0985	313.1858	469.2271	(98)
Space heating												2188.8408	(98)
Space heating per m ²												(98) / (4) =	34.9543 (99)

8c. Space cooling requirement

Not applicable

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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													2341.0062 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	456.9335	346.8760	273.7967	136.5663	47.1569	0.0000	0.0000	0.0000	0.0000	145.0985	313.1858	469.2271	(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)	488.6990	370.9903	292.8307	146.0602	50.4352	0.0000	0.0000	0.0000	0.0000	155.1855	334.9581	501.8471	(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	187.1389	165.1538	173.9402	156.6087	153.9660	138.2849	133.4839	145.5413	144.9923	162.3608	170.8214	182.8668	(64)
Efficiency of water heater (217)m	87.1064	86.7482	86.0192	84.4511	82.0753	79.8000	79.8000	79.8000	79.8000	84.5157	86.4108	79.8000	(216)
Fuel for water heating, kWh/month	214.8394	190.3829	202.2109	185.4430	187.5912	173.2894	167.2730	182.3826	181.6946	192.1072	197.6852	209.6606	(219)
Water heating fuel used												2284.5600	(219)
Annual totals kWh/year													
Space heating fuel - main system												2341.0062	(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)												282.7164	(232)
Total delivered energy for all uses												4983.2826	(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	2341.0062	0.2160	505.6573 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2284.5600	0.2160	493.4650 (264)
Space and water heating			999.1223 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	282.7164	0.5190	146.7298 (268)
Total CO2, kg/m2/year			1184.7771 (272)
Emissions per m2 for space and water heating			15.9553 (272a)
Fuel factor (electricity)			1.5500
Emissions per m2 for lighting			2.3432 (272b)
Emissions per m2 for pumps and fans			0.6216 (272c)
Target Carbon Dioxide Emission Rate (TER) = (15.9553 * 1.55) + 2.3432 + 0.6216, rounded to 2 d.p.			27.7000 (273)

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CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	62.6200 (1b)	x 2.4000 (2b)	= 150.2880 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	62.6200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 150.2880 (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) = 0.1331 (8)
Measured/design AP50					Yes
Infiltration rate					5.0000
Number of sides sheltered					0.3831 (18)
					1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3543 (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	0.4518	0.4429	0.4341	0.3898	0.3809	0.3366	0.3366	0.3278	0.3543	0.3809	0.3986	0.4164 (22b)
Effective ac	0.6021	0.5981	0.5942	0.5760	0.5726	0.5567	0.5567	0.5537	0.5628	0.5726	0.5795	0.5867 (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)			17.8500	1.3258	23.6648		(27)
Door to Stairs			1.8900	1.4000	2.6460		(26)
Exposed Floor			4.1700	0.1400	0.5838		(28b)
Main Wall	61.2000	17.8500	43.3500	0.2200	9.5370	60.0000	2601.0000 (29a)
Wall to stairs	19.6800	1.8900	17.7900	0.1864	3.3157	190.0000	3380.1000 (29a)
Flat roof	12.5200		12.5200	0.1400	1.7528	9.0000	112.6800 (30)
Total net area of external elements Aum(A, m ²)			97.5700				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	41.5000		(33)
Party Wall 1			8.6400	0.0000	0.0000	180.0000	1555.2000 (32)
Party Floor 1			58.4500			40.0000	2338.0000 (32d)
Party Ceilings 1			50.0100			30.0000	1500.3000 (32b)
Internal Wall 1			58.9900			100.0000	5899.0000 (32c)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	17386.2800 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							277.6474 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.2688 (36)
Total fabric heat loss						(33) + (36) =	51.7688 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	29.8591	29.6626	29.4699	28.5650	28.3957	27.6076	27.6076	27.4616	27.9111	28.3957	28.7382	29.0963 (38)
Heat transfer coeff	81.6279	81.4314	81.2387	80.3338	80.1645	79.3764	79.3764	79.2304	79.6800	80.1645	80.5070	80.8651 (39)
Average = Sum(39)m / 12 =												80.3330 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.3035	1.3004	1.2973	1.2829	1.2802	1.2676	1.2676	1.2653	1.2724	1.2802	1.2856	1.2914 (40)
HLP (average)												1.2829 (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												2.0547 (42)
Average daily hot water use (litres/day)												82.9982 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	91.2980	87.9781	84.6581	81.3382	78.0183	74.6984	74.6984	78.0183	81.3382	84.6581	87.9781	91.2980 (44)
Energy conte	135.3923	118.4150	122.1936	106.5314	102.2194	88.2076	81.7373	93.7947	94.9149	110.6142	120.7440	131.1202 (45)
Energy content (annual)										Total = Sum(45)m =		1305.8846 (45)
Distribution loss (46)m = 0.15 x (45)m												

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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	28.7709	25.1632	25.9661	22.6379	21.7216	18.7441	17.3692	19.9314	20.1694	23.5055	25.6581	27.8630 (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	102.7330	102.7330	102.7330	102.7330	102.7330	102.7330	102.7330	102.7330	102.7330	102.7330	102.7330	102.7330 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	16.0028	14.2136	11.5592	8.7511	6.5415	5.5226	5.9674	7.7567	10.4110	13.2191	15.4287	16.4476 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	179.5030	181.3657	176.6718	166.6790	154.0650	142.2096	134.2894	132.4267	137.1206	147.1134	159.7274	171.5828 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.2733	33.2733	33.2733	33.2733	33.2733	33.2733	33.2733	33.2733	33.2733	33.2733	33.2733	33.2733 (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)	-82.1864	-82.1864	-82.1864	-82.1864	-82.1864	-82.1864	-82.1864	-82.1864	-82.1864	-82.1864	-82.1864	-82.1864 (71)
Water heating gains (Table 5)	38.6705	37.4452	34.9007	31.4416	29.1957	26.0335	23.3457	26.7895	28.0131	31.5934	35.6363	37.4503 (72)
Total internal gains	287.9962	286.8443	276.9516	260.6916	243.6222	227.5856	217.4224	220.7928	229.3646	245.7459	264.6123	279.3006 (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				8.1100	10.6334	0.6300	0.7000			0.7700			26.3551 (74)
East				4.8700	19.6403	0.6300	0.7000			0.7700			29.2313 (76)
South				4.8700	46.7521	0.6300	0.7000			0.7700			69.5827 (78)
Solar gains	125.1691	221.5072	324.9187	438.8794	524.4711	535.0830	509.8872	443.8710	364.0652	250.7211	151.4397	106.1352	(83)
Total gains	413.1653	508.3515	601.8704	699.5709	768.0932	762.6686	727.3096	664.6638	593.4298	496.4670	416.0519	385.4358	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	59.1651	59.3079	59.4485	60.1182	60.2451	60.8433	60.8433	60.9554	60.6115	60.2451	59.9888	59.7232
alpha	4.9443	4.9539	4.9632	5.0079	5.0163	5.0562	5.0562	5.0637	5.0408	5.0163	4.9993	4.9815
util living area	0.9981	0.9944	0.9822	0.9373	0.8211	0.6349	0.4740	0.5362	0.8010	0.9686	0.9955	0.9987 (86)
MIT	19.7215	19.9163	20.2102	20.5732	20.8450	20.9679	20.9939	20.9891	20.8994	20.5237	20.0495	19.6882 (87)
Th 2	19.8381	19.8405	19.8429	19.8543	19.8564	19.8663	19.8663	19.8681	19.8625	19.8564	19.8521	19.8476 (88)
util rest of house	0.9974	0.9922	0.9753	0.9131	0.7603	0.5359	0.3552	0.4106	0.7127	0.9516	0.9935	0.9981 (89)
MIT 2	18.6867	18.8824	19.1740	19.5289	19.7621	19.8538	19.8651	19.8656	19.8136	19.4925	19.0250	18.6611 (90)
Living area fraction									fLA = Living area / (4) =			0.5133 (91)
MIT	19.2178	19.4130	19.7058	20.0649	20.3179	20.4256	20.4445	20.4423	20.3709	20.0218	19.5508	19.1883 (92)
Temperature adjustment												0.0000
adjusted MIT	19.2178	19.4130	19.7058	20.0649	20.3179	20.4256	20.4445	20.4423	20.3709	20.0218	19.5508	19.1883 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9968	0.9912	0.9743	0.9182	0.7867	0.5863	0.4165	0.4756	0.7555	0.9546	0.9928	0.9977 (94)
Useful gains	411.8596	503.8870	586.3783	642.3717	604.2590	447.1746	302.9545	316.1054	448.3171	473.9276	413.0365	384.5617 (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	1217.7119	1181.8156	1072.8249	896.9186	690.8488	462.4130	305.1593	320.2699	499.6636	755.2936	1002.3783	1212.0307 (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	599.5541	455.5681	361.9162	183.2737	64.4229	0.0000	0.0000	0.0000	0.0000	209.3363	424.3261	615.6369 (98)
Space heating												2914.0343 (98)
Space heating per m2										(98) / (4) =		46.5352 (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	746.1381	587.3853	602.1513	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9225	0.9608	0.9427	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	688.3342	564.3468	567.6263	0.0000	0.0000	0.0000	0.0000 (102)

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Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	967.9907	925.1440	853.1191	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	201.3527	268.4331	212.4066	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												682.1925 (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	50.3382	67.1083	53.1017	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												170.5481 (107)
Space cooling per m2												2.7235 (108)
Energy for space heating												46.5352 (99)
Energy for space cooling												2.7235 (108)
Total												49.2587 (109)
Dwelling Fabric Energy Efficiency (DFEE)												49.3 (109)

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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	62.6200 (1b)	x 2.4000 (2b)	= 150.2880 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	62.6200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 150.2880 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					2 * 10 = 20.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				Air changes per hour
Pressure test					20.0000 / (5) = 0.1331 (8)
Measured/design AP50					Yes
Infiltration rate					5.0000
Number of sides sheltered					0.3831 (18)
					1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3543 (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	0.4518	0.4429	0.4341	0.3898	0.3809	0.3366	0.3366	0.3278	0.3543	0.3809	0.3986	0.4164 (22b)
Effective ac	0.6021	0.5981	0.5942	0.5760	0.5726	0.5567	0.5567	0.5537	0.5628	0.5726	0.5795	0.5867 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opaque door			1.8900	1.0000	1.8900			(26)				
TER Opening Type (Uw = 1.40)			13.7700	1.3258	18.2557			(27)				
Exposed Floor			4.1700	0.1300	0.5421			(28b)				
Main Wall	61.2000	13.7700	47.4300	0.1800	8.5374			(29a)				
Wall to stairs	19.6800	1.8900	17.7900	0.1800	3.2022			(29a)				
Flat roof	12.5200		12.5200	0.1300	1.6276			(30)				
Total net area of external elements Aum(A, m2)			97.5700					(31)				
Fabric heat loss, W/K = Sum (A x U)			(26) ... (30) + (32) =			34.0550		(33)				
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								250.0000 (35)				
Thermal bridges (Sum(L x Psi) calculated using Appendix K)								8.2096 (36)				
Total fabric heat loss						(33) + (36) =		42.2646 (37)				
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 29.8591	Feb 29.6626	Mar 29.4699	Apr 28.5650	May 28.3957	Jun 27.6076	Jul 27.6076	Aug 27.4616	Sep 27.9111	Oct 28.3957	Nov 28.7382	Dec 29.0963 (38)
Heat transfer coeff	72.1237	71.9271	71.7345	70.8296	70.6603	69.8721	69.8721	69.7262	70.1757	70.6603	71.0028	71.3608 (39)
Average = Sum(39)m / 12 =												70.8288 (39)
HLP	Jan 1.1518	Feb 1.1486	Mar 1.1456	Apr 1.1311	May 1.1284	Jun 1.1158	Jul 1.1158	Aug 1.1135	Sep 1.1207	Oct 1.1284	Nov 1.1339	Dec 1.1396 (40)
HLP (average)												1.1311 (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												2.0547 (42)
Average daily hot water use (litres/day)												82.9982 (43)
Daily hot water use	91.2980	87.9781	84.6581	81.3382	78.0183	74.6984	74.6984	78.0183	81.3382	84.6581	87.9781	91.2980 (44)
Energy conte	135.3923	118.4150	122.1936	106.5314	102.2194	88.2076	81.7373	93.7947	94.9149	110.6142	120.7440	131.1202 (45)
Energy content (annual)										Total = Sum(45)m =		1305.8846 (45)
Distribution loss (46)m = 0.15 x (45)m												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage												

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Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Heat gains from water heating, kWh/month	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
	28.7709	25.1632	25.9661	22.6379	21.7216	18.7441	17.3692	19.9314	20.1694	23.5055	25.6581	27.8630 (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	102.7330	102.7330	102.7330	102.7330	102.7330	102.7330	102.7330	102.7330	102.7330	102.7330	102.7330	102.7330	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	16.0086	14.2187	11.5634	8.7542	6.5439	5.5246	5.9696	7.7595	10.4147	13.2239	15.4342	16.4535	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	179.5030	181.3657	176.6718	166.6790	154.0650	142.2096	134.2894	132.4267	137.1206	147.1134	159.7274	171.5828	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.2733	33.2733	33.2733	33.2733	33.2733	33.2733	33.2733	33.2733	33.2733	33.2733	33.2733	33.2733	(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)	-82.1864	-82.1864	-82.1864	-82.1864	-82.1864	-82.1864	-82.1864	-82.1864	-82.1864	-82.1864	-82.1864	-82.1864	(71)
Water heating gains (Table 5)	38.6705	37.4452	34.9007	31.4416	29.1957	26.0335	23.3457	26.7895	28.0131	31.5934	35.6363	37.4503	(72)
Total internal gains	288.0020	286.8494	276.9558	260.6947	243.6245	227.5876	217.4245	220.7956	229.3684	245.7506	264.6178	279.3066	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	FF Access factor Table 6d	Gains W	
North	6.2500	10.6334	0.6300	0.7000	0.7700	20.3106	(74)
East	3.7600	19.6403	0.6300	0.7000	0.7700	22.5687	(76)
South	3.7600	46.7521	0.6300	0.7000	0.7700	53.7230	(78)

Solar gains	96.6024	170.9484	250.7397	338.6520	404.6674	412.8421	393.4077	342.4926	280.9391	193.4901	116.8764	81.9130	(83)
Total gains	384.6044	457.7978	527.6955	599.3468	648.2919	640.4296	610.8322	563.2882	510.3074	439.2407	381.4943	361.2196	(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	60.2938	60.4586	60.6209	61.3954	61.5425	62.2367	62.2367	62.3670	61.9675	61.5425	61.2456	60.9383	
alpha	5.0196	5.0306	5.0414	5.0930	5.1028	5.1491	5.1491	5.1578	5.1312	5.1028	5.0830	5.0626	
util living area	0.9978	0.9943	0.9836	0.9451	0.8418	0.6610	0.4959	0.5555	0.8142	0.9696	0.9951	0.9984	(86)
MIT	19.7695	19.9456	20.2178	20.5627	20.8322	20.9640	20.9932	20.9882	20.8964	20.5348	20.0865	19.7405	(87)
Th 2	19.9588	19.9613	19.9638	19.9755	19.9777	19.9879	19.9879	19.9898	19.9840	19.9777	19.9733	19.9686	(88)
util rest of house	0.9970	0.9924	0.9779	0.9257	0.7903	0.5715	0.3857	0.4406	0.7375	0.9550	0.9931	0.9978	(89)
MIT 2	18.8405	19.0177	19.2887	19.6299	19.8685	19.9722	19.9863	19.9866	19.9289	19.6116	19.1683	18.8194	(90)
Living area fraction									fLA = Living area / (4) =			0.5133	(91)
MIT	19.3173	19.4940	19.7656	20.1087	20.3631	20.4812	20.5031	20.5007	20.4254	20.0854	19.6395	19.2921	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.3173	19.4940	19.7656	20.1087	20.3631	20.4812	20.5031	20.5007	20.4254	20.0854	19.6395	19.2921	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9964	0.9913	0.9765	0.9286	0.8112	0.6166	0.4426	0.4999	0.7735	0.9568	0.9923	0.9974	(94)
Ext temp.	383.2294	453.8002	515.3148	556.5393	525.9245	394.8948	270.3249	281.5960	394.7351	420.2812	378.5422	360.2667	(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	1083.1026	1049.7026	951.5989	793.9040	612.1382	410.9340	272.7162	285.9255	443.8918	670.2410	890.3422	1076.9875	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	(98)
Space heating per m2	520.7057	400.4465	324.5954	170.9026	64.1430	0.0000	0.0000	0.0000	0.0000	185.9701	368.4960	533.2403	(98)
										(98) / (4) =		41.0172	(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	656.7982	517.0539	529.9191	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9164	0.9577	0.9403	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	601.9178	495.2055	498.2978	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	825.1166	789.0045	734.6319	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	160.7031	218.5865	175.8326	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												555.1222	(104)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Cooled fraction											FC = cooled area / (4) =	1.0000 (105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	40.1758	54.6466	43.9581	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												138.7806 (107)
Space cooling per m2												2.2162 (108)
Energy for space heating												41.0172 (99)
Energy for space cooling												2.2162 (108)
Total												43.2335 (109)
Target Fabric Energy Efficiency (TFEE)												49.7 (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	62.6200 (1b)	x 2.4000 (2b)	= 150.2880 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	62.6200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 150.2880 (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) = 0.1331 (8)
Measured/design AP50					Yes
Infiltration rate					5.0000
Number of sides sheltered					0.3831 (18)
					1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3543 (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												
Effective ac	0.3898	0.3632	0.3632	0.3455	0.3455	0.3012	0.3012	0.2923	0.3012	0.3366	0.3278	0.3543 (22b)
Effective ac	0.5760	0.5660	0.5660	0.5597	0.5597	0.5454	0.5454	0.5427	0.5454	0.5567	0.5537	0.5628 (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)			17.8500	1.3258	23.6648		(27)
Door to Stairs			1.8900	1.4000	2.6460		(26)
Exposed Floor			4.1700	0.1400	0.5838		(28b)
Main Wall	61.2000	17.8500	43.3500	0.2200	9.5370	60.0000	2601.0000 (29a)
Wall to stairs	19.6800	1.8900	17.7900	0.1864	3.3157	190.0000	3380.1000 (29a)
Flat roof	12.5200		12.5200	0.1400	1.7528	9.0000	112.6800 (30)
Total net area of external elements Aum(A, m ²)			97.5700				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	41.5000		(33)
Party Wall 1			8.6400	0.0000	0.0000	180.0000	1555.2000 (32)
Party Floor 1			58.4500			40.0000	2338.0000 (32d)
Party Ceilings 1			50.0100			40.0000	2000.4000 (32b)
Internal Wall 1			58.9900			100.0000	5899.0000 (32c)

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

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	28.5650	28.0688	28.0688	27.7574	27.7574	27.0471	27.0471	26.9167	27.0471	27.6076	27.4616	27.9111 (38)
Heat transfer coeff	80.3338	79.8376	79.8376	79.5262	79.5262	78.8159	78.8159	78.6856	78.8159	79.3764	79.2304	79.6800 (39)
Average = Sum(39)m / 12 =												79.3735 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2829	1.2750	1.2750	1.2700	1.2700	1.2586	1.2586	1.2566	1.2586	1.2676	1.2653	1.2724 (40)
HLP (average)												1.2675 (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												2.0547 (42)
Average daily hot water use (litres/day)												82.9982 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	91.2980	87.9781	84.6581	81.3382	78.0183	74.6984	74.6984	78.0183	81.3382	84.6581	87.9781	91.2980 (44)
Energy content (annual)	135.3923	118.4150	122.1936	106.5314	102.2194	88.2076	81.7373	93.7947	94.9149	110.6142	120.7440	131.1202 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		1305.8846 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Energy Calculations Ltd
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CALCULATION OF HEAT DEMAND 09 Jan 2014

	20.3088	17.7622	18.3290	15.9797	15.3329	13.2311	12.2606	14.0692	14.2372	16.5921	18.1116	19.6680 (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												
189.7911	167.5494	176.5924	159.1754	156.6182	140.8516	136.1361	148.1935	147.5589	165.0130	173.3880	185.5190	(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												
189.7911	167.5494	176.5924	159.1754	156.6182	140.8516	136.1361	148.1935	147.5589	165.0130	173.3880	185.5190	(64)
RHI water heating demand												
Heat gains from water heating, kWh/month												
88.5370	78.6805	84.1484	77.5369	77.5070	71.4442	70.6967	74.7058	73.6744	80.2983	82.2626	87.1165	(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	123.2796	123.2796	123.2796	123.2796	123.2796	123.2796	123.2796	123.2796	123.2796	123.2796	123.2796	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
40.0071	35.5339	28.8981	21.8777	16.3539	13.8066	14.9185	19.3917	26.0275	33.0479	38.5717	41.1190	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
267.9149	270.6950	263.6892	248.7747	229.9477	212.2531	200.4320	197.6519	204.6577	219.5722	238.3991	256.0938	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
49.3826	49.3826	49.3826	49.3826	49.3826	49.3826	49.3826	49.3826	49.3826	49.3826	49.3826	49.3826	(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)												
-82.1864	-82.1864	-82.1864	-82.1864	-82.1864	-82.1864	-82.1864	-82.1864	-82.1864	-82.1864	-82.1864	-82.1864	(71)
Water heating gains (Table 5)												
119.0013	117.0841	113.1027	107.6901	104.1761	99.2281	95.0224	100.4110	102.3256	107.9278	114.2536	117.0921	(72)
Total internal gains	517.3991	513.7888	496.1659	468.8183	440.9535	415.7636	400.8488	407.9304	423.4865	451.0236	481.7003	504.7807 (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					8.1100	12.7500	0.6300	0.7000			0.7700			31.6011 (74)
East					4.8700	23.7835	0.6300	0.7000			0.7700			35.3978 (76)
South					4.8700	54.0600	0.6300	0.7000			0.7700			80.4594 (78)
Solar gains	147.4583	228.5885	334.6450	462.0279	540.3385	584.0246	550.6924	487.1326	400.8057	278.1864	175.8541	125.6962	(83)	
Total gains	664.8574	742.3773	830.8108	930.8462	981.2919	999.7882	951.5412	895.0629	824.2922	729.2101	657.5544	630.4768	(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	61.8474	62.2318	62.2318	62.4755	62.4755	63.0385	63.0385	63.1430	63.0385	62.5934	62.7087	62.3549
alpha	5.1232	5.1488	5.1488	5.1650	5.1650	5.2026	5.2026	5.2095	5.2026	5.1729	5.1806	5.1570
util living area	0.9837	0.9699	0.9285	0.8227	0.6416	0.4228	0.2813	0.3159	0.5763	0.8559	0.9644	0.9868 (86)
Tweekday	18.9779	19.1534	19.4193	19.6592	19.7657	19.7958	19.7969	19.7986	19.7899	19.6627	19.3098	18.9535
Tweekend	20.5568	20.6345	20.7594	20.8809	20.9465	20.9644	20.9661	20.9660	20.9575	20.8776	20.7021	20.5427
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	20.3160	20.4346	20.6287	20.8140	20.9174	20.9453	20.9477	20.9475	20.9336	20.8112	20.5348	20.2942 (87)
Th 2	19.8543	19.8605	19.8605	19.8644	19.8644	19.8734	19.8734	19.8750	19.8734	19.8663	19.8681	19.8625 (88)
util rest of house	0.9779	0.9596	0.9050	0.7735	0.5654	0.3361	0.1883	0.2175	0.4792	0.8019	0.9502	0.9820 (89)
Tweekday	18.9779	19.1534	19.4193	19.6592	19.7657	19.7958	19.7969	19.7986	19.7899	19.6627	19.3098	18.9535
Tweekend	18.9779	19.1534	19.4193	19.6592	19.7657	19.7958	19.7969	19.7986	19.7899	19.6627	19.3098	18.9535
MIT 2	18.9779	19.1534	19.4193	19.6592	19.7657	19.7958	19.7969	19.7986	19.7899	19.6627	19.3098	18.9535 (90)
Living area fraction									fLA = Living area / (4) =			0.5133 (91)
MIT	19.6647	19.8110	20.0400	20.2519	20.3568	20.3858	20.3875	20.3883	20.3769	20.2522	19.9385	19.6416 (92)
Temperature adjustment												0.0000
adjusted MIT	19.6647	19.8110	20.0400	20.2519	20.3568	20.3858	20.3875	20.3883	20.3769	20.2522	19.9385	19.6416 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	649.3533	711.9922	755.3765	736.7236	588.1744	375.7204	219.6199	234.9713	431.6026	599.4583	625.4850	618.4139 (94)
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

Calculation Type: New Build (As Designed)

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CALCULATION OF HEAT DEMAND 09 Jan 2014

Month fracti	1186.1024	1142.5554	1017.1328	839.1515	608.9181	377.1976	219.7024	235.1353	439.5515	702.6524	961.7422	1174.6122	(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	399.3414	289.3385	194.7467	73.7480	15.4333	0.0000	0.0000	0.0000	0.0000	76.7764	242.1052	413.8115	(98)
RHI space heating demand												1705	(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	62.6200 (1b)	x 2.4000 (2b)	= 150.2880 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	62.6200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 150.2880 (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) = 0.1331 (8)
Measured/design AP50					Yes
Infiltration rate					5.0000
Number of sides sheltered					0.3831 (18)
					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3543 (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	0.4518	0.4429	0.4341	0.3898	0.3809	0.3366	0.3366	0.3278	0.3543	0.3809	0.3986	0.4164 (22b)
Effective ac	0.6021	0.5981	0.5942	0.5760	0.5726	0.5567	0.5567	0.5537	0.5628	0.5726	0.5795	0.5867 (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)			17.8500	1.3258	23.6648		(27)
Door to Stairs			1.8900	1.4000	2.6460		(26)
Exposed Floor			4.1700	0.1400	0.5838		(28b)
Main Wall	61.2000	17.8500	43.3500	0.2200	9.5370	60.0000	2601.0000 (29a)
Wall to stairs	19.6800	1.8900	17.7900	0.1864	3.3157	190.0000	3380.1000 (29a)
Flat roof	12.5200		12.5200	0.1400	1.7528	9.0000	112.6800 (30)
Total net area of external elements Aum(A, m ²)			97.5700				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	41.5000		(33)
Party Wall 1			8.6400	0.0000	0.0000	180.0000	1555.2000 (32)
Party Floor 1			58.4500			40.0000	2338.0000 (32d)
Party Ceilings 1			50.0100			40.0000	2000.4000 (32b)
Internal Wall 1			58.9900			100.0000	5899.0000 (32c)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	17886.3800 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							285.6337 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.2688 (36)
Total fabric heat loss						(33) + (36) =	51.7688 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	29.8591	29.6626	29.4699	28.5650	28.3957	27.6076	27.6076	27.4616	27.9111	28.3957	28.7382	29.0963 (38)
Heat transfer coeff	81.6279	81.4314	81.2387	80.3338	80.1645	79.3764	79.3764	79.2304	79.6800	80.1645	80.5070	80.8651 (39)
Average = Sum(39)m / 12 =												80.3330 (39)
HLP	1.3035	1.3004	1.2973	1.2829	1.2802	1.2676	1.2676	1.2653	1.2724	1.2802	1.2856	1.2914 (40)
HLP (average)												1.2829 (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												2.0547 (42)
Average daily hot water use (litres/day)												82.9982 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	91.2980	87.9781	84.6581	81.3382	78.0183	74.6984	74.6984	78.0183	81.3382	84.6581	87.9781	91.2980 (44)
Energy content (annual)	135.3923	118.4150	122.1936	106.5314	102.2194	88.2076	81.7373	93.7947	94.9149	110.6142	120.7440	131.1202 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		1305.8846 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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	20.3088	17.7622	18.3290	15.9797	15.3329	13.2311	12.2606	14.0692	14.2372	16.5921	18.1116	19.6680 (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	23.2624	22.5120	23.2624	22.5120	(59)
Total heat required for water heating calculated for each month												
189.7911	167.5494	176.5924	159.1754	156.6182	140.8516	136.1361	148.1935	147.5589	165.0130	173.3880	185.5190	(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												
189.7911	167.5494	176.5924	159.1754	156.6182	140.8516	136.1361	148.1935	147.5589	165.0130	173.3880	185.5190	(64)
Heat gains from water heating, kWh/month												
88.5370	78.6805	84.1484	77.5369	77.5070	71.4442	70.6967	74.7058	73.6744	80.2983	82.2626	87.1165	(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	123.2796	123.2796	123.2796	123.2796	123.2796	123.2796	123.2796	123.2796	123.2796	123.2796	123.2796	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
40.0071	35.5339	28.8981	21.8777	16.3539	13.8066	14.9185	19.3917	26.0275	33.0479	38.5717	41.1190	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
267.9149	270.6950	263.6892	248.7747	229.9477	212.2531	200.4320	197.6519	204.6577	219.5722	238.3991	256.0938	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
49.3826	49.3826	49.3826	49.3826	49.3826	49.3826	49.3826	49.3826	49.3826	49.3826	49.3826	49.3826	(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)												
-82.1864	-82.1864	-82.1864	-82.1864	-82.1864	-82.1864	-82.1864	-82.1864	-82.1864	-82.1864	-82.1864	-82.1864	(71)
Water heating gains (Table 5)												
119.0013	117.0841	113.1027	107.6901	104.1761	99.2281	95.0224	100.4110	102.3256	107.9278	114.2536	117.0921	(72)
Total internal gains												
517.3991	513.7888	496.1659	468.8183	440.9535	415.7636	400.8488	407.9304	423.4865	451.0236	481.7003	504.7807	(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				8.1100	10.6334	0.6300	0.7000	0.7700	26.3551 (74)			
East				4.8700	19.6403	0.6300	0.7000	0.7700	29.2313 (76)			
South				4.8700	46.7521	0.6300	0.7000	0.7700	69.5827 (78)			

Solar gains	125.1691	221.5072	324.9187	438.8794	524.4711	535.0830	509.8872	443.8710	364.0652	250.7211	151.4397	106.1352 (83)
Total gains	642.5682	735.2960	821.0846	907.6977	965.4245	950.8466	910.7359	851.8013	787.5517	701.7448	633.1400	610.9159 (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	60.8669	61.0138	61.1585	61.8474	61.9780	62.5934	62.5934	62.7087	62.3549	61.9780	61.7144	61.4411
alpha	5.0578	5.0676	5.0772	5.1232	5.1319	5.1729	5.1729	5.1806	5.1570	5.1319	5.1143	5.0961
util living area												
0.9881	0.9758	0.9454	0.8639	0.7135	0.5243	0.3818	0.4248	0.6610	0.8998	0.9757	0.9906	(86)
Tweekday	18.8407	19.0321	19.2983	19.5846	19.7333	19.7846	19.7890	19.7906	19.7675	19.5774	19.1731	18.8112
Tweekend	20.5010	20.5868	20.7091	20.8456	20.9295	20.9600	20.9651	20.9645	20.9473	20.8364	20.6452	20.4843
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	20.2299	20.3609	20.5511	20.7589	20.8912	20.9386	20.9461	20.9452	20.9176	20.7474	20.4460	20.2042 (87)
Th 2	19.8381	19.8405	19.8429	19.8543	19.8564	19.8663	19.8663	19.8681	19.8625	19.8564	19.8521	19.8476 (88)
util rest of house												
0.9839	0.9676	0.9274	0.8235	0.6447	0.4361	0.2844	0.3220	0.5674	0.8594	0.9659	0.9872	(89)
Tweekday	18.8407	19.0321	19.2983	19.5846	19.7333	19.7846	19.7890	19.7906	19.7675	19.5774	19.1731	18.8112
Tweekend	18.8407	19.0321	19.2983	19.5846	19.7333	19.7846	19.7890	19.7906	19.7675	19.5774	19.1731	18.8112
MIT 2	18.8407	19.0321	19.2983	19.5846	19.7333	19.7846	19.7890	19.7906	19.7675	19.5774	19.1731	18.8112 (90)
Living area fraction									fLA = Living area / (4) =			0.5133 (91)
MIT	19.5537	19.7141	19.9413	20.1873	20.3276	20.3769	20.3829	20.3832	20.3578	20.1779	19.8264	19.5261 (92)
Temperature adjustment												0.0000
adjusted MIT	19.5537	19.7141	19.9413	20.1873	20.3276	20.3769	20.3829	20.3832	20.3578	20.1779	19.8264	19.5261 (93)

8. Space heating requirement

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9826	0.9666	0.9291	0.8362	0.6743	0.4764	0.3290	0.3691	0.6097	0.8721	0.9656	0.9860 (94)
Useful gains	631.4100	710.7158	762.9005	759.0617	650.9459	453.0270	299.6265	314.4282	480.1977	612.0072	611.3611	602.3784 (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												
1245.1299	1206.3332	1091.9548	906.7523	691.6298	458.5472	300.2745	315.5900	498.6240	767.8111	1024.5642	1239.3504	(97)

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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	456.6076	333.0549	244.8164	106.3373	30.2689	0.0000	0.0000	0.0000	0.0000	115.9181	297.5063	473.9072 (98)
Space heating												2058.4166 (98)
Space heating per m2										(98) / (4) =		32.8716 (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 %)												274.4489 (206)
Efficiency of secondary/supplementary heating system, %												100.0000 (208)
Space heating requirement												750.0181 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	456.6076	333.0549	244.8164	106.3373	30.2689	0.0000	0.0000	0.0000	0.0000	115.9181	297.5063	473.9072 (98)
Space heating efficiency (main heating system 1)	274.4489	274.4489	274.4489	274.4489	274.4489	0.0000	0.0000	0.0000	0.0000	274.4489	274.4489	274.4489 (210)
Space heating fuel (main heating system)	166.3725	121.3540	89.2029	38.7457	11.0290	0.0000	0.0000	0.0000	0.0000	42.2367	108.4013	172.6759 (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	189.7911	167.5494	176.5924	159.1754	156.6182	140.8516	136.1361	148.1935	147.5589	165.0130	173.3880	185.5190 (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	112.0108	98.8842	104.2212	93.9420	92.4328	83.1277	80.3447	87.4608	87.0862	97.3873	102.3301	109.4895 (219)
Water heating fuel used												1148.7173 (219)
Annual totals kWh/year												
Space heating fuel - main system												750.0181 (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)												282.6148 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
Total delivered energy for all uses												2181.3502 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	750.0181	13.1900	98.9274 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1148.7173	13.1900	151.5158 (247)
Pumps and fans for heating	0.0000	0.0000	0.0000 (249)
Energy for lighting	282.6148	13.1900	37.2769 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit	0.0000	13.1900	0.0000 (252)
Total energy cost			287.7201 (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] =	1.1229 (257)
SAP value		84.3361
SAP rating (Section 12)		84 (258)
SAP band		B

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	750.0181	0.5190	389.2594 (261)
Space heating - secondary	0.0000	0.5190	0.0000 (263)
Water heating (other fuel)	1148.7173	0.5190	596.1843 (264)
Space and water heating			985.4436 (265)
Pumps and fans	0.0000	0.0000	0.0000 (267)
Energy for lighting	282.6148	0.5190	146.6771 (268)
Energy saving/generation technologies			
PV Unit	-300.0000	0.5190	-155.7000 (269)
Total kg/year			976.4207 (272)
CO2 emissions per m2			15.5900 (273)
EI value			87.8424
EI rating			88 (274)

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EI band

B

Calculation of stars for heating and DHW

Main heating energy efficiency $13.19 \times (1 + 0.29 \times 0.25) / 2.7445 = 5.154$, stars = 4
Main heating environmental impact $0.519 \times (1 + 0.29 \times 0.25) / 2.7445 = 0.2028$, stars = 5
Water heating energy efficiency $13.19 / 1.6944 = 7.784$, stars = 2
Water heating environmental impact $0.519 / 1.6944 = 0.3063$, stars = 4

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

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	62.6200 (1b)	x 2.4000 (2b)	= 150.2880 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	62.6200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 150.2880 (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) = 0.1331 (8)
Measured/design AP50					Yes
Infiltration rate					5.0000
Number of sides sheltered					0.3831 (18)
					1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3543 (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	0.3898	0.3632	0.3632	0.3455	0.3455	0.3012	0.3012	0.2923	0.3012	0.3366	0.3278	0.3543 (22b)
Effective ac	0.5760	0.5660	0.5660	0.5597	0.5597	0.5454	0.5454	0.5427	0.5454	0.5567	0.5537	0.5628 (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)			17.8500	1.3258	23.6648		(27)
Door to Stairs			1.8900	1.4000	2.6460		(26)
Exposed Floor			4.1700	0.1400	0.5838		(28b)
Main Wall	61.2000	17.8500	43.3500	0.2200	9.5370	60.0000	2601.0000 (29a)
Wall to stairs	19.6800	1.8900	17.7900	0.1864	3.3157	190.0000	3380.1000 (29a)
Flat roof	12.5200		12.5200	0.1400	1.7528	9.0000	112.6800 (30)
Total net area of external elements Aum(A, m ²)			97.5700				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		41.5000		(33)
Party Wall 1			8.6400	0.0000	0.0000	180.0000	1555.2000 (32)
Party Floor 1			58.4500			40.0000	2338.0000 (32d)
Party Ceilings 1			50.0100			40.0000	2000.4000 (32b)
Internal Wall 1			58.9900			100.0000	5899.0000 (32c)
Heat capacity Cm = Sum(A x k)			(28)...(30) + (32) + (32a)...(32e) =				17886.3800 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							285.6337 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.2688 (36)
Total fabric heat loss						(33) + (36) =	51.7688 (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	28.5650	28.0688	28.0688	27.7574	27.7574	27.0471	27.0471	26.9167	27.0471	27.6076	27.4616	27.9111 (38)
Heat transfer coeff	80.3338	79.8376	79.8376	79.5262	79.5262	78.8159	78.8159	78.6856	78.8159	79.3764	79.2304	79.6800 (39)
Average = Sum(39)m / 12 =												79.3735 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2829	1.2750	1.2750	1.2700	1.2700	1.2586	1.2586	1.2566	1.2586	1.2676	1.2653	1.2724 (40)
HLP (average)												1.2675 (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												2.0547 (42)
Average daily hot water use (litres/day)												82.9982 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	91.2980	87.9781	84.6581	81.3382	78.0183	74.6984	74.6984	78.0183	81.3382	84.6581	87.9781	91.2980 (44)
Energy content (annual)	135.3923	118.4150	122.1936	106.5314	102.2194	88.2076	81.7373	93.7947	94.9149	110.6142	120.7440	131.1202 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		1305.8846 (45)

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	20.3088	17.7622	18.3290	15.9797	15.3329	13.2311	12.2606	14.0692	14.2372	16.5921	18.1116	19.6680 (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												
189.7911	167.5494	176.5924	159.1754	156.6182	140.8516	136.1361	148.1935	147.5589	165.0130	173.3880	185.5190	(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												
189.7911	167.5494	176.5924	159.1754	156.6182	140.8516	136.1361	148.1935	147.5589	165.0130	173.3880	185.5190	(64)
Heat gains from water heating, kWh/month												
88.5370	78.6805	84.1484	77.5369	77.5070	71.4442	70.6967	74.7058	73.6744	80.2983	82.2626	87.1165	(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	123.2796	123.2796	123.2796	123.2796	123.2796	123.2796	123.2796	123.2796	123.2796	123.2796	123.2796	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
40.0071	35.5339	28.8981	21.8777	16.3539	13.8066	14.9185	19.3917	26.0275	33.0479	38.5717	41.1190	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
267.9149	270.6950	263.6892	248.7747	229.9477	212.2531	200.4320	197.6519	204.6577	219.5722	238.3991	256.0938	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
49.3826	49.3826	49.3826	49.3826	49.3826	49.3826	49.3826	49.3826	49.3826	49.3826	49.3826	49.3826	(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)												
-82.1864	-82.1864	-82.1864	-82.1864	-82.1864	-82.1864	-82.1864	-82.1864	-82.1864	-82.1864	-82.1864	-82.1864	(71)
Water heating gains (Table 5)												
119.0013	117.0841	113.1027	107.6901	104.1761	99.2281	95.0224	100.4110	102.3256	107.9278	114.2536	117.0921	(72)
Total internal gains												
517.3991	513.7888	496.1659	468.8183	440.9535	415.7636	400.8488	407.9304	423.4865	451.0236	481.7003	504.7807	(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					8.1100	12.7500	0.6300	0.7000	0.7700		31.6011 (74)	
East					4.8700	23.7835	0.6300	0.7000	0.7700		35.3978 (76)	
South					4.8700	54.0600	0.6300	0.7000	0.7700		80.4594 (78)	
Solar gains	147.4583	228.5885	334.6450	462.0279	540.3385	584.0246	550.6924	487.1326	400.8057	278.1864	175.8541	125.6962 (83)
Total gains	664.8574	742.3773	830.8108	930.8462	981.2919	999.7882	951.5412	895.0629	824.2922	729.2101	657.5544	630.4768 (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	61.8474	62.2318	62.2318	62.4755	62.4755	63.0385	63.0385	63.1430	63.0385	62.5934	62.7087	62.3549
alpha	5.1232	5.1488	5.1488	5.1650	5.1650	5.2026	5.2026	5.2095	5.2026	5.1729	5.1806	5.1570
util living area												
0.9837	0.9699	0.9285	0.8227	0.6416	0.4228	0.2813	0.3159	0.5763	0.8559	0.9644	0.9868	(86)
Tweekday	18.9779	19.1534	19.4193	19.6592	19.7657	19.7958	19.7969	19.7986	19.7899	19.6627	19.3098	18.9535
Tweekend	20.5568	20.6345	20.7594	20.8809	20.9465	20.9644	20.9661	20.9660	20.9575	20.8776	20.7021	20.5427
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	20.3160	20.4346	20.6287	20.8140	20.9174	20.9453	20.9477	20.9475	20.9336	20.8112	20.5348	20.2942 (87)
Th 2	19.8543	19.8605	19.8605	19.8644	19.8644	19.8734	19.8734	19.8750	19.8734	19.8663	19.8681	19.8625 (88)
util rest of house												
0.9779	0.9596	0.9050	0.7735	0.5654	0.3361	0.1883	0.2175	0.4792	0.8019	0.9502	0.9820	(89)
Tweekday	18.9779	19.1534	19.4193	19.6592	19.7657	19.7958	19.7969	19.7986	19.7899	19.6627	19.3098	18.9535
Tweekend	18.9779	19.1534	19.4193	19.6592	19.7657	19.7958	19.7969	19.7986	19.7899	19.6627	19.3098	18.9535
MIT 2	18.9779	19.1534	19.4193	19.6592	19.7657	19.7958	19.7969	19.7986	19.7899	19.6627	19.3098	18.9535 (90)
Living area fraction												
fLA = Living area / (4) =												0.5133 (91)
MIT	19.6647	19.8110	20.0400	20.2519	20.3568	20.3858	20.3875	20.3883	20.3769	20.2522	19.9385	19.6416 (92)
Temperature adjustment												0.0000
adjusted MIT	19.6647	19.8110	20.0400	20.2519	20.3568	20.3858	20.3875	20.3883	20.3769	20.2522	19.9385	19.6416 (93)

8. Space heating requirement

Utilisation	0.9767	0.9591	0.9092	0.7915	0.5994	0.3758	0.2308	0.2625	0.5236	0.8221	0.9512	0.9809 (94)
Useful gains	649.3533	711.9922	755.3765	736.7236	588.1744	375.7204	219.6199	234.9713	431.6026	599.4583	625.4850	618.4139 (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												
1186.1024	1142.5554	1017.1328	839.1515	608.9181	377.1976	219.7024	235.1353	439.5515	702.6524	961.7422	1174.6122	(97)

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 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	399.3414	289.3385	194.7467	73.7480	15.4333	0.0000	0.0000	0.0000	0.0000	76.7764	242.1052	413.8115 (98)
Space heating												1705.3010 (98)
Space heating per m2										(98) / (4) =		27.2325 (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 %)												271.9442 (206)
Efficiency of secondary/supplementary heating system, %												100.0000 (208)
Space heating requirement												627.0775 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	399.3414	289.3385	194.7467	73.7480	15.4333	0.0000	0.0000	0.0000	0.0000	76.7764	242.1052	413.8115 (98)
Space heating efficiency (main heating system 1)	271.9442	271.9442	271.9442	271.9442	271.9442	0.0000	0.0000	0.0000	0.0000	271.9442	271.9442	271.9442 (210)
Space heating fuel (main heating system)	146.8468	106.3963	71.6127	27.1188	5.6752	0.0000	0.0000	0.0000	0.0000	28.2324	89.0275	152.1678 (211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating requirement	189.7911	167.5494	176.5924	159.1754	156.6182	140.8516	136.1361	148.1935	147.5589	165.0130	173.3880	185.5190 (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	112.0108	98.8842	104.2212	93.9420	92.4328	83.1277	80.3447	87.4608	87.0862	97.3873	102.3301	109.4895 (219)
Water heating fuel used												1148.7173 (219)
Annual totals kWh/year												
Space heating fuel - main system												627.0775 (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)												282.6148 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
Total delivered energy for all uses												2058.4096 (238)

10a. Fuel costs - using BEDF prices (472)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	627.0775	18.9000	118.5177 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1148.7173	18.9000	217.1076 (247)
Pumps and fans for heating	0.0000	0.0000	0.0000 (249)
Energy for lighting	282.6148	18.9000	53.4142 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit	0.0000	18.9000	0.0000 (252)
Total energy cost			389.0394 (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	627.0775	0.5190	325.4532 (261)
Space heating - secondary	0.0000	0.5190	0.0000 (263)
Water heating (other fuel)	1148.7173	0.5190	596.1843 (264)
Space and water heating			921.6375 (265)
Pumps and fans	0.0000	0.0000	0.0000 (267)
Energy for lighting	282.6148	0.5190	146.6771 (268)
Energy saving/generation technologies			
PV Unit	-300.0000	0.5190	-155.7000 (269)
Total kg/year			912.6146 (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	627.0775	3.0700	1925.1280 (261)
Space heating - secondary	0.0000	3.0700	0.0000 (263)
Water heating (other fuel)	1148.7173	3.0700	3526.5620 (264)
Space and water heating			5451.6900 (265)
Pumps and fans	0.0000	0.0000	0.0000 (267)
Energy for lighting	282.6148	3.0700	867.6275 (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			5398.3175 (272)
Primary energy kWh/m ² /year			86.2076 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating:	B 84
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 84
Potential environmental impact rating:	B 88

Fuel prices for cost data on this page from database revision number 472 TEST (30 Jan 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	£389	£389	£0
Space heating	£119	£119	£0
Water heating	£217	£217	£0
Lighting	£53	£53	£0
Total cost of fuels	£389	£389	£0
Total cost of uses	£389	£389	£0
Delivered energy	33 kWh/m ²	33 kWh/m ²	0 kWh/m ²
Carbon dioxide emissions	0.9 tonnes	0.9 tonnes	0.0 tonnes
CO2 emissions per m ²	15 kg/m ²	15 kg/m ²	0 kg/m ²
Primary energy	86 kWh/m ²	86 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	285.6 (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	297.57 (P1)
Transmission heat loss coefficient	51.77 (37)
Summer heat loss coefficient	349.34 (P2)

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

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

[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	8.1100	81.1852	0.6300	0.7000	0.9000	235.1913
East	4.8700	117.5071	0.6300	0.7000	0.9000	204.4168
South	4.8700	112.2060	0.6300	0.7000	0.9000	195.1950
total:						634.8030

	Jun	Jul	Aug	
Solar gains	674	635	564	(P3)
Internal gains	416	401	408	
Total summer gains	1090	1036	972	(P5)
Summer gain/loss ratio	3.12	2.96	2.78	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 285.6)	0.00	0.00	0.00	
Threshold temperature	19.12	20.86	20.58	(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	015725	Issued on Date	01/03/2021
Assessment Reference	003	Prop Type Ref	
Property	Flat 4, 18, Parkside Road, READING, RG30 2DB		
SAP Rating	84 B	DER	17.20
Environmental	88 B	TER	27.70
CO ₂ Emissions (t/year)	0.91	% DER<TER	37.90
General Requirements Compliance	Pass	DFEE	49.26
		TFEE	49.72
		% DFEE<TFEE	0.92
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)	27.70	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	17.20	kgCO ₂ /m ²	Pass
	-10.50 (-37.9%)	kgCO ₂ /m ²	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	49.72	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DFEE)	49.26	kWh/m ² /yr	
	-0.4 (-0.8%)	kWh/m ² /yr	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.22 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
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

8.11 m², No overhang

Windows facing East

4.87 m², No overhang

Windows facing South

4.87 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
SAP • CODE • SBEM • DESIGN

Calculation Type: New Build (As Designed)

Property Reference	015725	Issued on Date	01/03/2021
Assessment Reference	003	Prop Type Ref	
Property	Flat 4, 18, Parkside Road, READING, RG30 2DB		
SAP Rating	84 B	DER	17.20
Environmental	88 B	TER	27.70
CO ₂ Emissions (t/year)	0.91	% DER<TER	37.90
General Requirements Compliance	Pass	DFEE	49.26
		TFEE	49.72
		% DFEE<TFEE	0.92
Assessor Details	Mr. Matthew Carter, Energy Calculations Limited, Tel: 01754 761035, mcarter@energycalculations.co.uk		Assessor ID
			7869-0001
Client			

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

Orientation	West					
Property Tenure	Unknown					
Transaction Type	New dwelling					
Terrain Type	Urban					
1.0 Property Type	Flat, End-Terrace					
2.0 Number of Storeys	1					
3.0 Date Built	2020					
4.0 Sheltered Sides	1					
5.0 Sunlight/Shade	Average or unknown					
6.0 Measurements						
Ground Floor:		Heat Loss Perimeter		Internal Floor Area		Average Storey Height
		33.70 m		62.62 m²		2.40 m
7.0 Living Area	32.14			m²		
8.0 Thermal Mass Parameter	Precise calculation					
Thermal Mass	285.63			kJ/m²K		
9.0 External Walls						
Description	Type	Construction		U-Value (W/m²K)	Kappa (kJ/m²K)	Gross Area (m²)
						Nett Area (m²)
Main Wall	Cavity Wall	Cavity wall : plasterboard on dabs, AAC block, filled cavity, any outside structure		0.22	60.00	61.20
Wall to stairs	Cavity Wall	Cavity wall : dense plaster, dense block, filled cavity, any outside structure		0.22	190.00	19.68
9.1 Party Walls						
Description	Type	Construction		U-Value (W/m²K)	Kappa (kJ/m²K)	Area (m²)
Party Wall 1	Solid Wall	Dense plaster both sides, dense blocks, cavity or cavity fill		0.00	180.00	8.64
9.2 Internal Walls						
Description	Construction				Kappa (kJ/m²K)	Area (m²)
Internal Wall 1	Dense block, dense plaster				100.00	58.99
10.0 External Roofs						
Description	Type	Construction		U-Value (W/m²K)	Kappa (kJ/m²K)	Gross Area (m²)
						Nett Area (m²)
Flat roof	External Flat Roof	Plasterboard, insulated flat roof		0.14	9.00	12.52
10.1 Party Ceilings						

SUMMARY FOR INPUT DATA

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

Description	Construction	Kappa (kJ/m²K)	Area (m²)
Party Ceilings 1	Precast concrete planks floor, screed, carpeted	30.00	50.01

11.0 Heat Loss Floors					
Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Area (m²)
Exposed Floor	Exposed Floor - Solid	Other	0.14	0.00	4.17

11.1 Party Floors			
Description	Construction	Kappa (kJ/m²K)	Area (m²)
Party Floor 1	Precast concrete planks floor, screed, carpeted	40.00	58.45

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

13.0 Openings											
Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
Door	Door to Corridor	[2] Wall to stairs	West							1.89	
Windows	Window	[1] Main Wall	North	None	0.00					8.11	
Windows	Window	[1] Main Wall	East	None	0.00					4.87	
Windows	Window	[1] Main Wall	South	None	0.00					4.87	

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)	8.58	0.300	No	
Table K1 - Approved	E3 Sill	8.58	0.040	No	
Table K1 - Approved	E4 Jamb	45.75	0.050	No	
Table K1 - Default	E19 Ground floor (inverted)	8.61	0.070	No	
Table K1 - Approved	E7 Party floor between dwellings (in blocks of flats)	33.70	0.070	No	
Table K1 - Default	E14 Flat roof	17.28	0.080	No	
Table K1 - Approved	E16 Corner (normal)	12.00	0.090	No	
Table K1 - Approved	E17 Corner (inverted – internal area greater than external area)	7.20	-0.090	No	
Table K1 - Approved	E18 Party wall between dwellings	4.80	0.060	No	
Table K1 - Default	P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	3.60	0.000	No	

Y-value	0.105	W/m²K
18.0 Pressure Testing	Yes	
Designed AP ₅₀	5.00	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP ₅₀		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation	
Summer Overheating	

SUMMARY FOR INPUT DATA

Energy Calculations Ltd
SAP ♦ CODE ♦ SBEM ♦ DESIGN

Calculation Type: New Build (As Designed)

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	6.00

Mechanical Ventilation

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

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				2
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System

No

22.0 Lighting

Internal

Total number of light fittings	9	
Total number of L.E.L. fittings	9	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	Yes
Light and motion sensor	Yes

23.0 Electricity Tariff

Standard

24.0 Main Heating 1

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

25.0 Main Heating 2

None

Community Heating	None
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28.0 Water Heating

	HWP From main heating 1
Water Heating	Main Heating 1
Flue Gas Heat Recovery System	No
Waste Water Heat Recovery	No

SUMMARY FOR INPUT DATA

Energy Calculations Ltd
SAP ♦ CODE ♦ SBEM ♦ DESIGN

Calculation Type: New Build (As Designed)

Instantaneous System 1		
Waste Water Heat Recovery	No	
Instantaneous System 2		
Waste Water Heat Recovery	No	
Storage System		
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	01/03/2021
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
015722-003	1	73.4	16.43	27.83	40.96 %
015723-003	1	53	21.18	34.27	38.19 %
015724-003	1	50	19.12	28.78	33.57 %
015725-003	1	62.62	17.20	27.70	37.90 %
015726-003	1	45.84	19.12	29.28	34.69 %
015727-003	1	50.5	18.06	27.97	35.44 %
015728-003	1	44.2	21.03	31.09	32.37 %
015729-003	1	78.1	14.72	23.84	38.25 %
015730-003	1	63.8	17.28	28.45	39.26 %
015731-003	1	60.7	17.13	27.10	36.79 %
015732-003	1	43.25	21.26	29.47	27.86 %
015733-003	1	78.25	15.78	27.04	41.63 %
Totals:	12	703.66	218.31	342.81	
Average DER = 17.80 kgCO ₂ /m ²		% DER/TER	PASS		
Average TER = 28.24 kgCO ₂ /m ²		36.97 %			

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
015722-003	1	73.4	51.81	54.01	4.08 %
015723-003	1	53	67.01	66.99	-0.03 %
015724-003	1	50	45.25	46.33	2.34 %
015725-003	1	62.62	49.26	49.72	0.92 %
015726-003	1	45.84	46.34	45.82	-1.15 %
015727-003	1	50.5	45.03	44.75	-0.61 %
015728-003	1	44.2	47.58	50.81	6.35 %
015729-003	1	78.1	41.12	42.82	3.99 %
015730-003	1	63.8	50.50	52.76	4.28 %
015731-003	1	60.7	45.65	47.49	3.89 %
015732-003	1	43.25	42.47	43.04	1.31 %
015733-003	1	78.25	50.76	53.42	4.97 %
Totals:	12	703.66	582.78	597.97	
Average DFEE = 48.63 kWh/m ² /yr		% DFEE/TFEE	PASS		
Average TFEE = 50.00 kWh/m ² /yr		2.74 %			