

Energy Calculations Ltd

SAP ♦ CODE ♦ SBEM ♦ DESIGN

01754-761035



SAP Report Submission for Building Regulations Compliance

Client:

Project: Flat 12, 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

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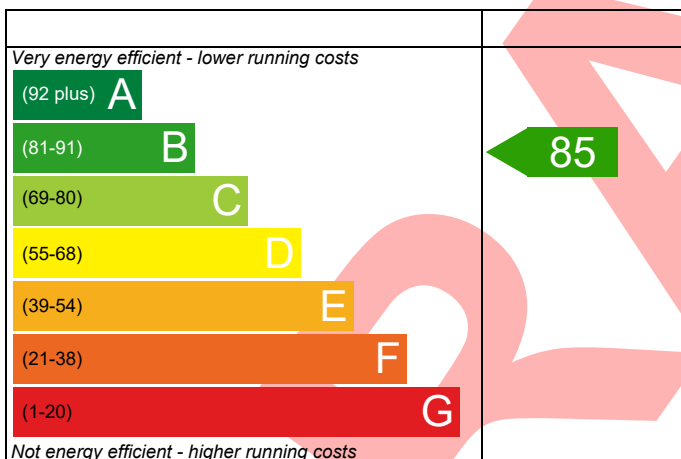
Flat 12, 18, Parkside Road,
READING,
RG30 2DB

Dwelling type: Flat, End-Terrace
Date of assessment: 01/03/2021
Produced by: Energy Calculations Limited
Total floor area: 78.25 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

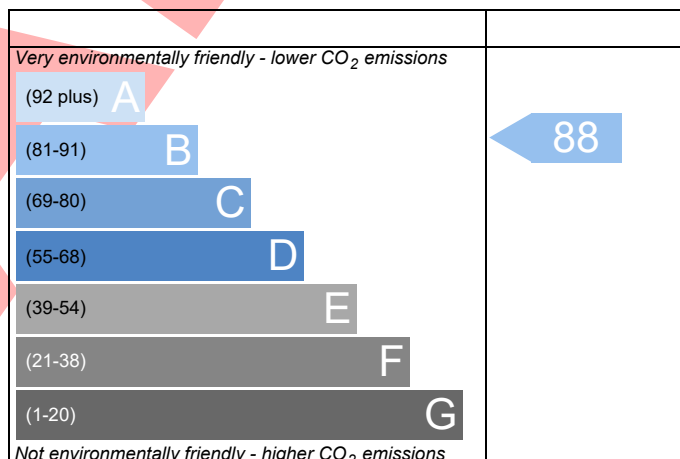


England

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	015733	Issued on Date	01/03/2021
Assessment Reference	003	Prop Type Ref	
Property	Flat 12, 18, Parkside Road, READING, RG30 2DB		
SAP Rating	85 B	DER	15.78
Environmental	88 B	TER	27.04
CO ₂ Emissions (t/year)	1.04	% DER<TER	41.63
General Requirements Compliance	Pass	DFEE	50.76
		TFEE	53.42
		% DFEE<TFEE	4.97
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	8.27	2.48	
External wall	E3 Sill	Table K1 - Approved	0.040	8.27	0.33	
External wall	E4 Jamb	Table K1 - Approved	0.050	45.76	2.29	
External wall	E7 Party floor between dwellings (in blocks of flats)	Table K1 - Approved	0.070	30.54	2.14	
External wall	E14 Flat roof	Table K1 - Default	0.080	30.54	2.44	
External wall	E16 Corner (normal)	Table K1 - Approved	0.090	7.20	0.65	
External wall	E17 Corner (inverted – internal area greater than external area)	Table K1 - Approved	-0.090	7.20	-0.65	
External wall	E18 Party wall between dwellings	Table K1 - Approved	0.060	12.00	0.72	
Party wall	P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	Table K1 - Default	0.000	13.20	0.00	

Total: **10.40** W/mK:
Y-Value: **0.069** W/m²K:

FULL SAP CALCULATION PRINTOUT

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Environmental	88 B	% DER<TER	41.63		
CO ₂ Emissions (t/year)	1.04	DFEE	50.76	TFEE	53.42
General Requirements Compliance	Pass	% DFEE<TFEE	4.97		
Assessor Details	Mr. Matthew Carter, Energy Calculations Limited, Tel: 01754 761035, mcarter@energycalculations.co.uk			Assessor ID	7869-0001
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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

Top-floor flat, total floor area 78 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating:Electricity

Fuel factor:1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER) 27.04 kgCO₂/m²

Dwelling Carbon Dioxide Emission Rate (DER) 15.78 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)53.4 kWh/m²/yr

Dwelling Fabric Energy Efficiency (DFEE)50.8 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.22 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	(no floor)		
Roof	0.14 (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): Not significant OK

Based on:

Overshading:	Average
Windows facing North:	10.13 m ² , No overhang
Windows facing East:	2.60 m ² , No overhang
Windows facing West:	5.20 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	78.2500 (1b)	x 2.4000 (2b)	= 187.8000 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	78.2500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	187.8000 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					2 * 10 = 20.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				20.0000 / (5) =	0.1065 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3565 (18)
Number of sides sheltered					2 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.8500 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3030 (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	0.3864	0.3788	0.3712	0.3333	0.3257	0.2879	0.2879	0.2803	0.3030	0.3257	0.3409	0.3561 (22b)
Effective ac	0.5746	0.5717	0.5689	0.5556	0.5531	0.5414	0.5414	0.5393	0.5459	0.5531	0.5581	0.5634 (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)			17.9300	1.3258	23.7708		(27)
Door to Stairs			1.8900	1.4000	2.6460		(26)
Main Wall	56.3100	17.9300	38.3800	0.2200	8.4436	60.0000	2302.8000 (29a)
Wall to stairs	16.9900	1.8900	15.1000	0.1864	2.8143	190.0000	2869.0000 (29a)
Flat roof	78.2500		78.2500	0.1400	10.9550	9.0000	704.2500 (30)
Total net area of external elements Aum, m ²			151.5500				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	48.6297			(33)
Party Wall 1			31.6800	0.0000	0.0000	180.0000	5702.4000 (32)
Party Floor 1			78.2500			40.0000	3130.0000 (32d)
Internal Wall 1			101.4200			100.0000	10142.0000 (32c)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	24850.4500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							317.5776 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.4008 (36)
Total fabric heat loss						(33) + (36) =	59.0305 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	35.6124	35.4328	35.2567	34.4298	34.2751	33.5549	33.5549	33.4215	33.8323	34.2751	34.5881	34.9153 (38)
Heat transfer coeff												
Average = Sum(39)m / 12 =	94.6429	94.4633	94.2873	93.4603	93.3056	92.5854	92.5854	92.4520	92.8628	93.3056	93.6186	93.9458 (39)
												93.4596 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2095	1.2072	1.2049	1.1944	1.1924	1.1832	1.1832	1.1815	1.1867	1.1924	1.1964	1.2006 (40)
HLP (average)												1.1944 (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												2.4288 (42)
Average daily hot water use (litres/day)												91.8844 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	101.0729	97.3975	93.7221	90.0467	86.3713	82.6960	82.6960	86.3713	90.0467	93.7221	97.3975	101.0729 (44)
Energy conte	149.8881	131.0931	135.2763	117.9372	113.1635	97.6515	90.4885	103.8369	105.0770	122.4571	133.6715	145.1586 (45)
Energy content (annual)										Total = Sum(45)m =		1445.6996 (45)
Distribution loss (46)m = 0.15 x (45)m												
Water storage loss:	22.4832	19.6640	20.2915	17.6906	16.9745	14.6477	13.5733	15.5755	15.7616	18.3686	20.0507	21.7738 (46)

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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	30.1320	(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	30.1320	(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													
204.2869	180.2275	189.6751	170.5812	167.5623	150.2955	144.8873	158.2357	157.7210	176.8559	186.3155	199.5574	199.5574	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Solar input (sum of months) = Sum(63)m =													
Output from w/h													
204.2869	180.2275	189.6751	170.5812	167.5623	150.2955	144.8873	158.2357	157.7210	176.8559	186.3155	199.5574	199.5574	(64)
Heat gains from water heating, kWh/month													
93.3568	82.8960	88.4984	81.3293	81.1459	74.5843	73.6065	78.0448	77.0533	84.2360	86.5610	91.7843	91.7843	(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	121.4409	121.4409	121.4409	121.4409	121.4409	121.4409	121.4409	121.4409	121.4409	121.4409	121.4409	121.4409	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
19.2338	17.0832	13.8930	10.5179	7.8623	6.6377	7.1722	9.3227	12.5129	15.8881	18.5437	19.7683	19.7683	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
215.7442	217.9830	212.3414	200.3311	185.1703	170.9213	161.4021	159.1634	164.8050	176.8152	191.9760	206.2250	206.2250	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
35.1441	35.1441	35.1441	35.1441	35.1441	35.1441	35.1441	35.1441	35.1441	35.1441	35.1441	35.1441	35.1441	(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)													
-97.1527	-97.1527	-97.1527	-97.1527	-97.1527	-97.1527	-97.1527	-97.1527	-97.1527	-97.1527	-97.1527	-97.1527	-97.1527	(71)
Water heating gains (Table 5)													
125.4796	123.3571	118.9495	112.9574	109.0671	103.5894	98.9334	104.8989	107.0185	113.2205	120.2236	123.3660	123.3660	(72)
Total internal gains													
419.8898	417.8556	404.6162	383.2387	361.5320	340.5806	326.9400	332.8173	343.7687	365.3560	390.1756	408.7916	408.7916	(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				10.1300	10.6334	0.6300	0.7000	0.7700	32.9195 (74)				
East				2.6000	19.6403	0.6300	0.7000	0.7700	15.6060 (76)				
West				5.2000	19.6403	0.6300	0.7000	0.7700	31.2121 (80)				
Solar gains	79.7376	154.4970	257.7302	391.6858	500.8977	523.5951	493.9244	409.1049	303.9502	183.5618	98.9871	65.9442	(83)
Total gains	499.6274	572.3525	662.3463	774.9245	862.4296	864.1758	820.8645	741.9222	647.7189	548.9178	489.1627	474.7358	(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	72.9363	73.0750	73.2114	73.8592	73.9816	74.5571	74.5571	74.6647	74.3344	73.9816	73.7343	73.4775	
alpha	5.8624	5.8717	5.8808	5.9239	5.9321	5.9705	5.9705	5.9776	5.9556	5.9321	5.9156	5.8985	
util living area													
0.9992	0.9980	0.9927	0.9638	0.8584	0.6613	0.4924	0.5642	0.8516	0.9849	0.9981	0.9994	0.9994	(86)
Tweekday	18.7909	18.9335	19.1914	19.5371	19.7766	19.8585	19.8661	19.8667	19.8174	19.4973	19.0867	18.7713	
Tweekend	20.4562	20.5186	20.6326	20.7874	20.9096	20.9605	20.9690	20.9674	20.9280	20.7656	20.5831	20.4449	
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	20.1607	20.2554	20.4330	20.6681	20.8605	20.9393	20.9522	20.9497	20.8875	20.6383	20.3491	20.1434	(87)
Th 2	19.9124	19.9142	19.9160	19.9245	19.9261	19.9335	19.9335	19.9348	19.9306	19.9261	19.9229	19.9195	(88)
util rest of house													
0.9989	0.9971	0.9893	0.9467	0.8015	0.5626	0.3753	0.4386	0.7697	0.9750	0.9971	0.9992	0.9992	(89)
Tweekday	18.7909	18.9335	19.1914	19.5371	19.7766	19.8585	19.8661	19.8667	19.8174	19.4973	19.0867	18.7713	
Tweekend	18.7909	18.9335	19.1914	19.5371	19.7766	19.8585	19.8661	19.8667	19.8174	19.4973	19.0867	18.7713	
MIT 2	18.7909	18.9335	19.1914	19.5371	19.7766	19.8585	19.8661	19.8667	19.8174	19.4973	19.0867	18.7713	(90)
Living area fraction													
fLA = Living area / (4) =													
19.2863	19.4116	19.6405	19.9461	20.1686	20.2494	20.2589	20.2584	20.2044	19.9100	19.5432	19.2675	19.2675	(92)
Temperature adjustment													
adjusted MIT	19.2863	19.4116	19.6405	19.9461	20.1686	20.2494	20.2589	20.2584	20.2044	19.9100	19.5432	19.2675	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9986	0.9965	0.9881	0.9472	0.8158	0.5930	0.4115	0.4776	0.7935	0.9748	0.9966	0.9989	(94)
Useful gains	498.9131	570.3719	654.4875	733.9774	703.5452	512.4268	337.7532	354.3765	513.9557	535.0720	487.4847	474.2339	(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													
1418.3467	1370.8117	1238.9773	1032.3755	790.1678	523.0501	338.7642	356.7163	566.8740	868.6728	1164.9194	1415.5289	1415.5289	(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													

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Space heating	684.0586	537.8956	434.8605	214.8466	64.4472	0.0000	0.0000	0.0000	0.0000	248.1990	487.7529	700.3235 (98)
Space heating per m2											(98) / (4) =	3372.3839 (98)
												43.0976 (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 %)												304.2782 (206)
Efficiency of secondary/supplementary heating system, %												100.0000 (208)
Space heating requirement												1108.3225 (211)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	684.0586	537.8956	434.8605	214.8466	64.4472	0.0000	0.0000	0.0000	0.0000	248.1990	487.7529	700.3235 (98)
Space heating efficiency (main heating system 1)	304.2782	304.2782	304.2782	304.2782	304.2782	0.0000	0.0000	0.0000	0.0000	304.2782	304.2782	304.2782 (210)
Space heating fuel (main heating system)	224.8135	176.7775	142.9154	70.6086	21.1803	0.0000	0.0000	0.0000	0.0000	81.5698	160.2983	230.1589 (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	204.2869	180.2275	189.6751	170.5812	167.5623	150.2955	144.8873	158.2357	157.7210	176.8559	186.3155	199.5574 (64)
Efficiency of water heater	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400 (216)
Fuel for water heating, kWh/month	120.5659	106.3666	111.9424	100.6735	98.8918	88.7013	85.5095	93.3874	93.0837	104.3767	109.9596	117.7747 (219)
Water heating fuel used												1231.2332 (219)
Annual totals kWh/year												
Space heating fuel - main system												1108.3225 (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)												339.6741 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
Total delivered energy for all uses												2679.2298 (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	1108.3225	0.5190	575.2194 (261)	
Space heating - secondary	0.0000	0.5190	0.0000 (263)	
Water heating (other fuel)	1231.2332	0.5190	639.0101 (264)	
Space and water heating			1214.2294 (265)	
Pumps and fans	0.0000	0.0000	0.0000 (267)	
Energy for lighting	339.6741	0.5190	176.2908 (268)	
Energy saving/generation technologies				
PV Unit	-300.0000	0.5190	-155.7000 (269)	
Total CO2, kg/year			1234.8203 (272)	
Dwelling Carbon Dioxide Emission Rate (DER)			15.7800 (273)	

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

DER		15.7800	ZC1
Total Floor Area		78.2500	
Assumed number of occupants		2.4288	
CO2 emission factor in Table 12 for electricity displaced from grid		0.5190	
CO2 emissions from appliances, equation (L14)		16.3381	ZC2
CO2 emissions from cooking, equation (L16)		2.2657	ZC3
Total CO2 emissions		34.3838	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		34.3838	ZC8

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Energy Calculations Ltd
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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	78.2500 (1b)	x 2.4000 (2b)	= 187.8000 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	78.2500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 187.8000 (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					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					Air changes per hour 30.0000 / (5) = 0.1597 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4097 (18)
Number of sides sheltered					2 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.8500 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3483 (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	0.4441	0.4354	0.4266	0.3831	0.3744	0.3309	0.3309	0.3222	0.3483	0.3744	0.3918	0.4092 (22b)
Effective ac	0.5986	0.5948	0.5910	0.5734	0.5701	0.5547	0.5547	0.5519	0.5607	0.5701	0.5768	0.5837 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			1.8900	1.0000	1.8900		(26)
TER Opening Type (Uw = 1.40)			17.6700	1.3258	23.4261		(27)
Main Wall	56.3100	17.6700	38.6400	0.1800	6.9552		(29a)
Wall to stairs	16.9900	1.8900	15.1000	0.1800	2.7180		(29a)
Flat roof	78.2500		78.2500	0.1300	10.1725		(30)
Total net area of external elements Aum(A, m ²)			151.5500				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		45.1618		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.4160 (36)
Total fabric heat loss						(33) + (36) =	53.5778 (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	37.0973	36.8600	36.6275	35.5351	35.3307	34.3793	34.3793	34.2031	34.7458	35.3307	35.7442	36.1764 (38)
Heat transfer coeff	90.6752	90.4379	90.2053	89.1129	88.9085	87.9571	87.9571	87.7809	88.3236	88.9085	89.3220	89.7543 (39)
Average = Sum(39)m / 12 =												89.1119 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1588	1.1558	1.1528	1.1388	1.1362	1.1241	1.1241	1.1218	1.1287	1.1362	1.1415	1.1470 (40)
HLP (average)												1.1388 (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												2.4288 (42)
Average daily hot water use (litres/day)												91.8844 (43)
Daily hot water use	101.0729	97.3975	93.7221	90.0467	86.3713	82.6960	82.6960	86.3713	90.0467	93.7221	97.3975	101.0729 (44)
Energy conte	149.8881	131.0931	135.2763	117.9372	113.1635	97.6515	90.4885	103.8369	105.0770	122.4571	133.6715	145.1586 (45)
Energy content (annual)										Total = Sum(45)m =		1445.6996 (45)
Distribution loss (46)m = 0.15 x (45)m	22.4832	19.6640	20.2915	17.6906	16.9745	14.6477	13.5733	15.5755	15.7616	18.3686	20.0507	21.7738 (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)
Enter (49) or (54) in (55)												0.9188 (55)

FULL SAP CALCULATION PRINTOUT

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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	201.6347	177.8320	187.0229	168.0145	164.9101	147.7289	142.2351	155.5835	155.1544	174.2037	183.7489	196.9052 (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	201.6347	177.8320	187.0229	168.0145	164.9101	147.7289	142.2351	155.5835	155.1544	174.2037	183.7489	196.9052 (64)
Heat gains from water heating, kWh/month	91.2351	80.9795	86.3767	79.2760	79.0242	72.5310	71.4847	75.9230	75.0000	82.1143	84.5077	89.6625 (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	121.4409	121.4409	121.4409	121.4409	121.4409	121.4409	121.4409	121.4409	121.4409	121.4409	121.4409	121.4409 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	19.2304	17.0803	13.8906	10.5161	7.8609	6.6365	7.1710	9.3211	12.5108	15.8853	18.5405	19.7649 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	215.7442	217.9830	212.3414	200.3311	185.1703	170.9213	161.4021	159.1634	164.8050	176.8152	191.9760	206.2250 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.1441	35.1441	35.1441	35.1441	35.1441	35.1441	35.1441	35.1441	35.1441	35.1441	35.1441	35.1441 (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)	-97.1527	-97.1527	-97.1527	-97.1527	-97.1527	-97.1527	-97.1527	-97.1527	-97.1527	-97.1527	-97.1527	-97.1527 (71)
Water heating gains (Table 5)	122.6278	120.5053	116.0977	110.1055	106.2153	100.7375	96.0816	102.0471	104.1666	110.3686	117.3718	120.5141 (72)
Total internal gains	420.0346	418.0007	404.7619	383.3850	361.6788	340.7276	327.0870	332.9638	343.9146	365.5014	390.3205	408.9363 (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				9.9800	10.6334	0.6300	0.7000	0.7700	32.4320 (74)			
East				2.5600	19.6403	0.6300	0.7000	0.7700	15.3659 (76)			
West				5.1300	19.6403	0.6300	0.7000	0.7700	30.7919 (80)			
Solar gains	78.5899	152.2738	254.0202	386.0410	493.6707	516.0366	486.7959	403.2062	299.5731	180.9203	97.5625	64.9949 (83)
Total gains	498.6245	570.2745	658.7821	769.4260	855.3494	856.7642	813.8828	736.1700	643.4878	546.4217	487.8830	473.9312 (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	59.9285	60.0857	60.2407	60.9791	61.1193	61.7804	61.7804	61.9044	61.5241	61.1193	60.8364	60.5434
alpha	4.9952	5.0057	5.0160	5.0653	5.0746	5.1187	5.1187	5.1270	5.1016	5.0746	5.0558	5.0362
util living area	0.9974	0.9944	0.9838	0.9405	0.8209	0.6286	0.4699	0.5368	0.8126	0.9704	0.9946	0.9980 (86)
MIT	19.7814	19.9342	20.2084	20.5735	20.8500	20.9706	20.9945	20.9896	20.8957	20.5255	20.0908	19.7572 (87)
Th 2	19.9531	19.9556	19.9580	19.9693	19.9714	19.9812	19.9812	19.9831	19.9774	19.9714	19.9671	19.9626 (88)
util rest of house	0.9965	0.9925	0.9781	0.9197	0.7665	0.5403	0.3641	0.4241	0.7353	0.9562	0.9924	0.9973 (89)
MIT 2	18.3341	18.5585	18.9572	19.4782	19.8308	19.9628	19.9793	19.9790	19.8964	19.4238	18.7960	18.3056 (90)
Living area fraction	18.8575	19.0560	19.4097	19.8743	20.1994	20.3273	20.3465	20.3445	20.2578	19.8222	19.2643	18.8306 (92)
Temperature adjustment	18.8575	19.0560	19.4097	19.8743	20.1994	20.3273	20.3465	20.3445	20.2578	19.8222	19.2643	18.8306 (93)
adjusted MIT	18.8575	19.0560	19.4097	19.8743	20.1994	20.3273	20.3465	20.3445	20.2578	19.8222	19.2643	18.8306 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	496.2201	564.7107	641.8052	705.9010	666.8825	489.5087	327.6036	342.3769	488.2406	521.0183	483.1534	472.1399 (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	1320.0077	1280.2397	1164.5247	977.9550	755.6697	503.7565	329.5279	346.2508	543.8791	819.9338	1086.5411	1313.1591 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	612.8980	480.8355	388.9033	195.8789	66.0577	0.0000	0.0000	0.0000	0.0000	222.3931	434.4392	625.7183 (98)
Space heating												3027.1239 (98)
Space heating per m2										(98) / (4) =		38.6853 (99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

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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													3237.5656 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	612.8980	480.8355	388.9033	195.8789	66.0577	0.0000	0.0000	0.0000	0.0000	222.3931	434.4392	625.7183	(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)	655.5059	514.2625	415.9394	209.4961	70.6499	0.0000	0.0000	0.0000	0.0000	237.8536	464.6408	669.2174	(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	201.6347	177.8320	187.0229	168.0145	164.9101	147.7289	142.2351	155.5835	155.1544	174.2037	183.7489	196.9052	(64)
Efficiency of water heater (217)m	87.5926	87.3382	86.7239	85.2239	82.5929	79.8000	79.8000	79.8000	79.8000	85.4663	87.0313	87.6857	(216)
Fuel for water heating, kWh/month	230.1961	203.6129	215.6534	197.1449	199.6663	185.1239	178.2395	194.9668	194.4290	203.8273	211.1295	224.5579	(219)
Water heating fuel used												2438.5476	(219)
Annual totals kWh/year													
Space heating fuel - main system													3237.5656 (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)													339.6146 (232)
Total delivered energy for all uses													6090.7278 (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	3237.5656	0.2160	699.3142 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2438.5476	0.2160	526.7263 (264)
Space and water heating			1226.0405 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	339.6146	0.5190	176.2600 (268)
Total CO2, kg/m2/year			1441.2254 (272)
Emissions per m2 for space and water heating			15.6682 (272a)
Fuel factor (electricity)			1.5500
Emissions per m2 for lighting			2.2525 (272b)
Emissions per m2 for pumps and fans			0.4974 (272c)
Target Carbon Dioxide Emission Rate (TER) = (15.6682 * 1.55) + 2.2525 + 0.4974, rounded to 2 d.p.			27.0400 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	78.2500 (1b)	x 2.4000 (2b)	= 187.8000 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	78.2500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 187.8000 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				Air changes per hour
Pressure test					30.0000 / (5) = 0.1597 (8)
Measured/design AP50					Yes
Infiltration rate					5.0000
Number of sides sheltered					0.4097 (18)
					2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3483 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
	0.4441	0.4354	0.4266	0.3831	0.3744	0.3309	0.3309	0.3222	0.3483	0.3744	0.3918	0.4092 (22b)
Effective ac	0.5986	0.5948	0.5910	0.5734	0.5701	0.5547	0.5547	0.5519	0.5607	0.5701	0.5768	0.5837 (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)			17.9300	1.3258	23.7708		(27)
Door to Stairs			1.8900	1.4000	2.6460		(26)
Main Wall	56.3100	17.9300	38.3800	0.2200	8.4436	60.0000	2302.8000 (29a)
Wall to stairs	16.9900	1.8900	15.1000	0.1864	2.8143	190.0000	2869.0000 (29a)
Flat roof	78.2500		78.2500	0.1400	10.9550	9.0000	704.2500 (30)
Total net area of external elements Aum, m ²			151.5500				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		48.6297		(33)
Party Wall 1			31.6800	0.0000	0.0000	180.0000	5702.4000 (32)
Party Floor 1			78.2500			40.0000	3130.0000 (32d)
Internal Wall 1			101.4200			100.0000	10142.0000 (32c)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 24850.4500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							317.5776 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.4008 (36)
Total fabric heat loss							(33) + (36) = 59.0305 (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	37.0973	36.8600	36.6275	35.5351	35.3307	34.3793	34.3793	34.2031	34.7458	35.3307	35.7442	36.1764 (38)
Heat transfer coeff	96.1279	95.8906	95.6580	94.5656	94.3612	93.4098	93.4098	93.2336	93.7763	94.3612	94.7747	95.2070 (39)
Average = Sum(39)m / 12 =												94.5646 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2285	1.2254	1.2225	1.2085	1.2059	1.1937	1.1937	1.1915	1.1984	1.2059	1.2112	1.2167 (40)
HLP (average)												1.2085 (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												2.4288 (42)
Average daily hot water use (litres/day)												91.8844 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	101.0729	97.3975	93.7221	90.0467	86.3713	82.6960	82.6960	86.3713	90.0467	93.7221	97.3975	101.0729 (44)
Energy conte	149.8881	131.0931	135.2763	117.9372	113.1635	97.6515	90.4885	103.8369	105.0770	122.4571	133.6715	145.1586 (45)
Energy content (annual)										Total = Sum(45)m =		1445.6996 (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:												

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Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	31.8512	27.8573	28.7462	25.0617	24.0473	20.7510	19.2288	22.0653	22.3289	26.0221	28.4052	30.8462 (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	121.4409	121.4409	121.4409	121.4409	121.4409	121.4409	121.4409	121.4409	121.4409	121.4409	121.4409	121.4409	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	19.2338	17.0832	13.8930	10.5179	7.8623	6.6377	7.1722	9.3227	12.5129	15.8881	18.5437	19.7683	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	215.7442	217.9830	212.3414	200.3311	185.1703	170.9213	161.4021	159.1634	164.8050	176.8152	191.9760	206.2250	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.1441	35.1441	35.1441	35.1441	35.1441	35.1441	35.1441	35.1441	35.1441	35.1441	35.1441	35.1441	(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)	-97.1527	-97.1527	-97.1527	-97.1527	-97.1527	-97.1527	-97.1527	-97.1527	-97.1527	-97.1527	-97.1527	-97.1527	(71)
Water heating gains (Table 5)	42.8108	41.4543	38.6374	34.8079	32.3216	28.8208	25.8452	29.6577	31.0123	34.9760	39.4517	41.4600	(72)
Total internal gains	337.2210	335.9528	324.3041	305.0892	284.7864	265.8120	253.8518	257.5761	267.7625	287.1115	309.4036	326.8855	(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	10.1300	10.6334	0.6300	0.7000	0.7700	32.9195 (74)
East	2.6000	19.6403	0.6300	0.7000	0.7700	15.6060 (76)
West	5.2000	19.6403	0.6300	0.7000	0.7700	31.2121 (80)

Solar gains	79.7376	154.4970	257.7302	391.6858	500.8977	523.5951	493.9244	409.1049	303.9502	183.5618	98.9871	65.9442	(83)
Total gains	416.9586	490.4497	582.0342	696.7749	785.6841	789.4072	747.7762	666.6810	571.7127	470.6733	408.3907	392.8298	(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	71.8096	71.9873	72.1623	72.9959	73.1540	73.8991	73.8991	74.0388	73.6103	73.1540	72.8349	72.5042	
alpha	5.7873	5.7992	5.8108	5.8664	5.8769	5.9266	5.9266	5.9359	5.9074	5.8769	5.8557	5.8336	
util living area	0.9997	0.9991	0.9963	0.9780	0.8974	0.7159	0.5424	0.6257	0.9025	0.9930	0.9993	0.9998	(86)
MIT	19.8384	19.9696	20.2104	20.5463	20.8308	20.9679	20.9947	20.9885	20.8713	20.4960	20.1090	19.8185	(87)
Th 2	19.8973	19.8997	19.9021	19.9132	19.9153	19.9250	19.9250	19.9268	19.9213	19.9153	19.9111	19.9067	(88)
util rest of house	0.9996	0.9987	0.9944	0.9666	0.8488	0.6144	0.4140	0.4894	0.8347	0.9880	0.9989	0.9997	(89)
MIT 2	18.8392	18.9722	19.2141	19.5525	19.8091	19.9128	19.9240	19.9243	19.8539	19.5093	19.1210	18.8270	(90)
Living area fraction													
MIT	19.2006	19.3329	19.5744	19.9119	20.1786	20.2944	20.3112	20.3092	20.2218	19.8662	19.4784	19.1856	(92)
Temperature adjustment													0.0000
adjusted MIT	19.2006	19.3329	19.5744	19.9119	20.1786	20.2944	20.3112	20.3092	20.2218	19.8662	19.4784	19.1856	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9994	0.9984	0.9937	0.9665	0.8622	0.6512	0.4610	0.5397	0.8570	0.9877	0.9986	0.9996	(94)
Useful gains	416.7247	489.6766	578.3610	673.4672	677.4275	514.0356	344.7039	359.8136	489.9517	464.8854	407.8386	392.6760	(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	1432.3607	1383.9815	1250.6745	1041.3470	800.0503	531.9117	346.6667	364.4690	574.0822	874.3658	1173.1548	1426.7353	(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	755.6332	600.9729	500.2012	264.8735	91.2313	0.0000	0.0000	0.0000	0.0000	304.6534	551.0277	769.3401	(98)
Space heating												3837.9334	(98)
Space heating per m2											(98) / (4) =	49.0471	(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	878.0522	691.2326	708.5755	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9092	0.9559	0.9275	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	798.3194	660.7813	657.1960	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1013.0938	962.5668	869.2744	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)

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Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	154.6376	224.5284	157.7863	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												536.9524 (104)
Cooled fraction									fC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	38.6594	56.1321	39.4466	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												134.2381 (107)
Space cooling per m2												1.7155 (108)
Energy for space heating												49.0471 (99)
Energy for space cooling												1.7155 (108)
Total												50.7626 (109)
Dwelling Fabric Energy Efficiency (DFEE)												50.8 (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	78.2500 (1b)	x 2.4000 (2b)	= 187.8000 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	78.2500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 187.8000 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1597 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4097 (18)
Number of sides sheltered					2 (19)
Shelter factor					(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor					(21) = (18) x (20) = 0.3483 (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	0.4441	0.4354	0.4266	0.3831	0.3744	0.3309	0.3309	0.3222	0.3483	0.3744	0.3918	0.4092 (22b)
	0.5986	0.5948	0.5910	0.5734	0.5701	0.5547	0.5547	0.5519	0.5607	0.5701	0.5768	0.5837 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			1.8900	1.0000	1.8900		(26)
TER Opening Type (Uw = 1.40)			17.6700	1.3258	23.4261		(27)
Main Wall	56.3100	17.6700	38.6400	0.1800	6.9552		(29a)
Wall to stairs	16.9900	1.8900	15.1000	0.1800	2.7180		(29a)
Flat roof	78.2500		78.2500	0.1300	10.1725		(30)
Total net area of external elements Aum(A, m ²)			151.5500				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 45.1618		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.4160 (36)
Total fabric heat loss						(33) + (36) =	53.5778 (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	37.0973	36.8600	36.6275	35.5351	35.3307	34.3793	34.3793	34.2031	34.7458	35.3307	35.7442	36.1764 (38)
Heat transfer coeff	90.6752	90.4379	90.2053	89.1129	88.9085	87.9571	87.9571	87.7809	88.3236	88.9085	89.3220	89.7543 (39)
Average = Sum(39)m / 12 =												89.1119 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1588	1.1558	1.1528	1.1388	1.1362	1.1241	1.1241	1.1218	1.1287	1.1362	1.1415	1.1470 (40)
HLP (average)												1.1388 (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												2.4288 (42)
Average daily hot water use (litres/day)												91.8844 (43)
Daily hot water use	101.0729	97.3975	93.7221	90.0467	86.3713	82.6960	82.6960	86.3713	90.0467	93.7221	97.3975	101.0729 (44)
Energy conte	149.8881	131.0931	135.2763	117.9372	113.1635	97.6515	90.4885	103.8369	105.0770	122.4571	133.6715	145.1586 (45)
Energy content (annual)										Total = Sum(45)m =		1445.6996 (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	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)

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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 (59)
Heat gains from water heating, kWh/month	31.8512	27.8573	28.7462	25.0617	24.0473	20.7510	19.2288	22.0653	22.3289	26.0221	28.4052	30.8462 (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	121.4409	121.4409	121.4409	121.4409	121.4409	121.4409	121.4409	121.4409	121.4409	121.4409	121.4409	121.4409	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	19.2304	17.0803	13.8906	10.5161	7.8609	6.6365	7.1710	9.3211	12.5108	15.8853	18.5405	19.7649	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	215.7442	217.9830	212.3414	200.3311	185.1703	170.9213	161.4021	159.1634	164.8050	176.8152	191.9760	206.2250	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.1441	35.1441	35.1441	35.1441	35.1441	35.1441	35.1441	35.1441	35.1441	35.1441	35.1441	35.1441	(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)	-97.1527	-97.1527	-97.1527	-97.1527	-97.1527	-97.1527	-97.1527	-97.1527	-97.1527	-97.1527	-97.1527	-97.1527	(71)
Water heating gains (Table 5)	42.8108	41.4543	38.6374	34.8079	32.3216	28.8208	25.8452	29.6577	31.0123	34.9760	39.4517	41.4600	(72)
Total internal gains	337.2176	335.9498	324.3016	305.0873	284.7851	265.8109	253.8505	257.5745	267.7603	287.1087	309.4004	326.8821	(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	9.9800	10.6334	0.6300	0.7000	0.7700	32.4320	(74)
East	2.5600	19.6403	0.6300	0.7000	0.7700	15.3659	(76)
West	5.1300	19.6403	0.6300	0.7000	0.7700	30.7919	(80)

Solar gains	78.5899	152.2738	254.0202	386.0410	493.6707	516.0366	486.7959	403.2062	299.5731	180.9203	97.5625	64.9949	(83)
Total gains	415.8075	488.2236	578.3218	691.1283	778.4557	781.8474	740.6464	660.7806	567.3334	468.0290	406.9629	391.8770	(84)

7. Mean internal temperature (heating season)

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

													21.0000 (85)
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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	59.9285	60.0857	60.2407	60.9791	61.1193	61.7804	61.7804	61.9044	61.5241	61.1193	60.8364	60.5434	
alpha	4.9952	5.0057	5.0160	5.0653	5.0746	5.1187	5.1187	5.1270	5.1016	5.0746	5.0558	5.0362	
util living area	0.9989	0.9972	0.9906	0.9595	0.8595	0.6767	0.5134	0.5911	0.8645	0.9842	0.9976	0.9992	(86)
MIT	19.6832	19.8380	20.1182	20.5008	20.8102	20.9592	20.9918	20.9841	20.8567	20.4417	19.9956	19.6595	(87)
Th 2	19.9531	19.9556	19.9580	19.9693	19.9714	19.9812	19.9812	19.9831	19.9774	19.9714	19.9671	19.9626	(88)
util rest of house	0.9985	0.9962	0.9872	0.9442	0.8107	0.5862	0.3993	0.4704	0.7969	0.9758	0.9966	0.9989	(89)
MIT 2	18.7498	18.9062	19.1865	19.5677	19.8459	19.9631	19.9792	19.9786	19.8967	19.5184	19.0731	18.7338	(90)
Living area fraction									fLA = Living area / (4) =			0.3617	(91)
MIT	19.0874	19.2432	19.5235	19.9052	20.1946	20.3234	20.3454	20.3422	20.2439	19.8523	19.4067	19.0685	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0874	19.2432	19.5235	19.9052	20.1946	20.3234	20.3454	20.3422	20.2439	19.8523	19.4067	19.0685	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9980	0.9953	0.9853	0.9430	0.8225	0.6180	0.4409	0.5145	0.8170	0.9745	0.9958	0.9985	(94)
Useful gains	414.9795	485.9303	569.8091	651.7413	640.2666	483.2155	326.5246	339.9560	463.4899	456.1090	405.2724	391.2985	(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	1340.8469	1297.1688	1174.7864	980.7028	755.2461	503.4105	329.4376	346.0529	542.6480	822.6068	1099.2593	1334.5151	(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	688.8454	545.1523	450.1030	236.8522	85.5447	0.0000	0.0000	0.0000	0.0000	272.6744	499.6706	701.7531	(98)
Space heating												3480.5958	(98)
Space heating per m2										(98) / (4) =		44.4805	(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	826.7968	650.8826	667.1350	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9061	0.9504	0.9234	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	749.1758	618.5781	616.0254	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1004.2562	954.2315	862.3757	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	183.6579	249.7262	183.2846	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												616.6687	(104)
Cooled fraction									fC = cooled area / (4) =			1.0000	(105)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	45.9145	62.4315	45.8212	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling											154.1672 (107)
Space cooling per m2											1.9702 (108)
Energy for space heating											44.4805 (99)
Energy for space cooling											1.9702 (108)
Total											46.4506 (109)
Target Fabric Energy Efficiency (TFEE)											53.4 (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	78.2500 (1b)	x 2.4000 (2b)	= 187.8000 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	78.2500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 187.8000 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					2 * 10 = 20.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					20.0000 / (5) = 0.1065 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3565 (18)
Number of sides sheltered					2 (19)
Shelter factor					(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor					(21) = (18) x (20) = 0.3030 (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	0.3333	0.3106	0.3106	0.2954	0.2954	0.2576	0.2576	0.2500	0.2576	0.2879	0.2803	0.3030 (22b)
Effective ac	0.5556	0.5482	0.5482	0.5436	0.5436	0.5332	0.5332	0.5312	0.5332	0.5414	0.5393	0.5459 (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)			17.9300	1.3258	23.7708		(27)
Door to Stairs			1.8900	1.4000	2.6460		(26)
Main Wall	56.3100	17.9300	38.3800	0.2200	8.4436	60.0000	2302.8000 (29a)
Wall to stairs	16.9900	1.8900	15.1000	0.1864	2.8143	190.0000	2869.0000 (29a)
Flat roof	78.2500		78.2500	0.1400	10.9550	9.0000	704.2500 (30)
Total net area of external elements Aum, m ²			151.5500				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	48.6297			(33)
Party Wall 1			31.6800	0.0000	0.0000	180.0000	5702.4000 (32)
Party Floor 1			78.2500			40.0000	3130.0000 (32d)
Internal Wall 1			101.4200			100.0000	10142.0000 (32c)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 24850.4500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							317.5776 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.4008 (36)
Total fabric heat loss							(33) + (36) = 59.0305 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	34.4298	33.9763	33.9763	33.6918	33.6918	33.0427	33.0427	32.9236	33.0427	33.5549	33.4215	33.8323 (38)
Heat transfer coeff	93.4603	93.0069	93.0069	92.7223	92.7223	92.0733	92.0733	91.9541	92.0733	92.5854	92.4520	92.8628 (39)
Average = Sum(39)m / 12 =												92.5827 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1944	1.1886	1.1886	1.1850	1.1850	1.1767	1.1767	1.1751	1.1767	1.1832	1.1815	1.1867 (40)
HLP (average)												1.1832 (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												2.4288 (42)
Average daily hot water use (litres/day)												91.8844 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	101.0729	97.3975	93.7221	90.0467	86.3713	82.6960	82.6960	86.3713	90.0467	93.7221	97.3975	101.0729 (44)
Energy conte	149.8881	131.0931	135.2763	117.9372	113.1635	97.6515	90.4885	103.8369	105.0770	122.4571	133.6715	145.1586 (45)
Energy content (annual)										Total = Sum(45)m =		1445.6996 (45)
Distribution loss (46)m = 0.15 x (45)m												
	22.4832	19.6640	20.2915	17.6906	16.9745	14.6477	13.5733	15.5755	15.7616	18.3686	20.0507	21.7738 (46)
Water storage loss:												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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CALCULATION OF HEAT DEMAND 09 Jan 2014

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	30.1320	(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	30.1320	(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	22.5120	(59)
Total heat required for water heating calculated for each month													
204.2869	180.2275	189.6751	170.5812	167.5623	150.2955	144.8873	158.2357	157.7210	176.8559	186.3155	199.5574	199.5574	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Solar input (sum of months) = Sum(63)m =													
Output from w/h													
204.2869	180.2275	189.6751	170.5812	167.5623	150.2955	144.8873	158.2357	157.7210	176.8559	186.3155	199.5574	199.5574	(64)
RHI water heating demand													
Heat gains from water heating, kWh/month													
93.3568	82.8960	88.4984	81.3293	81.1459	74.5843	73.6065	78.0448	77.0533	84.2360	86.5610	91.7843	91.7843	(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	145.7290	145.7290	145.7290	145.7290	145.7290	145.7290	145.7290	145.7290	145.7290	145.7290	145.7290	145.7290	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
48.0844	42.7081	34.7326	26.2948	19.6557	16.5941	17.9306	23.3068	31.2824	39.7201	46.3593	49.4208	49.4208	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
322.0063	325.3477	316.9274	299.0017	276.3736	255.1065	240.8987	237.5573	245.9776	263.9033	286.5313	307.7985	307.7985	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
52.0017	52.0017	52.0017	52.0017	52.0017	52.0017	52.0017	52.0017	52.0017	52.0017	52.0017	52.0017	52.0017	(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)													
-97.1527	-97.1527	-97.1527	-97.1527	-97.1527	-97.1527	-97.1527	-97.1527	-97.1527	-97.1527	-97.1527	-97.1527	-97.1527	(71)
Water heating gains (Table 5)													
125.4796	123.3571	118.9495	112.9574	109.0671	103.5894	98.9334	104.8989	107.0185	113.2205	120.2236	123.3660	123.3660	(72)
Total internal gains													
596.1483	591.9910	571.1876	538.8319	505.6745	475.8681	458.3408	466.3411	484.8565	517.4220	553.6923	581.1633	581.1633	(73)

6. Solar gains

[Jan]				Area	Solar flux		g	FF	Access		Gains	
				m2	Table 6a	Table 6b	or Table 6b	or Table 6c	Table 6d	W		
					W/m2							
North				10.1300	12.7500		0.6300	0.7000	0.7700			39.4721 (74)
East				2.6000	23.7835		0.6300	0.7000	0.7700			18.8982 (76)
West				5.2000	23.7835		0.6300	0.7000	0.7700			37.7964 (80)

Solar gains	96.1668	163.4422	271.7136	419.7794	522.5412	577.2625	539.4125	456.0153	341.8963	208.7750	117.7413	79.8971 (83)
Total gains	692.3151	755.4332	842.9011	958.6114	1028.2156	1053.1305	997.7533	922.3564	826.7528	726.1970	671.4335	661.0604 (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	73.8592	74.2193	74.2193	74.4470	74.4470	74.9719	74.9719	75.0690	74.9719	74.5571	74.6647	74.3344	
alpha	5.9239	5.9480	5.9480	5.9631	5.9631	5.9981	5.9981	6.0046	5.9981	5.9705	5.9776	5.9556	
util living area													
0.9945	0.9897	0.9693	0.8915	0.7099	0.4693	0.3135	0.3584	0.6654	0.9275	0.9872	0.9957	0.9957	(86)
Tweekday	19.0833	19.2167	19.4643	19.7225	19.8445	19.8715	19.8723	19.8736	19.8645	19.7114	19.3672	19.0656	
Tweekend	20.5816	20.6396	20.7525	20.8784	20.9516	20.9693	20.9706	20.9705	20.9608	20.8679	20.7045	20.5714	
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	20.3542	20.4426	20.6180	20.8101	20.9253	20.9528	20.9546	20.9545	20.9388	20.7961	20.5386	20.3386	(87)
Th 2	19.9245	19.9291	19.9291	19.9321	19.9321	19.9387	19.9387	19.9399	19.9387	19.9335	19.9348	19.9306	(88)
util rest of house													
0.9923	0.9854	0.9564	0.8519	0.6335	0.3786	0.2158	0.2532	0.5635	0.8900	0.9808	0.9938	0.9938	(89)
Tweekday	19.0833	19.2167	19.4643	19.7225	19.8445	19.8715	19.8723	19.8736	19.8645	19.7114	19.3672	19.0656	
Tweekend	19.0833	19.2167	19.4643	19.7225	19.8445	19.8715	19.8723	19.8736	19.8645	19.7114	19.3672	19.0656	
MIT 2	19.0833	19.2167	19.4643	19.7225	19.8445	19.8715	19.8723	19.8736	19.8645	19.7114	19.3672	19.0656	(90)
Living area fraction													
MIT	19.5429	19.6601	19.8815	20.1159	20.2354	20.2626	20.2637	20.2645	20.2530	20.1037	19.7909	19.5260	(91)
Temperature adjustment													
adjusted MIT	19.5429	19.6601	19.8815	20.1159	20.2354	20.2626	20.2637	20.2645	20.2530	20.1037	19.7909	19.5260	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	686.2222	743.3691	805.5838	823.9829	674.7087	428.1280	245.2167	263.2994	491.8643	651.4478	657.8041	656.3719	(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													
1368.5351	1316.9843	1170.1690	965.7843	698.6982	429.2990	245.2577	263.4009	502.0751	805.8321	1108.5814	1358.2090	1358.2090	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000	(97a)

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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	78.2500 (1b)	x 2.4000 (2b)	= 187.8000 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	78.2500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 187.8000 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					2 * 10 = 20.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					Air changes per hour 20.0000 / (5) = 0.1065 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3565 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3030 (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	0.3864	0.3788	0.3712	0.3333	0.3257	0.2879	0.2879	0.2803	0.3030	0.3257	0.3409	0.3561 (22b)
Effective ac	0.5746	0.5717	0.5689	0.5556	0.5531	0.5414	0.5414	0.5393	0.5459	0.5531	0.5581	0.5634 (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)			17.9300	1.3258	23.7708		(27)
Door to Stairs			1.8900	1.4000	2.6460		(26)
Main Wall	56.3100	17.9300	38.3800	0.2200	8.4436	60.0000	2302.8000 (29a)
Wall to stairs	16.9900	1.8900	15.1000	0.1864	2.8143	190.0000	2869.0000 (29a)
Flat roof	78.2500		78.2500	0.1400	10.9550	9.0000	704.2500 (30)
Total net area of external elements Aum, m ²			151.5500				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	48.6297			(33)
Party Wall 1			31.6800	0.0000	0.0000	180.0000	5702.4000 (32)
Party Floor 1			78.2500			40.0000	3130.0000 (32d)
Internal Wall 1			101.4200			100.0000	10142.0000 (32c)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 24850.4500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							317.5776 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.4008 (36)
Total fabric heat loss							(33) + (36) = 59.0305 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	35.6124	35.4328	35.2567	34.4298	34.2751	33.5549	33.5549	33.4215	33.8323	34.2751	34.5881	34.9153 (38)
Heat transfer coeff												
Average = Sum(39)m / 12 =	94.6429	94.4633	94.2873	93.4603	93.3056	92.5854	92.5854	92.4520	92.8628	93.3056	93.6186	93.9458 (39)
												93.4596 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2095	1.2072	1.2049	1.1944	1.1924	1.1832	1.1832	1.1815	1.1867	1.1924	1.1964	1.2006 (40)
HLP (average)												1.1944 (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												2.4288 (42)
Average daily hot water use (litres/day)												91.8844 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	101.0729	97.3975	93.7221	90.0467	86.3713	82.6960	82.6960	86.3713	90.0467	93.7221	97.3975	101.0729 (44)
Energy conte	149.8881	131.0931	135.2763	117.9372	113.1635	97.6515	90.4885	103.8369	105.0770	122.4571	133.6715	145.1586 (45)
Energy content (annual)										Total = Sum(45)m =		1445.6996 (45)
Distribution loss (46)m = 0.15 x (45)m												
Water storage loss:	22.4832	19.6640	20.2915	17.6906	16.9745	14.6477	13.5733	15.5755	15.7616	18.3686	20.0507	21.7738 (46)

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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	30.1320	(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	30.1320	(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													
204.2869	180.2275	189.6751	170.5812	167.5623	150.2955	144.8873	158.2357	157.7210	176.8559	186.3155	199.5574	199.5574	(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													
204.2869	180.2275	189.6751	170.5812	167.5623	150.2955	144.8873	158.2357	157.7210	176.8559	186.3155	199.5574	199.5574	(64)
Heat gains from water heating, kWh/month													
93.3568	82.8960	88.4984	81.3293	81.1459	74.5843	73.6065	78.0448	77.0533	84.2360	86.5610	91.7843	91.7843	(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	145.7290	145.7290	145.7290	145.7290	145.7290	145.7290	145.7290	145.7290	145.7290	145.7290	145.7290	145.7290	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
48.0844	42.7081	34.7326	26.2948	19.6557	16.5941	17.9306	23.3068	31.2824	39.7201	46.3593	49.4208	49.4208	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
322.0063	325.3477	316.9274	299.0017	276.3736	255.1065	240.8987	237.5573	245.9776	263.9033	286.5313	307.7985	307.7985	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
52.0017	52.0017	52.0017	52.0017	52.0017	52.0017	52.0017	52.0017	52.0017	52.0017	52.0017	52.0017	52.0017	(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)													
-97.1527	-97.1527	-97.1527	-97.1527	-97.1527	-97.1527	-97.1527	-97.1527	-97.1527	-97.1527	-97.1527	-97.1527	-97.1527	(71)
Water heating gains (Table 5)													
125.4796	123.3571	118.9495	112.9574	109.0671	103.5894	98.9334	104.8989	107.0185	113.2205	120.2236	123.3660	123.3660	(72)
Total internal gains													
596.1483	591.9910	571.1876	538.8319	505.6745	475.8681	458.3408	466.3411	484.8565	517.4220	553.6923	581.1633	581.1633	(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				10.1300	10.6334			0.6300	0.7000		0.7700	32.9195 (74)
East				2.6000	19.6403			0.6300	0.7000		0.7700	15.6060 (76)
West				5.2000	19.6403			0.6300	0.7000		0.7700	31.2121 (80)

Solar gains	79.7376	154.4970	257.7302	391.6858	500.8977	523.5951	493.9244	409.1049	303.9502	183.5618	98.9871	65.9442 (83)
Total gains	675.8859	746.4879	828.9177	930.5177	1006.5722	999.4632	952.2652	875.4460	788.8067	700.9838	652.6794	647.1076 (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	72.9363	73.0750	73.2114	73.8592	73.9816	74.5571	74.5571	74.6647	74.3344	73.9816	73.7343	73.4775	
alpha	5.8624	5.8717	5.8808	5.9239	5.9321	5.9705	5.9705	5.9776	5.9556	5.9321	5.9156	5.8985	
util living area													
0.9961	0.9921	0.9786	0.9247	0.7854	0.5819	0.4263	0.4824	0.7545	0.9549	0.9915	0.9969	0.9969	(86)
Tweekday	18.9773	19.1140	19.3514	19.6444	19.8124	19.8627	19.8665	19.8676	19.8427	19.6238	19.2558	18.9545	
Tweekend	20.5388	20.5992	20.7057	20.8415	20.9336	20.9653	20.9699	20.9692	20.9487	20.8270	20.6588	20.5261	
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	20.2883	20.3799	20.5458	20.7525	20.8975	20.9468	20.9535	20.9524	20.9199	20.7330	20.4672	20.2687	(87)
Th 2	19.9124	19.9142	19.9160	19.9245	19.9261	19.9335	19.9335	19.9348	19.9306	19.9261	19.9229	19.9195	(88)
util rest of house													
0.9944	0.9889	0.9696	0.8953	0.7197	0.4903	0.3238	0.3727	0.6617	0.9306	0.9874	0.9957	0.9957	(89)
Tweekday	18.9773	19.1140	19.3514	19.6444	19.8124	19.8627	19.8665	19.8676	19.8427	19.6238	19.2558	18.9545	
Tweekend	18.9773	19.1140	19.3514	19.6444	19.8124	19.8627	19.8665	19.8676	19.8427	19.6238	19.2558	18.9545	
MIT 2	18.9773	19.1140	19.3514	19.6444	19.8124	19.8627	19.8665	19.8676	19.8427	19.6238	19.2558	18.9545	(90)
Living area fraction													
fLA = Living area / (4) =												0.3617	(91)
MIT	19.4514	19.5718	19.7834	20.0452	20.2049	20.2548	20.2596	20.2599	20.2323	20.0249	19.6939	19.4298	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.4514	19.5718	19.7834	20.0452	20.2049	20.2548	20.2596	20.2599	20.2323	20.0249	19.6939	19.4298	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9935	0.9876	0.9683	0.8991	0.7380	0.5185	0.3553	0.4065	0.6898	0.9333	0.9863	0.9949	(94)
Useful gains	671.5159	737.2525	802.6356	836.6514	742.8140	518.2406	338.3687	355.8673	544.0869	654.2255	643.7151	643.8056	(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													
1433.9724	1385.9483	1252.4528	1041.6338	793.5513	523.5491	338.8256	356.8587	569.4620	879.3982	1179.0238	1430.7758	1430.7758	(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													

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Space heating	567.2677	435.9236	334.6640	147.5873	37.7486	0.0000	0.0000	0.0000	0.0000	167.5285	385.4223	585.5058 (98)
Space heating per m2												2661.6476 (98)
											(98) / (4) =	34.0147 (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 %)												304.2782 (206)
Efficiency of secondary/supplementary heating system, %												100.0000 (208)
Space heating requirement												874.7414 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	567.2677	435.9236	334.6640	147.5873	37.7486	0.0000	0.0000	0.0000	0.0000	167.5285	385.4223	585.5058 (98)
Space heating efficiency (main heating system 1)	304.2782	304.2782	304.2782	304.2782	304.2782	0.0000	0.0000	0.0000	0.0000	304.2782	304.2782	304.2782 (210)
Space heating fuel (main heating system)	186.4306	143.2648	109.9862	48.5041	12.4059	0.0000	0.0000	0.0000	0.0000	55.0577	126.6677	192.4245 (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	204.2869	180.2275	189.6751	170.5812	167.5623	150.2955	144.8873	158.2357	157.7210	176.8559	186.3155	199.5574 (64)
Efficiency of water heater (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 (216)
Fuel for water heating, kWh/month	120.5659	106.3666	111.9424	100.6735	98.8918	88.7013	85.5095	93.3874	93.0837	104.3767	109.9596	117.7747 (219)
Water heating fuel used												1231.2332 (219)
Annual totals kWh/year												
Space heating fuel - main system												874.7414 (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)												339.6741 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
Total delivered energy for all uses												2445.6488 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	874.7414	13.1900	115.3784 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1231.2332	13.1900	162.3997 (247)
Pumps and fans for heating	0.0000	0.0000	0.0000 (249)
Energy for lighting	339.6741	13.1900	44.8030 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit	0.0000	13.1900	0.0000 (252)
Total energy cost			322.5811 (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] =	1.0993 (257)
SAP value		84.6653
SAP rating (Section 12)		85 (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	874.7414	0.5190	453.9908 (261)
Space heating - secondary	0.0000	0.5190	0.0000 (263)
Water heating (other fuel)	1231.2332	0.5190	639.0101 (264)
Space and water heating			1093.0009 (265)
Pumps and fans	0.0000	0.0000	0.0000 (267)
Energy for lighting	339.6741	0.5190	176.2908 (268)
Energy saving/generation technologies			
PV Unit	-300.0000	0.5190	-155.7000 (269)
Total kg/year			1113.5917 (272)
CO2 emissions per m2			14.2300 (273)
EI value			87.8928
EI rating			88 (274)
EI band			B

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Calculation of stars for heating and DHW

Main heating energy efficiency	$13.19 \times (1 + 0.29 \times 0.25) / 3.0428 = 4.649$, stars = 4
Main heating environmental impact	$0.519 \times (1 + 0.29 \times 0.25) / 3.0428 = 0.1829$, 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	78.2500 (1b)	x 2.4000 (2b)	= 187.8000 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	78.2500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 187.8000 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					2 * 10 = 20.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
					Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					20.0000 / (5) = 0.1065 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3565 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3030 (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												
	0.3333	0.3106	0.3106	0.2954	0.2954	0.2576	0.2576	0.2500	0.2576	0.2879	0.2803	0.3030 (22b)
Effective ac	0.5556	0.5482	0.5482	0.5436	0.5436	0.5332	0.5332	0.5312	0.5332	0.5414	0.5393	0.5459 (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)			17.9300	1.3258	23.7708		(27)
Door to Stairs			1.8900	1.4000	2.6460		(26)
Main Wall	56.3100	17.9300	38.3800	0.2200	8.4436	60.0000	2302.8000 (29a)
Wall to stairs	16.9900	1.8900	15.1000	0.1864	2.8143	190.0000	2869.0000 (29a)
Flat roof	78.2500		78.2500	0.1400	10.9550	9.0000	704.2500 (30)
Total net area of external elements Aum, m ²			151.5500				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	48.6297		(33)
Party Wall 1			31.6800	0.0000	0.0000	180.0000	5702.4000 (32)
Party Floor 1			78.2500			40.0000	3130.0000 (32d)
Internal Wall 1			101.4200			100.0000	10142.0000 (32c)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 24850.4500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							317.5776 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.4008 (36)
Total fabric heat loss							(33) + (36) = 59.0305 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	34.4298	33.9763	33.9763	33.6918	33.6918	33.0427	33.0427	32.9236	33.0427	33.5549	33.4215	33.8323 (38)
Heat transfer coeff	93.4603	93.0069	93.0069	92.7223	92.7223	92.0733	92.0733	91.9541	92.0733	92.5854	92.4520	92.8628 (39)
Average = Sum(39)m / 12 =												92.5827 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1944	1.1886	1.1886	1.1850	1.1850	1.1767	1.1767	1.1751	1.1767	1.1832	1.1815	1.1867 (40)
HLP (average)												1.1832 (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												2.4288 (42)
Average daily hot water use (litres/day)												91.8844 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	101.0729	97.3975	93.7221	90.0467	86.3713	82.6960	82.6960	86.3713	90.0467	93.7221	97.3975	101.0729 (44)
Energy conte	149.8881	131.0931	135.2763	117.9372	113.1635	97.6515	90.4885	103.8369	105.0770	122.4571	133.6715	145.1586 (45)
Energy content (annual)										Total = Sum(45)m =		1445.6996 (45)
Distribution loss (46)m = 0.15 x (45)m												
	22.4832	19.6640	20.2915	17.6906	16.9745	14.6477	13.5733	15.5755	15.7616	18.3686	20.0507	21.7738 (46)
Water storage loss:												

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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	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	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	23.2624	(59)
Total heat required for water heating calculated for each month													
204.2869	180.2275	189.6751	170.5812	167.5623	150.2955	144.8873	158.2357	157.7210	176.8559	186.3155	199.5574	199.5574	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Solar input (sum of months) = Sum(63)m =													
Output from w/h													
204.2869	180.2275	189.6751	170.5812	167.5623	150.2955	144.8873	158.2357	157.7210	176.8559	186.3155	199.5574	199.5574	(64)
Heat gains from water heating, kWh/month													
93.3568	82.8960	88.4984	81.3293	81.1459	74.5843	73.6065	78.0448	77.0533	84.2360	86.5610	91.7843	91.7843	(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	145.7290	145.7290	145.7290	145.7290	145.7290	145.7290	145.7290	145.7290	145.7290	145.7290	145.7290	145.7290	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
48.0844	42.7081	34.7326	26.2948	19.6557	16.5941	17.9306	23.3068	31.2824	39.7201	46.3593	49.4208	49.4208	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
322.0063	325.3477	316.9274	299.0017	276.3736	255.1065	240.8987	237.5573	245.9776	263.9033	286.5313	307.7985	307.7985	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
52.0017	52.0017	52.0017	52.0017	52.0017	52.0017	52.0017	52.0017	52.0017	52.0017	52.0017	52.0017	52.0017	(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)													
-97.1527	-97.1527	-97.1527	-97.1527	-97.1527	-97.1527	-97.1527	-97.1527	-97.1527	-97.1527	-97.1527	-97.1527	-97.1527	(71)
Water heating gains (Table 5)													
125.4796	123.3571	118.9495	112.9574	109.0671	103.5894	98.9334	104.8989	107.0185	113.2205	120.2236	123.3660	123.3660	(72)
Total internal gains													
596.1483	591.9910	571.1876	538.8319	505.6745	475.8681	458.3408	466.3411	484.8565	517.4220	553.6923	581.1633	581.1633	(73)

6. Solar gains

[Jan]				Area	Solar flux		g	FF	Access		Gains	
				m2	Table 6a	Specific data	or Table 6b	Specific data	or Table 6c	factor	Table 6d	W
					W/m2							
North				10.1300	12.7500	0.6300		0.7000		0.7700		39.4721 (74)
East				2.6000	23.7835	0.6300		0.7000		0.7700		18.8982 (76)
West				5.2000	23.7835	0.6300		0.7000		0.7700		37.7964 (80)
Solar gains	96.1668	163.4422	271.7136	419.7794	522.5412	577.2625	539.4125	456.0153	341.8963	208.7750	117.7413	79.8971 (83)
Total gains	692.3151	755.4332	842.9011	958.6114	1028.2156	1053.1305	997.7533	922.3564	826.7528	726.1970	671.4335	661.0604 (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	73.8592	74.2193	74.2193	74.4470	74.4470	74.9719	74.9719	75.0690	74.9719	74.5571	74.6647	74.3344	
alpha	5.9239	5.9480	5.9480	5.9631	5.9631	5.9981	5.9981	6.0046	5.9981	5.9705	5.9776	5.9556	
util living area													
0.9945	0.9897	0.9693	0.8915	0.7099	0.4693	0.3135	0.3584	0.6654	0.9275	0.9872	0.9957	0.9957	(86)
Tweekday	19.0833	19.2167	19.4643	19.7225	19.8445	19.8715	19.8723	19.8736	19.8645	19.7114	19.3672	19.0656	
Tweekend	20.5816	20.6396	20.7525	20.8784	20.9516	20.9693	20.9706	20.9705	20.9608	20.8679	20.7045	20.5714	
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	20.3542	20.4426	20.6180	20.8101	20.9253	20.9528	20.9546	20.9545	20.9388	20.7961	20.5386	20.3386	(87)
Th 2	19.9245	19.9291	19.9291	19.9321	19.9321	19.9387	19.9387	19.9399	19.9387	19.9335	19.9348	19.9306	(88)
util rest of house													
0.9923	0.9854	0.9564	0.8519	0.6335	0.3786	0.2158	0.2532	0.5635	0.8900	0.9808	0.9938	0.9938	(89)
Tweekday	19.0833	19.2167	19.4643	19.7225	19.8445	19.8715	19.8723	19.8736	19.8645	19.7114	19.3672	19.0656	
Tweekend	19.0833	19.2167	19.4643	19.7225	19.8445	19.8715	19.8723	19.8736	19.8645	19.7114	19.3672	19.0656	
MIT 2	19.0833	19.2167	19.4643	19.7225	19.8445	19.8715	19.8723	19.8736	19.8645	19.7114	19.3672	19.0656	(90)
Living area fraction													
fLA = Living area / (4) =													0.3617 (91)
MIT	19.5429	19.6601	19.8815	20.1159	20.2354	20.2626	20.2637	20.2645	20.2530	20.1037	19.7909	19.5260	(92)
Temperature adjustment													0.0000
adjusted MIT	19.5429	19.6601	19.8815	20.1159	20.2354	20.2626	20.2637	20.2645	20.2530	20.1037	19.7909	19.5260	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9912	0.9840	0.9557	0.8596	0.6562	0.4065	0.2458	0.2855	0.5949	0.8971	0.9797	0.9929	(94)
Useful gains	686.2222	743.3691	805.5838	823.9829	674.7087	428.1280	245.2167	263.2994	491.8643	651.4478	657.8041	656.3719	(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													
1368.5351	1316.9843	1170.1690	965.7843	698.9982	429.2990	245.2577	263.4009	502.0751	805.8321	1108.5814	1358.2090	1358.2090	(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													

FULL SAP CALCULATION PRINTOUT

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

507.6408	385.4694	271.2514	102.0970	17.8482	0.0000	0.0000	0.0000	0.0000	114.8619	324.5597	522.1668 (98)
Space heating											2245.8951 (98)
Space heating per m2									(98) / (4) =		28.7015 (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 %)												304.5845 (206)
Efficiency of secondary/supplementary heating system, %												100.0000 (208)
Space heating requirement												737.3635 (211)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	507.6408	385.4694	271.2514	102.0970	17.8482	0.0000	0.0000	0.0000	0.0000	114.8619	324.5597	522.1668 (98)
Space heating efficiency (main heating system 1)	304.5845	304.5845	304.5845	304.5845	304.5845	0.0000	0.0000	0.0000	0.0000	304.5845	304.5845	304.5845 (210)
Space heating fuel (main heating system)	166.6666	126.5558	89.0562	33.5201	5.8599	0.0000	0.0000	0.0000	0.0000	37.7110	106.5582	171.4358 (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	204.2869	180.2275	189.6751	170.5812	167.5623	150.2955	144.8873	158.2357	157.7210	176.8559	186.3155	199.5574 (64)
Efficiency of water heater (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 (216)
Fuel for water heating, kWh/month	120.5659	106.3666	111.9424	100.6735	98.8918	88.7013	85.5095	93.3874	93.0837	104.3767	109.9596	117.7747 (219)
Water heating fuel used												1231.2332 (219)
Annual totals kWh/year												
Space heating fuel - main system												737.3635 (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)												339.6741 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
Total delivered energy for all uses												2308.2708 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	737.3635	18.9000	139.3617 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1231.2332	18.9000	232.7031 (247)
Pumps and fans for heating	0.0000	0.0000	0.0000 (249)
Energy for lighting	339.6741	18.9000	64.1984 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit	0.0000	18.9000	0.0000 (252)
Total energy cost			436.2632 (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	737.3635	0.5190	382.6917 (261)
Space heating - secondary	0.0000	0.5190	0.0000 (263)
Water heating (other fuel)	1231.2332	0.5190	639.0101 (264)
Space and water heating			1021.7017 (265)
Pumps and fans	0.0000	0.0000	0.0000 (267)
Energy for lighting	339.6741	0.5190	176.2908 (268)
Energy saving/generation technologies			
PV Unit	-300.0000	0.5190	-155.7000 (269)
Total kg/year			1042.2926 (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	737.3635	3.0700	2263.7060 (261)
Space heating - secondary	0.0000	3.0700	0.0000 (263)
Water heating (other fuel)	1231.2332	3.0700	3779.8861 (264)
Space and water heating			6043.5921 (265)
Pumps and fans	0.0000	0.0000	0.0000 (267)
Energy for lighting	339.6741	3.0700	1042.7994 (268)
Energy saving/generation technologies			

FULL SAP CALCULATION PRINTOUT

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PV Unit	-300.0000	3.0700	-921.0000 (269)
Primary energy kWh/year			6165.3915 (272)
Primary energy kWh/m2/year			78.7909 (273)

SAP 2012 EPC IMPROVEMENTS

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

(For testing purposes):

A	Not considered
B	Not considered
C	Not considered
D	Not considered
E Low energy lighting	Already installed
F	Not considered
G	Not considered
H	Not considered
I	Not considered
J	Not considered
K	Not considered
M	Not considered
N Solar water heating	Not applicable
O	Not considered
P	Not considered
R	Not considered
S	Not considered
T	Not considered
U Solar photovoltaic panels	Not applicable
A2	Not considered
A3	Not considered
T2	Not considered
W	Not considered
X	Not considered
Y	Not considered
J2	Not considered
Q2	Not considered
Z1	Not considered
Z2	Not considered
Z3	Not considered
Z4	Not considered
Z5	Not considered
V2 Wind turbine	Not applicable
L2	Not considered
Q3	Not considered
O3	Not considered

Recommended measures:	SAP change	Cost change	CO2 change
(none)			

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

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

Fuel prices for cost data on this page from database revision number 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	£436	£436	£0
Space heating	£139	£139	£0
Water heating	£233	£233	£0
Lighting	£64	£64	£0
Total cost of fuels	£436	£436	£0
Total cost of uses	£436	£436	£0
Delivered energy	29 kWh/m²	29 kWh/m²	0 kWh/m²
Carbon dioxide emissions	1.0 tonnes	1.0 tonnes	0.0 tonnes
CO2 emissions per m²	13 kg/m²	13 kg/m²	0 kg/m²
Primary energy	79 kWh/m²	79 kWh/m²	0 kWh/m²

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	317.6 (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	371.84 (P1)
Transmission heat loss coefficient	59.03 (37)
Summer heat loss coefficient	430.87 (P2)

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

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

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	10.1300	81.1852	0.6300	0.7000	0.9000	293.7716
East	2.6000	117.5071	0.6300	0.7000	0.9000	109.1342
West	5.2000	117.5071	0.6300	0.7000	0.9000	218.2684
total:						621.1742

	Jun	Jul	Aug	
Solar gains	665	621	527	(P3)
Internal gains	476	458	466	
Total summer gains	1141	1080	993	(P5)

	2.65	2.51	2.31	
Summer gain/loss ratio	2.65	2.51	2.31	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 317.6)	0.00	0.00	0.00	
Threshold temperature	18.65	20.41	20.11	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	

Assessment of likelihood of high internal temperature: Not significant

BASIC COMPLIANCE REPORT

Energy Calculations Ltd
SAP • CODE • SBEM • DESIGN

Calculation Type: New Build (As Designed)

Property Reference	015733	Issued on Date	01/03/2021
Assessment Reference	003	Prop Type Ref	
Property	Flat 12, 18, Parkside Road, READING, RG30 2DB		
SAP Rating	85 B	DER	15.78
Environmental	88 B	TER	27.04
CO ₂ Emissions (t/year)	1.04	% DER<TER	41.63
General Requirements Compliance	Pass	DFEE	50.76
		TFEE	53.42
		% DFEE<TFEE	4.97
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)	27.04	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	15.78	kgCO ₂ /m ²	Pass
	-11.26 (-41.6%)	kgCO ₂ /m ²	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	53.42	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DFEE)	50.76	kWh/m ² /yr	
	-2.6 (-4.9%)	kWh/m ² /yr	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.22 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Roof	0.14 (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	

5 Cylinder insulation

BASIC COMPLIANCE REPORT

Energy Calculations Ltd
SAP • CODE • SBEM • DESIGN

Calculation Type: New Build (As Designed)

Hot water storage

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

Pass

Primary pipework insulated

Yes

Pass

6 Controls

Space heating controls

Time and temperature zone control

Pass

Hot water controls

Cylinderstat

Pass

Independent timer for DHW

Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings

100

%

Minimum

75

%

Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Thames Valley)

Not significant

Pass

Based on:

Overshading

Average

Windows facing North

10.13 m², No overhang

Windows facing East

2.60 m², No overhang

Windows facing West

5.20 m², No overhang

Air change rate

6.00 ach

Blinds/curtains

None

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type

U-value

Solid Wall

0.00

W/m²K

Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals

5.00 (design value)

Maximum

10.0

Pass

10 Key features

Party wall U-value

0.00

W/m²K

Photovoltaic array

300.00

kWh/Year

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

SUMMARY FOR INPUT DATA

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

Property Reference	015733	Issued on Date	01/03/2021
Assessment Reference	003	Prop Type Ref	
Property	Flat 12, 18, Parkside Road, READING, RG30 2DB		
SAP Rating	85 B	DER	15.78
Environmental	88 B	TER	27.04
CO ₂ Emissions (t/year)	1.04	% DER<TER	41.63
General Requirements Compliance	Pass	DFEE	50.76
		TFEE	53.42
		% DFEE<TFEE	4.97
Assessor Details	Mr. Matthew Carter, Energy Calculations Limited, Tel: 01754 761035, mcarter@energycalculations.co.uk		Assessor ID
			7869-0001
Client			

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

Orientation	West
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	Flat, End-Terrace
2.0 Number of Storeys	1
3.0 Date Built	2020
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements			
	Ground Floor:	Heat Loss Perimeter 30.54 m	Internal Floor Area 78.25 m ²
			Average Storey Height 2.40 m

7.0 Living Area	28.30	m ²
-----------------	-------	----------------

8.0 Thermal Mass Parameter	Precise calculation	
Thermal Mass	317.58	kJ/m ² K

9.0 External Walls						
Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area (m ²)	Nett Area (m ²)
Main Wall	Cavity Wall	Cavity wall : plasterboard on dabs, AAC block, filled cavity, any outside structure	0.22	60.00	56.31	38.38
Wall to stairs	Cavity Wall	Cavity wall : dense plaster, dense block, filled cavity, any outside structure	0.22	190.00	16.99	15.10

9.1 Party Walls					
Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Area (m ²)
Party Wall 1	Solid Wall	Dense plaster both sides, dense blocks, cavity or cavity fill	0.00	180.00	31.68

9.2 Internal Walls					
Description	Construction		Kappa (kJ/m ² K)	Area (m ²)	
Internal Wall 1	Dense block, dense plaster		100.00	101.42	

10.0 External Roofs						
Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area (m ²)	Nett Area (m ²)
Flat roof	External Flat Roof	Plasterboard, insulated flat roof	0.14	9.00	78.25	78.25

11.1 Party Floors

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 Floor 1	Precast concrete planks floor, screed, carpeted	40.00	78.25

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
External Door	Manufacture	Half Glazed Door	Double Low-E Soft 0.05			0.63		0.70	1.40
Windows	Manufacture	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	South							1.89	
Windows	Window	[1] Main Wall	East	None	0.00					2.60	
Windows	Window	[1] Main Wall	North	None	0.00					10.13	
Windows	Window	[1] Main Wall	West	None	0.00					5.20	

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)	8.27	0.300	No
Table K1 - Approved	E3 Sill	8.27	0.040	No
Table K1 - Approved	E4 Jamb	45.76	0.050	No
Table K1 - Approved	E7 Party floor between dwellings (in blocks of flats)	30.54	0.070	No
Table K1 - Default	E14 Flat roof	30.54	0.080	No
Table K1 - Approved	E16 Corner (normal)	7.20	0.090	No
Table K1 - Approved	E17 Corner (inverted – internal area greater than external area)	7.20	-0.090	No
Table K1 - Approved	E18 Party wall between dwellings	12.00	0.060	No
Table K1 - Default	P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	13.20	0.000	No

Y-value 0.069 W/m²K

18.0 Pressure Testing

Yes

Designed AP₅₀ 5.00 m³/(h.m²) @ 50 Pa

Property Tested ?

As Built AP₅₀ m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather Windows fully open

Cross ventilation possible Yes

Night Ventilation No

Air change rate 6.00

Mechanical Ventilation

Mechanical Ventilation System Present No

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0

SUMMARY FOR INPUT DATA

Energy Calculations Ltd
SAP ♦ CODE ♦ SBEM ♦ DESIGN

Calculation Type: New Build (As Designed)

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

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

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

Community Heating

28.0 Water Heating

	HWP From main heating 1
Water Heating	Main Heating 1
Flue Gas Heat Recovery System	No
Waste Water Heat Recovery Instantaneous System 1	No
Waste Water Heat Recovery Instantaneous System 2	No
Waste Water Heat Recovery Storage System	No
Solar Panel	No
Water use ≤ 125 litres/person/day	Yes
SAP Code	901
Immersion Only Heating Hot Water	Yes

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

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
Loss	1.86
Pipes insulation	Fully insulated primary pipework

L

kWh/day

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 %			