

Energy Calculations Ltd

SAP ♦ CODE ♦ SBEM ♦ DESIGN

01754-761035



SAP Report Submission for Building Regulations Compliance

Client:

Project: Flat 11, 18, Parkside Road
READING, RG30 2DB

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

Report Issue Date: 16/08/2021

EXCELLENCE
IN ENERGY
ASSESSMENT

PREDICTED ENERGY ASSESSMENT

Energy Calculations Ltd
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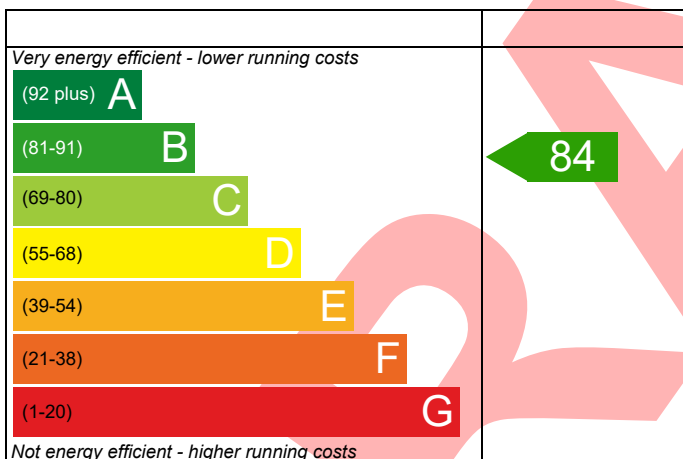
Flat 11, 18, Parkside Road,
READING,
RG30 2DB

Dwelling type: Flat, Mid-Terrace
Date of assessment: 16/08/2021
Produced by: Energy Calculations Limited
Total floor area: 77 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

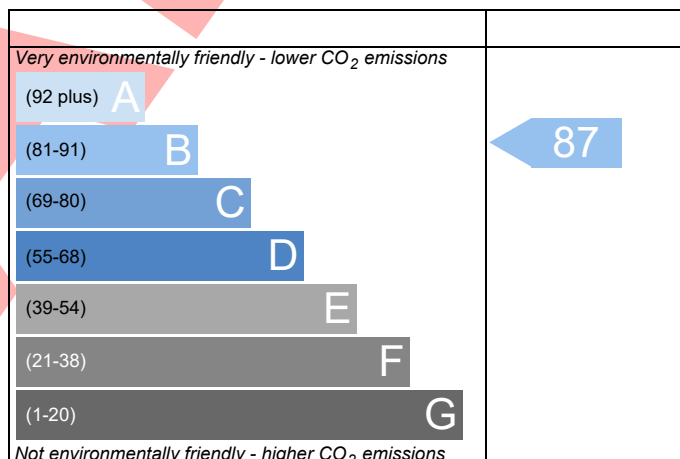


England

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	015732	Issued on Date	16/08/2021
Assessment Reference	004	Prop Type Ref	
Property	Flat 11, 18, Parkside Road, READING, RG30 2DB		
SAP Rating	84 B	DER	16.15
Environmental	87 B	TER	28.08
CO ₂ Emissions (t/year)	1.07	% DER<TER	42.48
General Requirements Compliance	Pass	DFEE	52.10
		TFEE	56.40
		% DFEE<TFEE	7.62
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	10.44	3.13	
External wall	E3 Sill	Table K1 - Approved	0.040	10.44	0.42	
External wall	E4 Jamb	Table K1 - Approved	0.050	33.95	1.70	
External wall	E7 Party floor between dwellings (in blocks of flats)	Table K1 - Approved	0.070	37.67	2.64	
External wall	E10 Eaves (insulation at ceiling level)	Table K1 - Approved	0.060	18.57	1.11	
External wall	E11 Eaves (insulation at rafter level)	Table K1 - Approved	0.040	13.50	0.54	
External wall	E12 Gable (insulation at ceiling level)	Table K1 - Approved	0.240	5.60	1.34	
External wall	E14 Flat roof	Table K1 - Default	0.080	14.01	1.12	
External wall	E16 Corner (normal)	Table K1 - Approved	0.090	12.00	1.08	
External wall	E17 Corner (inverted – internal area greater than external area)	Table K1 - Approved	-0.090	9.60	-0.86	
External wall	E18 Party wall between dwellings	Table K1 - Approved	0.060	7.40	0.44	
Party wall	P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	Table K1 - Default	0.000	9.33	0.00	
External roof	R1 Head of roof window	Table K1 - Default	0.080	1.60	0.13	
External roof	R2 Sill of roof window	Table K1 - Default	0.060	1.60	0.10	
External roof	R3 Jamb of roof window	Table K1 - Default	0.080	3.60	0.29	

Total: **13.18** W/mK:
Y-Value: **0.079** W/m²K:

FULL SAP CALCULATION PRINTOUT

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

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

DWELLING AS DESIGNED

Top-floor flat, total floor area 77 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) 28.08 kgCO₂/m²

Dwelling Carbon Dioxide Emission Rate (DER) 16.15 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)56.4 kWh/m²/yr

Dwelling Fabric Energy Efficiency (DFEE)52.1 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.22 (max. 0.30)	0.22 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	(no floor)		
Roof	0.11 (max. 0.20)	0.14 (max. 0.35)	OK
Openings	1.40 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

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

4 Heating efficiency

Main heating system: Heat pump with radiators or underfloor - Electric
Panasonic WH-MDC05F3E5

Secondary heating system: None

5 Cylinder insulation

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

6 Controls

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

Cylinderstat	OK
Independent timer for DHW	OK

7 Low energy lights

Percentage of fixed lights with low-energy fittings:100%	
Minimum	75% OK

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Thames Valley): Slight OK

Based on:

Overshading:	Average
Windows facing North:	12.71 m ² , No overhang
Windows facing East:	1.51 m ² , No overhang
Windows facing West:	2.43 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
Roof U-value	0.10 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	77.0000 (1b)	x 2.3500 (2b)	= 180.9500 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	77.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 180.9500 (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) = 0.1105 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3605 (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) =				0.3064 (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	0.3907	0.3831	0.3754	0.3371	0.3294	0.2911	0.2911	0.2835	0.3064	0.3294	0.3448	0.3601 (22b)
Effective ac	0.5763	0.5734	0.5705	0.5568	0.5543	0.5424	0.5424	0.5402	0.5470	0.5543	0.5594	0.5648 (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)			16.6500	1.3258	22.0739		(27)
Door to Stairs			1.8900	1.4000	2.6460		(26)
R light (Uw = 1.40)			1.4400	1.3258	1.9091		(27a)
Main Wall	70.8600	16.6500	54.2100	0.2200	11.9262	60.0000	3252.6000 (29a)
Wall to stairs	10.4600	1.8900	8.5700	0.1864	1.5973	190.0000	1628.3000 (29a)
Wall to Hall	7.2000		7.2000	0.2200	1.5840	190.0000	1368.0000 (29a)
Roof plane	63.0000		63.0000	0.1000	6.3000	9.0000	567.0000 (30)
Roof Slope	14.3000	1.4400	12.8600	0.1400	1.8004	9.0000	115.7400 (30)
Total net area of external elements Aum(A, m ²)			165.8200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	49.8368		(33)
Party Wall 1			22.3900	0.0000	0.0000	180.0000	4030.2000 (32)
Party Floor 1			77.0000			40.0000	3080.0000 (32d)
Internal Wall 1			77.5200			9.0000	697.6800 (32c)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss
(28)...(30) + (32) + (32a)...(32e) = 14739.5200 (34)
191.4223 (35)
13.1750 (36)
(33) + (36) = 63.0118 (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	34.4148	34.2378	34.0643	33.2494	33.0970	32.3872	32.3872	32.2558	32.6606	33.0970	33.4054	33.7278 (38)
Heat transfer coeff	97.4266	97.2496	97.0761	96.2612	96.1088	95.3991	95.3991	95.2676	95.6724	96.1088	96.4172	96.7397 (39)
Average = Sum(39)m / 12 =												96.2605 (39)
HLP	1.2653	1.2630	1.2607	1.2501	1.2482	1.2389	1.2389	1.2372	1.2425	1.2482	1.2522	1.2564 (40)
HLP (average)												1.2501 (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
Average daily hot water use (litres/day)
2.4035 (42)
91.2825 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	100.4108	96.7595	93.1082	89.4569	85.8056	82.1543	82.1543	85.8056	89.4569	93.1082	96.7595	100.4108 (44)
Energy conte	148.9063	130.2344	134.3902	117.1646	112.4223	97.0119	89.8957	103.1567	104.3887	121.6550	132.7959	144.2078 (45)
Energy content (annual)										Total = Sum(45)m =		1436.2293 (45)

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	22.3359	19.5352	20.1585	17.5747	16.8633	14.5518	13.4844	15.4735	15.6583	18.2482	19.9194	21.6312 (46)
Water storage loss:												
Store volume												210.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.8600 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.0044 (55)
Total storage loss												
31.1364 28.1232 31.1364 30.1320 31.1364 30.1320 31.1364 31.1364 30.1320 31.1364 30.1320 31.1364 (56)												
If cylinder contains dedicated solar storage												
31.1364 28.1232 31.1364 30.1320 31.1364 30.1320 31.1364 31.1364 30.1320 31.1364 30.1320 31.1364 (57)												
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624 (59)
Total heat required for water heating calculated for each month												
203.3051 179.3688 188.7890 169.8086 166.8211 149.6559 144.2945 157.5555 157.0327 176.0538 185.4399 198.6066 (62)												
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Solar input (sum of months) = Sum(63)m =												0.0000 (63)
Output from w/h	203.3051	179.3688	188.7890	169.8086	166.8211	149.6559	144.2945	157.5555	157.0327	176.0538	185.4399	198.6066 (64)
Total per year (kWh/year) = Sum(64)m =												2076.7313 (64)
Heat gains from water heating, kWh/month												
93.0304 82.6104 88.2038 81.0724 80.8994 74.3716 73.4094 77.8186 76.8244 83.9693 86.2698 91.4681 (65)												

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	120.1737	120.1737	120.1737	120.1737	120.1737	120.1737	120.1737	120.1737	120.1737	120.1737	120.1737	120.1737	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
18.9941 16.8704 13.7200 10.3869 7.7643 6.5550 7.0829 9.2066 12.3571 15.6901 18.3127 19.5221 (67)													
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
213.0566 215.2674 209.6961 197.8355 182.8636 168.7921 159.3915 157.1806 162.7519 174.6125 189.5845 203.6559 (68)													
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
35.0174 35.0174 35.0174 35.0174 35.0174 35.0174 35.0174 35.0174 35.0174 35.0174 35.0174 35.0174 (69)													
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)	
Losses e.g. evaporation (negative values) (Table 5)													
-96.1390 -96.1390 -96.1390 -96.1390 -96.1390 -96.1390 -96.1390 -96.1390 -96.1390 -96.1390 -96.1390 -96.1390 (71)													
Water heating gains (Table 5)													
125.0408 122.9322 118.5535 112.6006 108.7358 103.2939 98.6685 104.5949 106.7006 112.8620 119.8192 122.9410 (72)													
Total internal gains	416.1436	414.1222	401.0217	379.8751	358.4158	337.6931	324.1950	330.0343	340.8617	362.2168	386.7685	405.1711 (73)	

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data FF or Table 6c	Access factor Table 6d	Gains W	
North	12.7100	10.6334	0.6300	0.7000	0.7700	41.3037 (74)	
East	1.5100	19.6403	0.6300	0.7000	0.7700	9.0635 (76)	
West	2.4300	19.6403	0.6300	0.7000	0.7700	14.5856 (80)	
South	1.4400	42.0754	0.6300	0.7000	1.0000	24.0476 (82)	

Solar gains	89.0004	169.6242	278.6589	421.2056	539.5542	565.0506	532.5652	440.0493	327.4998	200.1536	109.9158	74.0044 (83)
Total gains	505.1441	583.7464	679.6806	801.0807	897.9701	902.7437	856.7602	770.0836	668.3615	562.3704	496.6843	479.1756 (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	42.0246	42.1011	42.1763	42.5333	42.6008	42.9177	42.9177	42.9769	42.7951	42.6008	42.4645	42.3230	
alpha	3.8016	3.8067	3.8118	3.8356	3.8401	3.8612	3.8612	3.8651	3.8530	3.8401	3.8310	3.8215	
util living area	0.9919	0.9852	0.9668	0.9112	0.7915	0.6195	0.4735	0.5394	0.7890	0.9488	0.9858	0.9934 (86)	
Tweekday	18.1340	18.3497	18.7294	19.2194	19.5793	19.7461	19.7797	19.7758	19.6597	19.1844	18.5780	18.0991	
Tweekend	20.1573	20.2528	20.4226	20.6457	20.8245	20.9182	20.9447	20.9385	20.8602	20.6236	20.3508	20.1395	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
MIT	19.6995	19.8442	20.1089	20.4468	20.7291	20.8744	20.9147	20.9051	20.7817	20.4190	19.9864	19.6750 (87)	
Th 2	19.8681	19.8699	19.8717	19.8801	19.8817	19.8890	19.8890	19.8903	19.8862	19.8817	19.8785	19.8752 (88)	
util rest of house	0.9897	0.9813	0.9577	0.8867	0.7377	0.5312	0.3614	0.4221	0.7134	0.9296	0.9814	0.9916 (89)	
Tweekday	18.1340	18.3497	18.7294	19.2194	19.5793	19.7461	19.7797	19.7758	19.6597	19.1844	18.5780	18.0991	
Tweekend	18.1340	18.3497	18.7294	19.2194	19.5793	19.7461	19.7797	19.7758	19.6597	19.1844	18.5780	18.0991	
MIT 2	18.1340	18.3497	18.7294	19.2194	19.5793	19.7461	19.7797	19.7758	19.6597	19.1844	18.5780	18.0991 (90)	
Living area fraction									fLA = Living area / (4) =			0.4117 (91)	
MIT	18.7785	18.9650	19.2973	19.7247	20.0527	20.2106	20.2470	20.2407	20.1216	19.6927	19.1578	18.7466 (92)	
Temperature adjustment												0.0000	
adjusted MIT	18.7785	18.9650	19.2973	19.7247	20.0527	20.2106	20.2470	20.2407	20.1216	19.6927	19.1578	18.7466 (93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
0.9870 0.9772 0.9519 0.8828 0.7468 0.5581 0.3986 0.4607 0.7313 0.9256 0.9776 0.9892 (94)													
Useful gains	498.5592	570.4383	646.9894	707.1913	670.5741	503.8142	341.4709	354.7789	488.7578	520.5218	485.5588	473.9979 (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)	

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Heat loss rate W	1410.5900	1367.8148	1242.3116	1042.0014	802.7638	535.2445	347.9197	365.8979	576.1049	873.8850	1162.5816	1407.2366 (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	678.5509	535.8370	442.9197	241.0633	98.3491	0.0000	0.0000	0.0000	0.0000	262.9022	487.4564	694.3295 (98)
Space heating												3441.4082 (98)
Space heating per m2											(98) / (4) =	44.6936 (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 %)												303.3410 (206)
Efficiency of secondary/supplementary heating system, %												100.0000 (208)
Space heating requirement												1134.5015 (211)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	678.5509	535.8370	442.9197	241.0633	98.3491	0.0000	0.0000	0.0000	0.0000	262.9022	487.4564	694.3295 (98)
Space heating efficiency (main heating system 1)	303.3410	303.3410	303.3410	303.3410	303.3410	0.0000	0.0000	0.0000	0.0000	303.3410	303.3410	303.3410 (210)
Space heating fuel (main heating system)	223.6924	176.6451	146.0138	79.4694	32.4220	0.0000	0.0000	0.0000	0.0000	86.6689	160.6958	228.8941 (211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating requirement	203.3051	179.3688	188.7890	169.8086	166.8211	149.6559	144.2945	157.5555	157.0327	176.0538	185.4399	198.6066 (64)
Efficiency of water heater	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400 (216)
(217)m	119.9865	105.8598	111.4194	100.2176	98.4544	88.3238	85.1597	92.9860	92.6775	103.9033	109.4428	117.2135 (219)
Fuel for water heating, kWh/month												1225.6441 (219)
Water heating fuel used												1134.5015 (211)
Annual totals kWh/year												0.0000 (215)
Space heating fuel - main system												
Space heating fuel - secondary												
Electricity for pumps and fans:												0.0000 (231)
Total electricity for the above, kWh/year												335.4426 (232)
Electricity for lighting (calculated in Appendix L)												
Energy saving/generation technologies (Appendices M ,N and Q)												2695.5881 (238)
Total delivered energy for all uses												

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	1134.5015	0.5190	588.8063 (261)	
Space heating - secondary	0.0000	0.5190	0.0000 (263)	
Water heating (other fuel)	1225.6441	0.5190	636.1093 (264)	
Space and water heating			1224.9155 (265)	
Pumps and fans	0.0000	0.0000	0.0000 (267)	
Energy for lighting	335.4426	0.5190	174.0947 (268)	
Energy saving/generation technologies				
PV Unit	-300.0000	0.5190	-155.7000 (269)	
Total CO2, kg/year			1243.3102 (272)	
Dwelling Carbon Dioxide Emission Rate (DER)			16.1500 (273)	

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

DER		16.1500	ZC1
Total Floor Area		77.0000	
Assumed number of occupants	TFA	2.4035	
CO2 emission factor in Table 12 for electricity displaced from grid	N	0.5190	
CO2 emissions from appliances, equation (L14)	EF	16.3965	ZC2
CO2 emissions from cooking, equation (L16)		2.2946	ZC3
Total CO2 emissions		34.8411	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		34.8411	ZC8

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1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	77.0000 (1b)	x 2.3500 (2b)	= 180.9500 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	77.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 180.9500 (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) = 0.1658 (8)
Measured/design AP50					Yes
Infiltration rate					5.0000
Number of sides sheltered					0.4158 (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) =	0.3534 (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												
	0.4506	0.4418	0.4329	0.3888	0.3799	0.3358	0.3358	0.3269	0.3534	0.3799	0.3976	0.4153 (22b)
Effective ac	0.6015	0.5976	0.5937	0.5756	0.5722	0.5564	0.5564	0.5534	0.5625	0.5722	0.5790	0.5862 (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)			15.9800	1.3258	21.1856		(27)
TER Room Window (Uw = 1.70)			1.3800	1.5918	2.1966		(27a)
Main Wall	70.8600	15.9800	54.8800	0.1800	9.8784		(29a)
Wall to stairs	10.4600	1.8900	8.5700	0.1800	1.5426		(29a)
Wall to Hall	7.2000		7.2000	0.1800	1.2960		(29a)
Roof plane	63.0000		63.0000	0.1300	8.1900		(30)
Roof Slope	14.3000	1.3800	12.9200	0.1300	1.6796		(30)
Total net area of external elements Aum(A, m ²)			165.8200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	47.8588		(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)							9.6614 (36)
Total fabric heat loss						(33) + (36) =	57.5202 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	35.9193	35.6838	35.4531	34.3693	34.1665	33.2225	33.2225	33.0477	33.5861	34.1665	34.5767	35.0056 (38)
Heat transfer coeff	93.4395	93.2041	92.9733	91.8895	91.6867	90.7427	90.7427	90.5679	91.1063	91.6867	92.0969	92.5258 (39)
Average = Sum(39)m / 12 =												91.8885 (39)
HLP	1.2135	1.2104	1.2074	1.1934	1.1907	1.1785	1.1785	1.1762	1.1832	1.1907	1.1961	1.2016 (40)
HLP (average)												1.1934 (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												2.4035 (42)
Average daily hot water use (litres/day)												91.2825 (43)
Daily hot water use	100.4108	96.7595	93.1082	89.4569	85.8056	82.1543	82.1543	85.8056	89.4569	93.1082	96.7595	100.4108 (44)
Energy conte	148.9063	130.2344	134.3902	117.1646	112.4223	97.0119	89.8957	103.1567	104.3887	121.6550	132.7959	144.2078 (45)
Energy content (annual)										Total = Sum(45)m =		1436.2293 (45)
Distribution loss (46)m = 0.15 x (45)m												
	22.3359	19.5352	20.1585	17.5747	16.8633	14.5518	13.4844	15.4735	15.6583	18.2482	19.9194	21.6312 (46)
Water storage loss:												
Store volume												210.0000 (47)

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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)
Total storage loss	
28.4842 25.7277 28.4842 27.5653 28.4842 27.5653 28.4842 27.5653 28.4842 27.5653 28.4842 27.5653	(56)
If cylinder contains dedicated solar storage	
28.4842 25.7277 28.4842 27.5653 28.4842 27.5653 28.4842 27.5653 28.4842 27.5653 28.4842 27.5653	(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
Total heat required for water heating calculated for each month	
200.6528 176.9732 186.1368 167.2420 164.1688 147.0892 141.6423 154.9033 154.4660 173.4016 182.8733 195.9544	(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
Solar input (sum of months) = Sum(63)m =	0.0000 (63)
Output from w/h	
200.6528 176.9732 186.1368 167.2420 164.1688 147.0892 141.6423 154.9033 154.4660 173.4016 182.8733 195.9544	(64)
Heat gains from water heating, kWh/month	
90.9086 80.6940 86.0820 79.0191 78.7777 72.3183 71.2876 75.6969 74.7711 81.8475 84.2165 89.3464	(65)

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

Metabolic gains (Table 5), Watts	
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec	
(66)m 120.1737 120.1737 120.1737 120.1737 120.1737 120.1737 120.1737 120.1737 120.1737 120.1737 120.1737 120.1737	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	
18.9941 16.8704 13.7200 10.3869 7.7643 6.5550 7.0829 9.2066 12.3571 15.6901 18.3127 19.5221	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	
213.0566 215.2674 209.6961 197.8355 182.8636 168.7921 159.3915 157.1806 162.7519 174.6125 189.5845 203.6559	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	
35.0174 35.0174 35.0174 35.0174 35.0174 35.0174 35.0174 35.0174 35.0174 35.0174 35.0174 35.0174	(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
Losses e.g. evaporation (negative values) (Table 5)	
-96.1390 -96.1390 -96.1390 -96.1390 -96.1390 -96.1390 -96.1390 -96.1390 -96.1390 -96.1390 -96.1390 -96.1390	(71)
Water heating gains (Table 5)	
122.1890 120.0804 115.7016 109.7488 105.8840 100.4421 95.8167 101.7431 103.8488 110.0101 116.9674 120.0892	(72)
Total internal gains	
416.2918 414.2703 401.1698 380.0233 358.5640 337.8413 324.3431 330.1824 341.0099 362.3649 386.9166 405.3193	(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	12.2000	10.6334	0.6300	0.7000	0.7700	39.6464 (74)
East	1.4500	19.6403	0.6300	0.7000	0.7700	8.7034 (76)
West	2.3300	19.6403	0.6300	0.7000	0.7700	13.9854 (80)
South	1.3800	42.0754	0.6300	0.7000	1.0000	23.0456 (82)

Solar gains	85.3807	162.7271	267.3354	404.1048	517.6640	542.1329	510.9623	422.1891	314.1961	192.0167	105.4457	70.9945	(83)
Total gains	501.6725	576.9975	668.5052	784.1281	876.2280	879.9742	835.3054	752.3715	655.2060	554.3817	492.3624	476.3138	(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 57.2266 57.3711 57.5135 58.1919 58.3206 58.9273 58.9273 59.0410 58.6921 58.3206 58.0608 57.7917	
alpha 4.8151 4.8247 4.8342 4.8795 4.8880 4.9285 4.9285 4.9361 4.9128 4.8880 4.8707 4.8528	
util living area	
0.9971 0.9939 0.9827 0.9385 0.8187 0.6283 0.4713 0.5400 0.8132 0.9692 0.9941 0.9978	(86)
MIT 19.7217 19.8815 20.1657 20.5450 20.8361 20.9662 20.9933 20.9874 20.8839 20.4961 20.0436 19.6960	(87)
Th 2 19.9092 19.9117 19.9140 19.9253 19.9274 19.9373 19.9373 19.9391 19.9335 19.9274 19.9232 19.9187	(88)
util rest of house	
0.9961 0.9918 0.9766 0.9168 0.7626 0.5369 0.3610 0.4224 0.7340 0.9542 0.9917 0.9970	(89)
MIT 2 18.2160 18.4506 18.8634 19.4038 19.7747 19.9163 19.9349 19.9342 19.8437 19.3489 18.6960 18.1852	(90)
Living area fraction	
MIT 18.8359 19.0397 19.3996 19.8736 20.2117 20.3485 20.3706 20.3678 20.2719 19.8212 19.2508 18.8072	(91)
Temperature adjustment	
adjusted MIT 18.8359 19.0397 19.3996 19.8736 20.2117 20.3485 20.3706 20.3678 20.2719 19.8212 19.2508 18.8072	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9948	0.9895	0.9729	0.9156	0.7788	0.5736	0.4066	0.4710	0.7617	0.9523	0.9896	0.9959 (94)
Useful gains	499.0498	570.9166	650.3652	717.9324	682.3944	504.7336	339.6625	354.4019	499.0916	527.9202	487.2659	474.3543 (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												
	1358.2249	1317.8739	1199.3159	1008.3629	780.4091	521.6355	342.1581	359.3554	562.3000	845.4601	1119.0535	1351.5415 (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												
	639.2262	501.9553	408.4193	209.1100	72.9230	0.0000	0.0000	0.0000	0.0000	236.2497	454.8871	652.6273 (98)
Space heating												3175.3980 (98)
Space heating per m2												(98) / (4) = 41.2389 (99)

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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 %)													93.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3396.1476 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	639.2262	501.9553	408.4193	209.1100	72.9230	0.0000	0.0000	0.0000	0.0000	236.2497	454.8871	652.6273	(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)	683.6644	536.8506	436.8121	223.6471	77.9925	0.0000	0.0000	0.0000	0.0000	252.6735	486.5103	697.9971	(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	200.6528	176.9732	186.1368	167.2420	164.1688	147.0892	141.6423	154.9033	154.4660	173.4016	182.8733	195.9544	(64)
Efficiency of water heater (217)m	87.6909	87.4437	86.8541	85.4109	82.8114	79.8000	79.8000	79.8000	79.8000	85.6394	87.1493	87.7820	(216)
Fuel for water heating, kWh/month	228.8183	202.3853	214.3098	195.8088	198.2442	184.3223	177.4967	194.1144	193.5665	202.4788	209.8391	223.2284	(219)
Water heating fuel used												2424.6125	(219)
Annual totals kWh/year													
Space heating fuel - main system												3396.1476	(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)												335.4426	(232)
Total delivered energy for all uses												6231.2026	(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	3396.1476	0.2160	733.5679 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2424.6125	0.2160	523.7163 (264)
Space and water heating			1257.2842 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	335.4426	0.5190	174.0947 (268)
Total CO2, kg/m2/year			1470.3039 (272)
Emissions per m2 for space and water heating			16.3284 (272a)
Fuel factor (electricity)			1.5500
Emissions per m2 for lighting			2.2610 (272b)
Emissions per m2 for pumps and fans			0.5055 (272c)
Target Carbon Dioxide Emission Rate (TER) = (16.3284 * 1.55) + 2.2610 + 0.5055, rounded to 2 d.p.			28.0800 (273)

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CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	77.0000 (1b)	x 2.3500 (2b)	= 180.9500 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	77.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 180.9500 (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) = 0.1658 (8)
Measured/design AP50					Yes
Infiltration rate					5.0000
Number of sides sheltered					0.4158 (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) =				0.3534 (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	0.4506	0.4418	0.4329	0.3888	0.3799	0.3358	0.3358	0.3269	0.3534	0.3799	0.3976	0.4153 (22b)
Effective ac	0.6015	0.5976	0.5937	0.5756	0.5722	0.5564	0.5564	0.5534	0.5625	0.5722	0.5790	0.5862 (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)			16.6500	1.3258	22.0739		(27)
Door to Stairs			1.8900	1.4000	2.6460		(26)
R light (Uw = 1.40)			1.4400	1.3258	1.9091		(27a)
Main Wall	70.8600	16.6500	54.2100	0.2200	11.9262	60.0000	3252.6000 (29a)
Wall to stairs	10.4600	1.8900	8.5700	0.1864	1.5973	190.0000	1628.3000 (29a)
Wall to Hall	7.2000		7.2000	0.2200	1.5840	190.0000	1368.0000 (29a)
Roof plane	63.0000		63.0000	0.1000	6.3000	9.0000	567.0000 (30)
Roof Slope	14.3000	1.4400	12.8600	0.1400	1.8004	9.0000	115.7400 (30)
Total net area of external elements Aum(A, m ²)			165.8200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	49.8368		(33)
Party Wall 1			22.3900	0.0000	0.0000	180.0000	4030.2000 (32)
Party Floor 1			77.0000			40.0000	3080.0000 (32d)
Internal Wall 1			77.5200			9.0000	697.6800 (32c)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss
(28)...(30) + (32) + (32a)...(32e) = 14739.5200 (34)
191.4223 (35)
13.1750 (36)
(33) + (36) = 63.0118 (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	35.9193	35.6838	35.4531	34.3693	34.1665	33.2225	33.2225	33.0477	33.5861	34.1665	34.5767	35.0056 (38)
Heat transfer coeff	98.9311	98.6957	98.4649	97.3811	97.1783	96.2343	96.2343	96.0595	96.5979	97.1783	97.5885	98.0174 (39)
Average = Sum(39)m / 12 =												97.3801 (39)
HLP	1.2848	1.2818	1.2788	1.2647	1.2621	1.2498	1.2498	1.2475	1.2545	1.2621	1.2674	1.2730 (40)
HLP (average)												1.2647 (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
Average daily hot water use (litres/day)
2.4035 (42)
91.2825 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	100.4108	96.7595	93.1082	89.4569	85.8056	82.1543	82.1543	85.8056	89.4569	93.1082	96.7595	100.4108 (44)
Energy conte	148.9063	130.2344	134.3902	117.1646	112.4223	97.0119	89.8957	103.1567	104.3887	121.6550	132.7959	144.2078 (45)
Energy content (annual)										Total = Sum(45)m =		1436.2293 (45)

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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	(46)
Water storage loss:												
Total storage loss												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month												
	31.6426	27.6748	28.5579	24.8975	23.8897	20.6150	19.1028	21.9208	22.1826	25.8517	28.2191	30.6441 (65)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
((66)m	120.1737	120.1737	120.1737	120.1737	120.1737	120.1737	120.1737	120.1737	120.1737	120.1737	120.1737	120.1737	((66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	18.9941	16.8704	13.7200	10.3869	7.7643	6.5550	7.0829	9.2066	12.3571	15.6901	18.3127	19.5221	((67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	213.0566	215.2674	209.6961	197.8355	182.8636	168.7921	159.3915	157.1806	162.7519	174.6125	189.5845	203.6559	((68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.0174	35.0174	35.0174	35.0174	35.0174	35.0174	35.0174	35.0174	35.0174	35.0174	35.0174	35.0174	((69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	((70)
Losses e.g. evaporation (negative values) (Table 5)	-96.1390	-96.1390	-96.1390	-96.1390	-96.1390	-96.1390	-96.1390	-96.1390	-96.1390	-96.1390	-96.1390	-96.1390	((71)
Water heating gains (Table 5)	42.5303	41.1827	38.3843	34.5798	32.1099	28.6320	25.6759	29.4634	30.8092	34.7469	39.1932	41.1884	((72)
Total internal gains	333.6332	332.3727	320.8525	301.8543	281.7899	263.0311	251.2023	254.9027	264.9702	284.1017	306.1425	323.4185	((73)

[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	12.7100	10.6334	0.6300	0.7000	0.7700	41.3037 (74)
East	1.5100	19.6403	0.6300	0.7000	0.7700	9.0635 (76)
West	2.4300	19.6403	0.6300	0.7000	0.7700	14.5856 (80)
South	1.4400	42.0754	0.6300	0.7000	1.0000	24.0476 (82)

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	41.3855	41.4842	41.5814	42.0442	42.1320	42.5452	42.5452	42.6227	42.3851	42.1320	41.9549	41.7713
alpha	3.7590	3.7656	3.7721	3.8029	3.8088	3.8363	3.8363	3.8415	3.8257	3.8088	3.7970	3.7848
util living area	0.9956	0.9910	0.9777	0.9333	0.8281	0.6633	0.5156	0.5901	0.8367	0.9675	0.9922	0.9965 (86)
MIT	19.2106	19.4128	19.7754	20.2651	20.6735	20.9025	20.9717	20.9534	20.7501	20.2082	19.6235	19.1779 (87)
Th 2	19.8527	19.8551	19.8575	19.8686	19.8707	19.8804	19.8804	19.8822	19.8766	19.8707	19.8665	19.8621 (88)
util rest of house	0.9944	0.9886	0.9712	0.9135	0.7784	0.5734	0.3953	0.4658	0.7684	0.9542	0.9896	0.9955 (89)
MIT 2	18.2275	18.4304	18.7909	19.2736	19.6448	19.8316	19.8718	19.8664	19.7263	19.2298	18.6497	18.2019 (90)
Living area fraction									fLA = Living area / (4) =			0.4117 (91)
MIT	18.6322	18.8349	19.1962	19.6818	20.0683	20.2725	20.3246	20.3139	20.1478	19.6326	19.0506	18.6037 (92)
Temperature adjustment												0.0000
adjusted MIT	18.6322	18.8349	19.1962	19.6818	20.0683	20.2725	20.3246	20.3139	20.1478	19.6326	19.0506	18.6037 (93)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9926	0.9856	0.9664	0.9096	0.7881	0.6068	0.4447	0.5163	0.7872	0.9506	0.9871	0.9941 (94)
Useful gains	419.4890	494.7719	579.3975	657.6627	647.2947	502.4924	348.5419	358.7959	466.3746	460.3541	410.6760	395.0619 (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	1417.9020	1375.3111	1250.1321	1049.9439	813.2181	545.8867	358.4377	375.9671	584.2051	877.7745	1166.2412	1411.8127 (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	742.8193	591.7223	499.0266	282.4425	123.4470	0.0000	0.0000	0.0000	0.0000	310.5608	544.0070	756.4626 (98)
Space heating												3850.4880 (98)
Space heating per m2												50.0063 (99)
										(98) / (4) =		

	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	904.6023	712.1337	730.0520	0.0000	0.0000	0.0000	0.0000 (100)

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Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8439	0.8992	0.8622	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	763.4073	640.3648	629.4165	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1037.8817	985.1190	885.1214	0.0000	0.0000	0.0000	0.0000 (103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling kWh												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	197.6216	256.4972	190.2445	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												644.3632 (104)
Cooled fraction									FC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)												
Intermittency factor	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	49.4054	64.1243	47.5611	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												161.0908 (107)
Space cooling per m2												2.0921 (108)
Energy for space heating												50.0063 (99)
Energy for space cooling												2.0921 (108)
Total												52.0984 (109)
Dwelling Fabric Energy Efficiency (DFEE)												52.1 (109)

FULL SAP CALCULATION PRINTOUT

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CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	77.0000 (1b)	x 2.3500 (2b)	= 180.9500 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	77.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	180.9500 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					Air changes per hour 30.0000 / (5) = 0.1658 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4158 (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) =		0.3534 (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												
	0.4506	0.4418	0.4329	0.3888	0.3799	0.3358	0.3358	0.3269	0.3534	0.3799	0.3976	0.4153 (22b)
Effective ac	0.6015	0.5976	0.5937	0.5756	0.5722	0.5564	0.5564	0.5534	0.5625	0.5722	0.5790	0.5862 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
TER Opaque door			1.8900	1.0000	1.8900		(26)
TER Opening Type (Uw = 1.40)			15.9800	1.3258	21.1856		(27)
TER Room Window (Uw = 1.70)			1.3800	1.5918	2.1966		(27a)
Main Wall	70.8600	15.9800	54.8800	0.1800	9.8784		(29a)
Wall to stairs	10.4600	1.8900	8.5700	0.1800	1.5426		(29a)
Wall to Hall	7.2000		7.2000	0.1800	1.2960		(29a)
Roof plane	63.0000		63.0000	0.1300	8.1900		(30)
Roof Slope	14.3000	1.3800	12.9200	0.1300	1.6796		(30)
Total net area of external elements Aum(A, m2)			165.8200				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		47.8588		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.6614 (36)
Total fabric heat loss						(33) + (36) =	57.5202 (37)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.4035 (42)
Average daily hot water use (litres/day)												91.2825 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	100.4108	96.7595	93.1082	89.4569	85.8056	82.1543	82.1543	85.8056	89.4569	93.1082	96.7595	100.4108 (44)
Energy conte	148.9063	130.2344	134.3902	117.1646	112.4223	97.0119	89.8957	103.1567	104.3887	121.6550	132.7959	144.2078 (45)
Energy content (annual)										Total = Sum(45)m =		1436.2293 (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												

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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (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	31.6426	27.6748	28.5579	24.8975	23.8897	20.6150	19.1028	21.9208	22.1826	25.8517	28.2191	30.6441 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	120.1737	120.1737	120.1737	120.1737	120.1737	120.1737	120.1737	120.1737	120.1737	120.1737	120.1737	120.1737	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	18.9941	16.8704	13.7200	10.3869	7.7643	6.5550	7.0829	9.2066	12.3571	15.6901	18.3127	19.5221	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	213.0566	215.2674	209.6961	197.8355	182.8636	168.7921	159.3915	157.1806	162.7519	174.6125	189.5845	203.6559	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.0174	35.0174	35.0174	35.0174	35.0174	35.0174	35.0174	35.0174	35.0174	35.0174	35.0174	35.0174	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-96.1390	-96.1390	-96.1390	-96.1390	-96.1390	-96.1390	-96.1390	-96.1390	-96.1390	-96.1390	-96.1390	-96.1390	(71)
Water heating gains (Table 5)	42.5303	41.1827	38.3843	34.5798	32.1099	28.6320	25.6759	29.4634	30.8092	34.7469	39.1932	41.1884	(72)
Total internal gains	333.6332	332.3727	320.8525	301.8543	281.7899	263.0311	251.2023	254.9027	264.9702	284.1017	306.1425	323.4185	(73)

6. Solar gains

[Jan]		Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	FF	Access factor Table 6d	Gains W	
North		12.2000	10.6334	0.6300		0.7000	0.7700	39.6464	(74)
East		1.4500	19.6403	0.6300		0.7000	0.7700	8.7034	(76)
West		2.3300	19.6403	0.6300		0.7000	0.7700	13.9854	(80)
South		1.3800	42.0754	0.6300		0.7000	1.0000	23.0456	(82)

Solar gains	85.3807	162.7271	267.3354	404.1048	517.6640	542.1329	510.9623	422.1891	314.1961	192.0167	105.4457	70.9945	(83)
Total gains	419.0139	495.0998	588.1879	705.9591	799.4539	805.1641	762.1646	677.0918	579.1664	476.1184	411.5882	394.4130	(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	57.2266	57.3711	57.5135	58.1919	58.3206	58.9273	58.9273	59.0410	58.6921	58.3206	58.0608	57.7917		
alpha	4.8151	4.8247	4.8342	4.8795	4.8880	4.9285	4.9285	4.9361	4.9128	4.8880	4.8707	4.8528		
util living area	0.9987	0.9968	0.9897	0.9572	0.8558	0.6743	0.5133	0.5925	0.8630	0.9829	0.9973	0.9990	(86)	
MIT	19.6231	19.7851	20.0754	20.4723	20.7959	20.9541	20.9903	20.9813	20.8438	20.4121	19.9481	19.5979	(87)	
Th 2	19.9092	19.9117	19.9140	19.9253	19.9274	19.9373	19.9373	19.9391	19.9335	19.9274	19.9232	19.9187	(88)	
util rest of house	0.9982	0.9957	0.9859	0.9409	0.8052	0.5809	0.3948	0.4671	0.7933	0.9739	0.9962	0.9987	(89)	
MIT 2	18.6550	18.8184	19.1086	19.5031	19.7935	19.9171	19.9349	19.9339	19.8461	19.4534	18.9906	18.6373	(90)	
Living area fraction									fLA = Living area / (4) =			0.4117	(91)	
MIT	19.0535	19.2164	19.5066	19.9021	20.2062	20.3441	20.3694	20.3651	20.2569	19.8481	19.3848	19.0327	(92)	
Temperature adjustment												0.0000		
adjusted MIT	19.0535	19.2164	19.5066	19.9021	20.2062	20.3441	20.3694	20.3651	20.2569	19.8481	19.3848	19.0327	(93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	418.0700	492.4862	578.7793	663.9449	655.3323	497.9032	338.3776	351.5646	473.3608	463.2570	409.6817	393.7506	(94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1378.5612	1334.3455	1209.2692	1010.9792	779.9033	521.2320	342.0439	359.1098	560.9316	847.9272	1131.3933	1372.4115	(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	714.6055	565.7295	469.0845	249.8647	92.6808	0.0000	0.0000	0.0000	0.0000	286.1947	519.6323	728.1237	(98)
Space heating												3625.9157	(98)
Space heating per m2										(98) / (4) =		47.0898	(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	852.9815	671.4961	688.3161	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8937	0.9415	0.9109	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	762.3520	632.1873	626.9869	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1011.9036	960.6411	864.9206	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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	179.6771	244.3697	177.0227	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												601.0694 (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	44.9193	61.0924	44.2557	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												150.2674 (107)
Space cooling per m2												1.9515 (108)
Energy for space heating												47.0898 (99)
Energy for space cooling												1.9515 (108)
Total												49.0413 (109)
Target Fabric Energy Efficiency (TFEE)												56.4 (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	77.0000 (1b)	x 2.3500 (2b)	= 180.9500 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	77.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 180.9500 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					2 * 10 = 20.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				Air changes per hour
Pressure test					20.0000 / (5) = 0.1105 (8)
Measured/design AP50					Yes
Infiltration rate					5.0000
Number of sides sheltered					0.3605 (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) =				0.3064 (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	0.3371	0.3141	0.3141	0.2988	0.2988	0.2605	0.2605	0.2528	0.2605	0.2911	0.2835	0.3064 (22b)
Effective ac	0.5568	0.5493	0.5493	0.5446	0.5446	0.5339	0.5339	0.5320	0.5339	0.5424	0.5402	0.5470 (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)			16.6500	1.3258	22.0739		(27)
Door to Stairs			1.8900	1.4000	2.6460		(26)
R light (Uw = 1.40)			1.4400	1.3258	1.9091		(27a)
Main Wall	70.8600	16.6500	54.2100	0.2200	11.9262	60.0000	3252.6000 (29a)
Wall to stairs	10.4600	1.8900	8.5700	0.1864	1.5973	190.0000	1628.3000 (29a)
Wall to Hall	7.2000		7.2000	0.2200	1.5840	190.0000	1368.0000 (29a)
Roof plane	63.0000		63.0000	0.1000	6.3000	9.0000	567.0000 (30)
Roof Slope	14.3000	1.4400	12.8600	0.1400	1.8004	9.0000	115.7400 (30)
Total net area of external elements Aum(A, m ²)			165.8200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	49.8368		(33)
Party Wall 1			22.3900	0.0000	0.0000	180.0000	4030.2000 (32)
Party Floor 1			77.0000			40.0000	3080.0000 (32d)
Internal Wall 1			77.5200			9.0000	697.6800 (32c)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss
(28)...(30) + (32) + (32a)...(32e) = 14739.5200 (34)
191.4223 (35)
13.1750 (36)
(33) + (36) = 63.0118 (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	33.2494	32.8026	32.8026	32.5222	32.5222	31.8825	31.8825	31.7651	31.8825	32.3872	32.2558	32.6606 (38)
Heat transfer coeff	96.2612	95.8144	95.8144	95.5340	95.5340	94.8944	94.8944	94.7769	94.8944	95.3991	95.2676	95.6724 (39)
Average = Sum(39)m / 12 =												95.3964 (39)
HLP	1.2501	1.2443	1.2443	1.2407	1.2407	1.2324	1.2324	1.2309	1.2324	1.2389	1.2372	1.2425 (40)
HLP (average)												1.2389 (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
Average daily hot water use (litres/day)
2.4035 (42)
91.2825 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	100.4108	96.7595	93.1082	89.4569	85.8056	82.1543	82.1543	85.8056	89.4569	93.1082	96.7595	100.4108 (44)
Energy conte	148.9063	130.2344	134.3902	117.1646	112.4223	97.0119	89.8957	103.1567	104.3887	121.6550	132.7959	144.2078 (45)
Energy content (annual)										Total = Sum(45)m =		1436.2293 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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CALCULATION OF HEAT DEMAND 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	22.3359	19.5352	20.1585	17.5747	16.8633	14.5518	13.4844	15.4735	15.6583	18.2482	19.9194	21.6312 (46)
Water storage loss:												
Store volume												210.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.8600 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.0044 (55)
Total storage loss												
31.1364 28.1232 31.1364 30.1320 31.1364 30.1320 31.1364 31.1364 30.1320 31.1364 30.1320 31.1364 (56)												
If cylinder contains dedicated solar storage												
31.1364 28.1232 31.1364 30.1320 31.1364 30.1320 31.1364 31.1364 30.1320 31.1364 30.1320 31.1364 (57)												
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month												
203.3051 179.3688 188.7890 169.8086 166.8211 149.6559 144.2945 157.5555 157.0327 176.0538 185.4399 198.6066 (62)												
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Solar input (sum of months) = Sum(63)m =												0.0000 (63)
Output from w/h	203.3051	179.3688	188.7890	169.8086	166.8211	149.6559	144.2945	157.5555	157.0327	176.0538	185.4399	198.6066 (64)
RHI water heating demand												2077 (64)
Heat gains from water heating, kWh/month	93.0304	82.6104	88.2038	81.0724	80.8994	74.3716	73.4094	77.8186	76.8244	83.9693	86.2698	91.4681 (65)

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

Metabolic gains (Table 5), Watts												
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec												
(66)m 144.2084 144.2084 144.2084 144.2084 144.2084 144.2084 144.2084 144.2084 144.2084 144.2084 144.2084 144.2084 (66)												
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
47.4854 42.1761 34.2999 25.9672 19.4108 16.3874 17.7072 23.0165 30.8927 39.2253 45.7817 48.8051 (67)												
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
317.9949 321.2947 312.9793 295.2769 272.9307 251.9285 237.8977 234.5979 242.9133 260.6157 282.9619 303.9641 (68)												
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
51.8243 51.8243 51.8243 51.8243 51.8243 51.8243 51.8243 51.8243 51.8243 51.8243 51.8243 51.8243 (69)												
Pumps, fans 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (70)												
Losses e.g. evaporation (negative values) (Table 5)												
-96.1390 -96.1390 -96.1390 -96.1390 -96.1390 -96.1390 -96.1390 -96.1390 -96.1390 -96.1390 -96.1390 -96.1390 (71)												
Water heating gains (Table 5)												
125.0408 122.9322 118.5535 112.6006 108.7358 103.2939 98.6685 104.5949 106.7006 112.8620 119.8192 122.9410 (72)												
Total internal gains	590.4149	586.2968	565.7265	533.7385	500.9711	471.5037	454.1672	462.1031	480.4004	512.5968	548.4566	575.6041 (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					12.7100	12.7500	0.6300	0.7000	0.7700		49.5253 (74)	
East					1.5100	23.7835	0.6300	0.7000	0.7700		10.9755 (76)	
West					2.4300	23.7835	0.6300	0.7000	0.7700		17.6626 (80)	
South					1.4400	50.1591	0.6300	0.7000	1.0000		28.6677 (82)	
Solar gains	106.8311	178.7852	293.2584	451.4309	563.3469	623.6126	582.1761	490.7332	368.0307	226.9637	130.1568	89.2197 (83)
Total gains	697.2459	765.0820	858.9849	985.1694	1064.3180	1095.1162	1036.3433	952.8364	848.4310	739.5605	678.6135	664.8237 (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 42.5333 42.7317 42.7317 42.8571 42.8571 43.1460 43.1460 43.1994 43.1460 42.9177 42.9769 42.7951												
alpha 3.8356 3.8488 3.8488 3.8571 3.8571 3.8764 3.8764 3.8800 3.8764 3.8612 3.8651 3.8530												
util living area 0.9737 0.9607 0.9225 0.8288 0.6648 0.4545 0.3090 0.3538 0.6317 0.8695 0.9554 0.9773 (86)												
Tweekday 18.5422 18.7340 19.0896 19.4695 19.7027 19.7830 19.7914 19.7920 19.7515 19.4688 18.9616 18.5141												
Tweekend 20.3362 20.4214 20.5848 20.7676 20.8939 20.9444 20.9532 20.9520 20.9175 20.7606 20.5211 20.3213												
24 / 16 0 0 0 0 0 0 0 0 0 0 0												
24 / 9 0 0 0 0 0 0 0 0 0 0 0												
16 / 9 0 0 0 0 0 0 0 0 0 0 0												
MIT 19.9755 20.1050 20.3592 20.6370 20.8363 20.9146 20.9278 20.9260 20.8713 20.6306 20.2522 19.9526 (87)												
Th 2 19.8801 19.8847 19.8847 19.8876 19.8876 19.8942 19.8942 19.8954 19.8942 19.8890 19.8903 19.8862 (88)												
util rest of house 0.9672 0.9510 0.9034 0.7893 0.5972 0.3670 0.2097 0.2474 0.5402 0.8287 0.9424 0.9716 (89)												
Tweekday 18.5422 18.7340 19.0896 19.4695 19.7027 19.7830 19.7914 19.7920 19.7515 19.4688 18.9616 18.5141												
Tweekend 18.5422 18.7340 19.0896 19.4695 19.7027 19.7830 19.7914 19.7920 19.7515 19.4688 18.9616 18.5141												
MIT 2 18.5422 18.7340 19.0896 19.4695 19.7027 19.7830 19.7914 19.7920 19.7515 19.4688 18.9616 18.5141 (90)												
Living area fraction fLA = Living area / (4) =												0.4117 (91)
MIT 19.1323 19.2984 19.6123 19.9502 20.1694 20.2489 20.2592 20.2589 20.2125 19.9471 19.4929 19.1063 (92)												
Temperature adjustment												0.0000
adjusted MIT 19.1323 19.2984 19.6123 19.9502 20.1694 20.2489 20.2592 20.2589 20.2125 19.9471 19.4929 19.1063 (93)												

8. Space heating requirement

Utilisation	0.9617	0.9448	0.8979	0.7917	0.6153	0.3957	0.2427	0.2828	0.5680	0.8311	0.9368	0.9665 (94)
Useful gains	670.5591	722.8372	771.2820	779.9720	654.8477	433.2970	251.5437	269.4766	481.9071	614.6782	635.7144	642.5327 (95)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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CALCULATION OF HEAT DEMAND 09 Jan 2014

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	1370.0197	1322.0838	1179.6953	979.2396	713.5814	441.1527	252.3436	270.9543	513.6132	815.3863	1113.9580	1359.1523 (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	520.3987	402.6937	303.8595	143.4727	43.6979	0.0000	0.0000	0.0000	0.0000	149.3268	344.3354	533.1650 (98)
Space heating												2440.9497 (98)
RHI space heating demand												2441 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	77.0000 (1b)	x 2.3500 (2b)	= 180.9500 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	77.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 180.9500 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					2 * 10 = 20.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				Air changes per hour
Pressure test					20.0000 / (5) = 0.1105 (8)
Measured/design AP50					Yes
Infiltration rate					5.0000
Number of sides sheltered					0.3605 (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) =				0.3064 (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	0.3907	0.3831	0.3754	0.3371	0.3294	0.2911	0.2911	0.2835	0.3064	0.3294	0.3448	0.3601 (22b)
Effective ac	0.5763	0.5734	0.5705	0.5568	0.5543	0.5424	0.5424	0.5402	0.5470	0.5543	0.5594	0.5648 (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)			16.6500	1.3258	22.0739		(27)
Door to Stairs			1.8900	1.4000	2.6460		(26)
R light (Uw = 1.40)			1.4400	1.3258	1.9091		(27a)
Main Wall	70.8600	16.6500	54.2100	0.2200	11.9262	60.0000	3252.6000 (29a)
Wall to stairs	10.4600	1.8900	8.5700	0.1864	1.5973	190.0000	1628.3000 (29a)
Wall to Hall	7.2000		7.2000	0.2200	1.5840	190.0000	1368.0000 (29a)
Roof plane	63.0000		63.0000	0.1000	6.3000	9.0000	567.0000 (30)
Roof Slope	14.3000	1.4400	12.8600	0.1400	1.8004	9.0000	115.7400 (30)
Total net area of external elements Aum(A, m ²)			165.8200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	49.8368		(33)
Party Wall 1			22.3900	0.0000	0.0000	180.0000	4030.2000 (32)
Party Floor 1			77.0000			40.0000	3080.0000 (32d)
Internal Wall 1			77.5200			9.0000	697.6800 (32c)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss
(28)...(30) + (32) + (32a)...(32e) = 14739.5200 (34)
191.4223 (35)
13.1750 (36)
(33) + (36) = 63.0118 (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	34.4148	34.2378	34.0643	33.2494	33.0970	32.3872	32.3872	32.2558	32.6606	33.0970	33.4054	33.7278 (38)
Heat transfer coeff	97.4266	97.2496	97.0761	96.2612	96.1088	95.3991	95.3991	95.2676	95.6724	96.1088	96.4172	96.7397 (39)
Average = Sum(39)m / 12 =												96.2605 (39)
HLP	1.2653	1.2630	1.2607	1.2501	1.2482	1.2389	1.2389	1.2372	1.2425	1.2482	1.2522	1.2564 (40)
HLP (average)												1.2501 (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
Average daily hot water use (litres/day)
2.4035 (42)
91.2825 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	100.4108	96.7595	93.1082	89.4569	85.8056	82.1543	82.1543	85.8056	89.4569	93.1082	96.7595	100.4108 (44)
Energy conte	148.9063	130.2344	134.3902	117.1646	112.4223	97.0119	89.8957	103.1567	104.3887	121.6550	132.7959	144.2078 (45)
Energy content (annual)										Total = Sum(45)m =		1436.2293 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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CALCULATION OF ENERGY RATINGS 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	22.3359	19.5352	20.1585	17.5747	16.8633	14.5518	13.4844	15.4735	15.6583	18.2482	19.9194	21.6312 (46)
Water storage loss:												
Store volume												210.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.8600 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.0044 (55)
Total storage loss												
31.1364 28.1232 31.1364 30.1320 31.1364 30.1320 31.1364 31.1364 30.1320 31.1364 30.1320 31.1364 (56)												
If cylinder contains dedicated solar storage												
31.1364 28.1232 31.1364 30.1320 31.1364 30.1320 31.1364 31.1364 30.1320 31.1364 30.1320 31.1364 (57)												
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120 (59)
Total heat required for water heating calculated for each month												
203.3051 179.3688 188.7890 169.8086 166.8211 149.6559 144.2945 157.5555 157.0327 176.0538 185.4399 198.6066 (62)												
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Solar input (sum of months) = Sum(63)m =												0.0000 (63)
Output from w/h	203.3051	179.3688	188.7890	169.8086	166.8211	149.6559	144.2945	157.5555	157.0327	176.0538	185.4399	198.6066 (64)
Total per year (kWh/year) = Sum(64)m =												2076.7313 (64)
Heat gains from water heating, kWh/month												
93.0304 82.6104 88.2038 81.0724 80.8994 74.3716 73.4094 77.8186 76.8244 83.9693 86.2698 91.4681 (65)												

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	144.2084	144.2084	144.2084	144.2084	144.2084	144.2084	144.2084	144.2084	144.2084	144.2084	144.2084	144.2084 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	47.4854	42.1761	34.2999	25.9672	19.4108	16.3874	17.7072	23.0165	30.8927	39.2253	45.7817	48.8051 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	317.9949	321.2947	312.9793	295.2769	272.9307	251.9285	237.8977	234.5979	242.9133	260.6157	282.9619	303.9641 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	51.8243	51.8243	51.8243	51.8243	51.8243	51.8243	51.8243	51.8243	51.8243	51.8243	51.8243	51.8243 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-96.1390	-96.1390	-96.1390	-96.1390	-96.1390	-96.1390	-96.1390	-96.1390	-96.1390	-96.1390	-96.1390	-96.1390 (71)
Water heating gains (Table 5)	125.0408	122.9322	118.5535	112.6006	108.7358	103.2939	98.6685	104.5949	106.7006	112.8620	119.8192	122.9410 (72)
Total internal gains	590.4149	586.2968	565.7265	533.7385	500.9711	471.5037	454.1672	462.1031	480.4004	512.5968	548.4566	575.6041 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data FF or Table 6c	Access factor Table 6d	Gains W
North	12.7100	10.6334	0.6300	0.7000	0.7700	41.3037 (74)
East	1.5100	19.6403	0.6300	0.7000	0.7700	9.0635 (76)
West	2.4300	19.6403	0.6300	0.7000	0.7700	14.5856 (80)
South	1.4400	42.0754	0.6300	0.7000	1.0000	24.0476 (82)

Solar gains	89.0004	169.6242	278.6589	421.2056	539.5542	565.0506	532.5652	440.0493	327.4998	200.1536	109.9158	74.0044 (83)
Total gains	679.4153	755.9210	844.3854	954.9441	1040.5254	1036.5542	986.7324	902.1525	807.9001	712.7505	658.3725	649.6085 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	42.0246	42.1011	42.1763	42.5333	42.6008	42.9177	42.9177	42.9769	42.7951	42.6008	42.4645	42.3230
alpha	3.8016	3.8067	3.8118	3.8356	3.8401	3.8612	3.8612	3.8651	3.8530	3.8401	3.8310	3.8215
util living area	0.9786	0.9666	0.9376	0.8638	0.7293	0.5551	0.4162	0.4700	0.7073	0.9028	0.9655	0.9817 (86)
Tweekday	18.3927	18.5931	18.9346	19.3538	19.6365	19.7597	19.7823	19.7807	19.7055	19.3430	18.8059	18.3556
Tweekend	20.2733	20.3630	20.5179	20.7131	20.8586	20.9297	20.9483	20.9446	20.8915	20.7016	20.4544	20.2542
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	0	0	0	0	0	0	0	0	0	0	0	0
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0
MIT	19.8784	20.0146	20.2560	20.5521	20.7818	20.8920	20.9202	20.9146	20.8306	20.5395	20.1481	19.8490 (87)
Th 2	19.8681	19.8699	19.8717	19.8801	19.8817	19.8890	19.8890	19.8903	19.8862	19.8817	19.8785	19.8752 (88)
util rest of house	0.9734	0.9586	0.9223	0.8314	0.6709	0.4708	0.3154	0.3636	0.6254	0.8718	0.9556	0.9772 (89)
Tweekday	18.3927	18.5931	18.9346	19.3538	19.6365	19.7597	19.7823	19.7807	19.7055	19.3430	18.8059	18.3556
Tweekend	18.3927	18.5931	18.9346	19.3538	19.6365	19.7597	19.7823	19.7807	19.7055	19.3430	18.8059	18.3556
MIT 2	18.3927	18.5931	18.9346	19.3538	19.6365	19.7597	19.7823	19.7807	19.7055	19.3430	18.8059	18.3556 (90)
Living area fraction									fLA = Living area / (4) =			0.4117 (91)
MIT	19.0043	19.1783	19.4786	19.8471	20.1080	20.2259	20.2508	20.2475	20.1687	19.8356	19.3585	18.9704 (92)
Temperature adjustment												0.0000
adjusted MIT	19.0043	19.1783	19.4786	19.8471	20.1080	20.2259	20.2508	20.2475	20.1687	19.8356	19.3585	18.9704 (93)

8. Space heating requirement

Utilisation	0.9683	0.9524	0.9160	0.8303	0.6835	0.4973	0.3488	0.3988	0.6478	0.8703	0.9500	0.9726 (94)
Useful gains	657.8637	719.9662	773.4683	792.9202	711.2146	515.4548	344.2111	359.7594	523.3451	620.3279	625.4247	631.7895 (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)

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Heat loss rate W	1432.5930	1388.5635	1259.9141	1053.7852	808.0841	536.7024	348.2784	366.5402	580.6104	887.6220	1181.9271	1428.8809 (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	576.3986	449.2974	361.9157	187.8228	72.0709	0.0000	0.0000	0.0000	0.0000	198.8668	400.6817	593.0361 (98)
Space heating												2840.0898 (98)
Space heating per m2										(98) / (4) =		36.8843 (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 %)												303.3410 (206)
Efficiency of secondary/supplementary heating system, %												100.0000 (208)
Space heating requirement												936.2697 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	576.3986	449.2974	361.9157	187.8228	72.0709	0.0000	0.0000	0.0000	0.0000	198.8668	400.6817	593.0361 (98)
Space heating efficiency (main heating system 1)	303.3410	303.3410	303.3410	303.3410	303.3410	0.0000	0.0000	0.0000	0.0000	303.3410	303.3410	303.3410 (210)
Space heating fuel (main heating system)	190.0167	148.1163	119.3098	61.9180	23.7590	0.0000	0.0000	0.0000	0.0000	65.5588	132.0895	195.5014 (211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating requirement	203.3051	179.3688	188.7890	169.8086	166.8211	149.6559	144.2945	157.5555	157.0327	176.0538	185.4399	198.6066 (64)
Efficiency of water heater	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400 (216)
(217)m	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400 (217)
Fuel for water heating, kWh/month	119.9865	105.8598	111.4194	100.2176	98.4544	88.3238	85.1597	92.9860	92.6775	103.9033	109.4428	117.2135 (219)
Water heating fuel used												1225.6441 (219)
Annual totals kWh/year												
Space heating fuel - main system												936.2697 (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)												335.4426 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
Total delivered energy for all uses												2497.3564 (238)

10a. Fuel costs - using Table 12 prices

	Fuel	Fuel price	Fuel cost
	kWh/year	p/kWh	£/year
Space heating - main system 1	936.2697	13.1900	123.4940 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1225.6441	13.1900	161.6625 (247)
Pumps and fans for heating	0.0000	0.0000	0.0000 (249)
Energy for lighting	335.4426	13.1900	44.2449 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit	0.0000	13.1900	0.0000 (252)
Total energy cost			329.4013 (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] =	1.1340 (257)
SAP value		84.1806
SAP rating (Section 12)		84 (258)
SAP band		B

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

	Energy	Emission factor	Emissions
	kWh/year	kg CO2/kWh	kg CO2/year
Space heating - main system 1	936.2697	0.5190	485.9240 (261)
Space heating - secondary	0.0000	0.5190	0.0000 (263)
Water heating (other fuel)	1225.6441	0.5190	636.1093 (264)
Space and water heating			1122.0332 (265)
Pumps and fans	0.0000	0.0000	0.0000 (267)
Energy for lighting	335.4426	0.5190	174.0947 (268)
Energy saving/generation technologies			
PV Unit	-300.0000	0.5190	-155.7000 (269)
Total kg/year			1140.4279 (272)
CO2 emissions per m2			14.8100 (273)

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EI value 87.4740
EI rating 87 (274)
EI band B

Calculation of stars for heating and DHW

Main heating energy efficiency $13.19 \times (1 + 0.29 \times 0.25) / 3.0334 = 4.663$, stars = 4
Main heating environmental impact $0.519 \times (1 + 0.29 \times 0.25) / 3.0334 = 0.1835$, 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	77.0000 (1b)	x 2.3500 (2b)	= 180.9500 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	77.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 180.9500 (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) = 0.1105 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3605 (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) = 0.3064 (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	0.3371	0.3141	0.3141	0.2988	0.2988	0.2605	0.2605	0.2528	0.2605	0.2911	0.2835	0.3064 (22b)
Effective ac	0.5568	0.5493	0.5493	0.5446	0.5446	0.5339	0.5339	0.5320	0.5339	0.5424	0.5402	0.5470 (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)			16.6500	1.3258	22.0739		(27)
Door to Stairs			1.8900	1.4000	2.6460		(26)
R light (Uw = 1.40)			1.4400	1.3258	1.9091		(27a)
Main Wall	70.8600	16.6500	54.2100	0.2200	11.9262	60.0000	3252.6000 (29a)
Wall to stairs	10.4600	1.8900	8.5700	0.1864	1.5973	190.0000	1628.3000 (29a)
Wall to Hall	7.2000		7.2000	0.2200	1.5840	190.0000	1368.0000 (29a)
Roof plane	63.0000		63.0000	0.1000	6.3000	9.0000	567.0000 (30)
Roof Slope	14.3000	1.4400	12.8600	0.1400	1.8004	9.0000	115.7400 (30)
Total net area of external elements Aum(A, m ²)			165.8200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	49.8368		(33)
Party Wall 1			22.3900	0.0000	0.0000	180.0000	4030.2000 (32)
Party Floor 1			77.0000			40.0000	3080.0000 (32d)
Internal Wall 1			77.5200			9.0000	697.6800 (32c)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss
(28)...(30) + (32) + (32a)...(32e) = 14739.5200 (34)
191.4223 (35)
13.1750 (36)
(33) + (36) = 63.0118 (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	33.2494	32.8026	32.8026	32.5222	32.5222	31.8825	31.8825	31.7651	31.8825	32.3872	32.2558	32.6606 (38)
Heat transfer coeff	96.2612	95.8144	95.8144	95.5340	95.5340	94.8944	94.8944	94.7769	94.8944	95.3991	95.2676	95.6724 (39)
Average = Sum(39)m / 12 =												95.3964 (39)
HLP	1.2501	1.2443	1.2443	1.2407	1.2407	1.2324	1.2324	1.2309	1.2324	1.2389	1.2372	1.2425 (40)
HLP (average)												1.2389 (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												2.4035 (42)
Average daily hot water use (litres/day)												91.2825 (43)
Daily hot water use	100.4108	96.7595	93.1082	89.4569	85.8056	82.1543	82.1543	85.8056	89.4569	93.1082	96.7595	100.4108 (44)
Energy conte	148.9063	130.2344	134.3902	117.1646	112.4223	97.0119	89.8957	103.1567	104.3887	121.6550	132.7959	144.2078 (45)
Energy content (annual)										Total = Sum(45)m =		1436.2293 (45)

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Distribution loss (46)m = 0.15 x (45)m	22.3359	19.5352	20.1585	17.5747	16.8633	14.5518	13.4844	15.4735	15.6583	18.2482	19.9194	21.6312 (46)
Water storage loss:												
Store volume												210.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.8600 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.0044 (55)
Total storage loss												
31.1364 28.1232 31.1364 30.1320 31.1364 30.1320 31.1364 31.1364 30.1320 31.1364 30.1320 31.1364 (56)												
If cylinder contains dedicated solar storage												
31.1364 28.1232 31.1364 30.1320 31.1364 30.1320 31.1364 31.1364 30.1320 31.1364 30.1320 31.1364 (57)												
Primary loss 23.2624 21.0112 23.2624 22.5120 23.2624 22.5120 23.2624 23.2624 22.5120 23.2624 22.5120 23.2624 (59)												
Total heat required for water heating calculated for each month												
203.3051 179.3688 188.7890 169.8086 166.8211 149.6559 144.2945 157.5555 157.0327 176.0538 185.4399 198.6066 (62)												
Solar input 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63)												
Solar input (sum of months) = Sum(63)m =												0.0000 (63)
Output from w/h												
203.3051 179.3688 188.7890 169.8086 166.8211 149.6559 144.2945 157.5555 157.0327 176.0538 185.4399 198.6066 (64)												
Total per year (kWh/year) = Sum(64)m =												2076.7313 (64)
Heat gains from water heating, kWh/month												
93.0304 82.6104 88.2038 81.0724 80.8994 74.3716 73.4094 77.8186 76.8244 83.9693 86.2698 91.4681 (65)												

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	144.2084	144.2084	144.2084	144.2084	144.2084	144.2084	144.2084	144.2084	144.2084	144.2084	144.2084	144.2084	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
47.4854 42.1761 34.2999 25.9672 19.4108 16.3874 17.7072 23.0165 30.8927 39.2253 45.7817 48.8051 (67)													
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
317.9949 321.2947 312.9793 295.2769 272.9307 251.9285 237.8977 234.5979 242.9133 260.6157 282.9619 303.9641 (68)													
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
51.8243 51.8243 51.8243 51.8243 51.8243 51.8243 51.8243 51.8243 51.8243 51.8243 51.8243 51.8243 (69)													
Pumps, fans 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (70)													
Losses e.g. evaporation (negative values) (Table 5)													
-96.1390 -96.1390 -96.1390 -96.1390 -96.1390 -96.1390 -96.1390 -96.1390 -96.1390 -96.1390 -96.1390 -96.1390 (71)													
Water heating gains (Table 5)													
125.0408 122.9322 118.5535 112.6006 108.7358 103.2939 98.6685 104.5949 106.7006 112.8620 119.8192 122.9410 (72)													
Total internal gains	590.4149	586.2968	565.7265	533.7385	500.9711	471.5037	454.1672	462.1031	480.4004	512.5968	548.4566	575.6041 (73)	

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	g	Specific data or Table 6c	FF	Access factor Table 6d	Gains W
North					12.7100	12.7500		0.6300		0.7000	0.7700	49.5253 (74)
East					1.5100	23.7835		0.6300		0.7000	0.7700	10.9755 (76)
West					2.4300	23.7835		0.6300		0.7000	0.7700	17.6626 (80)
South					1.4400	50.1591		0.6300		0.7000	1.0000	28.6677 (82)
Solar gains	106.8311	178.7852	293.2584	451.4309	563.3469	623.6126	582.1761	490.7332	368.0307	226.9637	130.1568	89.2197 (83)
Total gains	697.2459	765.0820	858.9849	985.1694	1064.3180	1095.1162	1036.3433	952.8364	848.4310	739.5605	678.6135	664.8237 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
tau	42.5333	42.7317	42.7317	42.8571	42.8571	43.1460	43.1460	43.1994	43.1460	42.9177	42.9769	42.7951	
alpha	3.8356	3.8488	3.8488	3.8571	3.8571	3.8764	3.8764	3.8800	3.8764	3.8612	3.8651	3.8530	
util living area	0.9737	0.9607	0.9225	0.8288	0.6648	0.4545	0.3090	0.3538	0.6317	0.8695	0.9554	0.9773 (86)	
Tweekday	18.5422	18.7340	19.0896	19.4695	19.7027	19.7830	19.7914	19.7920	19.7515	19.4688	18.9616	18.5141	
Tweekend	20.3362	20.4214	20.5848	20.7676	20.8939	20.9444	20.9532	20.9520	20.9175	20.7606	20.5211	20.3213	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
MIT	19.9755	20.1050	20.3592	20.6370	20.8363	20.9146	20.9278	20.9260	20.8713	20.6306	20.2522	19.9526 (87)	
Th 2	19.8801	19.8847	19.8847	19.8876	19.8876	19.8942	19.8942	19.8954	19.8942	19.8890	19.8903	19.8862 (88)	
util rest of house	0.9672	0.9510	0.9034	0.7893	0.5972	0.3670	0.2097	0.2474	0.5402	0.8287	0.9424	0.9716 (89)	
Tweekday	18.5422	18.7340	19.0896	19.4695	19.7027	19.7830	19.7914	19.7920	19.7515	19.4688	18.9616	18.5141	
Tweekend	18.5422	18.7340	19.0896	19.4695	19.7027	19.7830	19.7914	19.7920	19.7515	19.4688	18.9616	18.5141	
MIT 2	18.5422	18.7340	19.0896	19.4695	19.7027	19.7830	19.7914	19.7920	19.7515	19.4688	18.9616	18.5141 (90)	
Living area fraction									fLA = Living area / (4) =			0.4117 (91)	
MIT	19.1323	19.2984	19.6123	19.9502	20.1694	20.2489	20.2592	20.2589	20.2125	19.9471	19.4929	19.1063 (92)	
Temperature adjustment												0.0000	
adjusted MIT	19.1323	19.2984	19.6123	19.9502	20.1694	20.2489	20.2592	20.2589	20.2125	19.9471	19.4929	19.1063 (93)	

8. Space heating requirement

Utilisation	0.9617	0.9448	0.8979	0.7917	0.6153	0.3957	0.2427	0.2828	0.5680	0.8311	0.9368	0.9665 (94)	
Useful gains	670.5591	722.8372	771.2820	779.9720	654.8477	433.2970	251.5437	269.4766	481.9071	614.6782	635.7144	642.5327 (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)	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Energy Calculations Ltd
SAP ♦ CODE ♦ SBEM ♦ DESIGN

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

Heat loss rate W	1370.0197	1322.0838	1179.6953	979.2396	713.5814	441.1527	252.3436	270.9543	513.6132	815.3863	1113.9580	1359.1523 (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	520.3987	402.6937	303.8595	143.4727	43.6979	0.0000	0.0000	0.0000	0.0000	149.3268	344.3354	533.1650 (98)
Space heating												2440.9497 (98)
Space heating per m2											(98) / (4) =	31.7006 (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 %)												303.6237 (206)
Efficiency of secondary/supplementary heating system, %												100.0000 (208)
Space heating requirement												803.9392 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	520.3987	402.6937	303.8595	143.4727	43.6979	0.0000	0.0000	0.0000	0.0000	149.3268	344.3354	533.1650 (98)
Space heating efficiency (main heating system 1)	303.6237	303.6237	303.6237	303.6237	303.6237	0.0000	0.0000	0.0000	0.0000	303.6237	303.6237	303.6237 (210)
Space heating fuel (main heating system)	171.3960	132.6292	100.0777	47.2535	14.3921	0.0000	0.0000	0.0000	0.0000	49.1815	113.4086	175.6006 (211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating requirement	203.3051	179.3688	188.7890	169.8086	166.8211	149.6559	144.2945	157.5555	157.0327	176.0538	185.4399	198.6066 (64)
Efficiency of water heater	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400 (216)
(217)m	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400 (217)
Fuel for water heating, kWh/month	119.9865	105.8598	111.4194	100.2176	98.4544	88.3238	85.1597	92.9860	92.6775	103.9033	109.4428	117.2135 (219)
Water heating fuel used												1225.6441 (219)
Annual totals kWh/year												
Space heating fuel - main system												803.9392 (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)												335.4426 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
Total delivered energy for all uses												2365.0259 (238)

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

	Fuel	Fuel price	Fuel cost
	kWh/year	p/kWh	£/year
Space heating - main system 1	803.9392	19.1200	153.7132 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1225.6441	19.1200	234.3431 (247)
Pumps and fans for heating	0.0000	0.0000	0.0000 (249)
Energy for lighting	335.4426	19.1200	64.1366 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit	0.0000	19.1200	0.0000 (252)
Total energy cost			452.1930 (255)

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

	Energy	Emission factor	Emissions
	kWh/year	kg CO2/kWh	kg CO2/year
Space heating - main system 1	803.9392	0.5190	417.2445 (261)
Space heating - secondary	0.0000	0.5190	0.0000 (263)
Water heating (other fuel)	1225.6441	0.5190	636.1093 (264)
Space and water heating			1053.3537 (265)
Pumps and fans	0.0000	0.0000	0.0000 (267)
Energy for lighting	335.4426	0.5190	174.0947 (268)
Energy saving/generation technologies			
PV Unit	-300.0000	0.5190	-155.7000 (269)
Total kg/year			1071.7484 (272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy	Primary energy factor	Primary energy
	kWh/year	kg CO2/kWh	kWh/year
Space heating - main system 1	803.9392	3.0700	2468.0935 (261)
Space heating - secondary	0.0000	3.0700	0.0000 (263)
Water heating (other fuel)	1225.6441	3.0700	3762.7273 (264)
Space and water heating			6230.8208 (265)

FULL SAP CALCULATION PRINTOUT

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

Pumps and fans	0.0000	0.0000	0.0000 (267)
Energy For lighting	335.4426	3.0700	1029.8087 (268)
Energy saving/generation technologies			
PV Unit	-300.0000	3.0700	-921.0000 (269)
Primary energy kWh/year			6339.6296 (272)
Primary energy kWh/m2/year			82.3329 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 84
Current environmental impact rating: B 87

(For testing purposes):

A	Not considered
B	Not considered
C	Not considered
D	Not considered
E Low energy lighting	Already installed
F	Not considered
G	Not considered
H	Not considered
I	Not considered
J	Not considered
K	Not considered
M	Not considered
N Solar water heating	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 Environmental
(none) efficiency impact
Total Savings £0 0.00 kg/m²

Potential energy efficiency rating: B 84
Potential environmental impact rating: B 87

Fuel prices for cost data on this page from database revision number 480 TEST (28 Jul 2021)
Recommendation texts revision number 4.9c (22 Feb 2014)

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

	Current £452	Potential £452	Saving £0
Electricity			
Space heating	£154	£154	£0
Water heating	£234	£234	£0
Lighting	£64	£64	£0
Total cost of fuels	£452	£452	£0
Total cost of uses	£452	£452	£0
Delivered energy	31 kWh/m²	31 kWh/m²	0 kWh/m²
Carbon dioxide emissions	1.1 tonnes	1.1 tonnes	0.0 tonnes
CO2 emissions per m²	14 kg/m²	14 kg/m²	0 kg/m²
Primary energy	82 kWh/m²	82 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	MidTerrace 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	191.4 (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	358.28 (P1)
Transmission heat loss coefficient	63.01 (37)
Summer heat loss coefficient	421.29 (P2)

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

Solar shading Orientation	Z blinds	Solar access	Z overhangs	Z summer
North	1.000	0.90	1.000	0.900 (P8)
East	1.000	0.90	1.000	0.900 (P8)
South	1.000	1.00	1.000	1.000 (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	12.7100	81.1852	0.6300	0.7000	0.9000	368.5920
East	1.5100	117.5071	0.6300	0.7000	0.9000	63.3818
West	2.4300	117.5071	0.6300	0.7000	0.9000	101.9985
South	1.4400	204.1575	0.6300	0.7000	1.0000	116.6834
total:						650.6557

	Jun	Jul	Aug	
Solar gains	698	651	549	(P3)
Internal gains	472	454	462	
Total summer gains	1169	1105	1011	(P5)
Summer gain/loss ratio	2.78	2.62	2.40	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 191.4)	0.66	0.66	0.66	
Threshold temperature	19.44	21.18	20.86	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	
Assessment of likelihood of high internal temperature:	Slight			

BASIC COMPLIANCE REPORT

Energy Calculations Ltd
SAP • CODE • SBEM • DESIGN

Calculation Type: New Build (As Designed)

Property Reference	015732	Issued on Date	16/08/2021
Assessment Reference	004	Prop Type Ref	
Property	Flat 11, 18, Parkside Road, READING, RG30 2DB		
SAP Rating	84 B	DER	16.15
Environmental	87 B	TER	28.08
CO ₂ Emissions (t/year)	1.07	% DER<TER	42.48
General Requirements Compliance	Pass	DFEE	52.10
		TFEE	56.40
		% DFEE<TFEE	7.62
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)	28.08	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	16.15	kgCO ₂ /m ²	Pass
	-11.93 (-42.5%)	kgCO ₂ /m ²	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	56.40	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DFEE)	52.10	kWh/m ² /yr	
	-4.3 (-7.6%)	kWh/m ² /yr	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.22 (max. 0.30)	0.22 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Roof	0.11 (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)	Slight	Pass
Based on:		
Overshading	Average	
Windows facing North	12.71 m ² , No overhang	
Windows facing East	1.51 m ² , No overhang	
Windows facing West	2.43 m ² , No overhang	
Air change rate	6.00 ach	
Blinds/curtains	None	

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

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

Air permeability and pressure testing

3 Air permeability

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

10 Key features

Party wall U-value	0.00	W/m ² K
Roof U-value	0.10	W/m ² K
Photovoltaic array	300.00	kWh/Year

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

SUMMARY FOR INPUT DATA

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

Property Reference	015732	Issued on Date	16/08/2021
Assessment Reference	004	Prop Type Ref	
Property	Flat 11, 18, Parkside Road, READING, RG30 2DB		
SAP Rating	84 B	DER	16.15
Environmental	87 B	TER	28.08
CO ₂ Emissions (t/year)	1.07	% DER<TER	42.48
General Requirements Compliance	Pass	DFEE	52.10
		TFEE	56.40
		% DFEE<TFEE	7.62
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, Mid-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

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	37.67 m	77.00 m ²	2.35 m

7.0 Living Area	31.70	m ²
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8.0 Thermal Mass Parameter	Precise calculation	
Thermal Mass	191.42	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	70.86	54.21
Wall to stairs	Cavity Wall	Cavity wall : dense plaster, dense block, filled cavity, any outside structure	0.22	190.00	10.46	8.57
Wall to Hall	Solid Wall	Solid wall : dense plaster, 200 mm dense block, insulated externally	0.22	190.00	7.20	7.20

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	22.39

9.2 Internal Walls

Description	Construction	Kappa (kJ/m ² K)	Area (m ²)
Internal Wall 1	Plasterboard on timber frame	9.00	77.52

10.0 External Roofs

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Gross Area (m²)	Nett Area (m²)
Roof plane	External Plane Roof	Plasterboard, insulated at ceiling level	0.10	9.00	63.00	63.00
Roof Slope	External Slope Roof	Plasterboard, insulated slope	0.14	9.00	14.30	12.86

11.1 Party Floors

Description	Construction	Kappa (kJ/m²K)	Area (m²)
Party Floor 1	Precast concrete planks floor, screed, carpeted	40.00	77.00

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
External Door	Manufacture r	Half Glazed Door	Double Low-E Soft 0.05			0.63		0.70	1.40
Windows	Manufacture r	Window	Double Low-E Soft 0.05			0.63		0.70	1.40
Door to Stairs	SAP table	Door to Corridor							1.40
R light	Manufacture r	Roof Window	Double Low-E Soft 0.05			0.63		0.70	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	North	None	0.00					12.71	
Windows	Window	[1] Main Wall	West	None	0.00					2.43	
Windows	Window	[1] Main Wall	East	None	0.00					1.51	
R lights	Roof Window	[2] Roof Slope	South	None						1.44	

14.0 Conservatory

15.0 Draught Proofing

 %

16.0 Draught Lobby

17.0 Thermal Bridging

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Table K1 - Approved	E2 Other lintels (including other steel lintels)	10.44	0.300	No
Table K1 - Approved	E3 Sill	10.44	0.040	No
Table K1 - Approved	E4 Jamb	33.95	0.050	No
Table K1 - Approved	E7 Party floor between dwellings (in blocks of flats)	37.67	0.070	No
Table K1 - Approved	E10 Eaves (insulation at ceiling level)	18.57	0.060	No
Table K1 - Approved	E11 Eaves (insulation at rafter level)	13.50	0.040	No
Table K1 - Approved	E12 Gable (insulation at ceiling level)	5.60	0.240	No
Table K1 - Default	E14 Flat roof	14.01	0.080	No
Table K1 - Approved	E16 Corner (normal)	12.00	0.090	No
Table K1 - Approved	E17 Corner (inverted – internal area greater than external area)	9.60	-0.090	No
Table K1 - Approved	E18 Party wall between dwellings	7.40	0.060	No
Table K1 - Default	P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	9.33	0.000	No
Table K1 - Default	R1 Head of roof window	1.60	0.080	No
Table K1 - Default	R2 Sill of roof window	1.60	0.060	No
Table K1 - Default	R3 Jamb of roof window	3.60	0.080	No

Y-value	0.079	W/m²K
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18.0 Pressure Testing

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

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

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
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20.0 Fans, Open Fireplaces, Flues

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

21.0 Fixed Cooling System

No

22.0 Lighting

Internal

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

External

External lights fitted	Yes
Light and motion sensor	Yes

23.0 Electricity Tariff

Standard

24.0 Main Heating 1

0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	102968	
Fuel Type	Electricity	
Main Heating	PET	
SAP Code	224	
In Winter	0.0	
In Summer	0.0	
Controls	CHD Time and temperature zone control	
PCDF Controls	0	
Sap Code	2207	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Underfloor	
Underfloor Heating	Yes - Pipes in thin screed	
Flow Temperature	<= 35°C	

25.0 Main Heating 2

None

Community Heating	None
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28.0 Water Heating

HWP From main heating 1

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

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	
29.0 Hot Water Cylinder	Hot Water Cylinder	
Cylinder Stat	Yes	
Cylinder In Heated Space	Yes	
Independent Time Control	Yes	
Insulation Type	Measured Loss	
Cylinder Volume	210.00	L
Loss	1.86	kWh/day
Pipes insulation	Fully insulated primary pipework	
31.0 Thermal Store	None	
32.0 Photovoltaic Unit	More Dwellings, One Block	
Apportioned	300.00	kWh/Year

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

None

BLOCK COMPLIANCE

Energy Calculations Ltd
SAP • CODE • SBEM • DESIGN

Calculation Type: New Build (As Designed)

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

Block Compliance Report - DER

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

Block Compliance Report - DFEE

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