

Energy Calculations Ltd

SAP ♦ CODE ♦ SBEM ♦ DESIGN

01754-761035



SAP Report Submission for Building Regulations Compliance

Client:

Project: Flat 8, 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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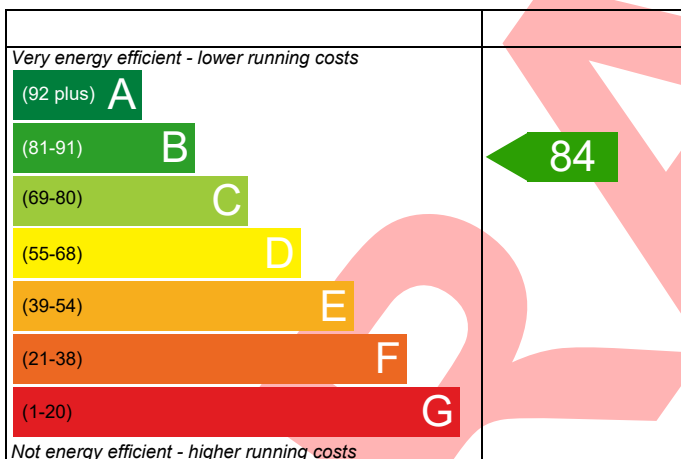
Flat 8, 18, Parkside Road,
READING,
RG30 2DB

Dwelling type: Flat, Semi-Detached
Date of assessment: 16/08/2021
Produced by: Energy Calculations Limited
Total floor area: 70.3 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

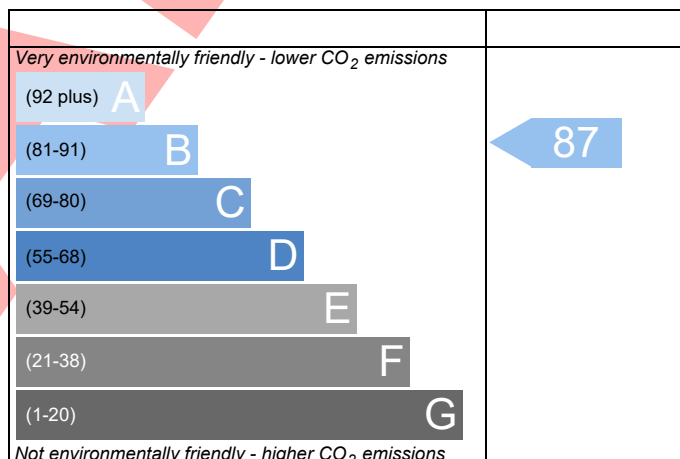


England

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	015729	Issued on Date	16/08/2021
Assessment Reference	004	Prop Type Ref	
Property	Flat 8, 18, Parkside Road, READING, RG30 2DB		
SAP Rating	84 B	DER	17.18
Environmental	87 B	TER	27.75
CO ₂ Emissions (t/year)	1.01	% DER<TER	38.08
General Requirements Compliance	Pass	DFEE	46.03
		TFEE	51.12
		% DFEE<TFEE	9.95
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	3.40	1.02	
External wall	E3 Sill	Table K1 - Approved	0.040	3.40	0.14	
External wall	E4 Jamb	Table K1 - Approved	0.050	14.40	0.72	
External wall	E7 Party floor between dwellings (in blocks of flats)	Table K1 - Approved	0.070	37.76	2.64	
External wall	E10 Eaves (insulation at ceiling level)	Table K1 - Approved	0.060	23.60	1.42	
External wall	E13 Gable (insulation at rafter level)	Table K1 - Approved	0.040	2.80	0.11	
External wall	E16 Corner (normal)	Table K1 - Approved	0.090	7.20	0.65	
External wall	E17 Corner (inverted – internal area greater than external area)	Table K1 - Approved	-0.090	7.20	-0.65	
External wall	E18 Party wall between dwellings	Table K1 - Approved	0.060	4.80	0.29	
Party wall	P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	Table K1 - Default	0.000	9.18	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: **6.85** W/mK:
Y-Value: **0.044** W/m²K:

FULL SAP CALCULATION PRINTOUT

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SAP Rating	84 B	DER	17.18	TER	27.75
Environmental	87 B	% DER<TER	38.08		
CO ₂ Emissions (t/year)	1.01	DFEE	46.03	TFEE	51.12
General Requirements Compliance	Pass	% DFEE<TFEE	9.95		
Assessor Details	Mr. Matthew Carter, Energy Calculations Limited, Tel: 01754 761035, mcarter@energycalculations.co.uk			Assessor ID	7869-0001
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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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

DWELLING AS DESIGNED

Top-floor flat, total floor area 70 m²

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

1a TER and DER

Fuel for main heating:Electricity

Fuel factor:1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER) 27.75 kgCO₂/m²

Dwelling Carbon Dioxide Emission Rate (DER) 17.18 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)51.1 kWh/m²/yr

Dwelling Fabric Energy Efficiency (DFEE)46.0 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.22 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	(no floor)		
Roof	0.11 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.40 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

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

4 Heating efficiency

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

Secondary heating system: None

5 Cylinder insulation

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

6 Controls

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

Cylinderstat	OK
Independent timer for DHW	OK

7 Low energy lights

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

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Thames Valley): Not significant OK

Based on:

Overshading:	Average
Windows facing North:	5.04 m ² , No overhang
Windows facing East:	0.63 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	70.3000 (1b)	x 2.3400 (2b)	= 164.5020 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.3000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	164.5020 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				30.0000 / (5) =	0.1824 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4324 (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) =		0.3675 (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												
	0.4686	0.4594	0.4502	0.4043	0.3951	0.3491	0.3491	0.3399	0.3675	0.3951	0.4135	0.4318 (22b)
Effective ac	0.6098	0.6055	0.6013	0.5817	0.5780	0.5609	0.5609	0.5578	0.5675	0.5780	0.5855	0.5932 (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)			5.6700	1.3258	7.5170		(27)
Door to Stairs			1.8900	1.4000	2.6460		(26)
R lights (Uw = 1.40)			1.4400	1.3258	1.9091		(27a)
Main Wall	59.3000	5.6700	53.6300	0.2200	11.7986	60.0000	3217.8000 (29a)
Wall to stairs	26.3000	1.8900	24.4100	0.1864	4.5495	190.0000	4637.9000 (29a)
Slope	15.9600	1.4400	14.5200	0.1600	2.3232	9.0000	130.6800 (30)
Plane	55.0000		55.0000	0.1000	5.5000	9.0000	495.0000 (30)
Total net area of external elements Aum(A, m ²)			156.5600				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		36.2434		(33)
Party Wall 1			22.0300	0.0000	0.0000	180.0000	3965.4000 (32)
Party Floor 1			70.3000			40.0000	2812.0000 (32d)
Internal Wall 1			63.6900			9.0000	573.2100 (32c)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	15831.9900 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							225.2061 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.8472 (36)
Total fabric heat loss						(33) + (36) =	43.0906 (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	33.1025	32.8711	32.6442	31.5788	31.3794	30.4515	30.4515	30.2796	30.8089	31.3794	31.7827	32.2043 (38)
Heat transfer coeff	76.1931	75.9617	75.7348	74.6694	74.4700	73.5421	73.5421	73.3702	73.8995	74.4700	74.8733	75.2949 (39)
Average = Sum(39)m / 12 =												74.6684 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0838	1.0805	1.0773	1.0622	1.0593	1.0461	1.0461	1.0437	1.0512	1.0593	1.0651	1.0711 (40)
HLP (average)												1.0621 (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	2.2534 (42)
Average daily hot water use (litres/day)	87.7179 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	96.4897	92.9810	89.4723	85.9636	82.4548	78.9461	78.9461	82.4548	85.9636	89.4723	92.9810	96.4897 (44)
Energy conte	143.0915	125.1487	129.1423	112.5893	108.0322	93.2235	86.3853	99.1284	100.3123	116.9043	127.6102	138.5764 (45)
Energy content (annual)										Total = Sum(45)m =		1380.1445 (45)
Distribution loss (46)m = 0.15 x (45)m												

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	21.4637	18.7723	19.3713	16.8884	16.2048	13.9835	12.9578	14.8693	15.0468	17.5356	19.1415	20.7865 (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												
197.4903	174.2831	183.5411	165.2333	162.4310	145.8675	140.7841	153.5272	152.9563	171.3031	180.2542	192.9752	(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												
197.4903	174.2831	183.5411	165.2333	162.4310	145.8675	140.7841	153.5272	152.9563	171.3031	180.2542	192.9752	(64)
Heat gains from water heating, kWh/month												
91.0969	80.9195	86.4588	79.5512	79.4397	73.1120	72.2422	76.4792	75.4690	82.3897	84.5456	89.5957	(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	
112.6693	112.6693	112.6693	112.6693	112.6693	112.6693	112.6693	112.6693	112.6693	112.6693	112.6693	112.6693	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
20.1588	17.9049	14.5612	11.0238	8.2404	6.9569	7.5172	9.7711	13.1148	16.6522	19.4356	20.7191	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
197.9962	200.0508	194.8733	183.8511	169.9375	156.8607	148.1246	146.0700	151.2475	162.2697	176.1833	189.2601	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
34.2669	34.2669	34.2669	34.2669	34.2669	34.2669	34.2669	34.2669	34.2669	34.2669	34.2669	34.2669	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)												
-90.1354	-90.1354	-90.1354	-90.1354	-90.1354	-90.1354	-90.1354	-90.1354	-90.1354	-90.1354	-90.1354	-90.1354	(71)
Water heating gains (Table 5)												
122.4421	120.4159	116.2081	110.4877	106.7738	101.5445	97.0997	102.7947	104.8181	110.7389	117.4244	120.4243	(72)
Total internal gains												
397.3980	395.1723	382.4435	362.1634	341.7525	322.1628	309.5422	315.4365	325.9811	346.4616	369.8441	387.2043	(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				5.0400	10.6334	0.6300	0.7000	0.7700	16.3785 (74)			
East				0.6300	19.6403	0.6300	0.7000	0.7700	3.7815 (76)			
North				1.4400	18.6305	0.6300	0.7000	1.0000	10.6480 (82)			
Solar gains	30.8080	59.6651	104.2300	172.7364	237.4065	256.1175	238.3420	186.2408	126.9602	71.6963	38.1249	25.6191 (83)
Total gains	428.2059	454.8375	486.6735	534.8998	579.1591	578.2803	547.8842	501.6774	452.9413	418.1578	407.9690	412.8234 (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	57.7188	57.8946	58.0681	58.8966	59.0543	59.7994	59.7994	59.9395	59.5102	59.0543	58.7362	58.4073
alpha	4.8479	4.8596	4.8712	4.9264	4.9370	4.9866	4.9866	4.9960	4.9673	4.9370	4.9157	4.8938
util living area												
0.9966	0.9948	0.9893	0.9677	0.8965	0.7373	0.5723	0.6393	0.8776	0.9775	0.9939	0.9972	(86)
Tweekday	18.6882	18.8105	19.0588	19.4330	19.7540	19.9293	19.9606	19.9585	19.8505	19.4704	19.0360	18.6813
Tweekend	20.3616	20.4149	20.5243	20.6884	20.8404	20.9330	20.9576	20.9528	20.8841	20.7027	20.5102	20.3549
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	0	0	0	0	0	0	0	0	0	0	0	0
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0
MIT	20.0147	20.0949	20.2658	20.5135	20.7537	20.8972	20.9346	20.9272	20.8191	20.5412	20.2352	20.0044 (87)
Th 2	20.0141	20.0168	20.0194	20.0319	20.0342	20.0451	20.0451	20.0471	20.0409	20.0342	20.0295	20.0245 (88)
util rest of house												
0.9956	0.9933	0.9858	0.9561	0.8590	0.6542	0.4571	0.5224	0.8192	0.9673	0.9917	0.9963	(89)
Tweekday	18.6882	18.8105	19.0588	19.4330	19.7540	19.9293	19.9606	19.9585	19.8505	19.4704	19.0360	18.6813
Tweekend	18.6882	18.8105	19.0588	19.4330	19.7540	19.9293	19.9606	19.9585	19.8505	19.4704	19.0360	18.6813
MIT 2	18.6882	18.8105	19.0588	19.4330	19.7540	19.9293	19.9606	19.9585	19.8505	19.4704	19.0360	18.6813 (90)
Living area fraction												
fLA = Living area / (4) =												0.4211 (91)
MIT	19.2467	19.3513	19.5670	19.8879	20.1749	20.3368	20.3707	20.3664	20.2583	19.9212	19.5410	19.2384 (92)
Temperature adjustment												0.0000
adjusted MIT	19.2467	19.3513	19.5670	19.8879	20.1749	20.3368	20.3707	20.3664	20.2583	19.9212	19.5410	19.2384 (93)

8. Space heating requirement

Utilisation	0.9945	0.9919	0.9837	0.9541	0.8652	0.6813	0.4976	0.5634	0.8344	0.9657	0.9902	0.9954 (94)
Useful gains	425.8680	451.1351	478.7556	510.3242	501.0777	393.9899	272.6359	282.6514	377.9292	403.8338	403.9776	410.9377 (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	1138.8365	1097.7419	989.6264	820.4628	631.1271	421.8998	277.3057	291.0150	455.0943	694.1529	931.4953	1132.3169 (97)

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Month fraction	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	530.4485	434.5198	380.0879	223.2997	96.7568	0.0000	0.0000	0.0000	0.0000	215.9974	379.8127	536.7061 (98)
Space heating												2797.6289 (98)
Space heating per m2										(98) / (4) =		39.7956 (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 %)												259.4529 (206)
Efficiency of secondary/supplementary heating system, %												100.0000 (208)
Space heating requirement												1078.2802 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	530.4485	434.5198	380.0879	223.2997	96.7568	0.0000	0.0000	0.0000	0.0000	215.9974	379.8127	536.7061 (98)
Space heating efficiency (main heating system 1)	259.4529	259.4529	259.4529	259.4529	259.4529	0.0000	0.0000	0.0000	0.0000	259.4529	259.4529	259.4529 (210)
Space heating fuel (main heating system)	204.4489	167.4754	146.4959	86.0656	37.2926	0.0000	0.0000	0.0000	0.0000	83.2511	146.3899	206.8607 (211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	197.4903	174.2831	183.5411	165.2333	162.4310	145.8675	140.7841	153.5272	152.9563	171.3031	180.2542	192.9752 (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	116.5547	102.8583	108.3221	97.5173	95.8634	86.0880	83.0879	90.6086	90.2717	101.0996	106.3823	113.8900 (219)
Water heating fuel used												1192.5439 (219)
Annual totals kWh/year												
Space heating fuel - main system												1078.2802 (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)												356.0107 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
Total delivered energy for all uses												2626.8348 (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	1078.2802	0.5190	559.6274 (261)
Space heating - secondary	0.0000	0.5190	0.0000 (263)
Water heating (other fuel)	1192.5439	0.5190	618.9303 (264)
Space and water heating			1178.5577 (265)
Pumps and fans	0.0000	0.0000	0.0000 (267)
Energy for lighting	356.0107	0.5190	184.7695 (268)
Energy saving/generation technologies			
PV Unit	-300.0000	0.5190	-155.7000 (269)
Total CO2, kg/year			1207.6273 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			17.1800 (273)

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

DER			17.1800 ZC1
Total Floor Area		TFA	70.3000
Assumed number of occupants		N	2.2534
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190
CO2 emissions from appliances, equation (L14)			16.6897 ZC2
CO2 emissions from cooking, equation (L16)			2.4620 ZC3
Total CO2 emissions			36.3317 ZC4
Residual CO2 emissions offset from biofuel CHP			0.0000 ZC5
Additional allowable electricity generation, kWh/m²/year			0.0000 ZC6
Resulting CO2 emissions offset from additional allowable electricity generation			0.0000 ZC7
Net CO2 emissions			36.3317 ZC8

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1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	70.3000 (1b)	x 2.3400 (2b)	= 164.5020 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.3000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 164.5020 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				30.0000 / (5) = 0.1824 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4324 (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) =				0.3675 (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	0.4686	0.4594	0.4502	0.4043	0.3951	0.3491	0.3491	0.3399	0.3675	0.3951	0.4135	0.4318 (22b)
Effective ac	0.6098	0.6055	0.6013	0.5817	0.5780	0.5609	0.5609	0.5578	0.5675	0.5780	0.5855	0.5932 (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)			5.6700	1.3258	7.5170		(27)
TER Room Window (Uw = 1.70)			1.4400	1.5918	2.2921		(27a)
Main Wall	59.3000	5.6700	53.6300	0.1800	9.6534		(29a)
Wall to stairs	26.3000	1.8900	24.4100	0.1800	4.3938		(29a)
Slope	15.9600	1.4400	14.5200	0.1300	1.8876		(30)
Plane	55.0000		55.0000	0.1300	7.1500		(30)
Total net area of external elements Aum(A, m ²)			156.5600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	34.7840		(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)							6.1432 (36)
Total fabric heat loss						(33) + (36) =	40.9272 (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	33.1025	32.8711	32.6442	31.5788	31.3794	30.4515	30.4515	30.2796	30.8089	31.3794	31.7827	32.2043 (38)
Heat transfer coeff	74.0297	73.7983	73.5714	72.5060	72.3066	71.3786	71.3786	71.2068	71.7361	72.3066	72.7099	73.1315 (39)
Average = Sum(39)m / 12 =												72.5050 (39)
HLP	1.0531	1.0498	1.0465	1.0314	1.0285	1.0153	1.0153	1.0129	1.0204	1.0285	1.0343	1.0403 (40)
HLP (average)												1.0314 (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												2.2534 (42)
Average daily hot water use (litres/day)												87.7179 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	96.4897	92.9810	89.4723	85.9636	82.4548	78.9461	78.9461	82.4548	85.9636	89.4723	92.9810	96.4897 (44)
Energy content (annual)	143.0915	125.1487	129.1423	112.5893	108.0322	93.2235	86.3853	99.1284	100.3123	116.9043	127.6102	138.5764 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		1380.1445 (45)
Water storage loss:	21.4637	18.7723	19.3713	16.8884	16.2048	13.9835	12.9578	14.8693	15.0468	17.5356	19.1415	20.7865 (46)
Store volume												210.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.7016 (48)

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Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.9188 (55)
Total storage loss												
28.4842	25.7277	28.4842	27.5653	28.4842	27.5653	28.4842	28.4842	27.5653	28.4842	27.5653	28.4842	(56)
If cylinder contains dedicated solar storage												
28.4842	25.7277	28.4842	27.5653	28.4842	27.5653	28.4842	28.4842	27.5653	28.4842	27.5653	28.4842	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month												
194.8380	171.8876	180.8888	162.6667	159.7787	143.3009	138.1319	150.8750	150.3897	168.6509	177.6876	190.3230	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Solar input (sum of months) = Sum(63)m =												0.0000 (63)
Output from w/h												
194.8380	171.8876	180.8888	162.6667	159.7787	143.3009	138.1319	150.8750	150.3897	168.6509	177.6876	190.3230	(64)
Heat gains from water heating, kWh/month												
88.9752	79.0030	84.3371	77.4978	77.3180	71.0587	70.1204	74.3575	73.4157	80.2680	82.4923	87.4739	(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	112.6693	112.6693	112.6693	112.6693	112.6693	112.6693	112.6693	112.6693	112.6693	112.6693	112.6693	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
20.1588	17.9049	14.5612	11.0238	8.2404	6.9569	7.5172	9.7711	13.1148	16.6522	19.4356	20.7191	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
197.9962	200.0508	194.8733	183.8511	169.9375	156.8607	148.1246	146.0700	151.2475	162.2697	176.1833	189.2601	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
34.2669	34.2669	34.2669	34.2669	34.2669	34.2669	34.2669	34.2669	34.2669	34.2669	34.2669	34.2669	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)												
-90.1354	-90.1354	-90.1354	-90.1354	-90.1354	-90.1354	-90.1354	-90.1354	-90.1354	-90.1354	-90.1354	-90.1354	(71)
Water heating gains (Table 5)												
119.5903	117.5640	113.3563	107.6359	103.9220	98.6926	94.2478	99.9428	101.9663	107.8870	114.5726	117.5725	(72)
Total internal gains												
397.5461	395.3205	382.5916	362.3115	341.9007	322.3110	309.6904	315.5847	326.1293	346.6097	369.9923	387.3525	(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				5.0400	10.6334	0.6300	0.7000			0.7700			16.3785 (74)
East				0.6300	19.6403	0.6300	0.7000			0.7700			3.7815 (76)
North				1.4400	18.6305	0.6300	0.7000			1.0000			10.6480 (82)
Solar gains	30.8080	59.6651	104.2300	172.7364	237.4065	256.1175	238.3420	186.2408	126.9602	71.6963	38.1249	25.6191	(83)
Total gains	428.3541	454.9856	486.8217	535.0479	579.3072	578.4285	548.0324	501.8255	453.0895	418.3060	408.1172	412.9715	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	65.9458	66.1526	66.3565	67.3316	67.5173	68.3950	68.3950	68.5601	68.0542	67.5173	67.1428	66.7557
alpha	5.3964	5.4102	5.4238	5.4888	5.5012	5.5597	5.5597	5.5707	5.5369	5.5012	5.4762	5.4504
util living area	0.9979	0.9966	0.9922	0.9731	0.9017	0.7330	0.5617	0.6303	0.8819	0.9820	0.9958	0.9983 (86)
MIT	19.9000	20.0002	20.2052	20.5130	20.7950	20.9550	20.9915	20.9846	20.8694	20.5338	20.1754	19.8872 (87)
Th 2	20.0394	20.0421	20.0447	20.0573	20.0596	20.0706	20.0706	20.0726	20.0663	20.0596	20.0549	20.0499 (88)
util rest of house	0.9971	0.9954	0.9894	0.9624	0.8636	0.6484	0.4490	0.5144	0.8219	0.9729	0.9942	0.9977 (89)
MIT 2	18.5693	18.7176	19.0180	19.4692	19.8512	20.0396	20.0673	20.0658	19.9549	19.5053	18.9831	18.5582 (90)
Living area fraction	fLA = Living area / (4) = 0.4211 (91)											
MIT	19.1296	19.2576	19.5179	19.9087	20.2486	20.4250	20.4564	20.4527	20.3400	19.9384	19.4851	19.1178 (92)
Temperature adjustment	0.0000											
adjusted MIT	19.1296	19.2576	19.5179	19.9087	20.2486	20.4250	20.4564	20.4527	20.3400	19.9384	19.4851	19.1178 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9962	0.9941	0.9873	0.9603	0.8722	0.6824	0.4968	0.5635	0.8418	0.9714	0.9928	0.9969	(94)
Ext temp.	426.7233	452.2940	480.6444	513.8319	505.2917	394.7162	272.2523	282.8027	381.4307	406.3495	405.1728	411.6812	(95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Month fracti	1097.8289	1059.5668	957.7425	798.1968	618.1169	415.7826	275.2643	288.5788	447.6314	675.2272	900.5196	1090.9597	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000	(97a)
Space heating per m2	499.3025	408.0873	354.9610	204.7427	83.9420	0.0000	0.0000	0.0000	0.0000	200.0450	356.6497	505.3832	(98)
Space heating												2613.1133	(98)
Space heating per m2												37.1709	(99)

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													2794.7736 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	499.3025	408.0873	354.9610	204.7427	83.9420	0.0000	0.0000	0.0000	0.0000	200.0450	356.6497	505.3832	(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)	534.0134	436.4570	379.6374	218.9762	89.7775	0.0000	0.0000	0.0000	0.0000	213.9519	381.4435	540.5168	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	194.8380	171.8876	180.8888	162.6667	159.7787	143.3009	138.1319	150.8750	150.3897	168.6509	177.6876	190.3230	(64)
Efficiency of water heater (217)m	87.2175	87.0411	86.5810	85.4285	83.1875	79.8000	79.8000	79.8000	79.8000	85.2700	86.6370	87.2978	(216)
Fuel for water heating, kWh/month	223.3934	197.4787	208.9243	190.4126	192.0706	179.5750	173.0976	189.0664	188.4582	197.7845	205.0943	218.0159	(219)
Water heating fuel used												2363.3715	(219)
Annual totals kWh/year													
Space heating fuel - main system												2794.7736	(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)												356.0107	(232)
Total delivered energy for all uses												5589.1558	(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	2794.7736	0.2160	603.6711 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2363.3715	0.2160	510.4883 (264)
Space and water heating			1114.1594 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	356.0107	0.5190	184.7695 (268)
Total CO2, kg/m2/year			1337.8539 (272)
Emissions per m2 for space and water heating			15.8486 (272a)
Fuel factor (electricity)			1.5500
Emissions per m2 for lighting			2.6283 (272b)
Emissions per m2 for pumps and fans			0.5537 (272c)
Target Carbon Dioxide Emission Rate (TER) = (15.8486 * 1.55) + 2.6283 + 0.5537, rounded to 2 d.p.			27.7500 (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	70.3000 (1b)	x 2.3400 (2b)	= 164.5020 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.3000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	164.5020 (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) = 0.1824 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4324 (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) =		0.3675 (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	0.4686	0.4594	0.4502	0.4043	0.3951	0.3491	0.3491	0.3399	0.3675	0.3951	0.4135	0.4318 (22b)
Effective ac	0.6098	0.6055	0.6013	0.5817	0.5780	0.5609	0.5609	0.5578	0.5675	0.5780	0.5855	0.5932 (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)			5.6700	1.3258	7.5170		(27)
Door to Stairs			1.8900	1.4000	2.6460		(26)
R lights (Uw = 1.40)			1.4400	1.3258	1.9091		(27a)
Main Wall	59.3000	5.6700	53.6300	0.2200	11.7986	60.0000	3217.8000 (29a)
Wall to stairs	26.3000	1.8900	24.4100	0.1864	4.5495	190.0000	4637.9000 (29a)
Slope	15.9600	1.4400	14.5200	0.1600	2.3232	9.0000	130.6800 (30)
Plane	55.0000		55.0000	0.1000	5.5000	9.0000	495.0000 (30)
Total net area of external elements Aum(A, m ²)			156.5600				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		36.2434		(33)
Party Wall 1			22.0300	0.0000	0.0000	180.0000	3965.4000 (32)
Party Floor 1			70.3000			40.0000	2812.0000 (32d)
Internal Wall 1			63.6900			9.0000	573.2100 (32c)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	15831.9900 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							225.2061 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.8472 (36)
Total fabric heat loss						(33) + (36) =	43.0906 (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	33.1025	32.8711	32.6442	31.5788	31.3794	30.4515	30.4515	30.2796	30.8089	31.3794	31.7827	32.2043 (38)
Heat transfer coeff	76.1931	75.9617	75.7348	74.6694	74.4700	73.5421	73.5421	73.3702	73.8995	74.4700	74.8733	75.2949 (39)
Average = Sum(39)m / 12 =												74.6684 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0838	1.0805	1.0773	1.0622	1.0593	1.0461	1.0461	1.0437	1.0512	1.0593	1.0651	1.0711 (40)
HLP (average)												1.0621 (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	2.2534 (42)
Average daily hot water use (litres/day)	87.7179 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	96.4897	92.9810	89.4723	85.9636	82.4548	78.9461	78.9461	82.4548	85.9636	89.4723	92.9810	96.4897 (44)
Energy conte	143.0915	125.1487	129.1423	112.5893	108.0322	93.2235	86.3853	99.1284	100.3123	116.9043	127.6102	138.5764 (45)
Energy content (annual)										Total = Sum(45)m =		1380.1445 (45)
Distribution loss (46)m = 0.15 x (45)m												

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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	30.4069	26.5941	27.4427	23.9252	22.9568	19.8100	18.3569	21.0648	21.3164	24.8422	27.1172	29.4475 (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	112.6693	112.6693	112.6693	112.6693	112.6693	112.6693	112.6693	112.6693	112.6693	112.6693	112.6693	112.6693	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	20.1588	17.9049	14.5612	11.0238	8.2404	6.9569	7.5172	9.7711	13.1148	16.6522	19.4356	20.7191	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	197.9962	200.0508	194.8733	183.8511	169.9375	156.8607	148.1246	146.0700	151.2475	162.2697	176.1833	189.2601	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.2669	34.2669	34.2669	34.2669	34.2669	34.2669	34.2669	34.2669	34.2669	34.2669	34.2669	34.2669	(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)	-90.1354	-90.1354	-90.1354	-90.1354	-90.1354	-90.1354	-90.1354	-90.1354	-90.1354	-90.1354	-90.1354	-90.1354	(71)
Water heating gains (Table 5)	40.8695	39.5746	36.8854	33.2295	30.8560	27.5139	24.6732	28.3129	29.6061	33.3900	37.6627	39.5800	(72)
Total internal gains	315.8254	314.3310	303.1207	284.9052	265.8347	248.1323	237.1157	240.9548	250.7691	269.1127	290.0824	306.3599	(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				5.0400	10.6334		0.6300	0.7000		0.7700		16.3785 (74)	
East				0.6300	19.6403		0.6300	0.7000		0.7700		3.7815 (76)	
North				1.4400	18.6305		0.6300	0.7000		1.0000		10.6480 (82)	
Solar gains	30.8080	59.6651	104.2300	172.7364	237.4065	256.1175	238.3420	186.2408	126.9602	71.6963	38.1249	25.6191	(83)
Total gains	346.6333	373.9962	407.3508	457.6416	503.2412	504.2497	475.4578	427.1956	377.7293	340.8090	328.2073	331.9790	(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	57.7188	57.8946	58.0681	58.8966	59.0543	59.7994	59.7994	59.9395	59.5102	59.0543	58.7362	58.4073	
alpha	4.8479	4.8596	4.8712	4.9264	4.9370	4.9866	4.9866	4.9960	4.9673	4.9370	4.9157	4.8938	
util living area	0.9987	0.9978	0.9950	0.9824	0.9335	0.8030	0.6451	0.7225	0.9299	0.9902	0.9976	0.9989	(86)
MIT	19.6395	19.7510	19.9810	20.3304	20.6712	20.9027	20.9751	20.9573	20.7654	20.3549	19.9484	19.6256	(87)
Th 2	20.0141	20.0168	20.0194	20.0319	20.0342	20.0451	20.0451	20.0471	20.0409	20.0342	20.0295	20.0245	(88)
util rest of house	0.9983	0.9971	0.9932	0.9755	0.9057	0.7249	0.5218	0.6023	0.8883	0.9853	0.9968	0.9986	(89)
MIT 2	18.7637	18.8771	19.1086	19.4643	19.7908	19.9934	20.0373	20.0319	19.8879	19.4928	19.0845	18.7582	(90)
Living area fraction									fLA = Living area / (4) =			0.4211	(91)
MIT	19.1325	19.2451	19.4759	19.8289	20.1615	20.3763	20.4322	20.4215	20.2574	19.8558	19.4482	19.1234	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1325	19.2451	19.4759	19.8289	20.1615	20.3763	20.4322	20.4215	20.2574	19.8558	19.4482	19.1234	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9977	0.9964	0.9919	0.9737	0.9099	0.7545	0.5741	0.6530	0.8996	0.9841	0.9960	0.9982	(94)
Ext temp.	345.8517	372.6342	404.0630	445.6183	457.9208	380.4409	272.9811	278.9399	339.7897	335.4036	326.9022	331.3793	(95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Month fracti	1130.1327	1089.6759	982.7296	816.0574	630.1272	424.7993	281.8244	295.0597	455.0279	689.2824	924.5538	1123.6566	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating	583.5050	481.8520	430.5279	266.7162	128.1216	0.0000	0.0000	0.0000	0.0000	263.2858	430.3092	589.4544	(98)
Space heating per m2												3173.7720	(98)
										(98) / (4) =		45.1461	(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	691.2955	544.2113	557.6137	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8101	0.8832	0.8432	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	560.0156	480.6403	470.1651	0.0000	0.0000	0.0000	0.0000	(102)

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Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	655.5488	621.7334	571.3223	0.0000	0.0000	0.0000	0.0000 (103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	68.7839	104.9733	75.2610	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												249.0182 (104)
Cooled fraction									fC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	17.1960	26.2433	18.8152	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												62.2545 (107)
Space cooling per m2												0.8856 (108)
Energy for space heating												45.1461 (99)
Energy for space cooling												0.8856 (108)
Total												46.0317 (109)
Dwelling Fabric Energy Efficiency (DFEE)												46.0 (109)

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	70.3000 (1b)	x 2.3400 (2b)	= 164.5020 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.3000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	164.5020 (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) = 0.1824 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4324 (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) =		0.3675 (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	0.4686	0.4594	0.4502	0.4043	0.3951	0.3491	0.3491	0.3399	0.3675	0.3951	0.4135	0.4318 (22b)
Effective ac	0.6098	0.6055	0.6013	0.5817	0.5780	0.5609	0.5609	0.5578	0.5675	0.5780	0.5855	0.5932 (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)			5.6700	1.3258	7.5170		(27)
TER Room Window (Uw = 1.70)			1.4400	1.5918	2.2921		(27a)
Main Wall	59.3000	5.6700	53.6300	0.1800	9.6534		(29a)
Wall to stairs	26.3000	1.8900	24.4100	0.1800	4.3938		(29a)
Slope	15.9600	1.4400	14.5200	0.1300	1.8876		(30)
Plane	55.0000		55.0000	0.1300	7.1500		(30)
Total net area of external elements Aum(A, m ²)			156.5600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	34.7840		(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)							6.1432 (36)
Total fabric heat loss						(33) + (36) =	40.9272 (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	33.1025	32.8711	32.6442	31.5788	31.3794	30.4515	30.4515	30.2796	30.8089	31.3794	31.7827	32.2043 (38)
Heat transfer coeff	74.0297	73.7983	73.5714	72.5060	72.3066	71.3786	71.3786	71.2068	71.7361	72.3066	72.7099	73.1315 (39)
Average = Sum(39)m / 12 =												72.5050 (39)
HLP	1.0531	1.0498	1.0465	1.0314	1.0285	1.0153	1.0153	1.0129	1.0204	1.0285	1.0343	1.0403 (40)
HLP (average)												1.0314 (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												2.2534 (42)
Average daily hot water use (litres/day)												87.7179 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	96.4897	92.9810	89.4723	85.9636	82.4548	78.9461	78.9461	82.4548	85.9636	89.4723	92.9810	96.4897 (44)
Energy content (annual)	143.0915	125.1487	129.1423	112.5893	108.0322	93.2235	86.3853	99.1284	100.3123	116.9043	127.6102	138.5764 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		1380.1445 (45)
Water storage loss:	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)

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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	30.4069	26.5941	27.4427	23.9252	22.9568	19.8100	18.3569	21.0648	21.3164	24.8422	27.1172	29.4475 (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	112.6693	112.6693	112.6693	112.6693	112.6693	112.6693	112.6693	112.6693	112.6693	112.6693	112.6693	112.6693	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	20.1588	17.9049	14.5612	11.0238	8.2404	6.9569	7.5172	9.7711	13.1148	16.6522	19.4356	20.7191	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	197.9962	200.0508	194.8733	183.8511	169.9375	156.8607	148.1246	146.0700	151.2475	162.2697	176.1833	189.2601	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.2669	34.2669	34.2669	34.2669	34.2669	34.2669	34.2669	34.2669	34.2669	34.2669	34.2669	34.2669	(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)	-90.1354	-90.1354	-90.1354	-90.1354	-90.1354	-90.1354	-90.1354	-90.1354	-90.1354	-90.1354	-90.1354	-90.1354	(71)
Water heating gains (Table 5)	40.8695	39.5746	36.8854	33.2295	30.8560	27.5139	24.6732	28.3129	29.6061	33.3900	37.6627	39.5800	(72)
Total internal gains	315.8254	314.3310	303.1207	284.9052	265.8347	248.1323	237.1157	240.9548	250.7691	269.1127	290.0824	306.3599	(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	5.0400	10.6334	0.6300	0.7000	0.7700	16.3785	(74)
East	0.6300	19.6403	0.6300	0.7000	0.7700	3.7815	(76)
North	1.4400	18.6305	0.6300	0.7000	1.0000	10.6480	(82)

Solar gains	30.8080	59.6651	104.2300	172.7364	237.4065	256.1175	238.3420	186.2408	126.9602	71.6963	38.1249	25.6191	(83)
Total gains	346.6333	373.9962	407.3508	457.6416	503.2412	504.2497	475.4578	427.1956	377.7293	340.8090	328.2073	331.9790	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	65.9458	66.1526	66.3565	67.3316	67.5173	68.3950	68.3950	68.5601	68.0542	67.5173	67.1428	66.7557	
alpha	5.3964	5.4102	5.4238	5.4888	5.5012	5.5597	5.5597	5.5707	5.5369	5.5012	5.4762	5.4504	
util living area	0.9992	0.9987	0.9967	0.9864	0.9398	0.8028	0.6366	0.7174	0.9361	0.9929	0.9986	0.9994	(86)
MIT	19.7898	19.8914	20.1003	20.4184	20.7274	20.9287	20.9844	20.9711	20.8065	20.4350	20.0680	19.7775	(87)
Th 2	20.0394	20.0421	20.0447	20.0573	20.0596	20.0706	20.0706	20.0726	20.0663	20.0596	20.0549	20.0499	(88)
util rest of house	0.9990	0.9982	0.9954	0.9805	0.9122	0.7225	0.5143	0.5961	0.8946	0.9890	0.9980	0.9992	(89)
MIT 2	18.9257	19.0295	19.2400	19.5653	19.8610	20.0348	20.0662	20.0632	19.9431	19.5857	19.2164	18.9220	(90)
Living area fraction									fLA = Living area / (4) =			0.4211	(91)
MIT	19.2895	19.3924	19.6022	19.9245	20.2258	20.4112	20.4528	20.4455	20.3067	19.9433	19.5750	19.2822	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.2895	19.3924	19.6022	19.9245	20.2258	20.4112	20.4528	20.4455	20.3067	19.9433	19.5750	19.2822	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	346.1861	373.1687	405.1416	448.2267	461.9320	380.3926	269.3261	276.7717	342.7449	336.8467	327.4056	331.6451	(94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(95)
Heat loss rate W	1109.6687	1069.5146	963.9476	799.3449	616.4726	414.7937	275.0078	288.0655	445.2411	675.5798	907.0533	1102.9837	(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	568.0311	467.9444	415.7517	252.8051	114.9782	0.0000	0.0000	0.0000	0.0000	252.0174	417.3464	573.8759	(98)
Space heating												3062.7502	(98)
Space heating per m2											(98) / (4) =	43.5669	(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	670.9592	528.2020	541.1716	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8375	0.9075	0.8698	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	561.9520	479.3285	470.7185	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	655.5488	621.7334	571.3223	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	67.3897	105.9492	74.8492	0.0000	0.0000	0.0000	0.0000	(104)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling											248.1881 (104)
Cooled fraction											1.0000 (105)
Intermittency factor (Table 10b)											
	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh											
	0.0000	0.0000	0.0000	0.0000	0.0000	16.8474	26.4873	18.7123	0.0000	0.0000	0.0000 (107)
Space cooling											62.0470 (107)
Space cooling per m2											0.8826 (108)
Energy for space heating											43.5669 (99)
Energy for space cooling											0.8826 (108)
Total											44.4495 (109)
Target Fabric Energy Efficiency (TFEE)											51.1 (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	70.3000 (1b)	x 2.3400 (2b)	= 164.5020 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.3000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	164.5020 (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)
					Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1824 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4324 (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) =		0.3675 (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												
	0.4043	0.3767	0.3767	0.3583	0.3583	0.3124	0.3124	0.3032	0.3124	0.3491	0.3399	0.3675 (22b)
Effective ac	0.5817	0.5710	0.5710	0.5642	0.5642	0.5488	0.5488	0.5460	0.5488	0.5609	0.5578	0.5675 (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)			5.6700	1.3258	7.5170		(27)
Door to Stairs			1.8900	1.4000	2.6460		(26)
R lights (Uw = 1.40)			1.4400	1.3258	1.9091		(27a)
Main Wall	59.3000	5.6700	53.6300	0.2200	11.7986	60.0000	3217.8000 (29a)
Wall to stairs	26.3000	1.8900	24.4100	0.1864	4.5495	190.0000	4637.9000 (29a)
Slope	15.9600	1.4400	14.5200	0.1600	2.3232	9.0000	130.6800 (30)
Plane	55.0000		55.0000	0.1000	5.5000	9.0000	495.0000 (30)
Total net area of external elements Aum(A, m ²)			156.5600				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		36.2434		(33)
Party Wall 1			22.0300	0.0000	0.0000	180.0000	3965.4000 (32)
Party Floor 1			70.3000			40.0000	2812.0000 (32d)
Internal Wall 1			63.6900			9.0000	573.2100 (32c)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	15831.9900 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							225.2061 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.8472 (36)
Total fabric heat loss						(33) + (36) =	43.0906 (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	31.5788	30.9945	30.9945	30.6279	30.6279	29.7916	29.7916	29.6381	29.7916	30.4515	30.2796	30.8089 (38)
Heat transfer coeff	74.6694	74.0851	74.0851	73.7185	73.7185	72.8822	72.8822	72.7287	72.8822	73.5421	73.3702	73.8995 (39)
Average = Sum(39)m / 12 =												73.5386 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0622	1.0538	1.0538	1.0486	1.0486	1.0367	1.0367	1.0345	1.0367	1.0461	1.0437	1.0512 (40)
HLP (average)												1.0461 (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	2.2534 (42)
Average daily hot water use (litres/day)	87.7179 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	96.4897	92.9810	89.4723	85.9636	82.4548	78.9461	78.9461	82.4548	85.9636	89.4723	92.9810	96.4897 (44)
Energy conte	143.0915	125.1487	129.1423	112.5893	108.0322	93.2235	86.3853	99.1284	100.3123	116.9043	127.6102	138.5764 (45)
Energy content (annual)										Total = Sum(45)m =		1380.1445 (45)
Distribution loss (46)m = 0.15 x (45)m												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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CALCULATION OF HEAT DEMAND 09 Jan 2014

	21.4637	18.7723	19.3713	16.8884	16.2048	13.9835	12.9578	14.8693	15.0468	17.5356	19.1415	20.7865 (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												
197.4903	174.2831	183.5411	165.2333	162.4310	145.8675	140.7841	153.5272	152.9563	171.3031	180.2542	192.9752	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Solar input (sum of months) = Sum(63)m =												0.0000 (63)
Output from w/h												
197.4903	174.2831	183.5411	165.2333	162.4310	145.8675	140.7841	153.5272	152.9563	171.3031	180.2542	192.9752	(64)
RHI water heating demand												
Heat gains from water heating, kWh/month												
91.0969	80.9195	86.4588	79.5512	79.4397	73.1120	72.2422	76.4792	75.4690	82.3897	84.5456	89.5957	(65)
												2021 (64)
												2020.6465 (64)

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	135.2032	135.2032	135.2032	135.2032	135.2032	135.2032	135.2032	135.2032	135.2032	135.2032	135.2032	135.2032 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
50.3970	44.7622	36.4030	27.5594	20.6010	17.3922	18.7929	24.4278	32.7869	41.6305	48.5889	51.7977	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
295.5168	298.5833	290.8557	274.4046	253.6381	234.1204	221.0814	218.0149	225.7425	242.1936	262.9601	282.4778	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
50.7737	50.7737	50.7737	50.7737	50.7737	50.7737	50.7737	50.7737	50.7737	50.7737	50.7737	50.7737	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)												
-90.1354	-90.1354	-90.1354	-90.1354	-90.1354	-90.1354	-90.1354	-90.1354	-90.1354	-90.1354	-90.1354	-90.1354	(71)
Water heating gains (Table 5)												
122.4421	120.4159	116.2081	110.4877	106.7738	101.5445	97.0997	102.7947	104.8181	110.7389	117.4244	120.4243	(72)
Total internal gains												
564.1973	559.6028	539.3083	508.2932	476.8543	448.8986	432.8155	441.0787	459.1889	490.4044	524.8149	550.5412	(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					5.0400	12.7500	0.6300	0.7000	0.7700		19.6387 (74)	
East					0.6300	23.7835	0.6300	0.7000	0.7700		4.5792 (76)	
North					1.4400	22.4438	0.6300	0.7000	1.0000		12.8274 (82)	
Solar gains	37.0453	63.4257	111.4081	188.3239	251.5971	286.4359	264.2231	211.1283	145.1049	82.2535	45.3147	30.8815 (83)
Total gains	601.2426	623.0285	650.7164	696.6171	728.4515	735.3345	697.0386	652.2071	604.2938	572.6578	570.1296	581.4228 (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	58.8966	59.3611	59.3611	59.6563	59.6563	60.3409	60.3409	60.4683	60.3409	59.7994	59.9395	59.5102
alpha	4.9264	4.9574	4.9574	4.9771	4.9771	5.0227	5.0227	5.0312	5.0227	4.9866	4.9960	4.9673
util living area	0.9833	0.9773	0.9574	0.8976	0.7528	0.5242	0.3542	0.3990	0.6948	0.9069	0.9696	0.9852 (86)
Tweekday	19.0737	19.1921	19.4246	19.7067	19.9011	19.9688	19.9735	19.9751	19.9490	19.7448	19.3960	19.0701
Tweekend	20.5274	20.5782	20.6838	20.8158	20.9192	20.9592	20.9644	20.9640	20.9420	20.8309	20.6665	20.5224
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	0	0	0	0	0	0	0	0	0	0	0	0
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0
MIT	20.2706	20.3475	20.5120	20.7123	20.8753	20.9374	20.9451	20.9444	20.9095	20.7390	20.4792	20.2629 (87)
Th 2	20.0319	20.0387	20.0387	20.0430	20.0430	20.0528	20.0528	20.0546	20.0528	20.0451	20.0471	20.0409 (88)
util rest of house												
0.9786	0.9709	0.9448	0.8679	0.6907	0.4373	0.2563	0.2956	0.6085	0.8733	0.9597	0.9810	(89)
Tweekday	19.0737	19.1921	19.4246	19.7067	19.9011	19.9688	19.9735	19.9751	19.9490	19.7448	19.3960	19.0701
Tweekend	19.0737	19.1921	19.4246	19.7067	19.9011	19.9688	19.9735	19.9751	19.9490	19.7448	19.3960	19.0701
MIT 2	19.0737	19.1921	19.4246	19.7067	19.9011	19.9688	19.9735	19.9751	19.9490	19.7448	19.3960	19.0701 (90)
Living area fraction												
MIT	19.5776	19.6786	19.8824	20.1301	20.3113	20.3766	20.3826	20.3833	20.3534	20.1634	19.8521	19.5723 (92)
Temperature adjustment												0.0000
adjusted MIT	19.5776	19.6786	19.8824	20.1301	20.3113	20.3766	20.3826	20.3833	20.3534	20.1634	19.8521	19.5723 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9759	0.9680	0.9424	0.8710	0.7091	0.4675	0.2905	0.3318	0.6373	0.8781	0.9573	0.9785 (94)
Ext temp.	586.7347	603.1156	613.2435	606.7266	516.5812	343.7969	202.5085	216.3977	385.1401	502.8336	545.7698	568.9186 (95)
Heat loss rate W	4.9000	5.5000	7.3000	9.7000	12.7000	15.6000	17.6000	17.4000	14.8000	11.4000	7.8000	4.9000 (96)

FULL SAP CALCULATION PRINTOUT

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CALCULATION OF HEAT DEMAND 09 Jan 2014

Month fracti	1095.9701	1050.4210	932.1711	768.8910	561.0925	348.1315	202.8002	216.9684	404.7469	644.4800	884.2618	1084.2778	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating	378.8711	300.5892	237.2821	116.7584	33.1164	0.0000	0.0000	0.0000	0.0000	105.3849	243.7142	383.4273	(98)
RHI space heating demand												1799	(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	70.3000 (1b)	x 2.3400 (2b)	= 164.5020 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.3000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	164.5020 (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)
					Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1824 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4324 (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) = 0.3675 (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	0.4686	0.4594	0.4502	0.4043	0.3951	0.3491	0.3491	0.3399	0.3675	0.3951	0.4135	0.4318 (22b)
Effective ac	0.6098	0.6055	0.6013	0.5817	0.5780	0.5609	0.5609	0.5578	0.5675	0.5780	0.5855	0.5932 (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)			5.6700	1.3258	7.5170		(27)
Door to Stairs			1.8900	1.4000	2.6460		(26)
R lights (Uw = 1.40)			1.4400	1.3258	1.9091		(27a)
Main Wall	59.3000	5.6700	53.6300	0.2200	11.7986	60.0000	3217.8000 (29a)
Wall to stairs	26.3000	1.8900	24.4100	0.1864	4.5495	190.0000	4637.9000 (29a)
Slope	15.9600	1.4400	14.5200	0.1600	2.3232	9.0000	130.6800 (30)
Plane	55.0000		55.0000	0.1000	5.5000	9.0000	495.0000 (30)
Total net area of external elements Aum(A, m ²)			156.5600				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		36.2434		(33)
Party Wall 1			22.0300	0.0000	0.0000	180.0000	3965.4000 (32)
Party Floor 1			70.3000			40.0000	2812.0000 (32d)
Internal Wall 1			63.6900			9.0000	573.2100 (32c)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 15831.9900 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							225.2061 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.8472 (36)
Total fabric heat loss							(33) + (36) = 43.0906 (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	33.1025	32.8711	32.6442	31.5788	31.3794	30.4515	30.4515	30.2796	30.8089	31.3794	31.7827	32.2043 (38)
Heat transfer coeff	76.1931	75.9617	75.7348	74.6694	74.4700	73.5421	73.5421	73.3702	73.8995	74.4700	74.8733	75.2949 (39)
Average = Sum(39)m / 12 =												74.6684 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0838	1.0805	1.0773	1.0622	1.0593	1.0461	1.0461	1.0437	1.0512	1.0593	1.0651	1.0711 (40)
HLP (average)												1.0621 (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	2.2534 (42)
Average daily hot water use (litres/day)	87.7179 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	96.4897	92.9810	89.4723	85.9636	82.4548	78.9461	78.9461	82.4548	85.9636	89.4723	92.9810	96.4897 (44)
Energy conte	143.0915	125.1487	129.1423	112.5893	108.0322	93.2235	86.3853	99.1284	100.3123	116.9043	127.6102	138.5764 (45)
Energy content (annual)												Total = Sum(45)m = 1380.1445 (45)
Distribution loss (46)m = 0.15 x (45)m												

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	21.4637	18.7723	19.3713	16.8884	16.2048	13.9835	12.9578	14.8693	15.0468	17.5356	19.1415	20.7865 (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												
197.4903	174.2831	183.5411	165.2333	162.4310	145.8675	140.7841	153.5272	152.9563	171.3031	180.2542	192.9752	(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												
197.4903	174.2831	183.5411	165.2333	162.4310	145.8675	140.7841	153.5272	152.9563	171.3031	180.2542	192.9752	(64)
Heat gains from water heating, kWh/month												
91.0969	80.9195	86.4588	79.5512	79.4397	73.1120	72.2422	76.4792	75.4690	82.3897	84.5456	89.5957	(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	135.2032	135.2032	135.2032	135.2032	135.2032	135.2032	135.2032	135.2032	135.2032	135.2032	135.2032	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
50.3970	44.7622	36.4030	27.5594	20.6010	17.3922	18.7929	24.4278	32.7869	41.6305	48.5889	51.7977	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
295.5168	298.5833	290.8557	274.4046	253.6381	234.1204	221.0814	218.0149	225.7425	242.1936	262.9601	282.4778	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
50.7737	50.7737	50.7737	50.7737	50.7737	50.7737	50.7737	50.7737	50.7737	50.7737	50.7737	50.7737	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)												
-90.1354	-90.1354	-90.1354	-90.1354	-90.1354	-90.1354	-90.1354	-90.1354	-90.1354	-90.1354	-90.1354	-90.1354	(71)
Water heating gains (Table 5)												
122.4421	120.4159	116.2081	110.4877	106.7738	101.5445	97.0997	102.7947	104.8181	110.7389	117.4244	120.4243	(72)
Total internal gains												
564.1973	559.6028	539.3083	508.2932	476.8543	448.8986	432.8155	441.0787	459.1889	490.4044	524.8149	550.5412	(73)

6. Solar gains

[Jan]												
				Area	Solar flux		g		FF		Access	Gains
				m2	Table 6a		Specific data		Specific data		factor	W
					W/m2		or Table 6b		or Table 6c		Table 6d	
North				5.0400	10.6334		0.6300		0.7000		0.7700	16.3785 (74)
East				0.6300	19.6403		0.6300		0.7000		0.7700	3.7815 (76)
North				1.4400	18.6305		0.6300		0.7000		1.0000	10.6480 (82)
Solar gains	30.8080	59.6651	104.2300	172.7364	237.4065	256.1175	238.3420	186.2408	126.9602	71.6963	38.1249	25.6191 (83)
Total gains	595.0053	619.2679	643.5383	681.0296	714.2609	705.0161	671.1575	627.3196	586.1491	562.1006	562.9398	576.1603 (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	57.7188	57.8946	58.0681	58.8966	59.0543	59.7994	59.7994	59.9395	59.5102	59.0543	58.7362	58.4073
alpha	4.8479	4.8596	4.8712	4.9264	4.9370	4.9866	4.9866	4.9960	4.9673	4.9370	4.9157	4.8938
util living area												
0.9865	0.9816	0.9680	0.9247	0.8185	0.6351	0.4755	0.5265	0.7696	0.9338	0.9770	0.9883	(86)
Tweekday	18.9438	19.0573	19.2803	19.6000	19.8372	19.9480	19.9634	19.9640	19.9090	19.6434	19.2648	18.9340
Tweekend	20.4757	20.5256	20.6251	20.7686	20.8872	20.9484	20.9616	20.9597	20.9225	20.7858	20.6135	20.4676
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	0	0	0	0	0	0	0	0	0	0	0	0
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0
MIT	20.1908	20.2661	20.4214	20.6387	20.8259	20.9207	20.9408	20.9378	20.8791	20.6695	20.3965	20.1783 (87)
Th 2	20.0141	20.0168	20.0194	20.0319	20.0342	20.0451	20.0451	20.0471	20.0409	20.0342	20.0295	20.0245 (88)
util rest of house												
0.9828	0.9764	0.9586	0.9023	0.7683	0.5529	0.3757	0.4231	0.6946	0.9094	0.9696	0.9850	(89)
Tweekday	18.9438	19.0573	19.2803	19.6000	19.8372	19.9480	19.9634	19.9640	19.9090	19.6434	19.2648	18.9340
Tweekend	18.9438	19.0573	19.2803	19.6000	19.8372	19.9480	19.9634	19.9640	19.9090	19.6434	19.2648	18.9340
MIT 2	18.9438	19.0573	19.2803	19.6000	19.8372	19.9480	19.9634	19.9640	19.9090	19.6434	19.2648	18.9340 (90)
Living area fraction												
fLA = Living area / (4) =												0.4211 (91)
MIT	19.4688	19.5663	19.7608	20.0374	20.2535	20.3576	20.3749	20.3740	20.3175	20.0754	19.7413	19.4579 (92)
Temperature adjustment												0.0000
adjusted MIT	19.4688	19.5663	19.7608	20.0374	20.2535	20.3576	20.3749	20.3740	20.3175	20.0754	19.7413	19.4579 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9802	0.9736	0.9557	0.9025	0.7807	0.5808	0.4106	0.4593	0.7179	0.9107	0.9670	0.9827 (94)
Useful gains	583.2135	602.8939	614.9992	614.6075	557.6000	409.4593	275.6098	288.1438	420.8016	511.8800	544.3422	566.1849 (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	1155.7606	1114.0765	1004.3039	831.6203	636.9789	423.4251	277.6144	291.5741	459.4680	705.6362	946.4988	1148.8439 (97)

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Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	425.9750	343.5147	289.6427	156.2492	59.0579	0.0000	0.0000	0.0000	0.0000	144.1546	289.5528	433.4983 (98)
Space heating												2141.6453 (98)
Space heating per m2										(98) / (4) =		30.4644 (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 %)												259.4529 (206)
Efficiency of secondary/supplementary heating system, %												100.0000 (208)
Space heating requirement												825.4468 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	425.9750	343.5147	289.6427	156.2492	59.0579	0.0000	0.0000	0.0000	0.0000	144.1546	289.5528	433.4983 (98)
Space heating efficiency (main heating system 1)	259.4529	259.4529	259.4529	259.4529	259.4529	0.0000	0.0000	0.0000	0.0000	259.4529	259.4529	259.4529 (210)
Space heating fuel (main heating system)	164.1821	132.3996	111.6360	60.2226	22.7625	0.0000	0.0000	0.0000	0.0000	55.5610	111.6013	167.0817 (211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	197.4903	174.2831	183.5411	165.2333	162.4310	145.8675	140.7841	153.5272	152.9563	171.3031	180.2542	192.9752 (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	116.5547	102.8583	108.3221	97.5173	95.8634	86.0880	83.0879	90.6086	90.2717	101.0996	106.3823	113.8900 (219)
Water heating fuel used												1192.5439 (219)
Annual totals kWh/year												
Space heating fuel - main system												825.4468 (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)												356.0107 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
Total delivered energy for all uses												2374.0014 (238)

10a. Fuel costs - using Table 12 prices

	Fuel	Fuel price	Fuel cost
	kWh/year	p/kWh	£/year
Space heating - main system 1	825.4468	13.1900	108.8764 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1192.5439	13.1900	157.2965 (247)
Pumps and fans for heating	0.0000	0.0000	0.0000 (249)
Energy for lighting	356.0107	13.1900	46.9578 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit	0.0000	13.1900	0.0000 (252)
Total energy cost			313.1308 (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] =	1.1406 (257)
SAP value			84.0882
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	825.4468	0.5190	428.4069 (261)
Space heating - secondary	0.0000	0.5190	0.0000 (263)
Water heating (other fuel)	1192.5439	0.5190	618.9303 (264)
Space and water heating			1047.3372 (265)
Pumps and fans	0.0000	0.0000	0.0000 (267)
Energy for lighting	356.0107	0.5190	184.7695 (268)
Energy saving/generation technologies			
PV Unit	-300.0000	0.5190	-155.7000 (269)
Total kg/year			1076.4067 (272)
CO2 emissions per m2			15.3100 (273)
EI value			87.4902
EI rating			87 (274)

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EI band

B

Calculation of stars for heating and DHW

Main heating energy efficiency	$13.19 \times (1 + 0.29 \times 0.25) / 2.5945 = 5.452$, stars = 3
Main heating environmental impact	$0.519 \times (1 + 0.29 \times 0.25) / 2.5945 = 0.2145$, 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	70.3000 (1b)	x 2.3400 (2b)	= 164.5020 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.3000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	164.5020 (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) = 0.1824 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4324 (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) =		0.3675 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.4000	4.1000	4.1000	3.9000	3.9000	3.4000	3.4000	3.3000	3.4000	3.8000	3.7000	4.0000 (22)
Wind factor	1.1000	1.0250	1.0250	0.9750	0.9750	0.8500	0.8500	0.8250	0.8500	0.9500	0.9250	1.0000 (22a)
Adj infilt rate												
Effective ac	0.4043	0.3767	0.3767	0.3583	0.3583	0.3124	0.3124	0.3032	0.3124	0.3491	0.3399	0.3675 (22b)
	0.5817	0.5710	0.5710	0.5642	0.5642	0.5488	0.5488	0.5460	0.5488	0.5609	0.5578	0.5675 (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)			5.6700	1.3258	7.5170		(27)
Door to Stairs			1.8900	1.4000	2.6460		(26)
R lights (Uw = 1.40)			1.4400	1.3258	1.9091		(27a)
Main Wall	59.3000	5.6700	53.6300	0.2200	11.7986	60.0000	3217.8000 (29a)
Wall to stairs	26.3000	1.8900	24.4100	0.1864	4.5495	190.0000	4637.9000 (29a)
Slope	15.9600	1.4400	14.5200	0.1600	2.3232	9.0000	130.6800 (30)
Plane	55.0000		55.0000	0.1000	5.5000	9.0000	495.0000 (30)
Total net area of external elements Aum(A, m ²)			156.5600				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		36.2434		(33)
Party Wall 1			22.0300	0.0000	0.0000	180.0000	3965.4000 (32)
Party Floor 1			70.3000			40.0000	2812.0000 (32d)
Internal Wall 1			63.6900			9.0000	573.2100 (32c)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	15831.9900 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							225.2061 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.8472 (36)
Total fabric heat loss						(33) + (36) =	43.0906 (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	31.5788	30.9945	30.9945	30.6279	30.6279	29.7916	29.7916	29.6381	29.7916	30.4515	30.2796	30.8089 (38)
Heat transfer coeff	74.6694	74.0851	74.0851	73.7185	73.7185	72.8822	72.8822	72.7287	72.8822	73.5421	73.3702	73.8995 (39)
Average = Sum(39)m / 12 =												73.5386 (39)
HLP	1.0622	1.0538	1.0538	1.0486	1.0486	1.0367	1.0367	1.0345	1.0367	1.0461	1.0437	1.0512 (40)
HLP (average)												1.0461 (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												2.2534 (42)
Average daily hot water use (litres/day)												87.7179 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	96.4897	92.9810	89.4723	85.9636	82.4548	78.9461	78.9461	82.4548	85.9636	89.4723	92.9810	96.4897 (44)
Energy content (annual)	143.0915	125.1487	129.1423	112.5893	108.0322	93.2235	86.3853	99.1284	100.3123	116.9043	127.6102	138.5764 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		1380.1445 (45)

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	21.4637	18.7723	19.3713	16.8884	16.2048	13.9835	12.9578	14.8693	15.0468	17.5356	19.1415	20.7865 (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												
197.4903	174.2831	183.5411	165.2333	162.4310	145.8675	140.7841	153.5272	152.9563	171.3031	180.2542	192.9752	(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												
197.4903	174.2831	183.5411	165.2333	162.4310	145.8675	140.7841	153.5272	152.9563	171.3031	180.2542	192.9752	(64)
Heat gains from water heating, kWh/month												
91.0969	80.9195	86.4588	79.5512	79.4397	73.1120	72.2422	76.4792	75.4690	82.3897	84.5456	89.5957	(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	135.2032	135.2032	135.2032	135.2032	135.2032	135.2032	135.2032	135.2032	135.2032	135.2032	135.2032	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
50.3970	44.7622	36.4030	27.5594	20.6010	17.3922	18.7929	24.4278	32.7869	41.6305	48.5889	51.7977	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
295.5168	298.5833	290.8557	274.4046	253.6381	234.1204	221.0814	218.0149	225.7425	242.1936	262.9601	282.4778	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
50.7737	50.7737	50.7737	50.7737	50.7737	50.7737	50.7737	50.7737	50.7737	50.7737	50.7737	50.7737	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)												
-90.1354	-90.1354	-90.1354	-90.1354	-90.1354	-90.1354	-90.1354	-90.1354	-90.1354	-90.1354	-90.1354	-90.1354	(71)
Water heating gains (Table 5)												
122.4421	120.4159	116.2081	110.4877	106.7738	101.5445	97.0997	102.7947	104.8181	110.7389	117.4244	120.4243	(72)
Total internal gains												
564.1973	559.6028	539.3083	508.2932	476.8543	448.8986	432.8155	441.0787	459.1889	490.4044	524.8149	550.5412	(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	5.0400				12.7500		0.6300		0.7000		0.7700		19.6387 (74)
East	0.6300				23.7835		0.6300		0.7000		0.7700		4.5792 (76)
North	1.4400				22.4438		0.6300		0.7000		1.0000		12.8274 (82)
Solar gains	37.0453	63.4257	111.4081	188.3239	251.5971	286.4359	264.2231	211.1283	145.1049	82.2535	45.3147	30.8815	(83)
Total gains	601.2426	623.0285	650.7164	696.6171	728.4515	735.3345	697.0386	652.2071	604.2938	572.6578	570.1296	581.4228	(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	58.8966	59.3611	59.3611	59.6563	59.6563	60.3409	60.3409	60.4683	60.3409	59.7994	59.9395	59.5102
alpha	4.9264	4.9574	4.9574	4.9771	4.9771	5.0227	5.0227	5.0312	5.0227	4.9866	4.9960	4.9673
util living area												
0.9833	0.9773	0.9574	0.8976	0.7528	0.5242	0.3542	0.3990	0.6948	0.9069	0.9696	0.9852	(86)
Tweekday	19.0737	19.1921	19.4246	19.7067	19.9011	19.9688	19.9735	19.9751	19.9490	19.7448	19.3960	19.0701
Tweekend	20.5274	20.5782	20.6838	20.8158	20.9192	20.9592	20.9644	20.9640	20.9420	20.8309	20.6665	20.5224
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	0	0	0	0	0	0	0	0	0	0	0	0
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0
MIT	20.2706	20.3475	20.5120	20.7123	20.8753	20.9374	20.9451	20.9444	20.9095	20.7390	20.4792	20.2629 (87)
Th 2	20.0319	20.0387	20.0387	20.0430	20.0430	20.0528	20.0528	20.0546	20.0528	20.0451	20.0471	20.0409 (88)
util rest of house												
0.9786	0.9709	0.9448	0.8679	0.6907	0.4373	0.2563	0.2956	0.6085	0.8733	0.9597	0.9810	(89)
Tweekday	19.0737	19.1921	19.4246	19.7067	19.9011	19.9688	19.9735	19.9751	19.9490	19.7448	19.3960	19.0701
Tweekend	19.0737	19.1921	19.4246	19.7067	19.9011	19.9688	19.9735	19.9751	19.9490	19.7448	19.3960	19.0701
MIT 2	19.0737	19.1921	19.4246	19.7067	19.9011	19.9688	19.9735	19.9751	19.9490	19.7448	19.3960	19.0701 (90)
Living area fraction												
fLA = Living area / (4) =												0.4211 (91)
MIT	19.5776	19.6786	19.8824	20.1301	20.3113	20.3766	20.3826	20.3833	20.3534	20.1634	19.8521	19.5723 (92)
Temperature adjustment												0.0000
adjusted MIT	19.5776	19.6786	19.8824	20.1301	20.3113	20.3766	20.3826	20.3833	20.3534	20.1634	19.8521	19.5723 (93)

8. Space heating requirement

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9759	0.9680	0.9424	0.8710	0.7091	0.4675	0.2905	0.3318	0.6373	0.8781	0.9573	0.9785 (94)
Useful gains	586.7347	603.1156	613.2435	606.7266	516.5812	343.7969	202.5085	216.3977	385.1401	502.8336	545.7698	568.9186 (95)
Ext temp.	4.9000	5.5000	7.3000	9.7000	12.7000	15.6000	17.6000	17.4000	14.8000	11.4000	7.8000	4.9000 (96)
Heat loss rate W												
1095.9701	1050.4210	932.1711	768.8910	561.0925	348.1315	202.8002	216.9684	404.7469	644.4800	884.2618	1084.2778	(97)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Energy Calculations Ltd
SAP ♦ CODE ♦ SBEM ♦ DESIGN

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

Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	378.8711	300.5892	237.2821	116.7584	33.1164	0.0000	0.0000	0.0000	0.0000	105.3849	243.7142	383.4273 (98)
Space heating												1799.1436 (98)
Space heating per m2										(98) / (4) =		25.5924 (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 %)												256.4004 (206)
Efficiency of secondary/supplementary heating system, %												100.0000 (208)
Space heating requirement												701.6929 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	378.8711	300.5892	237.2821	116.7584	33.1164	0.0000	0.0000	0.0000	0.0000	105.3849	243.7142	383.4273 (98)
Space heating efficiency (main heating system 1)	256.4004	256.4004	256.4004	256.4004	256.4004	0.0000	0.0000	0.0000	0.0000	256.4004	256.4004	256.4004 (210)
Space heating fuel (main heating system)	147.7654	117.2343	92.5436	45.5375	12.9159	0.0000	0.0000	0.0000	0.0000	41.1017	95.0522	149.5424 (211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	197.4903	174.2831	183.5411	165.2333	162.4310	145.8675	140.7841	153.5272	152.9563	171.3031	180.2542	192.9752 (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	116.5547	102.8583	108.3221	97.5173	95.8634	86.0880	83.0879	90.6086	90.2717	101.0996	106.3823	113.8900 (219)
Water heating fuel used												1192.5439 (219)
Annual totals kWh/year												
Space heating fuel - main system												701.6929 (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)												356.0107 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
Total delivered energy for all uses												2250.2475 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	701.6929	19.1200	134.1637 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1192.5439	19.1200	228.0144 (247)
Pumps and fans for heating	0.0000	0.0000	0.0000 (249)
Energy for lighting	356.0107	19.1200	68.0692 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit	0.0000	19.1200	0.0000 (252)
Total energy cost			430.2473 (255)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	701.6929	0.5190	364.1786 (261)
Space heating - secondary	0.0000	0.5190	0.0000 (263)
Water heating (other fuel)	1192.5439	0.5190	618.9303 (264)
Space and water heating			983.1089 (265)
Pumps and fans	0.0000	0.0000	0.0000 (267)
Energy for lighting	356.0107	0.5190	184.7695 (268)
Energy saving/generation technologies			
PV Unit	-300.0000	0.5190	-155.7000 (269)
Total kg/year			1012.1785 (272)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	701.6929	3.0700	2154.1973 (261)
Space heating - secondary	0.0000	3.0700	0.0000 (263)
Water heating (other fuel)	1192.5439	3.0700	3661.1099 (264)
Space and water heating			5815.3072 (265)
Pumps and fans	0.0000	0.0000	0.0000 (267)
Energy for lighting	356.0107	3.0700	1092.9527 (268)

FULL SAP CALCULATION PRINTOUT

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

Energy saving/generation technologies			
PV Unit	-300.0000	3.0700	-921.0000 (269)
Primary energy kWh/year			5987.2600 (272)
Primary energy kWh/m2/year			85.1673 (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 efficiency	Environmental impact
(none)			
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	Potential	Saving
Electricity	£430	£430	£0
Space heating	£134	£134	£0
Water heating	£228	£228	£0
Lighting	£68	£68	£0
Total cost of fuels	£430	£430	£0
Total cost of uses	£430	£430	£0
Delivered energy	32 kWh/m²	32 kWh/m²	0 kWh/m²
Carbon dioxide emissions	1.0 tonnes	1.0 tonnes	0.0 tonnes
CO2 emissions per m²	14 kg/m²	14 kg/m²	0 kg/m²
Primary energy	85 kWh/m²	85 kWh/m²	0 kWh/m²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

No improvements selected / applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Energy Calculations Ltd
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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	SemiDetached 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	225.2 (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	325.71 (P1)
Transmission heat loss coefficient	43.09 (37)
Summer heat loss coefficient	368.80 (P2)

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

Solar shading	Z blinds	Solar access	Z overhangs	Z summer
Orientation				
North	1.000	0.90	1.000	0.900 (P8)
North	1.000	1.00	1.000	1.000 (P8)
East	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	5.0400	81.1852	0.6300	0.7000	0.9000	146.1608
East	0.6300	117.5071	0.6300	0.7000	0.9000	26.4441
North	1.4400	196.4639	0.6300	0.7000	1.0000	112.2862
total:						284.8911

Solar gains	Jun	Jul	Aug	
	309	285	229	(P3)
Internal gains	449	433	441	
Total summer gains	758	718	670	(P5)

Summer gain/loss ratio	2.05	1.95	1.82	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 225.2)	0.42	0.42	0.42	
Threshold temperature	18.48	20.27	20.04	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	

Assessment of likelihood of high internal temperature: Not significant

BASIC COMPLIANCE REPORT

Energy Calculations Ltd
SAP • CODE • SBEM • DESIGN

Calculation Type: New Build (As Designed)

Property Reference	015729	Issued on Date	16/08/2021
Assessment Reference	004	Prop Type Ref	
Property	Flat 8, 18, Parkside Road, READING, RG30 2DB		
SAP Rating	84 B	DER	17.18
Environmental	87 B	TER	27.75
CO ₂ Emissions (t/year)	1.01	% DER<TER	38.08
General Requirements Compliance	Pass	DFEE	46.03
		TFEE	51.12
		% DFEE<TFEE	9.95
Assessor Details	Mr. Matthew Carter, Energy Calculations Limited, Tel: 01754 761035, mcarter@energycalculations.co.uk		Assessor ID
			7869-0001
Client			

SUMMARY FOR INPUT DATA FOR New Build (As Designed)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Electricity		
Fuel factor	1.55 (electricity)		
Target Carbon Dioxide Emission Rate (TER)	27.75	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	17.18	kgCO ₂ /m ²	Pass
	-10.57 (-38.1%)	kgCO ₂ /m ²	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	51.12	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DFEE)	46.03	kWh/m ² /yr	
	-5.1 (-10.0%)	kWh/m ² /yr	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.22 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Roof	0.11 (max. 0.20)	0.16 (max. 0.35)	Pass
Openings	1.40 (max. 2.00)	1.40 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

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

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Heat pump with radiators or underfloor - Electric Panasonic WH-MDC05F3E5	
Secondary heating system	None	

5 Cylinder insulation

BASIC COMPLIANCE REPORT

Energy Calculations Ltd
SAP • CODE • SBEM • DESIGN

Calculation Type: New Build (As Designed)

Hot water storage

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

Pass

Primary pipework insulated

Yes

Pass

6 Controls

Space heating controls

Time and temperature zone control

Pass

Hot water controls

Cylinderstat

Pass

Independent timer for DHW

Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings

100

%

Minimum

75

%

Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Thames Valley)

Not significant

Pass

Based on:

Overshading

Average

Windows facing North

5.04 m², No overhang

Windows facing East

0.63 m², No overhang

Air change rate

6.00 ach

Blinds/curtains

None

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type

U-value

Solid Wall

0.00

W/m²K

Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals

5.00 (design value)

Maximum

10.0

Pass

10 Key features

Party wall U-value

0.00

W/m²K

Roof U-value

0.10

W/m²K

Photovoltaic array

300.00

kWh/Year

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

SUMMARY FOR INPUT DATA

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

Property Reference	015729	Issued on Date	16/08/2021
Assessment Reference	004	Prop Type Ref	
Property	Flat 8, 18, Parkside Road, READING, RG30 2DB		
SAP Rating	84 B	DER	17.18
Environmental	87 B	TER	27.75
CO ₂ Emissions (t/year)	1.01	% DER<TER	38.08
General Requirements Compliance	Pass	DFEE	46.03
		TFEE	51.12
		% DFEE<TFEE	9.95
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, Semi-Detached					
2.0 Number of Storeys	1					
3.0 Date Built	2020					
4.0 Sheltered Sides	2					
5.0 Sunlight/Shade	Average or unknown					
6.0 Measurements						
Ground Floor:		Heat Loss Perimeter	Internal Floor Area		Average Storey Height	
		37.26 m	70.30 m ²		2.34 m	
7.0 Living Area	29.60		m ²			
8.0 Thermal Mass Parameter	Precise calculation					
Thermal Mass	225.21		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	59.30	53.63
Wall to stairs	Cavity Wall	Cavity wall : dense plaster, dense block, filled cavity, any outside structure	0.22	190.00	26.30	24.41
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	22.03	
9.2 Internal Walls						
Description	Construction				Kappa (kJ/m ² K)	Area (m ²)
Internal Wall 1	Plasterboard on timber frame				9.00	63.69
10.0 External Roofs						
Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area (m ²)	Nett Area (m ²)
Slope	External Slope Roof	Plasterboard, insulated slope	0.16	9.00	15.96	14.52
Plane	External Plane Roof	Plasterboard, insulated at ceiling level	0.10	9.00	55.00	55.00

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

11.1 Party Floors

Description	Construction	Kappa (kJ/m²K)	Area (m²)
Party Floor 1	Precast concrete planks floor, screed, carpeted	40.00	70.30

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
External Door	Manufacture	Half Glazed Door	Double Low-E Soft 0.05			0.63		0.70	1.40
Windows	Manufacture	Window	Double Low-E Soft 0.05			0.63		0.70	1.40
Door to Stairs	SAP table	Door to Corridor							1.40
R lights	Manufacture	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	West							1.89	
Windows	Window	[1] Main Wall	East	None	0.00					0.63	
Windows	Window	[1] Main Wall	North	None	0.00					5.04	
Windows	Roof Window	[1] Slope	North	None						1.44	

14.0 Conservatory

None

15.0 Draught Proofing

100

%

16.0 Draught Lobby

Yes

17.0 Thermal Bridging

Calculate Bridges

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Table K1 - Approved	E2 Other lintels (including other steel lintels)	3.40	0.300	No
Table K1 - Approved	E3 Sill	3.40	0.040	No
Table K1 - Approved	E4 Jamb	14.40	0.050	No
Table K1 - Approved	E7 Party floor between dwellings (in blocks of flats)	37.76	0.070	No
Table K1 - Approved	E10 Eaves (insulation at ceiling level)	23.60	0.060	No
Table K1 - Approved	E13 Gable (insulation at rafter level)	2.80	0.040	No
Table K1 - Approved	E16 Corner (normal)	7.20	0.090	No
Table K1 - Approved	E17 Corner (inverted – internal area greater than external area)	7.20	-0.090	No
Table K1 - Approved	E18 Party wall between dwellings	4.80	0.060	No
Table K1 - Default	P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	9.18	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	0.044	W/m²K
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18.0 Pressure Testing

Yes

Designed AP₅₀

5.00

m³/(h.m²) @ 50 Pa

Property Tested ?

As Built AP₅₀

m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather

Windows fully open

Cross ventilation possible

Yes

Night Ventilation

No

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

Air change rate

Mechanical Ventilation

Mechanical Ventilation System Present

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				3
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System

22.0 Lighting

Internal

Total number of light fittings

Total number of L.E.L. fittings

Percentage of L.E.L. fittings %

External

External lights fitted

Light and motion sensor

23.0 Electricity Tariff

24.0 Main Heating 1

Percentage of Heat %

Database Ref. No.

Fuel Type

Main Heating

SAP Code

In Winter

In Summer

Controls

PCDF Controls

Sap Code

Is MHS Pumped

Heat Emitter

Underfloor Heating

Flow Temperature

25.0 Main Heating 2

Community Heating

28.0 Water Heating

Water Heating

Flue Gas Heat Recovery System

Waste Water Heat Recovery Instantaneous System 1

Waste Water Heat Recovery Instantaneous System 2

SUMMARY FOR INPUT DATA

Energy Calculations Ltd
SAP ♦ CODE ♦ SBEM ♦ DESIGN

Calculation Type: New Build (As Designed)

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 %			