

Energy Calculations Ltd

SAP ♦ CODE ♦ SBEM ♦ DESIGN

01754-761035



SAP Report Submission for Building Regulations Compliance

Client:

Project: Flat 7, 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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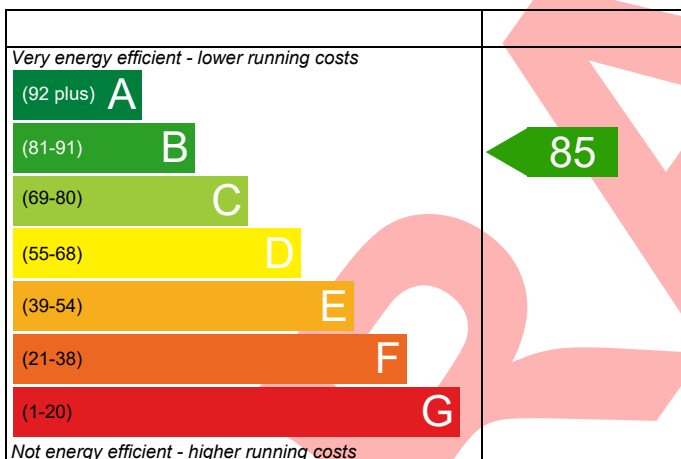
Flat 7, 18, Parkside Road,
READING,
RG30 2DB

Dwelling type: Flat, Mid-Terrace
Date of assessment: 16/08/2021
Produced by: Energy Calculations Limited
Total floor area: 77 m²

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

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

Energy Efficiency Rating

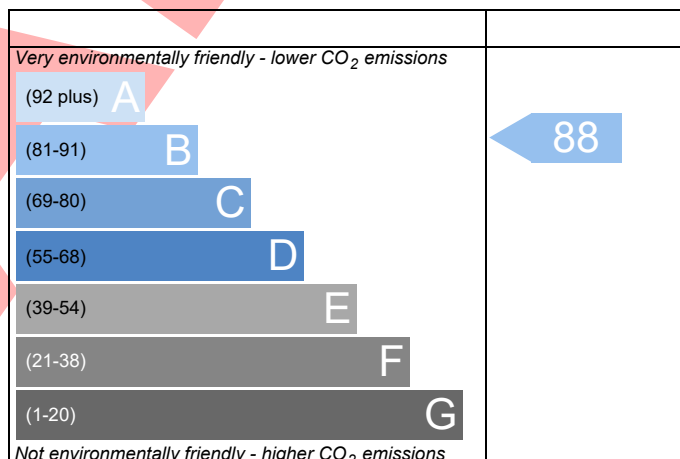


England

EU Directive
2002/91/EC

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

Environmental Impact (CO₂) Rating



England

EU Directive
2002/91/EC

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

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

THERMAL BRIDGING

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Calculation Type: New Build (As Designed)

Property Reference	015728	Issued on Date	16/08/2021
Assessment Reference	004	Prop Type Ref	
Property	Flat 7, 18, Parkside Road, READING, RG30 2DB		

SAP Rating	85 B	DER	15.36	TER	26.08
Environmental	88 B	% DER<TER	41.11		
CO ₂ Emissions (t/year)	1.01	DFEE	47.54	TFEE	49.93
General Requirements Compliance	Pass	% DFEE<TFEE	4.79		

Assessor Details	Mr. Matthew Carter, Energy Calculations Limited, Tel: 01754 761035, mcarter@energycalculations.co.uk	Assessor ID	7869-0001
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Client	
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	Junction detail	Source Type	Psi (W/mK)	Length (m)	Result	Reference
External wall	E2 Other lintels (including other steel lintels)	Table K1 - Approved	0.300	10.44	3.13	
External wall	E3 Sill	Table K1 - Approved	0.040	10.44	0.42	
External wall	E4 Jamb	Table K1 - Approved	0.050	33.90	1.70	
External wall	E20 Exposed floor (normal)	Table K1 - Default	0.320	20.00	6.40	
External wall	E7 Party floor between dwellings (in blocks of flats)	Table K1 - Approved	0.070	14.00	0.98	
External wall	E16 Corner (normal)	Table K1 - Approved	0.090	12.00	1.08	
External wall	E17 Corner (inverted – internal area greater than external area)	Table K1 - Approved	-0.090	9.60	-0.86	
External wall	E18 Party wall between dwellings	Table K1 - Approved	0.060	7.40	0.44	
Party wall	P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	Table K1 - Default	0.000	9.33	0.00	

Total: **13.28** W/mK:
Y-Value: **0.112** W/m²K:

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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Property Reference	015728			Issued on Date	16/08/2021
Assessment Reference	004	Prop Type Ref			
Property	Flat 7, 18, Parkside Road, READING, RG30 2DB				
SAP Rating	85 B	DER	15.36	TER	26.08
Environmental	88 B	% DER<TER	41.11		
CO ₂ Emissions (t/year)	1.01	DFEE	47.54	TFEE	49.93
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Assessor Details	Mr. Matthew Carter, Energy Calculations Limited, Tel: 01754 761035, mcarter@energycalculations.co.uk			Assessor ID	7869-0001
Client					

FULL SAP CALCULATION PRINTOUT

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

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

DWELLING AS DESIGNED

Mid-floor flat, total floor area 77 m²

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

1a TER and DER

Fuel for main heating:Electricity

Fuel factor:1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER) 26.08 kgCO₂/m²

Dwelling Carbon Dioxide Emission Rate (DER) 15.36 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)49.9 kWh/m²/yr

Dwelling Fabric Energy Efficiency (DFEE)47.5 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.22 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.13 (max. 0.25)	0.13 (max. 0.70)	OK
Roof	(no roof)		
Openings	1.40 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

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

4 Heating efficiency

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

Panasonic WH-MDC05F3E5

Secondary heating system: None

5 Cylinder insulation

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

6 Controls

Space heating controls:	Time and temperature zone control	OK
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Hot water controls:	Cylinderstat	OK
	Independent timer for DHW	OK

7 Low energy lights

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

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Thames Valley): Slight OK

Based on:

Overshading:	Average
Windows facing North:	2.43 m², No overhang
Windows facing East:	12.71 m², No overhang
Windows facing South:	1.51 m², No overhang
Air change rate:	6.00 ach
Blinds/curtains:	None

10 Key features

Party wall U-value	0.00 W/m²K
Photovoltaic array	300.00 kWh/Year

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	77.0000 (1b)	x 2.4000 (2b)	= 184.8000 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	77.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 184.8000 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					2 * 10 = 20.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				Air changes per hour
Pressure test					20.0000 / (5) = 0.1082 (8)
Measured/design AP50					Yes
Infiltration rate					5.0000
Number of sides sheltered					0.3582 (18)
					2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3045 (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												
	0.3882	0.3806	0.3730	0.3349	0.3273	0.2893	0.2893	0.2817	0.3045	0.3273	0.3426	0.3578 (22b)
Effective ac	0.5754	0.5724	0.5696	0.5561	0.5536	0.5418	0.5418	0.5397	0.5464	0.5536	0.5587	0.5640 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows (Uw = 1.40)			16.6500	1.3258	22.0739		(27)
Door to Stairs			1.8900	1.4000	2.6460		(26)
Exposed Floor			28.0000	0.1278	3.5793		(28b)
Main Wall	72.7500	16.6500	56.1000	0.2200	12.3420	60.0000	3366.0000 (29a)
Wall to stairs	17.6600	1.8900	15.7700	0.1864	2.9392	190.0000	2996.3000 (29a)
Total net area of external elements Aum(A, m ²)			118.4100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	43.5803		(33)
Party Wall 1			22.3900	0.0000	0.0000	180.0000	4030.2000 (32)
Party Floor 1			49.0000			40.0000	1960.0000 (32d)
Party Ceilings 1			77.0000			40.0000	3080.0000 (32b)
Internal Wall 1			77.5200			75.0000	5814.0000 (32c)

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

(28)...(30) + (32) + (32a)...(32e) =	21246.5000 (34)
	275.9286 (35)
	13.2846 (36)
(33) + (36) =	56.8649 (37)
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)	
(38)m	35.0877
Heat transfer coeff	91.9526
Average = Sum(39)m / 12 =	
HLP	1.1942
HLP (average)	1.1789
Days in month	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.4035 (42)
Average daily hot water use (litres/day)												91.2825 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												
Energy conte	100.4108	96.7595	93.1082	89.4569	85.8056	82.1543	82.1543	85.8056	89.4569	93.1082	96.7595	100.4108 (44)
Energy content (annual)	148.9063	130.2344	134.3902	117.1646	112.4223	97.0119	89.8957	103.1567	104.3887	121.6550	132.7959	144.2078 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		1436.2293 (45)
	22.3359	19.5352	20.1585	17.5747	16.8633	14.5518	13.4844	15.4735	15.6583	18.2482	19.9194	21.6312 (46)

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Water storage loss:												210.0000 (47)
Store volume												
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 (58)
Total heat required for water heating calculated for each month	203.3051	179.3688	188.7890	169.8086	166.8211	149.6559	144.2945	157.5555	157.0327	176.0538	185.4399	198.6066 (59)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
	Solar input (sum of months) = Sum(63)m = 0.0000 (63)											
Output from w/h	203.3051	179.3688	188.7890	169.8086	166.8211	149.6559	144.2945	157.5555	157.0327	176.0538	185.4399	198.6066 (64)
	Total per year (kWh/year) = Sum(64)m = 2076.7313 (64)											
Heat gains from water heating, kWh/month	93.0304	82.6104	88.2038	81.0724	80.8994	74.3716	73.4094	77.8186	76.8244	83.9693	86.2698	91.4681 (65)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9963	0.9911	0.9734	0.9117	0.7683	0.5587	0.3879	0.4414	0.7291	0.9501	0.9916	0.9972 (94)
Useful gains	519.9942	608.3109	698.3844	757.1038	696.2473	501.6155	332.6322	348.8247	513.7198	565.6598	512.9035	491.7863 (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	1378.3170	1334.9753	1209.5967	1009.2534	772.6031	512.7517	333.9147	351.3247	556.0278	850.0564	1134.2097	1374.7251 (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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Space heating kWh	638.5922	488.3185	380.3420	181.5477	56.8087	0.0000	0.0000	0.0000	0.0000	211.5910	447.3405	656.9065 (98)
Space heating												3061.4471 (98)
Space heating per m2												(98) / (4) = 39.7591 (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 %)												300.8169 (206)
Efficiency of secondary/supplementary heating system, %												100.0000 (208)
Space heating requirement												1017.7111 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	638.5922	488.3185	380.3420	181.5477	56.8087	0.0000	0.0000	0.0000	0.0000	211.5910	447.3405	656.9065 (98)
Space heating efficiency (main heating system 1)	300.8169	300.8169	300.8169	300.8169	300.8169	0.0000	0.0000	0.0000	0.0000	300.8169	300.8169	300.8169 (210)
Space heating fuel (main heating system)	212.2860	162.3308	126.4364	60.3516	18.8848	0.0000	0.0000	0.0000	0.0000	70.3388	148.7086	218.3742 (211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	203.3051	179.3688	188.7890	169.8086	166.8211	149.6559	144.2945	157.5555	157.0327	176.0538	185.4399	198.6066 (64)
Efficiency of water heater	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400 (216)
(217)m	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400 (217)
Fuel for water heating, kWh/month	119.9865	105.8598	111.4194	100.2176	98.4544	88.3238	85.1597	92.9860	92.6775	103.9033	109.4428	117.2135 (219)
Water heating fuel used												1225.6441 (219)
Annual totals kWh/year												
Space heating fuel - main system												1017.7111 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
Total electricity for the above, kWh/year												0.0000 (231)
Electricity for lighting (calculated in Appendix L)												335.7862 (232)
Energy saving/generation technologies (Appendices M,N and Q)												
Total delivered energy for all uses												2579.1413 (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	1017.7111	0.5190	528.1920 (261)
Space heating - secondary	0.0000	0.5190	0.0000 (263)
Water heating (other fuel)	1225.6441	0.5190	636.1093 (264)
Space and water heating			1164.3013 (265)
Pumps and fans	0.0000	0.0000	0.0000 (267)
Energy for lighting	335.7862	0.5190	174.2730 (268)
Energy saving/generation technologies			
PV Unit	-300.0000	0.5190	-155.7000 (269)
Total CO2, kg/year			1182.8744 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			15.3600 (273)

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

DER		15.3600 ZC1
Total Floor Area	TFA	77.0000
Assumed number of occupants	N	2.4035
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190
CO2 emissions from appliances, equation (L14)		16.3965 ZC2
CO2 emissions from cooking, equation (L16)		2.2946 ZC3
Total CO2 emissions		34.0511 ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000 ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000 ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000 ZC7
Net CO2 emissions		34.0511 ZC8

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	77.0000 (1b)	x 2.4000 (2b)	= 184.8000 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	77.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 184.8000 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1623 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4123 (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) = 0.3505 (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	0.4469	0.4381	0.4293	0.3855	0.3768	0.3330	0.3330	0.3242	0.3505	0.3768	0.3943	0.4118 (22b)
Effective ac	0.5998	0.5960	0.5922	0.5743	0.5710	0.5554	0.5554	0.5526	0.5614	0.5710	0.5777	0.5848 (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)			16.6500	1.3258	22.0739		(27)
Exposed Floor			28.0000	0.1300	3.6400		(28b)
Main Wall	72.7500	16.6500	56.1000	0.1800	10.0980		(29a)
Wall to stairs	17.6600	1.8900	15.7700	0.1800	2.8386		(29a)
Total net area of external elements Aum(A, m ²)			118.4100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	40.5405		(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)							10.7790 (36)
Total fabric heat loss							(33) + (36) = 51.3195 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	36.5811	36.3446	36.1128	35.0243	34.8206	33.8725	33.8725	33.6969	34.2377	34.8206	35.2326	35.6634 (38)
Heat transfer coeff	87.9005	87.6641	87.4323	86.3437	86.1401	85.1919	85.1919	85.0164	85.5571	86.1401	86.5521	86.9828 (39)
Average = Sum(39)m / 12 =												86.3428 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1416	1.1385	1.1355	1.1213	1.1187	1.1064	1.1064	1.1041	1.1111	1.1187	1.1241	1.1296 (40)
HLP (average)												1.1213 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.4035 (42)
Average daily hot water use (litres/day)												91.2825 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	100.4108	96.7595	93.1082	89.4569	85.8056	82.1543	82.1543	85.8056	89.4569	93.1082	96.7595	100.4108 (44)
Energy conte	148.9063	130.2344	134.3902	117.1646	112.4223	97.0119	89.8957	103.1567	104.3887	121.6550	132.7959	144.2078 (45)
Energy content (annual)										Total = Sum(45)m =		1436.2293 (45)
Distribution loss (46)m = 0.15 x (45)m												
	22.3359	19.5352	20.1585	17.5747	16.8633	14.5518	13.4844	15.4735	15.6583	18.2482	19.9194	21.6312 (46)
Water storage loss:												
Store volume												210.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.7016 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.9188 (55)

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Total storage loss	28.4842	25.7277	28.4842	27.5653	28.4842	27.5653	28.4842	28.4842	27.5653	28.4842	27.5653	28.4842 (56)
If cylinder contains dedicated solar storage	28.4842	25.7277	28.4842	27.5653	28.4842	27.5653	28.4842	28.4842	27.5653	28.4842	27.5653	28.4842 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	200.6528	176.9732	186.1368	167.2420	164.1688	147.0892	141.6423	154.9033	154.4660	173.4016	182.8733	195.9544 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	200.6528	176.9732	186.1368	167.2420	164.1688	147.0892	141.6423	154.9033	154.4660	173.4016	182.8733	195.9544 (64)
Heat gains from water heating, kWh/month	90.9086	80.6940	86.0820	79.0191	78.7777	72.3183	71.2876	75.6969	74.7711	81.8475	84.2165	89.3464 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	120.1737	120.1737	120.1737	120.1737	120.1737	120.1737	120.1737	120.1737	120.1737	120.1737	120.1737	120.1737 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	19.0136	16.8877	13.7340	10.3975	7.7723	6.5617	7.0901	9.2160	12.3697	15.7062	18.3315	19.5421 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	213.0566	215.2674	209.6961	197.8355	182.8636	168.7921	159.3915	157.1806	162.7519	174.6125	189.5845	203.6559 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.0174	35.0174	35.0174	35.0174	35.0174	35.0174	35.0174	35.0174	35.0174	35.0174	35.0174	35.0174 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-96.1390	-96.1390	-96.1390	-96.1390	-96.1390	-96.1390	-96.1390	-96.1390	-96.1390	-96.1390	-96.1390	-96.1390 (71)
Water heating gains (Table 5)	122.1890	120.0804	115.7016	109.7488	105.8840	100.4421	95.8167	101.7431	103.8488	110.0101	116.9674	120.0892 (72)
Total internal gains	416.3113	414.2876	401.1839	380.0339	358.5719	337.8480	324.3504	330.1918	341.0225	362.3810	386.9354	405.3393 (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				2.4300	10.6334	0.6300	0.7000	0.7700	7.8968 (74)			
East				12.7100	19.6403	0.6300	0.7000	0.7700	76.2895 (76)			
South				1.5100	46.7521	0.6300	0.7000	0.7700	21.5749 (78)			
Solar gains	105.7612	199.6638	316.4275	450.5079	547.7877	560.1076	533.4279	460.1582	363.6954	233.1592	130.4394	87.9626 (83)
Total gains	522.0725	613.9514	717.6113	830.5419	906.3597	897.9556	857.7783	790.3501	704.7179	595.5402	517.3748	493.3019 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	60.8327	60.9967	61.1584	61.9295	62.0759	62.7668	62.7668	62.8964	62.4988	62.0759	61.7804	61.4745
alpha	5.0555	5.0664	5.0772	5.1286	5.1384	5.1845	5.1845	5.1931	5.1666	5.1384	5.1187	5.0983
util living area	0.9965	0.9916	0.9751	0.9163	0.7814	0.5884	0.4336	0.4883	0.7558	0.9552	0.9924	0.9974 (86)
MIT	19.8424	20.0190	20.3053	20.6521	20.8861	20.9792	20.9964	20.9936	20.9291	20.5989	20.1549	19.8134 (87)
Th 2	19.9670	19.9695	19.9720	19.9834	19.9856	19.9956	19.9956	19.9975	19.9918	19.9856	19.9812	19.9767 (88)
util rest of house	0.9954	0.9889	0.9668	0.8899	0.7237	0.5040	0.3364	0.3853	0.6740	0.9353	0.9894	0.9965 (89)
MIT 2	18.4329	18.6914	19.1049	19.5922	19.8818	19.9829	19.9944	19.9950	19.9394	19.5338	18.8989	18.3975 (90)
Living area fraction	19.0131	19.2380	19.5991	20.0286	20.2953	20.3931	20.4069	20.4061	20.3468	19.9723	19.4159	18.9804 (92)
Temperature adjustment	19.0131	19.2380	19.5991	20.0286	20.2953	20.3931	20.4069	20.4061	20.3468	19.9723	19.4159	18.9804 (93)
adjusted MIT	19.0131	19.2380	19.5991	20.0286	20.2953	20.3931	20.4069	20.4061	20.3468	19.9723	19.4159	18.9804 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9939	0.9863	0.9631	0.8913	0.7425	0.5382	0.3766	0.4278	0.7048	0.9350	0.9871	0.9953 (94)
Ext temp.	518.8860	605.5157	691.1014	740.2410	672.9529	483.2873	323.0128	338.1260	496.6515	556.8455	510.7130	490.9939 (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	1293.2920	1256.9278	1145.2834	960.8816	740.3963	493.5217	324.3185	340.5876	534.4607	807.3311	1065.9710	1285.6411 (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	576.1581	437.7489	337.9114	158.8612	50.1779	0.0000	0.0000	0.0000	0.0000	186.3613	399.7858	591.2175 (98)
												2738.2220 (98)
												35.5613 (99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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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													2928.5797 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	576.1581	437.7489	337.9114	158.8612	50.1779	0.0000	0.0000	0.0000	0.0000	186.3613	399.7858	591.2175	(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)	616.2118	468.1807	361.4025	169.9050	53.6662	0.0000	0.0000	0.0000	0.0000	199.3169	427.5784	632.3182	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	200.6528	176.9732	186.1368	167.2420	164.1688	147.0892	141.6423	154.9033	154.4660	173.4016	182.8733	195.9544	(64)
Efficiency of water heater (217)m	87.4705	87.1364	86.3858	84.6771	82.0716	79.8000	79.8000	79.8000	79.8000	85.0063	86.8452	87.5768	(216)
Fuel for water heating, kWh/month	229.3949	203.0992	215.4715	197.5055	200.0314	184.3223	177.4967	194.1144	193.5665	203.9868	210.5738	223.7514	(219)
Water heating fuel used												2433.3142	(219)
Annual totals kWh/year													
Space heating fuel - main system												2928.5797	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												335.7862	(232)
Total delivered energy for all uses												5772.6801	(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	2928.5797	0.2160	632.5732 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2433.3142	0.2160	525.5959 (264)
Space and water heating			1158.1691 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	335.7862	0.5190	174.2730 (268)
Total CO2, kg/m2/year			1371.3671 (272)
Emissions per m2 for space and water heating			15.0412 (272a)
Fuel factor (electricity)			1.5500
Emissions per m2 for lighting			2.2633 (272b)
Emissions per m2 for pumps and fans			0.5055 (272c)
Target Carbon Dioxide Emission Rate (TER) = (15.0412 * 1.55) + 2.2633 + 0.5055, rounded to 2 d.p.			26.0800 (273)

FULL SAP CALCULATION PRINTOUT

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CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	77.0000 (1b)	x 2.4000 (2b)	= 184.8000 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	77.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 184.8000 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				Air changes per hour
Pressure test					30.0000 / (5) = 0.1623 (8)
Measured/design AP50					Yes
Infiltration rate					5.0000
Number of sides sheltered					0.4123 (18)
					2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3505 (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												
	0.4469	0.4381	0.4293	0.3855	0.3768	0.3330	0.3330	0.3242	0.3505	0.3768	0.3943	0.4118 (22b)
Effective ac	0.5998	0.5960	0.5922	0.5743	0.5710	0.5554	0.5554	0.5526	0.5614	0.5710	0.5777	0.5848 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows (Uw = 1.40)			16.6500	1.3258	22.0739		(27)
Door to Stairs			1.8900	1.4000	2.6460		(26)
Exposed Floor			28.0000	0.1278	3.5793		(28b)
Main Wall	72.7500	16.6500	56.1000	0.2200	12.3420	60.0000	3366.0000 (29a)
Wall to stairs	17.6600	1.8900	15.7700	0.1864	2.9392	190.0000	2996.3000 (29a)
Total net area of external elements Aum(A, m ²)			118.4100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	43.5803		(33)
Party Wall 1			22.3900	0.0000	0.0000	180.0000	4030.2000 (32)
Party Floor 1			49.0000			40.0000	1960.0000 (32d)
Party Ceilings 1			77.0000			30.0000	2310.0000 (32b)
Internal Wall 1			77.5200			75.0000	5814.0000 (32c)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss
(28)...(30) + (32) + (32a)...(32e) = 20476.5000 (34)
265.9286 (35)
13.2846 (36)
(33) + (36) = 56.8649 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	36.5811	36.3446	36.1128	35.0243	34.8206	33.8725	33.8725	33.6969	34.2377	34.8206	35.2326	35.6634 (38)
Heat transfer coeff	93.4460	93.2095	92.9777	91.8892	91.6855	90.7374	90.7374	90.5618	91.1026	91.6855	92.0975	92.5283 (39)
Average = Sum(39)m / 12 =												91.8882 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2136	1.2105	1.2075	1.1934	1.1907	1.1784	1.1784	1.1761	1.1832	1.1907	1.1961	1.2017 (40)
HLP (average)												1.1934 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy
Average daily hot water use (litres/day)
2.4035 (42)
91.2825 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	100.4108	96.7595	93.1082	89.4569	85.8056	82.1543	82.1543	85.8056	89.4569	93.1082	96.7595	100.4108 (44)
Energy conte	148.9063	130.2344	134.3902	117.1646	112.4223	97.0119	89.8957	103.1567	104.3887	121.6550	132.7959	144.2078 (45)
Energy content (annual)										Total = Sum(45)m =		1436.2293 (45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)

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CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	120.1737	120.1737	120.1737	120.1737	120.1737	120.1737	120.1737	120.1737	120.1737	120.1737	120.1737	120.1737 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	19.0136	16.8877	13.7340	10.3975	7.7723	6.5617	7.0901	9.2160	12.3697	15.7062	18.3315	19.5421 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	213.0566	215.2674	209.6961	197.8355	182.8636	168.7921	159.3915	157.1806	162.7519	174.6125	189.5845	203.6559 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.0174	35.0174	35.0174	35.0174	35.0174	35.0174	35.0174	35.0174	35.0174	35.0174	35.0174	35.0174 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-96.1390	-96.1390	-96.1390	-96.1390	-96.1390	-96.1390	-96.1390	-96.1390	-96.1390	-96.1390	-96.1390	-96.1390 (71)
Water heating gains (Table 5)	42.5303	41.1827	38.3843	34.5798	32.1099	28.6320	25.6759	29.4634	30.8092	34.7469	39.1932	41.1884 (72)
Total internal gains	333.6526	332.3900	320.8665	301.8650	281.7978	263.0379	251.2096	254.9122	264.9829	284.1177	306.1613	323.4385 (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				2.4300	10.6334	0.6300	0.7000	0.7700	7.8968 (74)			
East				12.7100	19.6403	0.6300	0.7000	0.7700	76.2895 (76)			
South				1.5100	46.7521	0.6300	0.7000	0.7700	21.5749 (78)			
Solar gains	105.7612	199.6638	316.4275	450.5079	547.7877	560.1076	533.4279	460.1582	363.6954	233.1592	130.4394	87.9626 (83)
Total gains	439.4138	532.0537	637.2940	752.3729	829.5855	823.1454	784.6375	715.0704	628.6783	517.2770	436.6006	411.4011 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	60.8685	61.0229	61.1750	61.8998	62.0373	62.6855	62.6855	62.8070	62.4342	62.0373	61.7597	61.4722
alpha	5.0579	5.0682	5.0783	5.1267	5.1358	5.1790	5.1790	5.1871	5.1623	5.1358	5.1173	5.0981
util living area	0.9988	0.9966	0.9881	0.9520	0.8483	0.6669	0.5012	0.5673	0.8377	0.9797	0.9973	0.9992 (86)
MIT	19.7117	19.8849	20.1740	20.5440	20.8283	20.9633	20.9930	20.9874	20.8823	20.4849	20.0269	19.6841 (87)
Th 2	19.9091	19.9116	19.9140	19.9253	19.9274	19.9373	19.9373	19.9391	19.9335	19.9274	19.9231	19.9187 (88)
util rest of house	0.9984	0.9954	0.9836	0.9332	0.7948	0.5722	0.3842	0.4443	0.7602	0.9687	0.9961	0.9989 (89)
MIT 2	18.7377	18.9123	19.2007	19.5669	19.8179	19.9220	19.9358	19.9359	19.8717	19.5191	19.0637	18.7177 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	19.1387	19.3127	19.6014	19.9692	20.2339	20.3507	20.3710	20.3688	20.2877	19.9167	19.4602	19.1155 (92)
Temperature adjustment												0.0000
adjusted MIT	19.1387	19.3127	19.6014	19.9692	20.2339	20.3507	20.3710	20.3688	20.2877	19.9167	19.4602	19.1155 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9980	0.9945	0.9819	0.9341	0.8116	0.6106	0.4327	0.4955	0.7889	0.9685	0.9954	0.9985 (94)
Ext temp.	438.5155	529.1035	625.7481	702.8150	673.2764	502.6331	339.5346	354.3064	495.9332	501.0068	434.5987	410.7972 (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	1386.6190	1343.9980	1218.1387	1017.1368	782.4306	521.8008	342.1733	359.4214	563.7180	854.2078	1138.3446	1380.1099 (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	705.3890	547.2059	440.7386	226.3117	81.2107	0.0000	0.0000	0.0000	0.0000	262.7816	506.6971	721.1686 (98)
Space heating												3491.5031 (98)
Space heating per m2										(98) / (4) =		45.3442 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	852.9312	671.4565	688.2695	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9120	0.9551	0.9342	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	777.8522	641.3311	642.9585	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1051.5297	1004.6799	924.8425	0.0000	0.0000	0.0000	0.0000 (103)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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Month fraction	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	197.0478	270.3315	209.7217	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												677.1009 (104)
Cooled fraction									fC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	49.2619	67.5829	52.4304	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												169.2752 (107)
Space cooling per m2												2.1984 (108)
Energy for space heating												45.3442 (99)
Energy for space cooling												2.1984 (108)
Total												47.5426 (109)
Dwelling Fabric Energy Efficiency (DFEE)												47.5 (109)

FULL SAP CALCULATION PRINTOUT

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CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	77.0000 (1b)	x 2.4000 (2b)	= 184.8000 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	77.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 184.8000 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					Air changes per hour 30.0000 / (5) = 0.1623 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4123 (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) =		0.3505 (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	0.4469	0.4381	0.4293	0.3855	0.3768	0.3330	0.3330	0.3242	0.3505	0.3768	0.3943	0.4118 (22b)
	0.5998	0.5960	0.5922	0.5743	0.5710	0.5554	0.5554	0.5526	0.5614	0.5710	0.5777	0.5848 (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)			16.6500	1.3258	22.0739		(27)
Exposed Floor			28.0000	0.1300	3.6400		(28b)
Main Wall	72.7500	16.6500	56.1000	0.1800	10.0980		(29a)
Wall to stairs	17.6600	1.8900	15.7700	0.1800	2.8386		(29a)
Total net area of external elements Aum(A, m ²)			118.4100				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		40.5405		(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)							10.7790 (36)
Total fabric heat loss						(33) + (36) =	51.3195 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	36.5811	36.3446	36.1128	35.0243	34.8206	33.8725	33.8725	33.6969	34.2377	34.8206	35.2326	35.6634 (38)
Heat transfer coeff	87.9005	87.6641	87.4323	86.3437	86.1401	85.1919	85.1919	85.0164	85.5571	86.1401	86.5521	86.9828 (39)
Average = Sum(39)m / 12 =												86.3428 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1416	1.1385	1.1355	1.1213	1.1187	1.1064	1.1064	1.1041	1.1111	1.1187	1.1241	1.1296 (40)
HLP (average)												1.1213 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.4035 (42)
Average daily hot water use (litres/day)												91.2825 (43)
Daily hot water use	100.4108	96.7595	93.1082	89.4569	85.8056	82.1543	82.1543	85.8056	89.4569	93.1082	96.7595	100.4108 (44)
Energy conte	148.9063	130.2344	134.3902	117.1646	112.4223	97.0119	89.8957	103.1567	104.3887	121.6550	132.7959	144.2078 (45)
Energy content (annual)										Total = Sum(45)m =		1436.2293 (45)
Distribution loss (46)m = 0.15 x (45)m	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)

FULL SAP CALCULATION PRINTOUT

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Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	31.6426	27.6748	28.5579	24.8975	23.8897	20.6150	19.1028	21.9208	22.1826	25.8517	28.2191	30.6441 (65)

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	120.1737	120.1737	120.1737	120.1737	120.1737	120.1737	120.1737	120.1737	120.1737	120.1737	120.1737	120.1737	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	19.0136	16.8877	13.7340	10.3975	7.7723	6.5617	7.0901	9.2160	12.3697	15.7062	18.3315	19.5421	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	213.0566	215.2674	209.6961	197.8355	182.8636	168.7921	159.3915	157.1806	162.7519	174.6125	189.5845	203.6559	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.0174	35.0174	35.0174	35.0174	35.0174	35.0174	35.0174	35.0174	35.0174	35.0174	35.0174	35.0174	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-96.1390	-96.1390	-96.1390	-96.1390	-96.1390	-96.1390	-96.1390	-96.1390	-96.1390	-96.1390	-96.1390	-96.1390	(71)
Water heating gains (Table 5)	42.5303	41.1827	38.3843	34.5798	32.1099	28.6320	25.6759	29.4634	30.8092	34.7469	39.1932	41.1884	(72)
Total internal gains	333.6526	332.3900	320.8665	301.8650	281.7978	263.0379	251.2096	254.9122	264.9829	284.1177	306.1613	323.4385	(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	2.4300	10.6334	0.6300	0.7000	0.7700	7.8968	(74)
East	12.7100	19.6403	0.6300	0.7000	0.7700	76.2895	(76)
South	1.5100	46.7521	0.6300	0.7000	0.7700	21.5749	(78)

Solar gains	105.7612	199.6638	316.4275	450.5079	547.7877	560.1076	533.4279	460.1582	363.6954	233.1592	130.4394	87.9626	(83)
Total gains	439.4138	532.0537	637.2940	752.3729	829.5855	823.1454	784.6375	715.0704	628.6783	517.2770	436.6006	411.4011	(84)

7. Mean internal temperature (heating season)

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

Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	21.0000 (85)
tau	60.8327	60.9967	61.1584	61.9295	62.0759	62.7668	62.7668	62.8964	62.4988	62.0759	61.7804	61.4745	
alpha	5.0555	5.0664	5.0772	5.1286	5.1384	5.1845	5.1845	5.1931	5.1666	5.1384	5.1187	5.0983	
util living area	0.9984	0.9955	0.9846	0.9400	0.8221	0.6337	0.4723	0.5359	0.8104	0.9740	0.9964	0.9989	(86)
MIT	19.7427	19.9223	20.2170	20.5862	20.8539	20.9710	20.9947	20.9903	20.9007	20.5191	20.0588	19.7141	(87)
Th 2	19.9670	19.9695	19.9720	19.9834	19.9856	19.9956	19.9956	19.9975	19.9918	19.9856	19.9812	19.9767	(88)
util rest of house	0.9979	0.9940	0.9792	0.9193	0.7683	0.5461	0.3674	0.4247	0.7336	0.9612	0.9950	0.9985	(89)
MIT 2	18.8204	19.0013	19.2947	19.6581	19.8920	19.9831	19.9943	19.9949	19.9391	19.6038	19.1473	18.7996	(90)
Living area fraction									fLA = Living area / (4) =			0.4117	(91)
MIT	19.2001	19.3805	19.6744	20.0402	20.2880	20.3898	20.4062	20.4047	20.3349	19.9806	19.5226	19.1761	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.2001	19.3805	19.6744	20.0402	20.2880	20.3898	20.4062	20.4047	20.3349	19.9806	19.5226	19.1761	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9973	0.9929	0.9773	0.9206	0.7857	0.5816	0.4108	0.4708	0.7621	0.9611	0.9941	0.9981	(94)
Useful gains	438.2441	528.2613	622.7967	692.6272	651.7645	478.7382	322.2999	336.6412	479.1397	497.1622	434.0178	410.6108	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1309.7283	1269.4163	1151.8659	961.8833	739.7696	493.2447	342.2564	340.4613	533.4430	808.0443	1075.1981	1302.6616	(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	648.3842	498.0562	393.6275	193.8643	65.4758	0.0000	0.0000	0.0000	0.0000	231.2963	461.6498	663.6858	(98)
Space heating												3156.0400	(98)
Space heating per m2										(98) / (4) =		40.9875	(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	800.8042	630.4203	646.1243	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9287	0.9648	0.9475	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	743.6916	608.2134	612.2042	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1051.5297	1004.6799	924.8425	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	221.6434	294.9711	232.6029	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												749.2174	(104)
Cooled fraction									fC = cooled area / (4) =			1.0000	(105)

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CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	55.4108	73.7428	58.1507	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling											187.3044 (107)
Space cooling per m2											2.4325 (108)
Energy for space heating											40.9875 (99)
Energy for space cooling											2.4325 (108)
Total											43.4201 (109)
Target Fabric Energy Efficiency (TFEE)											49.9 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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CALCULATION OF HEAT DEMAND 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	77.0000 (1b)	x 2.4000 (2b)	= 184.8000 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	77.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 184.8000 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					2 * 10 = 20.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					Air changes per hour
Pressure test					20.0000 / (5) = 0.1082 (8)
Measured/design AP50					Yes
Infiltration rate					5.0000
Number of sides sheltered					0.3582 (18)
					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3045 (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	0.3349	0.3121	0.3121	0.2969	0.2969	0.2588	0.2588	0.2512	0.2588	0.2893	0.2817	0.3045 (22b)
Effective ac	0.5561	0.5487	0.5487	0.5441	0.5441	0.5335	0.5335	0.5316	0.5335	0.5418	0.5397	0.5464 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows (Uw = 1.40)			16.6500	1.3258	22.0739		(27)
Door to Stairs			1.8900	1.4000	2.6460		(26)
Exposed Floor			28.0000	0.1278	3.5793		(28b)
Main Wall	72.7500	16.6500	56.1000	0.2200	12.3420	60.0000	3366.0000 (29a)
Wall to stairs	17.6600	1.8900	15.7700	0.1864	2.9392	190.0000	2996.3000 (29a)
Total net area of external elements Aum(A, m ²)			118.4100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	43.5803		(33)
Party Wall 1			22.3900	0.0000	0.0000	180.0000	4030.2000 (32)
Party Floor 1			49.0000			40.0000	1960.0000 (32d)
Party Ceilings 1			77.0000			40.0000	3080.0000 (32b)
Internal Wall 1			77.5200			75.0000	5814.0000 (32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 21246.5000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 275.9286 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 13.2846 (36)
Total fabric heat loss (33) + (36) = 56.8649 (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	33.9127	33.4622	33.4622	33.1795	33.1795	32.5346	32.5346	32.4162	32.5346	33.0434	32.9109	33.3191 (38)
Heat transfer coeff	90.7776	90.3271	90.3271	90.0444	90.0444	89.3994	89.3994	89.2811	89.3994	89.9083	89.7758	90.1840 (39)
Average = Sum(39)m / 12 =												89.9057 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1789	1.1731	1.1731	1.1694	1.1694	1.1610	1.1610	1.1595	1.1610	1.1676	1.1659	1.1712 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.4035 (42)
Average daily hot water use (litres/day)												91.2825 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	100.4108	96.7595	93.1082	89.4569	85.8056	82.1543	82.1543	85.8056	89.4569	93.1082	96.7595	100.4108 (44)
Energy content (annual)	148.9063	130.2344	134.3902	117.1646	112.4223	97.0119	89.8957	103.1567	104.3887	121.6550	132.7959	144.2078 (45)
Distribution loss (46)m = 0.15 x (45)m	22.3359	19.5352	20.1585	17.5747	16.8633	14.5518	13.4844	15.4735	15.6583	18.2482	19.9194	21.6312 (46)

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Water storage loss:											210.0000	(47)	
Store volume													
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	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	30.1320	31.1364	30.1320	31.1364	(57)	
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month													
	203.3051	179.3688	188.7890	169.8086	166.8211	149.6559	144.2945	157.5555	157.0327	176.0538	185.4399	198.6066	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Solar input (sum of months) = Sum(63)m =											0.0000	(63)	
Output from w/h	203.3051	179.3688	188.7890	169.8086	166.8211	149.6559	144.2945	157.5555	157.0327	176.0538	185.4399	198.6066	(64)
Total per year (kWh/year) = Sum(64)m =											2076.7313	(64)	
RHI water heating demand											2077	(64)	
Heat gains from water heating, kWh/month													
	93.0304	82.6104	88.2038	81.0724	80.8994	74.3716	73.4094	77.8186	76.8244	83.9693	86.2698	91.4681	(65)

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	144.2084	144.2084	144.2084	144.2084	144.2084	144.2084	144.2084	144.2084	144.2084	144.2084	144.2084	144.2084 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	47.5340	42.2193	34.3350	25.9938	19.4307	16.4042	17.7253	23.0400	30.9243	39.2655	45.8286	48.8551 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	317.9949	321.2947	312.9793	295.2769	272.9307	251.9285	237.8977	234.5979	242.9133	260.6157	282.9619	303.9641 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	51.8243	51.8243	51.8243	51.8243	51.8243	51.8243	51.8243	51.8243	51.8243	51.8243	51.8243	51.8243 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-96.1390	-96.1390	-96.1390	-96.1390	-96.1390	-96.1390	-96.1390	-96.1390	-96.1390	-96.1390	-96.1390	-96.1390 (71)
Water heating gains (Table 5)	125.0408	122.9322	118.5535	112.6006	108.7358	103.2939	98.6685	104.5949	106.7006	112.8620	119.8192	122.9410 (72)
Total internal gains	590.4635	586.3400	565.7616	533.7651	500.9910	471.5204	454.1854	462.1267	480.4320	512.6370	548.5035	575.6540 (73)

[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					2.4300	12.7500	0.6300	0.7000	0.7700			9.4686 (74)
East					12.7100	23.7835	0.6300	0.7000	0.7700			92.3832 (76)
South					1.5100	54.0600	0.6300	0.7000	0.7700			24.9474 (78)
Solar gains	126.7992	209.4253	329.8470	477.0284	565.2024	611.3312	576.4623	506.9192	404.2565	262.6108	154.1150	106.0286 (83)
Total gains	717.2627	795.7653	895.6085	1010.7935	1066.1934	1082.8517	1030.6477	969.0460	884.6885	775.2478	702.6185	681.6826 (84)

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	65.0139	65.3382	65.3382	65.5433	65.5433	66.0161	66.0161	66.1037	66.0161	65.6425	65.7394	65.4419
alpha	5.3343	5.3559	5.3559	5.3696	5.3696	5.4011	5.4011	5.4069	5.4011	5.3762	5.3826	5.3628
util living area	0.9884	0.9785	0.9439	0.8458	0.6662	0.4427	0.2946	0.3311	0.6068	0.8847	0.9747	0.9907 (86)
Tweekday	19.0503	19.2115	19.4811	19.7325	19.8471	19.8764	19.8776	19.8789	19.8695	19.7267	19.3636	19.0255
Tweekend	20.5578	20.6289	20.7537	20.8787	20.9471	20.9656	20.9673	20.9672	20.9580	20.8707	20.6947	20.5443
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	20.3175	20.4259	20.6199	20.8106	20.9184	20.9472	20.9496	20.9494	20.9344	20.8005	20.5233	20.2967 (87)
Th 2	19.9369	19.9416	19.9416	19.9446	19.9446	19.9513	19.9513	19.9525	19.9513	19.9460	19.9474	19.9431 (88)
util rest of house	0.9844	0.9711	0.9253	0.8021	0.5941	0.3583	0.2039	0.2351	0.5131	0.8394	0.9645	0.9874 (89)
Tweekday	19.0503	19.2115	19.4811	19.7325	19.8471	19.8764	19.8776	19.8789	19.8695	19.7267	19.3636	19.0255
Tweekend	19.0503	19.2115	19.4811	19.7325	19.8471	19.8764	19.8776	19.8789	19.8695	19.7267	19.3636	19.0255
MIT 2	19.0503	19.2115	19.4811	19.7325	19.8471	19.8764	19.8776	19.8789	19.8695	19.7267	19.3636	19.0255 (90)
Living area fraction									FLA = Living area / (4) =			0.4117 (91)
MIT	19.5720	19.7115	19.9499	20.1764	20.2881	20.3172	20.3189	20.3196	20.3079	20.1688	19.8410	19.5489 (92)
Temperature adjustment												0.0000
adjusted MIT	19.5720	19.7115	19.9499	20.1764	20.2881	20.3172	20.3189	20.3196	20.3079	20.1688	19.8410	19.5489 (93)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9827	0.9692	0.9255	0.8125	0.6184	0.3880	0.2358	0.2688	0.5459	0.8502	0.9632	0.9859 (94)
Useful gains	704.8254	771.2345	828.8998	821.2656	659.3616	420.1344	242.9938	260.5075	482.9604	659.0878	676.7714	672.0460 (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												
	1331.8895	1283.6796	1142.6315	943.3383	683.2692	421.7185	243.0697	260.6648	492.4020	788.3882	1080.9913	1321.0917 (97)

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CALCULATION OF HEAT DEMAND 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													
	466.5357	344.3632	233.4164	87.8923	17.7872	0.0000	0.0000	0.0000	0.0000	96.1994	291.0383	482.8899	(98)
Space heating												2020.1225	(98)
RHI space heating demand												2020	(98)

FULL SAP CALCULATION PRINTOUT

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CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	77.0000 (1b)	x 2.4000 (2b)	= 184.8000 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	77.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 184.8000 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					2 * 10 = 20.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				Air changes per hour
Pressure test					20.0000 / (5) = 0.1082 (8)
Measured/design AP50					Yes
Infiltration rate					5.0000
Number of sides sheltered					0.3582 (18)
					2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3045 (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												
	0.3882	0.3806	0.3730	0.3349	0.3273	0.2893	0.2893	0.2817	0.3045	0.3273	0.3426	0.3578 (22b)
Effective ac	0.5754	0.5724	0.5696	0.5561	0.5536	0.5418	0.5418	0.5397	0.5464	0.5536	0.5587	0.5640 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows (Uw = 1.40)			16.6500	1.3258	22.0739		(27)
Door to Stairs			1.8900	1.4000	2.6460		(26)
Exposed Floor			28.0000	0.1278	3.5793		(28b)
Main Wall	72.7500	16.6500	56.1000	0.2200	12.3420	60.0000	3366.0000 (29a)
Wall to stairs	17.6600	1.8900	15.7700	0.1864	2.9392	190.0000	2996.3000 (29a)
Total net area of external elements Aum(A, m ²)			118.4100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	43.5803		(33)
Party Wall 1			22.3900	0.0000	0.0000	180.0000	4030.2000 (32)
Party Floor 1			49.0000			40.0000	1960.0000 (32d)
Party Ceilings 1			77.0000			40.0000	3080.0000 (32b)
Internal Wall 1			77.5200			75.0000	5814.0000 (32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 21246.5000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 275.9286 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 13.2846 (36)
Total fabric heat loss (33) + (36) = 56.8649 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	35.0877	34.9093	34.7344	33.9127	33.7590	33.0434	33.0434	32.9109	33.3191	33.7590	34.0700	34.3951 (38)
Heat transfer coeff	91.9526	91.7742	91.5993	90.7776	90.6239	89.9083	89.9083	89.7758	90.1840	90.6239	90.9349	91.2600 (39)
Average = Sum(39)m / 12 =												90.7769 (39)
HLP	1.1942	1.1919	1.1896	1.1789	1.1769	1.1676	1.1676	1.1659	1.1712	1.1769	1.1810	1.1852 (40)
HLP (average)												1.1789 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.4035 (42)
Average daily hot water use (litres/day)												91.2825 (43)
Daily hot water use	100.4108	96.7595	93.1082	89.4569	85.8056	82.1543	82.1543	85.8056	89.4569	93.1082	96.7595	100.4108 (44)
Energy conte	148.9063	130.2344	134.3902	117.1646	112.4223	97.0119	89.8957	103.1567	104.3887	121.6550	132.7959	144.2078 (45)
Energy content (annual)										Total = Sum(45)m =		1436.2293 (45)
Distribution loss (46)m = 0.15 x (45)m	22.3359	19.5352	20.1585	17.5747	16.8633	14.5518	13.4844	15.4735	15.6583	18.2482	19.9194	21.6312 (46)

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Space heating kWh	526.4923	392.5164	290.6932	126.1780	35.1795	0.0000	0.0000	0.0000	0.0000	142.8790	350.9487	546.2354 (98)
Space heating												2411.1226 (98)
Space heating per m2												(98) / (4) = 31.3133 (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 %)												300.8169 (206)
Efficiency of secondary/supplementary heating system, %												100.0000 (208)
Space heating requirement												801.5249 (211)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	526.4923	392.5164	290.6932	126.1780	35.1795	0.0000	0.0000	0.0000	0.0000	142.8790	350.9487	546.2354 (98)
Space heating efficiency (main heating system 1)	300.8169	300.8169	300.8169	300.8169	300.8169	0.0000	0.0000	0.0000	0.0000	300.8169	300.8169	300.8169 (210)
Space heating fuel (main heating system)	175.0208	130.4835	96.6346	41.9451	11.6947	0.0000	0.0000	0.0000	0.0000	47.4970	116.6652	181.5840 (211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating requirement	203.3051	179.3688	188.7890	169.8086	166.8211	149.6559	144.2945	157.5555	157.0327	176.0538	185.4399	198.6066 (64)
Efficiency of water heater (217)m	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400 (216)
Fuel for water heating, kWh/month	119.9865	105.8598	111.4194	100.2176	98.4544	88.3238	85.1597	92.9860	92.6775	103.9033	109.4428	117.2135 (219)
Water heating fuel used												1225.6441 (219)
Annual totals kWh/year												
Space heating fuel - main system												801.5249 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
Total electricity for the above, kWh/year												0.0000 (231)
Electricity for lighting (calculated in Appendix L)												335.7862 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
Total delivered energy for all uses												2362.9552 (238)

10a. Fuel costs - using Table 12 prices

	Fuel	Fuel price	Fuel cost
	kWh/year	p/kWh	£/year
Space heating - main system 1	801.5249	13.1900	105.7211 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1225.6441	13.1900	161.6625 (247)
Pumps and fans for heating	0.0000	0.0000	0.0000 (249)
Energy for lighting	335.7862	13.1900	44.2902 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit	0.0000	13.1900	0.0000 (252)
Total energy cost			311.6738 (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] =	1.0730 (257)
SAP value		85.0320
SAP rating (Section 12)		85 (258)
SAP band		B

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

	Energy	Emission factor	Emissions
	kWh/year	kg CO2/kWh	kg CO2/year
Space heating - main system 1	801.5249	0.5190	415.9914 (261)
Space heating - secondary	0.0000	0.5190	0.0000 (263)
Water heating (other fuel)	1225.6441	0.5190	636.1093 (264)
Space and water heating			1052.1007 (265)
Pumps and fans	0.0000	0.0000	0.0000 (267)
Energy for lighting	335.7862	0.5190	174.2730 (268)
Energy saving/generation technologies			
PV Unit	-300.0000	0.5190	-155.7000 (269)
Total kg/year			1070.6737 (272)
CO2 emissions per m2			13.9000 (273)
EI value			88.2401
EI rating			88 (274)
EI band			B

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Calculation of stars for heating and DHW

Main heating energy efficiency	$13.19 \times (1 + 0.29 \times 0.25) / 3.0082 = 4.703$	stars = 4
Main heating environmental impact	$0.519 \times (1 + 0.29 \times 0.25) / 3.0082 = 0.1850$	stars = 5
Water heating energy efficiency	$13.19 / 1.6944 = 7.784$	stars = 2
Water heating environmental impact	$0.519 / 1.6944 = 0.3063$	stars = 4

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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	77.0000 (1b)	x 2.4000 (2b)	= 184.8000 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	77.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 184.8000 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					2 * 10 = 20.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				Air changes per hour
Pressure test					20.0000 / (5) = 0.1082 (8)
Measured/design AP50					Yes
Infiltration rate					5.0000
Number of sides sheltered					0.3582 (18)
					2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3045 (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	0.3349	0.3121	0.3121	0.2969	0.2969	0.2588	0.2588	0.2512	0.2588	0.2893	0.2817	0.3045 (22b)
Effective ac	0.5561	0.5487	0.5487	0.5441	0.5441	0.5335	0.5335	0.5316	0.5335	0.5418	0.5397	0.5464 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows (Uw = 1.40)			16.6500	1.3258	22.0739		(27)
Door to Stairs			1.8900	1.4000	2.6460		(26)
Exposed Floor			28.0000	0.1278	3.5793		(28b)
Main Wall	72.7500	16.6500	56.1000	0.2200	12.3420	60.0000	3366.0000 (29a)
Wall to stairs	17.6600	1.8900	15.7700	0.1864	2.9392	190.0000	2996.3000 (29a)
Total net area of external elements Aum(A, m ²)			118.4100				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		43.5803		(33)
Party Wall 1			22.3900	0.0000	0.0000	180.0000	4030.2000 (32)
Party Floor 1			49.0000			40.0000	1960.0000 (32d)
Party Ceilings 1			77.0000			40.0000	3080.0000 (32b)
Internal Wall 1			77.5200			75.0000	5814.0000 (32c)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 21246.5000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 275.9286 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 13.2846 (36)
Total fabric heat loss (33) + (36) = 56.8649 (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	33.9127	33.4622	33.4622	33.1795	33.1795	32.5346	32.5346	32.4162	32.5346	33.0434	32.9109	33.3191 (38)
Heat transfer coeff	90.7776	90.3271	90.3271	90.0444	90.0444	89.3994	89.3994	89.2811	89.3994	89.9083	89.7758	90.1840 (39)
Average = Sum(39)m / 12 =												89.9057 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1789	1.1731	1.1731	1.1694	1.1694	1.1610	1.1610	1.1595	1.1610	1.1676	1.1659	1.1712 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.4035 (42)
Average daily hot water use (litres/day)												91.2825 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	100.4108	96.7595	93.1082	89.4569	85.8056	82.1543	82.1543	85.8056	89.4569	93.1082	96.7595	100.4108 (44)
Energy content (annual)	148.9063	130.2344	134.3902	117.1646	112.4223	97.0119	89.8957	103.1567	104.3887	121.6550	132.7959	144.2078 (45)
Distribution loss (46)m = 0.15 x (45)m	22.3359	19.5352	20.1585	17.5747	16.8633	14.5518	13.4844	15.4735	15.6583	18.2482	19.9194	21.6312 (46)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9827	0.9692	0.9255	0.8125	0.6184	0.3880	0.2358	0.2688	0.5459	0.8502	0.9632	0.9859 (94)
Useful gains	704.8254	771.2345	828.8998	821.2656	659.3616	420.1344	242.9938	260.5075	482.9604	659.0878	676.7714	672.0460 (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												
	1331.8895	1283.6796	1142.6315	943.3383	683.2692	421.7185	243.0697	260.6648	492.4020	788.3882	1080.9913	1321.0917 (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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Space heating kWh	466.5357	344.3632	233.4164	87.8923	17.7872	0.0000	0.0000	0.0000	0.0000	96.1994	291.0383	482.8899 (98)
Space heating												2020.1225 (98)
Space heating per m2												(98) / (4) = 26.2354 (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 %)												298.6780 (206)
Efficiency of secondary/supplementary heating system, %												100.0000 (208)
Space heating requirement												676.3547 (211)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	466.5357	344.3632	233.4164	87.8923	17.7872	0.0000	0.0000	0.0000	0.0000	96.1994	291.0383	482.8899 (98)
Space heating efficiency (main heating system 1)	298.6780	298.6780	298.6780	298.6780	298.6780	0.0000	0.0000	0.0000	0.0000	298.6780	298.6780	298.6780 (210)
Space heating fuel (main heating system)	156.2002	115.2958	78.1499	29.4271	5.9553	0.0000	0.0000	0.0000	0.0000	32.2084	97.4422	161.6758 (211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating requirement	203.3051	179.3688	188.7890	169.8086	166.8211	149.6559	144.2945	157.5555	157.0327	176.0538	185.4399	198.6066 (64)
Efficiency of water heater (217)m	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400 (216)
Fuel for water heating, kWh/month	119.9865	105.8598	111.4194	100.2176	98.4544	88.3238	85.1597	92.9860	92.6775	103.9033	109.4428	117.2135 (219)
Water heating fuel used												1225.6441 (219)
Annual totals kWh/year												
Space heating fuel - main system												676.3547 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
Total electricity for the above, kWh/year												0.0000 (231)
Electricity for lighting (calculated in Appendix L)												335.7862 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
Total delivered energy for all uses												2237.7850 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	676.3547	19.1200	129.3190 (240)	
Space heating - secondary	0.0000	0.0000	0.0000 (242)	
Water heating (other fuel)	1225.6441	19.1200	234.3431 (247)	
Pumps and fans for heating	0.0000	0.0000	0.0000 (249)	
Energy for lighting	335.7862	19.1200	64.2023 (250)	
Additional standing charges			0.0000 (251)	
Energy saving/generation technologies				
PV Unit	0.0000	19.1200	0.0000 (252)	
Total energy cost			427.8645 (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	676.3547	0.5190	351.0281 (261)	
Space heating - secondary	0.0000	0.5190	0.0000 (263)	
Water heating (other fuel)	1225.6441	0.5190	636.1093 (264)	
Space and water heating			987.1374 (265)	
Pumps and fans	0.0000	0.0000	0.0000 (267)	
Energy for lighting	335.7862	0.5190	174.2730 (268)	
Energy saving/generation technologies				
PV Unit	-300.0000	0.5190	-155.7000 (269)	
Total kg/year			1005.7104 (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	676.3547	3.0700	2076.4089 (261)	
Space heating - secondary	0.0000	3.0700	0.0000 (263)	
Water heating (other fuel)	1225.6441	3.0700	3762.7273 (264)	
Space and water heating			5839.1363 (265)	
Pumps and fans	0.0000	0.0000	0.0000 (267)	
Energy for lighting	335.7862	3.0700	1030.8636 (268)	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Energy saving/generation technologies			
PV Unit	-300.0000	3.0700	-921.0000 (269)
Primary energy kWh/year			5948.9998 (272)
Primary energy kWh/m ² /year			77.2597 (273)

SAP 2012 EPC IMPROVEMENTS

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

(For testing purposes):

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

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

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
(none)			
	Total Savings £0		0.00 kg/m ²

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

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

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

	Current	Potential	Saving
Electricity	£428	£428	£0
Space heating	£129	£129	£0
Water heating	£234	£234	£0
Lighting	£64	£64	£0
Total cost of fuels	£428	£428	£0
Total cost of uses	£427	£427	£0
Delivered energy	29 kWh/m ²	29 kWh/m ²	0 kWh/m ²
Carbon dioxide emissions	1.0 tonnes	1.0 tonnes	0.0 tonnes
CO2 emissions per m ²	13 kg/m ²	13 kg/m ²	0 kg/m ²
Primary energy	77 kWh/m ²	77 kWh/m ²	0 kWh/m ²

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	MidTerrace Flat
Number of storeys	1
Cross ventilation possible	Yes
SAP Region	Thames Valley
Front of dwelling faces	West
Overshading	Average or unknown
Thermal mass parameter	275.9 (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	365.90 (P1)
Transmission heat loss coefficient	56.86 (37)
Summer heat loss coefficient	422.77 (P2)

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

Solar shading Orientation	Z blinds	Solar access	Z overhangs	Z summer
North	1.000	0.90	1.000	0.900 (P8)
East	1.000	0.90	1.000	0.900 (P8)
South	1.000	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	2.4300	81.1852	0.6300	0.7000	0.9000	70.4704
East	12.7100	117.5071	0.6300	0.7000	0.9000	533.4984
South	1.5100	112.2060	0.6300	0.7000	0.9000	60.5225
total:						664.4913

	Jun	Jul	Aug	
Solar gains	705	664	586	(P3)
Internal gains	472	454	462	
Total summer gains	1177	1119	1048	(P5)
Summer gain/loss ratio	2.78	2.65	2.48	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 275.9)	0.07	0.07	0.07	
Threshold temperature	18.85	20.61	20.35	(P7)
Likelihood of high internal temperature	Not significant	Slight	Not significant	
Assessment of likelihood of high internal temperature:	Slight			

BASIC COMPLIANCE REPORT

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

Property Reference	015728	Issued on Date	16/08/2021
Assessment Reference	004	Prop Type Ref	
Property	Flat 7, 18, Parkside Road, READING, RG30 2DB		
SAP Rating	85 B	DER	15.36
Environmental	88 B	TER	26.08
CO ₂ Emissions (t/year)	1.01	% DER<TER	41.11
General Requirements Compliance	Pass	DFEE	47.54
		TFEE	49.93
		% DFEE<TFEE	4.79
Assessor Details	Mr. Matthew Carter, Energy Calculations Limited, Tel: 01754 761035, mcarter@energycalculations.co.uk		Assessor ID
Client	7869-0001		

SUMMARY FOR INPUT DATA FOR New Build (As Designed)

Criterion 1 – Achieving the TER and TFE rate

1a TER and DER

Fuel for main heating	Electricity		
Fuel factor	1.55 (electricity)		
Target Carbon Dioxide Emission Rate (TER)	26.08	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	15.36	kgCO ₂ /m ²	Pass
	-10.72 (-41.1%)	kgCO ₂ /m ²	

1b TFE and DFEE

Target Fabric Energy Efficiency (TFEE)	49.93	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DFEE)	47.54	kWh/m ² /yr	
	-2.4 (-4.8%)	kWh/m ² /yr	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.22 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.13 (max. 0.25)	0.13 (max. 0.70)	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
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Calculation Type: New Build (As Designed)

Hot water storage

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

Pass

Primary pipework insulated

Yes

Pass

6 Controls

Space heating controls

Time and temperature zone control

Pass

Hot water controls

Cylinderstat

Pass

Independent timer for DHW

Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings

100

%

Minimum

75

%

Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Thames Valley)

Slight

Pass

Based on:

Overshading

Average

Windows facing North

2.43 m², No overhang

Windows facing East

12.71 m², No overhang

Windows facing South

1.51 m², No overhang

Air change rate

6.00 ach

Blinds/curtains

None

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type

U-value

Solid Wall

0.00

W/m²K

Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals

5.00 (design value)

Maximum

10.0

Pass

10 Key features

Party wall U-value

0.00

W/m²K

Photovoltaic array

300.00

kWh/Year

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

SUMMARY FOR INPUT DATA

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

Property Reference	015728	Issued on Date	16/08/2021
Assessment Reference	004	Prop Type Ref	
Property	Flat 7, 18, Parkside Road, READING, RG30 2DB		
SAP Rating	85 B	DER	15.36
Environmental	88 B	TER	26.08
CO ₂ Emissions (t/year)	1.01	% DER<TER	41.11
General Requirements Compliance	Pass	DFEE	47.54
		TFEE	49.93
		% DFEE<TFEE	4.79
Assessor Details	Mr. Matthew Carter, Energy Calculations Limited, Tel: 01754 761035, mcarter@energycalculations.co.uk		Assessor ID
			7869-0001
Client			

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

Orientation	West					
Property Tenure	Unknown					
Transaction Type	New dwelling					
Terrain Type	Urban					
1.0 Property Type	Flat, Mid-Terrace					
2.0 Number of Storeys	1					
3.0 Date Built	2020					
4.0 Sheltered Sides	2					
5.0 Sunlight/Shade	Average or unknown					
6.0 Measurements						
Ground Floor:		Heat Loss Perimeter		Internal Floor Area		Average Storey Height
		37.67 m		77.00 m²		2.40 m
7.0 Living Area	31.70		m²			
8.0 Thermal Mass Parameter	Precise calculation		kJ/m²K			
Thermal Mass	275.93					
9.0 External Walls						
Description	Type	Construction		U-Value (W/m²K)	Kappa (kJ/m²K)	Gross Area (m²)
						Nett Area (m²)
Main Wall	Cavity Wall	Cavity wall : plasterboard on dabs, AAC block, filled cavity, any outside structure		0.22	60.00	72.75
Wall to stairs	Cavity Wall	Cavity wall : dense plaster, dense block, filled cavity, any outside structure		0.22	190.00	17.66
9.1 Party Walls						
Description	Type	Construction		U-Value (W/m²K)	Kappa (kJ/m²K)	Area (m²)
Party Wall 1	Solid Wall	Dense plaster both sides, dense blocks, cavity or cavity fill		0.00	180.00	22.39
9.2 Internal Walls						
Description	Construction				Kappa (kJ/m²K)	Area (m²)
Internal Wall 1	Dense block, plasterboard on dabs				75.00	77.52
10.1 Party Ceilings						
Description	Construction				Kappa (kJ/m²K)	Area (m²)
Party Ceilings 1	Precast concrete planks floor, screed, carpeted				30.00	77.00
11.0 Heat Loss Floors						

SUMMARY FOR INPUT DATA

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

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Area (m²)
Exposed Floor	Exposed Floor - Solid	Other	0.14	0.00	28.00

11.1 Party Floors

Description	Construction	Kappa (kJ/m²K)	Area (m²)
Party Floor 1	Precast concrete planks floor, screed, carpeted	40.00	49.00

12.0 Opening Types

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

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
Door	Door to Corridor	[2] Wall to stairs	West							1.89	
Windows	Window	[1] Main Wall	East	None	0.00					12.71	
Windows	Window	[1] Main Wall	North	None	0.00					2.43	
Windows	Window	[1] Main Wall	South	None	0.00					1.51	

14.0 Conservatory

15.0 Draught Proofing

 %

16.0 Draught Lobby

17.0 Thermal Bridging

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Table K1 - Approved	E2 Other lintels (including other steel lintels)	10.44	0.300	No
Table K1 - Approved	E3 Sill	10.44	0.040	No
Table K1 - Approved	E4 Jamb	33.90	0.050	No
Table K1 - Default	E20 Exposed floor (normal)	20.00	0.320	No
Table K1 - Approved	E7 Party floor between dwellings (in blocks of flats)	14.00	0.070	No
Table K1 - Approved	E16 Corner (normal)	12.00	0.090	No
Table K1 - Approved	E17 Corner (inverted – internal area greater than external area)	9.60	-0.090	No
Table K1 - Approved	E18 Party wall between dwellings	7.40	0.060	No
Table K1 - Default	P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	9.33	0.000	No

Y-value	0.112	W/m²K
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18.0 Pressure Testing

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

19.0 Mechanical Ventilation

Summer Overheating

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

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

Mechanical Ventilation

Mechanical Ventilation System Present

No

20.0 Fans, Open Fireplaces, Flues

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

21.0 Fixed Cooling System

No

22.0 Lighting

Internal

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

External

External lights fitted	Yes
Light and motion sensor	Yes

23.0 Electricity Tariff

Standard

24.0 Main Heating 1

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

25.0 Main Heating 2

None

Community Heating	None
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28.0 Water Heating

HWP From main heating 1	
Water Heating	Main Heating 1
Flue Gas Heat Recovery System	No
Waste Water Heat Recovery Instantaneous System 1	No
Waste Water Heat Recovery Instantaneous System 2	No
Waste Water Heat Recovery Storage System	No

SUMMARY FOR INPUT DATA

Energy Calculations Ltd
SAP ♦ CODE ♦ SBEM ♦ DESIGN

Calculation Type: New Build (As Designed)

Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	
Immersion Only Heating Hot Water	Yes	
29.0 Hot Water Cylinder	Hot Water Cylinder	
Cylinder Stat	Yes	
Cylinder In Heated Space	Yes	
Independent Time Control	Yes	
Insulation Type	Measured Loss	
Cylinder Volume	210.00	L
Loss	1.86	kWh/day
Pipes insulation	Fully insulated primary pipework	
31.0 Thermal Store	None	
32.0 Photovoltaic Unit	More Dwellings, One Block	
Apportioned	300.00	kWh/Year

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

None

BLOCK COMPLIANCE

Energy Calculations Ltd
SAP • CODE • SBEM • DESIGN

Calculation Type: New Build (As Designed)

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

Block Compliance Report - DER

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

Block Compliance Report - DFEE

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