

Energy Calculations Ltd

SAP ♦ CODE ♦ SBEM ♦ DESIGN

01754-761035



SAP Report Submission for Building Regulations Compliance

Client:

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

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

Report Issue Date: 01/03/2021

EXCELLENCE
IN ENERGY
ASSESSMENT

PREDICTED ENERGY ASSESSMENT

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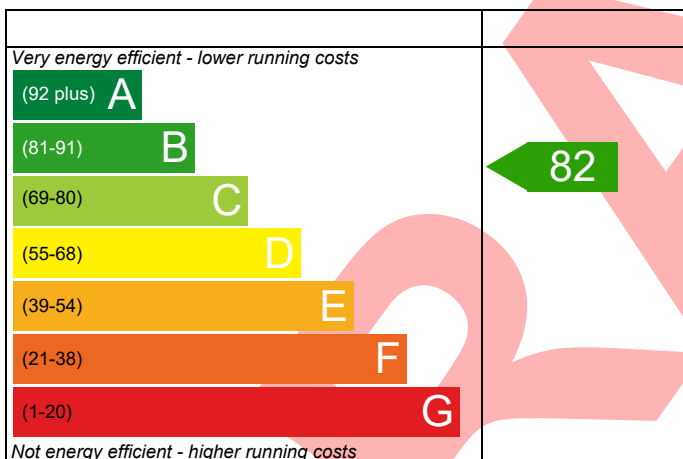
Flat 2, 18, Parkside Road,
READING,
RG30 2DB

Dwelling type: Flat, Mid-Terrace
Date of assessment: 01/03/2021
Produced by: Energy Calculations Limited
Total floor area: 53 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

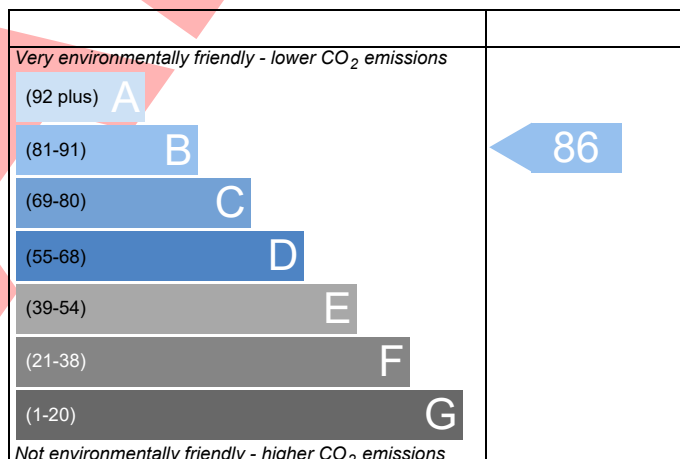


England

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	015723	Issued on Date	01/03/2021
Assessment Reference	003	Prop Type Ref	
Property	Flat 2, 18, Parkside Road, READING, RG30 2DB		

SAP Rating	82 B	DER	21.18	TER	34.27
Environmental	86 B	% DER<TER	38.19		
CO ₂ Emissions (t/year)	0.96	DFEE	67.01	TFEE	66.99
General Requirements Compliance	Fail	% DFEE<TFEE	-0.03		

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	8.05	2.42	
External wall	E3 Sill	Table K1 - Approved	0.040	7.05	0.28	
External wall	E4 Jamb	Table K1 - Approved	0.050	39.88	1.99	
External wall	E5 Ground floor (normal)	Table K1 - Approved	0.160	35.91	5.75	
External wall	E7 Party floor between dwellings (in blocks of flats)	Table K1 - Approved	0.070	5.09	0.36	
External wall	E14 Flat roof	Table K1 - Default	0.080	5.90	0.47	
External wall	E16 Corner (normal)	Table K1 - Approved	0.090	4.74	0.43	
External wall	E17 Corner (inverted – internal area greater than external area)	Table K1 - Approved	-0.090	4.74	-0.43	
External wall	E18 Party wall between dwellings	Table K1 - Approved	0.060	9.48	0.57	
Party wall	P1 Party wall - Ground floor	Table K1 - Default	0.160	5.09	0.81	

Total: **12.65** W/mK:
Y-Value: **0.090** W/m²K:

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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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

Calculation Type: New Build (As Designed)

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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

Ground-floor flat, total floor area 53 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) 34.27 kgCO₂/m²

Dwelling Carbon Dioxide Emission Rate (DER) 21.18 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)67.0 kWh/m²/yr

Dwelling Fabric Energy Efficiency (DFEE)67.0 kWh/m²/yrFail

2 Fabric U-values

Element	Average	Highest	
External wall	0.22 (max. 0.30)	0.22 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.14 (max. 0.25)	0.14 (max. 0.70)	OK
Roof	0.14 (max. 0.20)	0.14 (max. 0.35)	OK
Openings	1.40 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

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

4 Heating efficiency

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

Secondary heating system: None

5 Cylinder insulation

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

6 Controls

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

Cylinderstat	OK
Independent timer for DHW	OK

7 Low energy lights

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

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Thames Valley): Slight OK

Based on:

Overshading:	Average
Windows facing North:	8.00 m ² , No overhang
Windows facing East:	5.05 m ² , No overhang
Windows facing South:	0.92 m ² , No overhang
Air change rate:	6.00 ach
Blinds/curtains:	None

10 Key features

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

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	53.0000 (1b)	x 2.4000 (2b)	= 127.2000 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	53.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 127.2000 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					2 * 10 = 20.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					20.0000 / (5) = 0.1572 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4072 (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) = 0.3461 (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												
	0.4413	0.4327	0.4240	0.3808	0.3721	0.3288	0.3288	0.3202	0.3461	0.3721	0.3894	0.4067 (22b)
Effective ac	0.5974	0.5936	0.5899	0.5725	0.5692	0.5541	0.5541	0.5513	0.5599	0.5692	0.5758	0.5827 (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
External Door			2.1000	1.4000	2.9400		(26a)
Windows (Uw = 1.40)			13.9700	1.3258	18.5208		(27)
Main Floor			53.0000	0.1400	7.4200	110.0000	5830.0000 (28a)
Main Wall	85.3000	16.0700	69.2300	0.2200	15.2306	60.0000	4153.8000 (29a)
wall to Stairs	0.8800		0.8800	0.1864	0.1640	60.0000	52.8000 (29a)
Flat roof	1.3500		1.3500	0.1400	0.1890	9.0000	12.1500 (30)
Total net area of external elements Aum(A, m ²)			140.5300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	44.4644		(33)
Party Wall 1			12.0600	0.0000	0.0000	180.0000	2170.8000 (32)
Party Ceilings 1			51.6300			40.0000	2065.2000 (32b)
Internal Wall 1			28.9000			100.0000	2890.0000 (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) = 17174.7500 (34)
324.0519 (35)
12.6481 (36)
(33) + (36) = 57.1125 (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	25.0760	24.9173	24.7617	24.0308	23.8941	23.2576	23.2576	23.1397	23.5027	23.8941	24.1707	24.4599 (38)
Heat transfer coeff	82.1886	82.0298	81.8742	81.1434	81.0066	80.3701	80.3701	80.2522	80.6153	81.0066	81.2833	81.5725 (39)
Average = Sum(39)m / 12 =												81.1427 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.5507	1.5477	1.5448	1.5310	1.5284	1.5164	1.5164	1.5142	1.5210	1.5284	1.5336	1.5391 (40)
HLP (average)												1.5310 (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)
1.7786 (42)
76.4408 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	84.0849	81.0273	77.9696	74.9120	71.8544	68.7967	68.7967	71.8544	74.9120	77.9696	81.0273	84.0849 (44)
Energy conte	124.6955	109.0595	112.5396	98.1148	94.1434	81.2386	75.2795	86.3844	87.4161	101.8750	111.2045	120.7609 (45)
Energy content (annual)												Total = Sum(45)m = 1202.7119 (45)
Distribution loss (46)m = 0.15 x (45)m	18.7043	16.3589	16.8809	14.7172	14.1215	12.1858	11.2919	12.9577	13.1124	15.2813	16.6807	18.1141 (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													
	179.0943	158.1939	166.9384	150.7588	148.5422	133.8826	129.6783	140.7832	140.0601	156.2738	163.8485	175.1597	(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	179.0943	158.1939	166.9384	150.7588	148.5422	133.8826	129.6783	140.7832	140.0601	156.2738	163.8485	175.1597	(64)
								Total per year (kWh/year) = Sum(64)m =				1843.2139	(64)
Heat gains from water heating, kWh/month													
	84.9803	75.5698	80.9385	74.7384	74.8217	69.1270	68.5495	72.2418	71.1810	77.3925	79.0907	83.6720	(65)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9970	0.9938	0.9834	0.9445	0.8360	0.6405	0.4580	0.5236	0.8104	0.9679	0.9938	0.9977 (94)
Useful gains	400.9961	458.6843	521.7123	579.9000	567.1793	434.6612	295.8579	308.0435	421.1433	430.6204	393.7676	381.5922 (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												
	1224.5126	1183.9595	1070.7423	892.9293	686.2753	458.1579	299.4475	314.7726	494.3919	752.8630	1006.8158	1221.8667 (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	612.6963	487.3849	408.4783	225.3811	88.6075	0.0000	0.0000	0.0000	0.0000	239.7485	441.3947	625.1642 (98)
Space heating												3128.8555 (98)
Space heating per m2												(98) / (4) = 59.0350 (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 %)												276.5515 (206)
Efficiency of secondary/supplementary heating system, %												100.0000 (208)
Space heating requirement												1131.3827 (211)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	612.6963	487.3849	408.4783	225.3811	88.6075	0.0000	0.0000	0.0000	0.0000	239.7485	441.3947	625.1642 (98)
Space heating efficiency (main heating system 1)	276.5515	276.5515	276.5515	276.5515	276.5515	0.0000	0.0000	0.0000	0.0000	276.5515	276.5515	276.5515 (210)
Space heating fuel (main heating system)	221.5487	176.2366	147.7043	81.4970	32.0401	0.0000	0.0000	0.0000	0.0000	86.6922	159.6067	226.0571 (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	179.0943	158.1939	166.9384	150.7588	148.5422	133.8826	129.6783	140.7832	140.0601	156.2738	163.8485	175.1597 (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	105.6978	93.3628	98.5236	88.9747	87.6666	79.0148	76.5335	83.0873	82.6606	92.2296	96.7000	103.3757 (219)
Water heating fuel used												1087.8269 (219)
Annual totals kWh/year												
Space heating fuel - main system												1131.3827 (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)												244.0646 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
Total delivered energy for all uses												2463.2742 (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	1131.3827	0.5190	587.1876 (261)
Space heating - secondary	0.0000	0.5190	0.0000 (263)
Water heating (other fuel)	1087.8269	0.5190	564.5822 (264)
Space and water heating			1151.7698 (265)
Pumps and fans	0.0000	0.0000	0.0000 (267)
Energy for lighting	244.0646	0.5190	126.6695 (268)
Energy saving/generation technologies			
PV Unit	-300.0000	0.5190	-155.7000 (269)
Total CO2, kg/year			1122.7393 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			21.1800 (273)

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

DER		21.1800 ZC1
Total Floor Area	TFA	53.0000
Assumed number of occupants	N	1.7786
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190
CO2 emissions from appliances, equation (L14)		17.3321 ZC2
CO2 emissions from cooking, equation (L16)		3.0507 ZC3
Total CO2 emissions		41.5628 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		41.5628 ZC8

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Energy Calculations Ltd
SAP ♦ CODE ♦ SBEM ♦ DESIGN

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	53.0000 (1b)	x 2.4000 (2b)	= 127.2000 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	53.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 127.2000 (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) = 0.1572 (8)
Measured/design AP50					Yes
Infiltration rate					5.0000
Number of sides sheltered					0.4072 (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) =				0.3461 (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	0.4413	0.4327	0.4240	0.3808	0.3721	0.3288	0.3288	0.3202	0.3461	0.3721	0.3894	0.4067 (22b)
	0.5974	0.5936	0.5899	0.5725	0.5692	0.5541	0.5541	0.5513	0.5599	0.5692	0.5758	0.5827 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K						
TER Semi-glazed door			2.1000	1.2000	2.5200			(26a)					
TER Opening Type (Uw = 1.40)			11.1500	1.3258	14.7822			(27)					
Main Floor			53.0000	0.1300	6.8900			(28a)					
Main Wall	85.3000	13.2500	72.0500	0.1800	12.9690			(29a)					
wall to Stairs	0.8800		0.8800	0.1800	0.1584			(29a)					
Flat roof	1.3500		1.3500	0.1300	0.1755			(30)					
Total net area of external elements Aum(A, m2)			140.5300					(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	37.4951			(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.2989	(36)					
Total fabric heat loss						(33) + (36) =	47.7940	(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 25.0760	Feb 24.9173	Mar 24.7617	Apr 24.0308	May 23.8941	Jun 23.2576	Jul 23.2576	Aug 23.1397	Sep 23.5027	Oct 23.8941	Nov 24.1707	Dec 24.4599	(38)
Heat transfer coeff	72.8700	72.7113	72.5557	71.8248	71.6881	71.0516	71.0516	70.9337	71.2967	71.6881	71.9647	72.2539	(39)
Average = Sum(39)m / 12 =												71.8242	(39)
HLP	Jan 1.3749	Feb 1.3719	Mar 1.3690	Apr 1.3552	May 1.3526	Jun 1.3406	Jul 1.3406	Aug 1.3384	Sep 1.3452	Oct 1.3526	Nov 1.3578	Dec 1.3633	(40)
HLP (average)												1.3552	(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												1.7786 (42)
Average daily hot water use (litres/day)												76.4408 (43)
Daily hot water use	84.0849	81.0273	77.9696	74.9120	71.8544	68.7967	68.7967	71.8544	74.9120	77.9696	81.0273	84.0849 (44)
Energy conte	124.6955	109.0595	112.5396	98.1148	94.1434	81.2386	75.2795	86.3844	87.4161	101.8750	111.2045	120.7609 (45)
Energy content (annual)										Total = Sum(45)m =		1202.7119 (45)
Distribution loss (46)m = 0.15 x (45)m												
	18.7043	16.3589	16.8809	14.7172	14.1215	12.1858	11.2919	12.9577	13.1124	15.2813	16.6807	18.1141 (46)
Water storage loss:												
Store volume												210.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.7016 (48)
Temperature factor from Table 2b												0.5400 (49)

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Enter (49) or (54) in (55)												0.9188 (55)
Total storage loss	28.4842	25.7277	28.4842	27.5653	28.4842	27.5653	28.4842	28.4842	27.5653	28.4842	27.5653	28.4842 (56)
If cylinder contains dedicated solar storage	28.4842	25.7277	28.4842	27.5653	28.4842	27.5653	28.4842	28.4842	27.5653	28.4842	27.5653	28.4842 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	176.4421	155.7983	164.2862	148.1921	145.8900	131.3160	127.0261	138.1310	137.4934	153.6216	161.2819	172.5075 (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	176.4421	155.7983	164.2862	148.1921	145.8900	131.3160	127.0261	138.1310	137.4934	153.6216	161.2819	172.5075 (64)
								Total per year (kWh/year) =	Sum(64)m =			1811.9862 (64)
Heat gains from water heating, kWh/month	82.8585	73.6534	78.8167	72.6850	72.7000	67.0737	66.4277	70.1201	69.1277	75.2707	77.0374	81.5503 (65)

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	88.9281	88.9281	88.9281	88.9281	88.9281	88.9281	88.9281	88.9281	88.9281	88.9281	88.9281	88.9281 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	13.8561	12.3069	10.0086	7.5772	5.6640	4.7818	5.1669	6.7162	9.0144	11.4459	13.3590	14.2412 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	155.0178	156.6264	152.5728	143.9431	133.0497	122.8114	115.9716	114.3630	118.4166	127.0463	137.9397	148.1780 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	31.8928	31.8928	31.8928	31.8928	31.8928	31.8928	31.8928	31.8928	31.8928	31.8928	31.8928	31.8928 (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)	-71.1424	-71.1424	-71.1424	-71.1424	-71.1424	-71.1424	-71.1424	-71.1424	-71.1424	-71.1424	-71.1424	-71.1424 (71)
Water heating gains (Table 5)	111.3690	109.6032	105.9364	100.9514	97.7150	93.1579	89.2846	94.2474	96.0107	101.1703	106.9964	109.6106 (72)
Total internal gains	332.9213	331.2149	321.1962	305.1501	289.1071	273.4296	263.1015	268.0050	276.1202	292.3409	310.9735	324.7082 (73)

[Jan				Area	Solar flux	g		FF	Access		Gains
				m2	Table 6a	Specific data		Specific data	factor	W	
					W/m2	or Table 6b		or Table 6c	Table 6d		
North				6.3900	10.6334	0.6300		0.7000	0.7700	20.7656 (74)	
East				4.0300	19.6403	0.6300		0.7000	0.7700	24.1893 (76)	
South				0.7300	46.7521	0.6300		0.7000	0.7700	10.4303 (78)	
Solar gains	55.3852	104.0857	167.1211	246.5618	310.8246	323.4491	305.6777	255.7066	194.4408	46.2161 (83)	
Total gains	388.3065	435.3006	488.3173	551.7119	599.9317	596.8787	568.7792	523.7116	470.5610	370.9243 (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	50.5085	50.6188	50.7273	51.2435	51.3412	51.8012	51.8012	51.8873	51.6231	51.3412	51.1439	50.9392
alpha	4.3672	4.3746	4.3818	4.4162	4.4227	4.4534	4.4534	4.4592	4.4415	4.4227	4.4096	4.3959
util living area	0.9953	0.9917	0.9811	0.9463	0.8559	0.6920	0.5317	0.5922	0.8339	0.9656	0.9913	0.9962 (86)
MIT	19.5864	19.7414	20.0237	20.4073	20.7381	20.9286	20.9826	20.9724	20.8297	20.4093	19.9338	19.5598 (87)
Th 2	19.7826	19.7849	19.7872	19.7979	19.7999	19.8092	19.8092	19.8109	19.8056	19.7999	19.7958	19.7916 (88)
util rest of house	0.9938	0.9888	0.9743	0.9259	0.8020	0.5898	0.3968	0.4539	0.7524	0.9483	0.9878	0.9949 (89)
MIT 2	17.9318	18.1588	18.5685	19.1175	19.5508	19.7638	19.8033	19.8003	19.6734	19.1321	18.4475	17.8991 (90)
Living area fraction												0.5453 (91)
MIT	18.8340	19.0218	19.3620	19.8208	20.1982	20.3989	20.4463	20.4394	20.3039	19.8285	19.2580	18.8046 (92)
Temperature adjustment												0.0000
adjusted MIT	18.8340	19.0218	19.3620	19.8208	20.1982	20.3989	20.4463	20.4394	20.3039	19.8285	19.2580	18.8046 (93)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9920	0.9864	0.9712	0.9263	0.8218	0.6430	0.4708	0.5296	0.7901	0.9488	0.9857	0.9934 (94)
Useful gains	385.2180	429.3689	474.2573	511.0706	493.0259	383.7909	267.7582	277.3750	371.7933	392.9680	373.6796	368.4883 (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	1059.0950	1026.8119	933.2097	784.3869	609.2230	412.0240	273.2871	286.5299	442.3156	661.5771	874.9445	1055.2415 (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	501.3645	401.4817	341.4606	196.7878	86.4506	0.0000	0.0000	0.0000	0.0000	199.8452	360.9108	510.9444 (98)
Space heating												2599.2454 (98)
Space heating per m2										(98) / (4) =		49.0424 (99)

FULL SAP CALCULATION PRINTOUT

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												93.5000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												2779.9416 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	501.3645	401.4817	341.4606	196.7878	86.4506	0.0000	0.0000	0.0000	0.0000	199.8452	360.9108	510.9444 (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)	536.2187	429.3922	365.1985	210.4682	92.4605	0.0000	0.0000	0.0000	0.0000	213.7381	386.0008	546.4646 (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	176.4421	155.7983	164.2862	148.1921	145.8900	131.3160	127.0261	138.1310	137.4934	153.6216	161.2819	172.5075 (64)
Efficiency of water heater (217)m	87.4477	87.2301	86.7227	85.5712	83.4721	79.8000	79.8000	79.8000	79.8000	85.5165	86.9012	79.8000 (216)
Fuel for water heating, kWh/month	201.7687	178.6062	189.4385	173.1799	174.7769	164.5564	159.1806	173.0964	172.2975	179.6397	185.5923	197.0672 (219)
Water heating fuel used												2149.2004 (219)
Annual totals kWh/year												
Space heating fuel - main system												2779.9416 (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)												244.7035 (232)
Total delivered energy for all uses												5248.8454 (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	2779.9416	0.2160	600.4674 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2149.2004	0.2160	464.2273 (264)
Space and water heating			1064.6947 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	244.7035	0.5190	127.0011 (268)
Total CO2, kg/m2/year			1230.6208 (272)
Emissions per m2 for space and water heating			20.0886 (272a)
Fuel factor (electricity)			1.5500
Emissions per m2 for lighting			2.3962 (272b)
Emissions per m2 for pumps and fans			0.7344 (272c)
Target Carbon Dioxide Emission Rate (TER) = (20.0886 * 1.55) + 2.3962 + 0.7344, rounded to 2 d.p.			34.2700 (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	53.0000 (1b)	x 2.4000 (2b)	= 127.2000 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	53.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 127.2000 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					2 * 10 = 20.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
					Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					20.0000 / (5) = 0.1572 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4072 (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) = 0.3461 (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	0.4413	0.4327	0.4240	0.3808	0.3721	0.3288	0.3288	0.3202	0.3461	0.3721	0.3894	0.4067 (22b)
	0.5974	0.5936	0.5899	0.5725	0.5692	0.5541	0.5541	0.5513	0.5599	0.5692	0.5758	0.5827 (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
External Door			2.1000	1.4000	2.9400		(26a)
Windows (Uw = 1.40)			13.9700	1.3258	18.5208		(27)
Main Floor			53.0000	0.1400	7.4200	110.0000	5830.0000 (28a)
Main Wall	85.3000	16.0700	69.2300	0.2200	15.2306	60.0000	4153.8000 (29a)
wall to Stairs	0.8800		0.8800	0.1864	0.1640	60.0000	52.8000 (29a)
Flat roof	1.3500		1.3500	0.1400	0.1890	9.0000	12.1500 (30)
Total net area of external elements Aum(A, m ²)				140.5300			(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	44.4644		(33)
Party Wall 1			12.0600	0.0000	0.0000	180.0000	2170.8000 (32)
Party Ceilings 1			51.6300			30.0000	1548.9000 (32b)
Internal Wall 1			28.9000			100.0000	2890.0000 (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) = 16658.4500 (34)
314.3104 (35)
12.6481 (36)
(33) + (36) = 57.1125 (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	25.0760	24.9173	24.7617	24.0308	23.8941	23.2576	23.2576	23.1397	23.5027	23.8941	24.1707	24.4599 (38)
Heat transfer coeff	82.1886	82.0298	81.8742	81.1434	81.0066	80.3701	80.3701	80.2522	80.6153	81.0066	81.2833	81.5725 (39)
Average = Sum(39)m / 12 =	81.1427 (39)											
HLP	1.5507	1.5477	1.5448	1.5310	1.5284	1.5164	1.5164	1.5142	1.5210	1.5284	1.5336	1.5391 (40)
HLP (average)	1.5310 (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)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	84.0849	81.0273	77.9696	74.9120	71.8544	68.7967	68.7967	71.8544	74.9120	77.9696	81.0273	84.0849 (44)
Energy conte	124.6955	109.0595	112.5396	98.1148	94.1434	81.2386	75.2795	86.3844	87.4161	101.8750	111.2045	120.7609 (45)
Energy content (annual)												
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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Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month	26.4978	23.1751	23.9147	20.8494	20.0055	17.2632	15.9969	18.3567	18.5759	21.6484	23.6310	25.6617	(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	88.9281	88.9281	88.9281	88.9281	88.9281	88.9281	88.9281	88.9281	88.9281	88.9281	88.9281	88.9281	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	13.8199	12.2748	9.9825	7.5574	5.6492	4.7693	5.1534	6.6986	8.9909	11.4160	13.3241	14.2040	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	155.0178	156.6264	152.5728	143.9431	133.0497	122.8114	115.9716	114.3630	118.4166	127.0463	137.9397	148.1780	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	31.8928	31.8928	31.8928	31.8928	31.8928	31.8928	31.8928	31.8928	31.8928	31.8928	31.8928	31.8928	(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)	-71.1424	-71.1424	-71.1424	-71.1424	-71.1424	-71.1424	-71.1424	-71.1424	-71.1424	-71.1424	-71.1424	-71.1424	(71)
Water heating gains (Table 5)	35.6153	34.4868	32.1434	28.9575	26.8891	23.9767	21.5012	24.6730	25.7999	29.0974	32.8208	34.4915	(72)
Total internal gains	254.1315	253.0664	244.3771	230.1364	215.2664	201.2358	192.3047	195.4130	202.8858	217.2381	233.7631	246.5520	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific FF or Table 6c	Access factor Table 6d	Gains W
North	8.0000	10.6334	0.6300	0.7000	0.7700	25.9976 (74)
East	5.0500	19.6403	0.6300	0.7000	0.7700	30.3117 (76)
South	0.9200	46.7521	0.6300	0.7000	0.7700	13.1450 (78)

Solar gains	69.4543	130.5071	209.4985	309.0193	389.5115	405.3126	383.0510	320.4617	243.7243	152.7208	85.4479	57.9583	(83)
Total gains	323.5858	383.5734	453.8756	539.1557	604.7779	606.5484	575.3557	515.8747	446.6101	369.9589	319.2109	304.5103	(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	56.3016	56.4105	56.5177	57.0268	57.1231	57.5755	57.5755	57.6600	57.4004	57.1231	56.9287	56.7268	
alpha	4.7534	4.7607	4.7678	4.8018	4.8082	4.8384	4.8384	4.8440	4.8267	4.8082	4.7952	4.7818	
util living area	0.9992	0.9980	0.9937	0.9738	0.9049	0.7541	0.5908	0.6687	0.9053	0.9892	0.9983	0.9994	(86)
MIT	19.5433	19.6974	19.9771	20.3640	20.7129	20.9205	20.9808	20.9663	20.7882	20.3363	19.8711	19.5175	(87)
Th 2	19.6497	19.6519	19.6541	19.6643	19.6662	19.6752	19.6752	19.6769	19.6718	19.6662	19.6624	19.6583	(88)
util rest of house	0.9988	0.9971	0.9905	0.9598	0.8535	0.6367	0.4254	0.5000	0.8307	0.9813	0.9974	0.9992	(89)
MIT 2	18.3469	18.5024	18.7823	19.1687	19.4864	19.6449	19.6719	19.6699	19.5628	19.1490	18.6843	18.3278	(90)
Living area fraction									fLA = Living area / (4) =				0.5453 (91)
MIT	18.9993	19.1540	19.4338	19.8205	20.1552	20.3405	20.3856	20.3768	20.2310	19.7964	19.3315	18.9765	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9993	19.1540	19.4338	19.8205	20.1552	20.3405	20.3856	20.3768	20.2310	19.7964	19.3315	18.9765	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	323.1337	382.2928	449.2741	518.5781	529.1850	424.5135	297.5177	306.4929	387.4313	363.4133	318.2765	304.1940	(94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1208.1146	1169.2522	1058.9439	886.1275	684.9278	461.3619	304.2521	319.1439	494.2511	744.9716	994.2127	1205.3571	(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	658.4258	528.8367	453.5943	264.6355	115.8726	0.0000	0.0000	0.0000	0.0000	283.8793	486.6740	670.4654	(98)
Space heating												3462.3838	(98)
Space heating per m2												65.3280	(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	755.4790	594.7388	609.9169	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8396	0.9047	0.8652	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	634.3093	538.0653	527.6972	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	775.9637	738.2198	669.6974	0.0000	0.0000	0.0000	0.0000	(103)

FULL SAP CALCULATION PRINTOUT

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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	101.9912	148.9149	105.6482	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												356.5543 (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	25.4978	37.2287	26.4120	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												89.1386 (107)
Space cooling per m2												1.6819 (108)
Energy for space heating												65.3280 (99)
Energy for space cooling												1.6819 (108)
Total												67.0099 (109)
Dwelling Fabric Energy Efficiency (DFEE)												67.0 (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	53.0000 (1b)	x 2.4000 (2b)	= 127.2000 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	53.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 127.2000 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	0 * 40 =	0.0000 (6a)
Number of open flues	0	+	0	0 * 20 =	0.0000 (6b)
Number of intermittent fans				2 * 10 =	20.0000 (7a)
Number of passive vents				0 * 10 =	0.0000 (7b)
Number of flueless gas fires				0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				20.0000 / (5) =	0.1572 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4072 (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) =		0.3461 (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	0.4413	0.4327	0.4240	0.3808	0.3721	0.3288	0.3288	0.3202	0.3461	0.3721	0.3894	0.4067 (22b)
Effective ac	0.5974	0.5936	0.5899	0.5725	0.5692	0.5541	0.5541	0.5513	0.5599	0.5692	0.5758	0.5827 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K						
TER Semi-glazed door			2.1000	1.2000	2.5200			(26a)					
TER Opening Type (Uw = 1.40)			11.1500	1.3258	14.7822			(27)					
Main Floor			53.0000	0.1300	6.8900			(28a)					
Main Wall	85.3000	13.2500	72.0500	0.1800	12.9690			(29a)					
wall to Stairs	0.8800		0.8800	0.1800	0.1584			(29a)					
Flat roof	1.3500		1.3500	0.1300	0.1755			(30)					
Total net area of external elements Aum(A, m2)			140.5300					(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	37.4951			(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.2989	(36)					
Total fabric heat loss						(33) + (36) =	47.7940	(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 25.0760	Feb 24.9173	Mar 24.7617	Apr 24.0308	May 23.8941	Jun 23.2576	Jul 23.2576	Aug 23.1397	Sep 23.5027	Oct 23.8941	Nov 24.1707	Dec 24.4599	(38)
Heat transfer coeff	72.8700	72.7113	72.5557	71.8248	71.6881	71.0516	71.0516	70.9337	71.2967	71.6881	71.9647	72.2539	(39)
Average = Sum(39)m / 12 =												71.8242	(39)
HLP	Jan 1.3749	Feb 1.3719	Mar 1.3690	Apr 1.3552	May 1.3526	Jun 1.3406	Jul 1.3406	Aug 1.3384	Sep 1.3452	Oct 1.3526	Nov 1.3578	Dec 1.3633	(40)
HLP (average)												1.3552	(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												1.7786 (42)
Average daily hot water use (litres/day)												76.4408 (43)
Daily hot water use	84.0849	81.0273	77.9696	74.9120	71.8544	68.7967	68.7967	71.8544	74.9120	77.9696	81.0273	84.0849 (44)
Energy conte	124.6955	109.0595	112.5396	98.1148	94.1434	81.2386	75.2795	86.3844	87.4161	101.8750	111.2045	120.7609 (45)
Energy content (annual)										Total = Sum(45)m =		1202.7119 (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												

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Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Heat gains from water heating, kWh/month	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
	26.4978	23.1751	23.9147	20.8494	20.0055	17.2632	15.9969	18.3567	18.5759	21.6484	23.6310	25.6617 (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	88.9281	88.9281	88.9281	88.9281	88.9281	88.9281	88.9281	88.9281	88.9281	88.9281	88.9281	88.9281	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	13.8561	12.3069	10.0086	7.5772	5.6640	4.7818	5.1669	6.7162	9.0144	11.4459	13.3590	14.2412	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	155.0178	156.6264	152.5728	143.9431	133.0497	122.8114	115.9716	114.3630	118.4166	127.0463	137.9397	148.1780	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	31.8928	31.8928	31.8928	31.8928	31.8928	31.8928	31.8928	31.8928	31.8928	31.8928	31.8928	31.8928	(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)	-71.1424	-71.1424	-71.1424	-71.1424	-71.1424	-71.1424	-71.1424	-71.1424	-71.1424	-71.1424	-71.1424	-71.1424	(71)
Water heating gains (Table 5)	35.6153	34.4868	32.1434	28.9575	26.8891	23.9767	21.5012	24.6730	25.7999	29.0974	32.8208	34.4915	(72)
Total internal gains	254.1676	253.0985	244.4032	230.1562	215.2812	201.2483	192.3182	195.4305	202.9093	217.2680	233.7979	246.5892	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	6.3900	10.6334	0.6300	0.7000	0.7700	20.7656 (74)
East	4.0300	19.6403	0.6300	0.7000	0.7700	24.1893 (76)
South	0.7300	46.7521	0.6300	0.7000	0.7700	10.4303 (78)

Solar gains	55.3852	104.0857	167.1211	246.5618	310.8246	323.4491	305.6777	255.7066	194.4408	121.8120	68.1417	46.2161 (83)
Total gains	309.5529	357.1842	411.5243	476.7180	526.1058	524.6974	497.9958	451.1372	397.3502	339.0799	301.9397	292.8053 (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	50.5085	50.6188	50.7273	51.2435	51.3412	51.8012	51.8012	51.8873	51.6231	51.3412	51.1439	50.9392	
alpha	4.3672	4.3746	4.3818	4.4162	4.4227	4.4534	4.4534	4.4592	4.4415	4.4227	4.4096	4.3959	
util living area	0.9981	0.9961	0.9900	0.9669	0.8977	0.7539	0.5959	0.6664	0.8916	0.9830	0.9964	0.9985	(86)
MIT	19.4544	19.6122	19.9015	20.3028	20.6678	20.8987	20.9728	20.9560	20.7644	20.2955	19.8058	19.4282	(87)
Th 2	19.7826	19.7849	19.7872	19.7979	19.7999	19.8092	19.8092	19.8109	19.8056	19.7999	19.7958	19.7916	(88)
util rest of house	0.9974	0.9947	0.9861	0.9530	0.8534	0.6538	0.4501	0.5203	0.8257	0.9737	0.9949	0.9980	(89)
MIT 2	18.3877	18.5467	18.8359	19.2369	19.5748	19.7628	19.8025	19.7985	19.6709	19.2370	18.7488	18.3685	(90)
Living area fraction									fLA = Living area / (4) =			0.5453	(91)
MIT	18.9694	19.1277	19.4169	19.8181	20.1708	20.3822	20.4407	20.4297	20.2672	19.8142	19.3251	18.9463	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9694	19.1277	19.4169	19.8181	20.1708	20.3822	20.4407	20.4297	20.2672	19.8142	19.3251	18.9463	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9968	0.9937	0.9846	0.9533	0.8689	0.7054	0.5303	0.6005	0.8550	0.9738	0.9941	0.9975	(94)
Ext temp.	308.5705	354.9454	405.1816	454.4656	457.1506	370.1165	264.0874	270.9169	339.7427	330.1974	300.1588	292.0784	(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	1068.9560	1034.5150	937.1981	784.1922	607.2550	410.8319	272.8850	285.8409	439.7004	660.5479	879.7794	1065.4782	(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	565.7268	456.6707	395.8202	237.4032	111.6776	0.0000	0.0000	0.0000	0.0000	245.7807	417.3269	575.4095	(98)
Space heating												3005.8156	(98)
Space heating per m2												56.7135	(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	667.8846	525.7815	539.0959	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8241	0.8906	0.8541	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	550.3867	468.2530	460.4560	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	680.3104	647.8172	594.0535	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	93.5450	133.5958	99.3965	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												326.5374	(104)

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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	23.3863	33.3989	24.8491	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												81.6343 (107)
Space cooling per m2												1.5403 (108)
Energy for space heating												56.7135 (99)
Energy for space cooling												1.5403 (108)
Total												58.2538 (109)
Target Fabric Energy Efficiency (TFEE)												67.0 (109)

FULL SAP CALCULATION PRINTOUT

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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	53.0000 (1b)	x 2.4000 (2b)	= 127.2000 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	53.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 127.2000 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					2 * 10 = 20.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					Air changes per hour 20.0000 / (5) = 0.1572 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4072 (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) =		0.3461 (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	0.3808	0.3548	0.3548	0.3375	0.3375	0.2942	0.2942	0.2856	0.2942	0.3288	0.3202	0.3461 (22b)
Effective ac	0.5725	0.5629	0.5629	0.5570	0.5570	0.5433	0.5433	0.5408	0.5433	0.5541	0.5513	0.5599 (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
External Door			2.1000	1.4000	2.9400		(26a)
Windows (Uw = 1.40)			13.9700	1.3258	18.5208		(27)
Main Floor			53.0000	0.1400	7.4200	110.0000	5830.0000 (28a)
Main Wall	85.3000	16.0700	69.2300	0.2200	15.2306	60.0000	4153.8000 (29a)
wall to Stairs	0.8800		0.8800	0.1864	0.1640	60.0000	52.8000 (29a)
Flat roof	1.3500		1.3500	0.1400	0.1890	9.0000	12.1500 (30)
Total net area of external elements Aum(A, m ²)			140.5300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	44.4644		(33)
Party Wall 1			12.0600	0.0000	0.0000	180.0000	2170.8000 (32)
Party Ceilings 1			51.6300			40.0000	2065.2000 (32b)
Internal Wall 1			28.9000			100.0000	2890.0000 (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) = 17174.7500 (34)
324.0519 (35)
12.6481 (36)
(33) + (36) = 57.1125 (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	24.0308	23.6301	23.6301	23.3786	23.3786	22.8049	22.8049	22.6996	22.8049	23.2576	23.1397	23.5027 (38)
Heat transfer coeff	81.1434	80.7426	80.7426	80.4911	80.4911	79.9174	79.9174	79.8121	79.9174	80.3701	80.2522	80.6153 (39)
Average = Sum(39)m / 12 =												80.3677 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.5310	1.5234	1.5234	1.5187	1.5187	1.5079	1.5079	1.5059	1.5079	1.5164	1.5142	1.5210 (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												1.7786 (42)
Average daily hot water use (litres/day)												76.4408 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	84.0849	81.0273	77.9696	74.9120	71.8544	68.7967	68.7967	71.8544	74.9120	77.9696	81.0273	84.0849 (44)
Energy content (annual)	124.6955	109.0595	112.5396	98.1148	94.1434	81.2386	75.2795	86.3844	87.4161	101.8750	111.2045	120.7609 (45)
Distribution loss (46)m = 0.15 x (45)m												Total = Sum(45)m = 1202.7119 (45)
	18.7043	16.3589	16.8809	14.7172	14.1215	12.1858	11.2919	12.9577	13.1124	15.2813	16.6807	18.1141 (46)

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Water storage loss:											210.0000	(47)	
Store volume											1.8600	(48)	
a) If manufacturer declared loss factor is known (kWh/day):											0.5400	(49)	
Temperature factor from Table 2b											1.0044	(55)	
Enter (49) or (54) in (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	22.5120	23.2624	22.5120	23.2624	(59)	
Total heat required for water heating calculated for each month													
	179.0943	158.1939	166.9384	150.7588	148.5422	133.8826	129.6783	140.7832	140.0601	156.2738	163.8485	175.1597	(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													
	179.0943	158.1939	166.9384	150.7588	148.5422	133.8826	129.6783	140.7832	140.0601	156.2738	163.8485	175.1597	(64)
Total per year (kWh/year) = Sum(64)m =											1843.2139	(64)	
RHI water heating demand											1843	(64)	
Heat gains from water heating, kWh/month													
	84.9803	75.5698	80.9385	74.7384	74.8217	69.1270	68.5495	72.2418	71.1810	77.3925	79.0907	83.6720	(65)

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	106.7137	106.7137	106.7137	106.7137	106.7137	106.7137	106.7137	106.7137	106.7137	106.7137	106.7137	106.7137 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	34.5499	30.6869	24.9563	18.8935	14.1231	11.9233	12.8836	16.7466	22.4772	28.5400	33.3103	35.5101 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	231.3698	233.7707	227.7206	214.8404	198.5816	183.3006	173.0920	170.6911	176.7412	189.6214	205.8802	221.1612 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	47.4499	47.4499	47.4499	47.4499	47.4499	47.4499	47.4499	47.4499	47.4499	47.4499	47.4499	47.4499 (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)	-71.1424	-71.1424	-71.1424	-71.1424	-71.1424	-71.1424	-71.1424	-71.1424	-71.1424	-71.1424	-71.1424	-71.1424 (71)
Water heating gains (Table 5)	114.2208	112.4551	108.7883	103.8033	100.5668	96.0098	92.1364	97.0993	98.8626	104.0222	109.8482	112.4624 (72)
Total internal gains	463.1617	459.9338	444.4862	420.5584	396.2927	374.2549	361.1331	367.5580	381.1021	405.2046	432.0599	452.1549 (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					8.0000	12.7500	0.6300	0.7000	0.7700	31.1725 (74)		
East					5.0500	23.7835	0.6300	0.7000	0.7700	36.7061 (76)		
South					0.9200	54.0600	0.6300	0.7000	0.7700	15.1997 (78)		
Solar gains	83.0783	136.9796	219.4702	329.8523	405.3715	446.0698	417.4816	356.0399	272.6678	172.4118	100.8070	69.6478 (83)
Total gains	546.2400	596.9134	663.9564	750.4107	801.6643	820.3247	778.6147	723.5979	653.7699	577.6164	532.8669	521.8027 (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	58.7942	59.0861	59.0861	59.2707	59.2707	59.6961	59.6961	59.7749	59.6961	59.3599	59.4471	59.1794
alpha	4.9196	4.9391	4.9391	4.9514	4.9514	4.9797	4.9797	4.9850	4.9797	4.9573	4.9631	4.9453
util living area	0.9920	0.9863	0.9662	0.9010	0.7483	0.5157	0.3478	0.3947	0.7009	0.9272	0.9833	0.9934 (86)
Tweekday	18.6009	18.7540	19.0404	19.3563	19.5443	19.5988	19.6017	19.6031	19.5829	19.3647	18.9475	18.5835
Tweekend	20.4604	20.5272	20.6579	20.8104	20.9196	20.9591	20.9642	20.9637	20.9401	20.8088	20.6110	20.4500
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	20.1673	20.2687	20.4721	20.7040	20.8758	20.9372	20.9447	20.9439	20.9065	20.7048	20.3926	20.1512 (87)
Th 2	19.6643	19.6700	19.6700	19.6735	19.6735	19.6816	19.6816	19.6831	19.6816	19.6752	19.6769	19.6718 (88)
util rest of house	0.9885	0.9804	0.9511	0.8587	0.6593	0.3952	0.2136	0.2516	0.5775	0.8850	0.9746	0.9904 (89)
Tweekday	18.6009	18.7540	19.0404	19.3563	19.5443	19.5988	19.6017	19.6031	19.5829	19.3647	18.9475	18.5835
Tweekend	18.6009	18.7540	19.0404	19.3563	19.5443	19.5988	19.6017	19.6031	19.5829	19.3647	18.9475	18.5835
MIT 2	18.6009	18.7540	19.0404	19.3563	19.5443	19.5988	19.6017	19.6031	19.5829	19.3647	18.9475	18.5835 (90)
Living area fraction									FLA = Living area / (4) =			0.5453 (91)
MIT	19.4550	19.5799	19.8211	20.0912	20.2704	20.3286	20.3340	20.3342	20.3046	20.0955	19.7355	19.4383 (92)
Temperature adjustment												0.0000
adjusted MIT	19.4550	19.5799	19.8211	20.0912	20.2704	20.3286	20.3340	20.3342	20.3046	20.0955	19.7355	19.4383 (93)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9878	0.9798	0.9531	0.8737	0.7018	0.4554	0.2803	0.3229	0.6391	0.9006	0.9751	0.9898 (94)
Useful gains	539.5595	584.8850	632.8271	655.6266	562.6280	373.5615	218.2133	233.6153	417.8399	520.1955	519.5915	516.4660 (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												
	1181.0428	1136.8490	1010.9840	836.3996	609.3460	377.8989	218.4941	234.1880	439.9171	698.8563	957.8474	1172.0128 (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													
	477.2636	370.9198	281.3488	130.1566	34.7582	0.0000	0.0000	0.0000	0.0000	132.9236	315.5443	487.7268	(98)
Space heating												2230.6418	(98)
RHI space heating demand												2231	(98)

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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	53.0000 (1b)	x 2.4000 (2b)	= 127.2000 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	53.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 127.2000 (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) = 0.1572 (8)
Measured/design AP50					Yes
Infiltration rate					5.0000
Number of sides sheltered					0.4072 (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) =				0.3461 (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												
	0.4413	0.4327	0.4240	0.3808	0.3721	0.3288	0.3288	0.3202	0.3461	0.3721	0.3894	0.4067 (22b)
Effective ac	0.5974	0.5936	0.5899	0.5725	0.5692	0.5541	0.5541	0.5513	0.5599	0.5692	0.5758	0.5827 (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
External Door			2.1000	1.4000	2.9400		(26a)
Windows (Uw = 1.40)			13.9700	1.3258	18.5208		(27)
Main Floor			53.0000	0.1400	7.4200	110.0000	5830.0000 (28a)
Main Wall	85.3000	16.0700	69.2300	0.2200	15.2306	60.0000	4153.8000 (29a)
wall to Stairs	0.8800		0.8800	0.1864	0.1640	60.0000	52.8000 (29a)
Flat roof	1.3500		1.3500	0.1400	0.1890	9.0000	12.1500 (30)
Total net area of external elements Aum(A, m ²)			140.5300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	44.4644		(33)
Party Wall 1			12.0600	0.0000	0.0000	180.0000	2170.8000 (32)
Party Ceilings 1			51.6300			40.0000	2065.2000 (32b)
Internal Wall 1			28.9000			100.0000	2890.0000 (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) = 17174.7500 (34)
324.0519 (35)
12.6481 (36)
(33) + (36) = 57.1125 (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	25.0760	24.9173	24.7617	24.0308	23.8941	23.2576	23.2576	23.1397	23.5027	23.8941	24.1707	24.4599 (38)
Heat transfer coeff	82.1886	82.0298	81.8742	81.1434	81.0066	80.3701	80.3701	80.2522	80.6153	81.0066	81.2833	81.5725 (39)
Average = Sum(39)m / 12 =												81.1427 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.5507	1.5477	1.5448	1.5310	1.5284	1.5164	1.5164	1.5142	1.5210	1.5284	1.5336	1.5391 (40)
HLP (average)												1.5310 (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)
1.7786 (42)
76.4408 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	84.0849	81.0273	77.9696	74.9120	71.8544	68.7967	68.7967	71.8544	74.9120	77.9696	81.0273	84.0849 (44)
Energy conte	124.6955	109.0595	112.5396	98.1148	94.1434	81.2386	75.2795	86.3844	87.4161	101.8750	111.2045	120.7609 (45)
Energy content (annual)												Total = Sum(45)m = 1202.7119 (45)
Distribution loss (46)m = 0.15 x (45)m	18.7043	16.3589	16.8809	14.7172	14.1215	12.1858	11.2919	12.9577	13.1124	15.2813	16.6807	18.1141 (46)

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Space heating kWh	528.0963	413.7244	335.7037	173.1102	61.4710	0.0000	0.0000	0.0000	0.0000	180.1575	367.3831	541.8549 (98)
Space heating												2601.5010 (98)
Space heating per m2												(98) / (4) = 49.0849 (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 %)												276.5515 (206)
Efficiency of secondary/supplementary heating system, %												100.0000 (208)
Space heating requirement												940.6932 (211)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	528.0963	413.7244	335.7037	173.1102	61.4710	0.0000	0.0000	0.0000	0.0000	180.1575	367.3831	541.8549 (98)
Space heating efficiency (main heating system 1)	276.5515	276.5515	276.5515	276.5515	276.5515	0.0000	0.0000	0.0000	0.0000	276.5515	276.5515	276.5515 (210)
Space heating fuel (main heating system)	190.9577	149.6012	121.3892	62.5960	22.2277	0.0000	0.0000	0.0000	0.0000	65.1443	132.8444	195.9327 (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	179.0943	158.1939	166.9384	150.7588	148.5422	133.8826	129.6783	140.7832	140.0601	156.2738	163.8485	175.1597 (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	105.6978	93.3628	98.5236	88.9747	87.6666	79.0148	76.5335	83.0873	82.6606	92.2296	96.7000	103.3757 (219)
Water heating fuel used												1087.8269 (219)
Annual totals kWh/year												
Space heating fuel - main system												940.6932 (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)												244.0646 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
Total delivered energy for all uses												2272.5847 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	940.6932	13.1900	124.0774 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1087.8269	13.1900	143.4844 (247)
Pumps and fans for heating	0.0000	0.0000	0.0000 (249)
Energy for lighting	244.0646	13.1900	32.1921 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit	0.0000	13.1900	0.0000 (252)
Total energy cost			299.7539 (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] =	1.2847 (257)
SAP value		82.0790
SAP rating (Section 12)		82 (258)
SAP band		B

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	940.6932	0.5190	488.2198 (261)
Space heating - secondary	0.0000	0.5190	0.0000 (263)
Water heating (other fuel)	1087.8269	0.5190	564.5822 (264)
Space and water heating			1052.8019 (265)
Pumps and fans	0.0000	0.0000	0.0000 (267)
Energy for lighting	244.0646	0.5190	126.6695 (268)
Energy saving/generation technologies			
PV Unit	-300.0000	0.5190	-155.7000 (269)
Total kg/year			1023.7715 (272)
CO2 emissions per m2			19.3200 (273)
EI value			86.0015
EI rating			86 (274)
EI band			B

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CALCULATION OF ENERGY RATINGS 09 Jan 2014

Calculation of stars for heating and DHW

Main heating energy efficiency $13.19 \times (1 + 0.29 \times 0.25) / 2.7655 = 5.115$, stars = 4
Main heating environmental impact $0.519 \times (1 + 0.29 \times 0.25) / 2.7655 = 0.2013$, 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

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

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	53.0000 (1b)	x 2.4000 (2b)	= 127.2000 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	53.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 127.2000 (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) = 0.1572 (8)
Measured/design AP50					Yes
Infiltration rate					5.0000
Number of sides sheltered					0.4072 (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) =				0.3461 (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	0.3808	0.3548	0.3548	0.3375	0.3375	0.2942	0.2942	0.2856	0.2942	0.3288	0.3202	0.3461 (22b)
Effective ac	0.5725	0.5629	0.5629	0.5570	0.5570	0.5433	0.5433	0.5408	0.5433	0.5541	0.5513	0.5599 (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
External Door			2.1000	1.4000	2.9400		(26a)
Windows (Uw = 1.40)			13.9700	1.3258	18.5208		(27)
Main Floor			53.0000	0.1400	7.4200	110.0000	5830.0000 (28a)
Main Wall	85.3000	16.0700	69.2300	0.2200	15.2306	60.0000	4153.8000 (29a)
wall to Stairs	0.8800		0.8800	0.1864	0.1640	60.0000	52.8000 (29a)
Flat roof	1.3500		1.3500	0.1400	0.1890	9.0000	12.1500 (30)
Total net area of external elements Aum(A, m ²)			140.5300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	44.4644		(33)
Party Wall 1			12.0600	0.0000	0.0000	180.0000	2170.8000 (32)
Party Ceilings 1			51.6300			40.0000	2065.2000 (32b)
Internal Wall 1			28.9000			100.0000	2890.0000 (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) = 17174.7500 (34)
324.0519 (35)
12.6481 (36)
(33) + (36) = 57.1125 (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	24.0308	23.6301	23.6301	23.3786	23.3786	22.8049	22.8049	22.6996	22.8049	23.2576	23.1397	23.5027 (38)
Heat transfer coeff	81.1434	80.7426	80.7426	80.4911	80.4911	79.9174	79.9174	79.8121	79.9174	80.3701	80.2522	80.6153 (39)
Average = Sum(39)m / 12 =												80.3677 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.5310	1.5234	1.5234	1.5187	1.5187	1.5079	1.5079	1.5059	1.5079	1.5164	1.5142	1.5210 (40)
HLP (average)												1.5164 (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)
1.7786 (42)
76.4408 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	84.0849	81.0273	77.9696	74.9120	71.8544	68.7967	68.7967	71.8544	74.9120	77.9696	81.0273	84.0849 (44)
Energy conte	124.6955	109.0595	112.5396	98.1148	94.1434	81.2386	75.2795	86.3844	87.4161	101.8750	111.2045	120.7609 (45)
Energy content (annual)												Total = Sum(45)m = 1202.7119 (45)
Distribution loss (46)m = 0.15 x (45)m	18.7043	16.3589	16.8809	14.7172	14.1215	12.1858	11.2919	12.9577	13.1124	15.2813	16.6807	18.1141 (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	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month												
179.0943	158.1939	166.9384	150.7588	148.5422	133.8826	129.6783	140.7832	140.0601	156.2738	163.8485	175.1597	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
	Solar input (sum of months) = Sum(63)m =										0.0000	(63)
Output from w/h												
179.0943	158.1939	166.9384	150.7588	148.5422	133.8826	129.6783	140.7832	140.0601	156.2738	163.8485	175.1597	(64)
	Total per year (kWh/year) = Sum(64)m =										1843.2139	(64)
Heat gains from water heating, kWh/month												
84.9803	75.5698	80.9385	74.7384	74.8217	69.1270	68.5495	72.2418	71.1810	77.3925	79.0907	83.6720	(65)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9878	0.9798	0.9531	0.8737	0.7018	0.4554	0.2803	0.3229	0.6391	0.9006	0.9751	0.9898 (94)
Useful gains	539.5595	584.8850	632.8271	655.6266	562.6280	373.5615	218.2133	233.6153	417.8399	520.1955	519.5915	516.4660 (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	1181.0428	1136.8490	1010.9840	836.3996	609.3460	377.9898	218.4941	234.1880	439.9171	698.8563	957.8474	1172.0128 (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

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Space heating kWh	477.2636	370.9198	281.3488	130.1566	34.7582	0.0000	0.0000	0.0000	0.0000	132.9236	315.5443	487.7268 (98)
Space heating												2230.6418 (98)
Space heating per m2												(98) / (4) = 42.0876 (99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												274.5393 (206)
Efficiency of secondary/supplementary heating system, %												100.0000 (208)
Space heating requirement												812.5036 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	477.2636	370.9198	281.3488	130.1566	34.7582	0.0000	0.0000	0.0000	0.0000	132.9236	315.5443	487.7268 (98)
Space heating efficiency (main heating system 1)	274.5393	274.5393	274.5393	274.5393	274.5393	0.0000	0.0000	0.0000	0.0000	274.5393	274.5393	274.5393 (210)
Space heating fuel (main heating system)	173.8416	135.1063	102.4803	47.4091	12.6606	0.0000	0.0000	0.0000	0.0000	48.4170	114.9359	177.6528 (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	179.0943	158.1939	166.9384	150.7588	148.5422	133.8826	129.6783	140.7832	140.0601	156.2738	163.8485	175.1597 (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	105.6978	93.3628	98.5236	88.9747	87.6666	79.0148	76.5335	83.0873	82.6606	92.2296	96.7000	103.3757 (219)
Water heating fuel used												1087.8269 (219)
Annual totals kWh/year												
Space heating fuel - main system												812.5036 (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)												244.0646 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
Total delivered energy for all uses												2144.3951 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	812.5036	18.9000	153.5632 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1087.8269	18.9000	205.5993 (247)
Pumps and fans for heating	0.0000	0.0000	0.0000 (249)
Energy for lighting	244.0646	18.9000	46.1282 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit	0.0000	18.9000	0.0000 (252)
Total energy cost			405.2907 (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	812.5036	0.5190	421.6894 (261)
Space heating - secondary	0.0000	0.5190	0.0000 (263)
Water heating (other fuel)	1087.8269	0.5190	564.5822 (264)
Space and water heating			986.2715 (265)
Pumps and fans	0.0000	0.0000	0.0000 (267)
Energy for lighting	244.0646	0.5190	126.6695 (268)
Energy saving/generation technologies			
PV Unit	-300.0000	0.5190	-155.7000 (269)
Total kg/year			957.2411 (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	812.5036	3.0700	2494.3861 (261)
Space heating - secondary	0.0000	3.0700	0.0000 (263)
Water heating (other fuel)	1087.8269	3.0700	3339.6285 (264)
Space and water heating			5834.0146 (265)
Pumps and fans	0.0000	0.0000	0.0000 (267)
Energy for lighting	244.0646	3.0700	749.2784 (268)

FULL SAP CALCULATION PRINTOUT

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Energy saving/generation technologies			
PV Unit	-300.0000	3.0700	-921.0000 (269)
Primary energy kWh/year			5662.2930 (272)
Primary energy kWh/m ² /year			106.8357 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating:	B 82
Current environmental impact rating:	B 86

(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 82
Potential environmental impact rating:	B 86

Fuel prices for cost data on this page from database revision number 472 TEST (30 Jan 2021)
Recommendation texts revision number 4.9c (22 Feb 2014)

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

	Current £405	Potential £405	Saving £0
Electricity			
Space heating	£154	£154	£0
Water heating	£206	£206	£0
Lighting	£46	£46	£0
Total cost of fuels	£405	£405	£0
Total cost of uses	£406	£406	£0
Delivered energy	40 kWh/m ²	40 kWh/m ²	0 kWh/m ²
Carbon dioxide emissions	1.0 tonnes	1.0 tonnes	0.0 tonnes
CO2 emissions per m ²	18 kg/m ²	18 kg/m ²	0 kg/m ²
Primary energy	107 kWh/m ²	107 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)

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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	324.1 (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	251.86 (P1)
Transmission heat loss coefficient	57.11 (37)
Summer heat loss coefficient	308.97 (P2)

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

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

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	8.0000	81.1852	0.6300	0.7000	0.9000	232.0013
East	5.0500	117.5071	0.6300	0.7000	0.9000	211.9722
South	0.9200	112.2060	0.6300	0.7000	0.9000	36.8746
total:						480.8481

	Jun	Jul	Aug	
Solar gains	514	481	412	(P3)
Internal gains	374	361	368	
Total summer gains	888	842	779	(P5)

Summer gain/loss ratio	2.88	2.73	2.52	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 324.1)	0.00	0.00	0.00	
Threshold temperature	18.88	20.63	20.32	(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	015723	Issued on Date	01/03/2021
Assessment Reference	003	Prop Type Ref	
Property	Flat 2, 18, Parkside Road, READING, RG30 2DB		
SAP Rating	82 B	DER	21.18
Environmental	86 B	TER	34.27
CO ₂ Emissions (t/year)	0.96	% DER<TER	38.19
General Requirements Compliance	Fail	DFEE	67.01
		TFEE	66.99
		% DFEE<TFEE	-0.03
Assessor Details	Mr. Matthew Carter, Energy Calculations Limited, Tel: 01754 761035, mcart@energycalculations.co.uk		Assessor ID
			7869-0001
Client			

SUMMARY FOR INPUT DATA FOR New Build (As Designed)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Electricity		
Fuel factor	1.55 (electricity)		
Target Carbon Dioxide Emission Rate (TER)	34.27	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	21.18	kgCO ₂ /m ²	Pass
	-13.09 (-38.2%)	kgCO ₂ /m ²	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	66.99	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DFEE)	67.01	kWh/m ² /yr	
	0.0 (0.0%)	kWh/m ² /yr	Fail

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.22 (max. 0.30)	0.22 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.14 (max. 0.25)	0.14 (max. 0.70)	Pass
Roof	0.14 (max. 0.20)	0.14 (max. 0.35)	Pass
Openings	1.40 (max. 2.00)	1.40 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

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

Limiting System Efficiencies

4 Heating efficiency

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

BASIC COMPLIANCE REPORT

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

5 Cylinder insulation

Hot water storage

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

Pass

Primary pipework insulated

Yes

Pass

6 Controls

Space heating controls

Time and temperature zone control

Pass

Hot water controls

Cylinderstat

Pass

Independent timer for DHW

Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings

100 %

Minimum

75 %

Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Thames Valley)

Slight

Pass

Based on:

Overshading

Average

Windows facing North

8.00 m², No overhang

Windows facing East

5.05 m², No overhang

Windows facing South

0.92 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	015723	Issued on Date	01/03/2021
Assessment Reference	003	Prop Type Ref	
Property	Flat 2, 18, Parkside Road, READING, RG30 2DB		
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Environmental	86 B	TER	34.27
CO ₂ Emissions (t/year)	0.96	% DER<TER	38.19
General Requirements Compliance	Fail	DFEE	67.01
		TFEE	66.99
		% DFEE<TFEE	-0.03
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
		35.91 m		53.00 m²		2.40 m
7.0 Living Area	28.90		m²			
8.0 Thermal Mass Parameter	Precise calculation					
Thermal Mass	324.05		kJ/m²K			
9.0 External Walls						
Description	Type	Construction		U-Value (W/m²K)	Kappa (kJ/m²K)	Gross Area (m²)
						Nett Area (m²)
Main Wall	Cavity Wall	Cavity wall : plasterboard on dabs, AAC block, filled cavity, any outside structure		0.22	60.00	85.30
wall to Stairs	Cavity Wall	Cavity wall : plasterboard on dabs, AAC block, filled cavity, any outside structure		0.22	60.00	0.88
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	12.06
9.2 Internal Walls						
Description	Construction				Kappa (kJ/m²K)	Area (m²)
Internal Wall 1	Dense block, dense plaster				100.00	28.90
10.0 External Roofs						
Description	Type	Construction		U-Value (W/m²K)	Kappa (kJ/m²K)	Gross Area (m²)
						Nett Area (m²)
Flat roof	External Flat Roof	Plasterboard, insulated flat roof		0.14	9.00	1.35
10.1 Party Ceilings						

SUMMARY FOR INPUT DATA

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

Description	Construction	Kappa (kJ/m²K)	Area (m²)
Party Ceilings 1	Precast concrete planks floor, screed, carpeted	30.00	51.63

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Area (m²)
Main Floor	Ground Floor - Solid	Slab on ground, screed over insulation	0.14	110.00	53.00

12.0 Opening Types

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

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
Door	Half Glazed Door	[1] Main Wall	East							2.10	
Windows	Window	[1] Main Wall	South	None	0.00					0.92	
Windows	Window	[1] Main Wall	East	None	0.00					5.05	
Windows	Window	[1] Main Wall	North	None	0.00					8.00	

14.0 Conservatory

None

15.0 Draught Proofing

100

 %

16.0 Draught Lobby

No

17.0 Thermal Bridging

Calculate Bridges

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Table K1 - Approved	E2 Other lintels (including other steel lintels)	8.05	0.300	No
Table K1 - Approved	E3 Sill	7.05	0.040	No
Table K1 - Approved	E4 Jamb	39.88	0.050	No
Table K1 - Approved	E5 Ground floor (normal)	35.91	0.160	No
Table K1 - Approved	E7 Party floor between dwellings (in blocks of flats)	5.09	0.070	No
Table K1 - Default	E14 Flat roof	5.90	0.080	No
Table K1 - Approved	E16 Corner (normal)	4.74	0.090	No
Table K1 - Approved	E17 Corner (inverted – internal area greater than external area)	4.74	-0.090	No
Table K1 - Approved	E18 Party wall between dwellings	9.48	0.060	No
Table K1 - Default	P1 Party wall - Ground floor	5.09	0.160	No

Y-value

0.090

 W/m²K

18.0 Pressure Testing

Yes

Designed AP₅₀

5.00

 m³/(h.m²) @ 50 Pa

Property Tested ?

As Built AP₅₀

 m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather

Windows fully open

Cross ventilation possible

Yes

Night Ventilation

No

Air change rate

6.00

Mechanical Ventilation

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

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

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

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

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

Water use <= 125 litres/person/day	Yes	
SAP Code	901	
Immersion Only Heating Hot Water	Yes	
29.0 Hot Water Cylinder	Hot Water Cylinder	
Cylinder Stat	Yes	
Cylinder In Heated Space	Yes	
Independent Time Control	Yes	
Insulation Type	Measured Loss	
Cylinder Volume	210.00	L
Loss	1.86	kWh/day
Pipes insulation	Fully insulated primary pipework	
31.0 Thermal Store	None	
32.0 Photovoltaic Unit	More Dwellings, One Block	
Apportioned	300.00	kWh/Year

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

None

BLOCK COMPLIANCE

Energy Calculations Ltd
SAP • CODE • SBEM • DESIGN

Calculation Type: New Build (As Designed)

Block Reference	000516	Issued on Date	01/03/2021
Block Name	Parkside Road		
Assessor Details	Mr. Matthew Carter, Energy Calculations Limited, Tel: 01754 761035, mcarter@energycalculations.co.uk		Assessor ID 7869-0001
Client			

Block Compliance Report - DER

Block Reference: 000516		Block Name: Parkside Road			
Property-Assessment Reference	Multiplier	Floor Area (m ²)	DER (kgCO ₂ /m ²)	TER (kgCO ₂ /m ²)	% DER/TER
015722-003	1	73.4	16.43	27.83	40.96 %
015723-003	1	53	21.18	34.27	38.19 %
015724-003	1	50	19.12	28.78	33.57 %
015725-003	1	62.62	17.20	27.70	37.90 %
015726-003	1	45.84	19.12	29.28	34.69 %
015727-003	1	50.5	18.06	27.97	35.44 %
015728-003	1	44.2	21.03	31.09	32.37 %
015729-003	1	78.1	14.72	23.84	38.25 %
015730-003	1	63.8	17.28	28.45	39.26 %
015731-003	1	60.7	17.13	27.10	36.79 %
015732-003	1	43.25	21.26	29.47	27.86 %
015733-003	1	78.25	15.78	27.04	41.63 %
Totals:	12	703.66	218.31	342.81	
Average DER = 17.80 kgCO ₂ /m ²		% DER/TER	PASS		
Average TER = 28.24 kgCO ₂ /m ²		36.97 %			

Block Compliance Report - DFEE

Block Reference: 000516		Block Name: Parkside Road			
Property-Assessment Reference	Multiplier	Floor Area (m ²)	DFEE (kWh/m ² /yr)	TFEE (kWh/m ² /yr)	% DFEE/TFEE
015722-003	1	73.4	51.81	54.01	4.08 %
015723-003	1	53	67.01	66.99	-0.03 %
015724-003	1	50	45.25	46.33	2.34 %
015725-003	1	62.62	49.26	49.72	0.92 %
015726-003	1	45.84	46.34	45.82	-1.15 %
015727-003	1	50.5	45.03	44.75	-0.61 %
015728-003	1	44.2	47.58	50.81	6.35 %
015729-003	1	78.1	41.12	42.82	3.99 %
015730-003	1	63.8	50.50	52.76	4.28 %
015731-003	1	60.7	45.65	47.49	3.89 %
015732-003	1	43.25	42.47	43.04	1.31 %
015733-003	1	78.25	50.76	53.42	4.97 %
Totals:	12	703.66	582.78	597.97	
Average DFEE = 48.63 kWh/m ² /yr		% DFEE/TFEE	PASS		
Average TFEE = 50.00 kWh/m ² /yr		2.74 %			