

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: 16/08/2021

EXCELLENCE
IN ENERGY
ASSESSMENT

PREDICTED ENERGY ASSESSMENT

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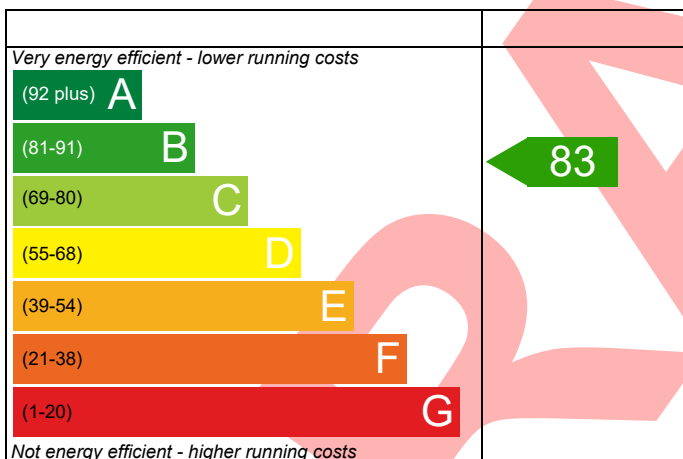
Flat 2, 18, Parkside Road,
READING,
RG30 2DB

Dwelling type: Flat, Mid-Terrace
Date of assessment: 16/08/2021
Produced by: Energy Calculations Limited
Total floor area: 50 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

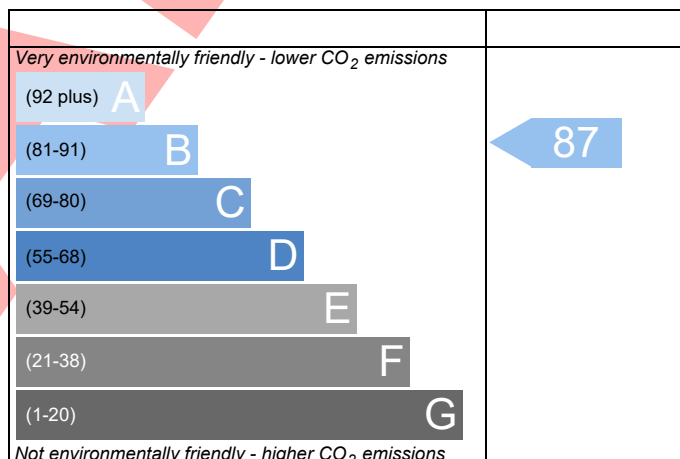


England

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	16/08/2021
Assessment Reference	004	Prop Type Ref	
Property	Flat 2, 18, Parkside Road, READING, RG30 2DB		
SAP Rating	83 B	DER	21.33
Environmental	87 B	TER	31.34
CO ₂ Emissions (t/year)	0.87	% DER<TER	31.93
General Requirements Compliance	Pass	DFEE	54.32
		TFEE	54.44
		% DFEE<TFEE	0.22
Assessor Details	Mr. Matthew Carter, Energy Calculations Limited, Tel: 01754 761035, mcarter@energycalculations.co.uk		Assessor ID
			7869-0001
Client			

	Junction detail	Source Type	Psi (W/mK)	Length (m)	Result	Reference
External wall	E2 Other lintels (including other steel lintels)	Table K1 - Approved	0.300	4.56	1.37	
External wall	E3 Sill	Table K1 - Approved	0.040	1.60	0.06	
External wall	E4 Jamb	Table K1 - Approved	0.050	13.00	0.65	
External wall	E5 Ground floor (normal)	Table K1 - Approved	0.160	22.39	3.58	
External wall	E7 Party floor between dwellings (in blocks of flats)	Table K1 - Approved	0.070	22.39	1.57	
External wall	E14 Flat roof	Table K1 - Default	0.080	5.90	0.47	
External wall	E16 Corner (normal)	Table K1 - Approved	0.090	4.71	0.42	
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	13.61	2.18	

Total: **10.45** W/mK:
Y-Value: **0.097** W/m²K:

FULL SAP CALCULATION PRINTOUT

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Property Reference	015723			Issued on Date	16/08/2021
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Environmental	87 B	% DER<TER	31.93		
CO ₂ Emissions (t/year)	0.87	DFEE	54.32	TFEE	54.44
General Requirements Compliance	Pass	% DFEE<TFEE	0.22		
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 50 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) 31.34 kgCO₂/m²

Dwelling Carbon Dioxide Emission Rate (DER) 21.33 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)54.4 kWh/m²/yr

Dwelling Fabric Energy Efficiency (DFEE)54.3 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.22 (max. 0.30)	0.22 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	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):	Not significant	OK
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Based on:

Overshading:	Average
Windows facing North:	0.92 m ² , No overhang
Windows facing East:	5.12 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	50.0000 (1b)	x 2.4000 (2b)	= 120.0000 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 120.0000 (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) =					Air changes per hour
Pressure test					20.0000 / (5) = 0.1667 (8)
Measured/design AP50					Yes
Infiltration rate					5.0000
Number of sides sheltered					0.4167 (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) =	0.3542 (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												
	0.4516	0.4427	0.4339	0.3896	0.3807	0.3365	0.3365	0.3276	0.3542	0.3807	0.3984	0.4161 (22b)
Effective ac	0.6020	0.5980	0.5941	0.5759	0.5725	0.5566	0.5566	0.5537	0.5627	0.5725	0.5794	0.5866 (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)			6.0400	1.3258	8.0076		(27)
Main Floor			50.0000	0.1400	7.0000	110.0000	5500.0000 (28a)
Main Wall	47.2300	8.1400	39.0900	0.2200	8.5998	60.0000	2345.4000 (29a)
wall to Stairs	6.5100		6.5100	0.1864	1.2133	60.0000	390.6000 (29a)
Flat roof	4.1000		4.1000	0.1400	0.5740	9.0000	36.9000 (30)
Total net area of external elements Aum(A, m ²)			107.8400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	28.3347		(33)
Party Wall 1			32.2500	0.0000	0.0000	180.0000	5805.0000 (32)
Party Ceilings 1			45.9000			40.0000	1836.0000 (32b)
Internal Wall 1			46.7400			100.0000	4674.0000 (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) = 20587.9000 (34)
411.7580 (35)
10.4474 (36)
(33) + (36) = 38.7821 (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	23.8374	23.6806	23.5269	22.8051	22.6701	22.0414	22.0414	21.9250	22.2836	22.6701	22.9433	23.2289 (38)
Heat transfer coeff	62.6195	62.4627	62.3090	61.5872	61.4522	60.8235	60.8235	60.7071	61.0657	61.4522	61.7254	62.0110 (39)
Average = Sum(39)m / 12 =												61.5866 (39)
HLP	1.2524	1.2493	1.2462	1.2317	1.2290	1.2165	1.2165	1.2141	1.2213	1.2290	1.2345	1.2402 (40)
HLP (average)												1.2317 (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)
1.6901 (42)
74.3399 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	81.7739	78.8003	75.8267	72.8531	69.8795	66.9059	66.9059	69.8795	72.8531	75.8267	78.8003	81.7739 (44)
Energy conte	121.2683	106.0620	109.4465	95.4181	91.5560	79.0058	73.2105	84.0101	85.0135	99.0750	108.1481	117.4419 (45)
Energy content (annual)												
Distribution loss (46)m = 0.15 x (45)m	18.1902	15.9093	16.4170	14.3127	13.7334	11.8509	10.9816	12.6015	12.7520	14.8613	16.2222	17.6163 (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														
	175.6671	155.1964	163.8453	148.0621	145.9548	131.6498	127.6093	138.4089	137.6575	153.4738	160.7921	171.8407	(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														
	175.6671	155.1964	163.8453	148.0621	145.9548	131.6498	127.6093	138.4089	137.6575	153.4738	160.7921	171.8407	(64)	
								Total per year (kWh/year) = Sum (64)m =						1810.1580 (64)
Heat gains from water heating, kWh/month														
	83.8408	74.5731	79.9100	73.8417	73.9614	68.3846	67.8615	71.4524	70.3822	76.4615	78.0745	82.5685	(65)	

[illegible]

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	447.6737	360.7804	307.0851	172.6838	65.2807	0.0000	0.0000	0.0000	0.0000	167.4299	317.4084	455.2028 (98)
Space heating per m2												2293.5449 (98)
										(98) / (4) =		45.8709 (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 %)												222.7832 (206)
Efficiency of secondary/supplementary heating system, %												100.0000 (208)
Space heating requirement												1029.4964 (211)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	447.6737	360.7804	307.0851	172.6838	65.2807	0.0000	0.0000	0.0000	0.0000	167.4299	317.4084	455.2028 (98)
Space heating efficiency (main heating system 1)	222.7832	222.7832	222.7832	222.7832	222.7832	0.0000	0.0000	0.0000	0.0000	222.7832	222.7832	222.7832 (210)
Space heating fuel (main heating system)	200.9459	161.9424	137.8403	77.5121	29.3024	0.0000	0.0000	0.0000	0.0000	75.1537	142.4742	204.3255 (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	175.6671	155.1964	163.8453	148.0621	145.9548	131.6498	127.6093	138.4089	137.6575	153.4738	160.7921	171.8407 (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	103.6751	91.5937	96.6981	87.3832	86.1395	77.6970	75.3124	81.6861	81.2426	90.5771	94.8962	101.4168 (219)
Water heating fuel used												1068.3180 (219)
Annual totals kWh/year												
Space heating fuel - main system												1029.4964 (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)												256.9219 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
Total delivered energy for all uses												2354.7364 (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	1029.4964	0.5190	534.3087 (261)
Space heating - secondary	0.0000	0.5190	0.0000 (263)
Water heating (other fuel)	1068.3180	0.5190	554.4570 (264)
Space and water heating			1088.7657 (265)
Pumps and fans	0.0000	0.0000	0.0000 (267)
Energy for lighting	256.9219	0.5190	133.3425 (268)
Energy saving/generation technologies			
PV Unit	-300.0000	0.5190	-155.7000 (269)
Total CO2, kg/year			1066.4082 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			21.3300 (273)

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

DER		21.3300 ZC1
Total Floor Area	TFA	50.0000
Assumed number of occupants	N	1.6901
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190
CO2 emissions from appliances, equation (L14)		17.4495 ZC2
CO2 emissions from cooking, equation (L16)		3.1912 ZC3
Total CO2 emissions		41.9708 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		41.9708 ZC8

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	50.0000 (1b)	x 2.4000 (2b)	= 120.0000 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 120.0000 (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) = 0.1667 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4167 (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) =				0.3542 (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	0.4516	0.4427	0.4339	0.3896	0.3807	0.3365	0.3365	0.3276	0.3542	0.3807	0.3984	0.4161 (22b)
Effective ac	0.6020	0.5980	0.5941	0.5759	0.5725	0.5566	0.5566	0.5537	0.5627	0.5725	0.5794	0.5866 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Semi-glazed door			2.1000	1.2000	2.5200		(26a)
TER Opening Type (Uw = 1.40)			6.0400	1.3258	8.0076		(27)
Main Floor			50.0000	0.1300	6.5000		(28a)
Main Wall	47.2300	8.1400	39.0900	0.1800	7.0362		(29a)
wall to Stairs	6.5100		6.5100	0.1800	1.1718		(29a)
Flat roof	4.1000		4.1000	0.1300	0.5330		(30)
Total net area of external elements Aum(A, m ²)			107.8400				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		25.7686		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.2346 (36)
Total fabric heat loss						(33) + (36) =	34.0032 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	23.8374	23.6806	23.5269	22.8051	22.6701	22.0414	22.0414	21.9250	22.2836	22.6701	22.9433	23.2289 (38)
Heat transfer coeff	57.8406	57.6838	57.5301	56.8083	56.6733	56.0446	56.0446	55.9282	56.2868	56.6733	56.9465	57.2321 (39)
Average = Sum(39)m / 12 =												56.8077 (39)
HLP	1.1568	1.1537	1.1506	1.1362	1.1335	1.1209	1.1209	1.1186	1.1257	1.1335	1.1389	1.1446 (40)
HLP (average)												1.1362 (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												1.6901 (42)
Average daily hot water use (litres/day)												74.3399 (43)
Daily hot water use	81.7739	78.8003	75.8267	72.8531	69.8795	66.9059	66.9059	69.8795	72.8531	75.8267	78.8003	81.7739 (44)
Energy conte	121.2683	106.0620	109.4465	95.4181	91.5560	79.0058	73.2105	84.0101	85.0135	99.0750	108.1481	117.4419 (45)
Energy content (annual)												Total = Sum(45)m = 1169.6560 (45)
Distribution loss (46)m = 0.15 x (45)m												
18.1902	15.9093	16.4170	14.3127	13.7334	11.8509	10.9816	12.6015	12.7520	14.8613	16.2222	17.6163 (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	173.0149	152.8009	161.1931	145.4955	143.3026	129.0832	124.9571	135.7567	135.0908	150.8216	158.2255	169.1885	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Output from w/h	173.0149	152.8009	161.1931	145.4955	143.3026	129.0832	124.9571	135.7567	135.0908	150.8216	158.2255	169.1885	(64)
Heat gains from water heating, kWh/month	81.7190	72.6567	77.7882	71.7884	71.8396	66.3313	65.7398	69.3306	68.3289	74.3397	76.0211	80.4467	(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	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	14.5480	12.9214	10.5084	7.9555	5.9468	5.0206	5.4249	7.0515	9.4645	12.0174	14.0260	14.9523	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	147.2339	148.7618	144.9117	136.7153	126.3689	116.6447	110.1484	108.6205	112.4706	120.6670	131.0134	140.7376	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	(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)	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	(71)
Water heating gains (Table 5)	109.8373	108.1201	104.5541	99.7061	96.5586	92.1268	88.3599	93.1864	94.9012	99.9190	105.5849	108.1273	(72)
Total internal gains	322.9708	321.1548	311.3257	295.7285	280.2259	265.1436	255.2847	260.2099	268.1878	283.9548	301.9759	315.1687	(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				0.9200	10.6334	0.6300	0.7000			0.7700	2.9897	
East				5.1200	19.6403	0.6300	0.7000			0.7700	30.7319 (76)	
Solar gains	33.7216	65.8316	108.7146	159.9888	197.9679	203.6396	193.4591	164.8009	126.8209	78.1364	42.0073	27.7648 (83)
Total gains	356.6924	386.9864	420.0402	455.7173	478.1938	468.7832	448.7438	425.0108	395.0088	362.0912	343.9831	342.9335 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	60.0309	60.1941	60.3549	61.1217	61.2674	61.9546	61.9546	62.0836	61.6881	61.2674	60.9734	60.6692	
alpha	5.0021	5.0129	5.0237	5.0748	5.0845	5.1303	5.1303	5.1389	5.1125	5.0845	5.0649	5.0446	
util living area	0.9957	0.9927	0.9839	0.9544	0.8735	0.7087	0.5378	0.5863	0.8292	0.9659	0.9916	0.9964	(86)
MIT	19.8542	19.9779	20.2095	20.5246	20.7939	20.9500	20.9900	20.9848	20.8853	20.5485	20.1522	19.8347	(87)
Th 2	19.9547	19.9572	19.9597	19.9714	19.9736	19.9838	19.9838	19.9857	19.9799	19.9736	19.9692	19.9645	(88)
util rest of house	0.9942	0.9903	0.9783	0.9375	0.8273	0.6180	0.4197	0.4665	0.7546	0.9498	0.9884	0.9953	(89)
MIT 2	18.4412	18.6230	18.9600	19.4150	19.7714	19.9506	19.9801	19.9795	19.8891	19.4567	18.8862	18.4199	(90)
Living area fraction	19.0863	19.2416	19.5305	19.9217	20.2383	20.4069	20.4413	20.4385	20.3439	19.9552	19.4642	19.0659	(92)
Temperature adjustment	19.0863	19.2416	19.5305	19.9217	20.2383	20.4069	20.4413	20.4385	20.3439	19.9552	19.4642	19.0659	(93)
adjusted MIT	19.0863	19.2416	19.5305	19.9217	20.2383	20.4069	20.4413	20.4385	20.3439	19.9552	19.4642	19.0659	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9926	0.9881	0.9753	0.9365	0.8406	0.6577	0.4739	0.5216	0.7840	0.9494	0.9862	0.9939	(94)
Ext temp.	354.0596	382.3704	409.6623	426.7768	401.9498	308.3155	212.6661	221.6696	309.6684	343.7762	339.2479	340.8335	(95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Month fracti	855.2509	827.2781	749.6483	626.1227	483.8938	325.4464	215.2815	225.8651	351.4499	530.1892	704.0999	850.8063	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating per m ²	372.8863	298.9780	252.9496	143.5291	60.9663	0.0000	0.0000	0.0000	0.0000	138.6912	262.6935	379.4198	(98)
												1910.1138	(98)
												38.2023	(99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													2042.9025 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	372.8863	298.9780	252.9496	143.5291	60.9663	0.0000	0.0000	0.0000	0.0000	138.6912	262.6935	379.4198	(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)	398.8089	319.7626	270.5343	153.5071	65.2046	0.0000	0.0000	0.0000	0.0000	148.3329	280.9556	405.7965	(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	173.0149	152.8009	161.1931	145.4955	143.3026	129.0832	124.9571	135.7567	135.0908	150.8216	158.2255	169.1885	(64)
Efficiency of water heater (217)m	86.8109	86.5738	86.0112	84.7776	82.7190	79.8000	79.8000	79.8000	79.8000	84.5912	86.1574	86.9063	(216)
Fuel for water heating, kWh/month	199.3010	176.4978	187.4095	171.6202	173.2403	161.7584	156.5879	170.1212	169.2868	178.2948	183.6470	194.6792	(219)
Water heating fuel used												2122.4439	(219)
Annual totals kWh/year													
Space heating fuel - main system												2042.9025	(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)												256.9219	(232)
Total delivered energy for all uses												4497.2682	(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	2042.9025	0.2160	441.2669 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2122.4439	0.2160	458.4479 (264)
Space and water heating			899.7148 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	256.9219	0.5190	133.3425 (268)
Total CO2, kg/m2/year			1071.9823 (272)
Emissions per m2 for space and water heating			17.9943 (272a)
Fuel factor (electricity)			1.5500
Emissions per m2 for lighting			2.6668 (272b)
Emissions per m2 for pumps and fans			0.7785 (272c)
Target Carbon Dioxide Emission Rate (TER) = (17.9943 * 1.55) + 2.6668 + 0.7785, rounded to 2 d.p.			31.3400 (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	50.0000 (1b)	x 2.4000 (2b)	= 120.0000 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 120.0000 (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) = 0.1667 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4167 (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) =				0.3542 (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	0.4516	0.4427	0.4339	0.3896	0.3807	0.3365	0.3365	0.3276	0.3542	0.3807	0.3984	0.4161 (22b)
Effective ac	0.6020	0.5980	0.5941	0.5759	0.5725	0.5566	0.5566	0.5537	0.5627	0.5725	0.5794	0.5866 (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)			6.0400	1.3258	8.0076		(27)
Main Floor			50.0000	0.1400	7.0000	110.0000	5500.0000 (28a)
Main Wall	47.2300	8.1400	39.0900	0.2200	8.5998	60.0000	2345.4000 (29a)
wall to Stairs	6.5100		6.5100	0.1864	1.2133	60.0000	390.6000 (29a)
Flat roof	4.1000		4.1000	0.1400	0.5740	9.0000	36.9000 (30)
Total net area of external elements Aum(A, m ²)			107.8400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	28.3347		(33)
Party Wall 1			32.2500	0.0000	0.0000	180.0000	5805.0000 (32)
Party Ceilings 1			45.9000			30.0000	1377.0000 (32b)
Internal Wall 1			46.7400			100.0000	4674.0000 (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) = 20128.9000 (34)
402.5780 (35)
10.4474 (36)
(33) + (36) = 38.7821 (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	23.8374	23.6806	23.5269	22.8051	22.6701	22.0414	22.0414	21.9250	22.2836	22.6701	22.9433	23.2289 (38)
Heat transfer coeff	62.6195	62.4627	62.3090	61.5872	61.4522	60.8235	60.8235	60.7071	61.0657	61.4522	61.7254	62.0110 (39)
Average = Sum(39)m / 12 =												61.5866 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.2524	1.2493	1.2462	1.2317	1.2290	1.2165	1.2165	1.2141	1.2213	1.2290	1.2345	1.2402 (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												1.6901 (42)
Average daily hot water use (litres/day)												74.3399 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	81.7739	78.8003	75.8267	72.8531	69.8795	66.9059	66.9059	69.8795	72.8531	75.8267	78.8003	81.7739 (44)
Energy content (annual)	121.2683	106.0620	109.4465	95.4181	91.5560	79.0058	73.2105	84.0101	85.0135	99.0750	108.1481	117.4419 (45)
Distribution loss (46)m = 0.15 x (45)m												Total = Sum(45)m = 1169.6560 (45)
	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	25.7695	22.5382	23.2574	20.2764	19.4556	16.7887	15.5572	17.8522	18.0654	21.0534	22.9815	24.9564	(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	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	14.5480	12.9214	10.5084	7.9555	5.9468	5.0206	5.4249	7.0515	9.4645	12.0174	14.0260	14.9523	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	147.2339	148.7618	144.9117	136.7153	126.3689	116.6447	110.1484	108.6205	112.4706	120.6670	131.0134	140.7376	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	(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)	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	(71)
Water heating gains (Table 5)	34.6364	33.5390	31.2599	28.1616	26.1501	23.3177	20.9103	23.9948	25.0908	28.2976	31.9187	33.5435	(72)
Total internal gains	244.7699	243.5736	235.0315	221.1840	206.8173	193.3345	184.8351	188.0184	195.3774	209.3335	225.3097	237.5850	(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				0.9200	10.6334	0.6300		0.7000	0.7700		2.9897	
East				5.1200	19.6403	0.6300		0.7000	0.7700		30.7319	
Solar gains	33.7216	65.8316	108.7146	159.9888	197.9679	203.6396	193.4591	164.8009	126.8209	78.1364	42.0073	27.7648 (83)
Total gains	278.4915	309.4052	343.7461	381.1728	404.7852	396.9741	378.2942	352.8193	322.1984	287.4699	267.3169	265.3498 (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	89.2911	89.5152	89.7360	90.7877	90.9872	91.9276	91.9276	92.1039	91.5631	90.9872	90.5845	90.1672		
alpha	6.9527	6.9677	6.9824	7.0525	7.0658	7.1285	7.1285	7.1403	7.1042	7.0658	7.0390	7.0111		
util living area	0.9999	0.9998	0.9993	0.9957	0.9728	0.8682	0.6888	0.7550	0.9605	0.9981	0.9998	0.9999	0.9999	(86)
MIT	20.0399	20.1284	20.2988	20.5413	20.7770	20.9439	20.9911	20.9838	20.8595	20.5581	20.2592	20.0270	20.0270	(87)
Th 2	19.8783	19.8808	19.8832	19.8947	19.8968	19.9068	19.9068	19.9087	19.9030	19.8968	19.8925	19.8880	19.8880	(88)
util rest of house	0.9999	0.9997	0.9988	0.9923	0.9494	0.7704	0.5289	0.5971	0.9141	0.9961	0.9997	0.9999	0.9999	(89)
MIT 2	19.0061	19.0967	19.2689	19.5198	19.7470	19.8855	19.9055	19.9058	19.8278	19.5393	19.2374	19.0014	19.0014	(90)
Living area fraction									fLA = Living area / (4) =			0.4566	0.4566	(91)
MIT	19.4782	19.5678	19.7392	19.9862	20.2173	20.3688	20.4012	20.3980	20.2989	20.0044	19.7040	19.4697	19.4697	(92)
Temperature adjustment												0.0000	0.0000	
adjusted MIT	19.4782	19.5678	19.7392	19.9862	20.2173	20.3688	20.4012	20.3980	20.2989	20.0044	19.7040	19.4697	19.4697	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9999	0.9997	0.9987	0.9927	0.9578	0.8167	0.6039	0.6723	0.9350	0.9964	0.9996	0.9999	(94)
Useful gains	278.4528	309.2989	343.3015	378.3872	387.7127	324.1921	228.4650	237.2056	301.2648	286.4265	267.2218	265.3242	(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	950.4483	916.1878	824.9194	682.7676	523.4068	350.8787	231.2030	242.7068	378.5391	577.9236	777.9858	946.8883	(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	499.9647	407.8293	358.3238	219.1539	100.9564	0.0000	0.0000	0.0000	0.0000	216.8739	367.7501	507.0837	(98)
Space heating												2677.9357	(98)
Space heating per m2												53.5587	(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	571.7412	450.0942	461.3741	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8400	0.9216	0.8913	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	480.2542	414.8260	411.2023	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	528.6188	505.6269	477.0009	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)

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Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	34.8225	67.5558	48.9542	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												151.3326 (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	8.7056	16.8890	12.2386	0.0000	0.0000	0.0000	0.0000 (107)	
Space cooling												37.8331 (107)
Space cooling per m2												0.7567 (108)
Energy for space heating												53.5587 (99)
Energy for space cooling												0.7567 (108)
Total												54.3154 (109)
Dwelling Fabric Energy Efficiency (DFEE)												54.3 (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	50.0000 (1b)	x 2.4000 (2b)	= 120.0000 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 120.0000 (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) = 0.1667 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4167 (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) =				0.3542 (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	0.4516	0.4427	0.4339	0.3896	0.3807	0.3365	0.3365	0.3276	0.3542	0.3807	0.3984	0.4161 (22b)
Effective ac	0.6020	0.5980	0.5941	0.5759	0.5725	0.5566	0.5566	0.5537	0.5627	0.5725	0.5794	0.5866 (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)			6.0400	1.3258	8.0076			(27)					
Main Floor			50.0000	0.1300	6.5000			(28a)					
Main Wall	47.2300	8.1400	39.0900	0.1800	7.0362			(29a)					
wall to Stairs	6.5100		6.5100	0.1800	1.1718			(29a)					
Flat roof	4.1000		4.1000	0.1300	0.5330			(30)					
Total net area of external elements Aum(A, m2)			107.8400					(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		25.7686			(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.2346	(36)					
Total fabric heat loss						(33) + (36) =	34.0032	(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	23.8374	23.6806	23.5269	22.8051	22.6701	22.0414	22.0414	21.9250	22.2836	22.6701	22.9433	23.2289	(38)
Heat transfer coeff	57.8406	57.6838	57.5301	56.8083	56.6733	56.0446	56.0446	55.9282	56.2868	56.6733	56.9465	57.2321	(39)
Average = Sum(39)m / 12 =												56.8077	(39)
HLP	1.1568	1.1537	1.1506	1.1362	1.1335	1.1209	1.1209	1.1186	1.1257	1.1335	1.1389	1.1446	(40)
HLP (average)												1.1362	(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												1.6901 (42)
Average daily hot water use (litres/day)												74.3399 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	81.7739	78.8003	75.8267	72.8531	69.8795	66.9059	66.9059	69.8795	72.8531	75.8267	78.8003	81.7739 (44)
Energy conte	121.2683	106.0620	109.4465	95.4181	91.5560	79.0058	73.2105	84.0101	85.0135	99.0750	108.1481	117.4419 (45)
Energy content (annual)											Total = Sum(45)m =	1169.6560 (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)
	25.7695	22.5382	23.2574	20.2764	19.4556	16.7887	15.5572	17.8522	18.0654	21.0534	22.9815	24.9564 (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	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	14.5480	12.9214	10.5084	7.9555	5.9468	5.0206	5.4249	7.0515	9.4645	12.0174	14.0260	14.9523	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	147.2339	148.7618	144.9117	136.7153	126.3689	116.6447	110.1484	108.6205	112.4706	120.6670	131.0134	140.7376	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	(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)	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	(71)
Water heating gains (Table 5)	34.6364	33.5390	31.2599	28.1616	26.1501	23.3177	20.9103	23.9948	25.0908	28.2976	31.9187	33.5435	(72)
Total internal gains	244.7699	243.5736	235.0315	221.1840	206.8173	193.3345	184.8351	188.0184	195.3774	209.3335	225.3097	237.5850	(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				0.9200	10.6334	0.6300	0.7000	0.7700	2.9897			
East				5.1200	19.6403	0.6300	0.7000	0.7700	30.7319 (76)			
Solar gains	33.7216	65.8316	108.7146	159.9888	197.9679	203.6396	193.4591	164.8009	126.8209	78.1364	42.0073	27.7648 (83)
Total gains	278.4915	309.4052	343.7461	381.1728	404.7852	396.9741	378.2942	352.8193	322.1984	287.4699	267.3169	265.3498 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	60.0309	60.1941	60.3549	61.1217	61.2674	61.9546	61.9546	62.0836	61.6881	61.2674	60.9734	60.6692	
alpha	5.0021	5.0129	5.0237	5.0748	5.0845	5.1303	5.1303	5.1389	5.1125	5.0845	5.0649	5.0446	
util living area	0.9986	0.9973	0.9931	0.9770	0.9242	0.7917	0.6246	0.6837	0.9037	0.9865	0.9973	0.9989	(86)
MIT	19.7096	19.8360	20.0745	20.4069	20.7118	20.9161	20.9805	20.9697	20.8166	20.4239	20.0120	19.6906	(87)
Th 2	19.9547	19.9572	19.9597	19.9714	19.9736	19.9838	19.9838	19.9857	19.9799	19.9736	19.9692	19.9645	(88)
util rest of house	0.9981	0.9963	0.9905	0.9674	0.8905	0.7052	0.4940	0.5545	0.8474	0.9793	0.9961	0.9985	(89)
MIT 2	18.7775	18.9056	19.1449	19.4814	19.7693	19.9427	19.9786	19.9764	19.8706	19.5031	19.0910	18.7664	(90)
Living area fraction													(91)
MIT	19.2031	19.3304	19.5693	19.9040	20.1996	20.3872	20.4361	20.4299	20.3025	19.9235	19.5115	19.1884	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.2031	19.3304	19.5693	19.9040	20.1996	20.3872	20.4361	20.4299	20.3025	19.9235	19.5115	19.1884	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9976	0.9956	0.9893	0.9666	0.8990	0.7424	0.5544	0.6142	0.8680	0.9788	0.9955	0.9981	(94)
Ext temp.	277.8287	308.0399	340.0546	368.4598	363.9175	294.7113	209.7141	216.6948	279.6795	281.3860	266.1060	264.8568	(95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Month fracti	862.0038	832.3987	751.8805	625.1189	481.7028	324.3399	214.9909	225.3878	349.1207	528.3955	706.7928	857.8152	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating	434.6262	352.3692	306.3985	184.7945	87.6323	0.0000	0.0000	0.0000	0.0000	183.7750	317.2945	441.1611	(98)
Space heating per m2												2308.0513	(98)
												46.1610	(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	526.8194	414.7302	425.0543	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8383	0.9075	0.8813	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	441.6324	376.3736	374.5997	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	528.6188	505.6269	477.0009	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	62.6302	96.1644	76.1865	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												234.9811	(104)
Cooled fraction												1.0000	(105)

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Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	15.6575	24.0411	19.0466	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling											58.7453 (107)
Space cooling per m2											1.1749 (108)
Energy for space heating											46.1610 (99)
Energy for space cooling											1.1749 (108)
Total											47.3359 (109)
Target Fabric Energy Efficiency (TFEE)											54.4 (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	50.0000 (1b)	x 2.4000 (2b)	= 120.0000 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 120.0000 (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) = 0.1667 (8)
Measured/design AP50					Yes
Infiltration rate					5.0000
Number of sides sheltered					0.4167 (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) =				0.3542 (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	0.3896	0.3630	0.3630	0.3453	0.3453	0.3010	0.3010	0.2922	0.3010	0.3365	0.3276	0.3542 (22b)
Effective ac	0.5759	0.5659	0.5659	0.5596	0.5596	0.5453	0.5453	0.5427	0.5453	0.5566	0.5537	0.5627 (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)			6.0400	1.3258	8.0076		(27)
Main Floor			50.0000	0.1400	7.0000	110.0000	5500.0000 (28a)
Main Wall	47.2300	8.1400	39.0900	0.2200	8.5998	60.0000	2345.4000 (29a)
wall to Stairs	6.5100		6.5100	0.1864	1.2133	60.0000	390.6000 (29a)
Flat roof	4.1000		4.1000	0.1400	0.5740	9.0000	36.9000 (30)
Total net area of external elements Aum(A, m ²)			107.8400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	28.3347		(33)
Party Wall 1			32.2500	0.0000	0.0000	180.0000	5805.0000 (32)
Party Ceilings 1			45.9000			40.0000	1836.0000 (32b)
Internal Wall 1			46.7400			100.0000	4674.0000 (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) = 20587.9000 (34)
411.7580 (35)
10.4474 (36)
(33) + (36) = 38.7821 (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	22.8051	22.4093	22.4093	22.1610	22.1610	21.5944	21.5944	21.4904	21.5944	22.0414	21.9250	22.2836 (38)
Heat transfer coeff	61.5872	61.1914	61.1914	60.9431	60.9431	60.3765	60.3765	60.2725	60.3765	60.8235	60.7071	61.0657 (39)
Average = Sum(39)m / 12 =												60.8212 (39)
HLP	1.2317	1.2238	1.2238	1.2189	1.2189	1.2075	1.2075	1.2054	1.2075	1.2165	1.2141	1.2213 (40)
HLP (average)												1.2164 (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												1.6901 (42)
Average daily hot water use (litres/day)												74.3399 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	81.7739	78.8003	75.8267	72.8531	69.8795	66.9059	66.9059	69.8795	72.8531	75.8267	78.8003	81.7739 (44)
Energy content (annual)	121.2683	106.0620	109.4465	95.4181	91.5560	79.0058	73.2105	84.0101	85.0135	99.0750	108.1481	117.4419 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		1169.6560 (45)
	18.1902	15.9093	16.4170	14.3127	13.7334	11.8509	10.9816	12.6015	12.7520	14.8613	16.2222	17.6163 (46)

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Water storage loss:											
Store volume											210.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):											1.8600 (48)
Temperature factor from Table 2b											0.5400 (49)
Enter (49) or (54) in (55)											1.0044 (55)
Total storage loss											
	31.1364	28.1232	31.1364	30.1320	31.1364	30.1320	31.1364	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											
	175.6671	155.1964	163.8453	148.0621	145.9548	131.6498	127.6093	138.4089	137.6575	153.4738	160.7921
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (62)
											0.0000 (63)
											Solar input (sum of months) = Sum(63)m =
											0.0000 (63)
Output from w/h											
	175.6671	155.1964	163.8453	148.0621	145.9548	131.6498	127.6093	138.4089	137.6575	153.4738	160.7921
											Total per year (kWh/year) = Sum(64)m =
											1810.1580 (64)
RHI water heating demand											1810 (64)
Heat gains from water heating, kWh/month											
	83.8408	74.5731	79.9100	73.8417	73.9614	68.3846	67.8615	71.4524	70.3822	76.4615	78.0745
											82.5685 (65)

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061	101.4061 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	36.3700	32.3035	26.2709	19.8888	14.8671	12.5514	13.5623	17.6288	23.6613	30.0434	35.0651	37.3808 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	219.7522	222.0325	216.2861	204.0527	188.6103	174.0966	164.4006	162.1202	167.8666	180.1000	195.5424	210.0561 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307	46.8307 (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)	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040 (71)
Water heating gains (Table 5)	112.6892	110.9719	107.4059	102.5580	99.4105	94.9787	91.2117	96.0382	97.7530	102.7708	108.4367	110.9791 (72)
Total internal gains	449.4440	445.9406	430.5957	407.1322	383.5206	362.2594	349.8073	356.4199	369.9136	393.5469	419.6770	439.0487 (73)

[Jan					Area	Solar flux		g		FF		Access		Gains	
					m2	Table 6a		Table 6b		Table 6c		factor		W	
						W/m2		or Table 6b		or Table 6c		Table 6d			
North					0.9200	12.7500		0.6300		0.7000		0.7700		3.5848 (74)	
East					5.1200	23.7835		0.6300		0.7000		0.7700		37.2149 (76)	
Solar gains	40.7998	69.6362	114.1045	170.2072	204.8975	222.8064	209.6372	182.2740	141.8144	88.7074	50.0791	33.7773	(83)		
Total gains	490.2438	515.5768	544.7003	577.3394	588.4181	585.0658	559.4445	538.6939	511.7281	482.2543	469.7560	472.8261	(84)		

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, n _{l1,m} (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	92.8579	93.4585	93.4585	93.8394	93.8394	94.7200	94.7200	94.8834	94.7200	94.0238	94.2041	93.6510
alpha	7.1905	7.2306	7.2306	7.2560	7.2560	7.3147	7.3147	7.3256	7.3147	7.2683	7.2803	7.2434
util living area												
	0.9968	0.9944	0.9840	0.9413	0.8032	0.5538	0.3668	0.4025	0.7100	0.9454	0.9914	0.9974 (86)
Tweekday	19.2503	19.3450	19.5209	19.7184	19.8301	19.8589	19.8594	19.8611	19.8552	19.7440	19.4854	19.2453
Tweekend	20.6755	20.7154	20.7951	20.8890	20.9559	20.9747	20.9759	20.9759	20.9693	20.8993	20.7751	20.6701
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	20.4991	20.5597	20.6838	20.8266	20.9319	20.9612	20.9628	20.9627	20.9521	20.8445	20.6489	20.4908 (87)
Th 2	19.8947	19.9010	19.9010	19.9049	19.9049	19.9140	19.9140	19.9156	19.9140	19.9068	19.9087	19.9030 (88)
util rest of house												
	0.9950	0.9913	0.9748	0.9089	0.7214	0.4445	0.2497	0.2814	0.5973	0.9076	0.9858	0.9960 (89)
Tweekday	19.2503	19.3450	19.5209	19.7184	19.8301	19.8589	19.8594	19.8611	19.8552	19.7440	19.4854	19.2453
Tweekend	19.2503	19.3450	19.5209	19.7184	19.8301	19.8589	19.8594	19.8611	19.8552	19.7440	19.4854	19.2453
MIT 2	19.2503	19.3450	19.5209	19.7184	19.8301	19.8589	19.8594	19.8611	19.8552	19.7440	19.4854	19.2453 (90)
Living area fraction									f _{LA} = Living area / (4) =			0.4566 (91)
MIT	19.8205	19.8996	20.0519	20.2244	20.3332	20.3622	20.3632	20.3641	20.3561	20.2465	20.0167	19.8140 (92)
Temperature adjustment												0.0000
adjusted MIT	19.8205	19.8996	20.0519	20.2244	20.3332	20.3622	20.3632	20.3641	20.3561	20.2465	20.0167	19.8140 (93)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9949	0.9913	0.9763	0.9198	0.7554	0.4901	0.2982	0.3316	0.6449	0.9214	0.9865	0.9958 (94)
Useful gains	487.7332	511.0831	531.8034	531.0449	444.5120	286.7120	166.8152	178.6185	330.0301	444.3688	463.4137	470.8467 (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												
	918.9123	881.1349	780.3046	641.3904	465.1903	287.5238	166.8320	178.6553	335.4550	538.0757	741.6387	910.7332 (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)

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1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	50.0000 (1b)	x 2.4000 (2b)	= 120.0000 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 120.0000 (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) = 0.1667 (8)
Measured/design AP50					Yes
Infiltration rate					5.0000
Number of sides sheltered					0.4167 (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) =	0.3542 (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												
	0.4516	0.4427	0.4339	0.3896	0.3807	0.3365	0.3365	0.3276	0.3542	0.3807	0.3984	0.4161 (22b)
Effective ac	0.6020	0.5980	0.5941	0.5759	0.5725	0.5566	0.5566	0.5537	0.5627	0.5725	0.5794	0.5866 (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)			6.0400	1.3258	8.0076		(27)
Main Floor			50.0000	0.1400	7.0000	110.0000	5500.0000 (28a)
Main Wall	47.2300	8.1400	39.0900	0.2200	8.5998	60.0000	2345.4000 (29a)
wall to Stairs	6.5100		6.5100	0.1864	1.2133	60.0000	390.6000 (29a)
Flat roof	4.1000		4.1000	0.1400	0.5740	9.0000	36.9000 (30)
Total net area of external elements Aum(A, m ²)			107.8400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	28.3347		(33)
Party Wall 1			32.2500	0.0000	0.0000	180.0000	5805.0000 (32)
Party Ceilings 1			45.9000			40.0000	1836.0000 (32b)
Internal Wall 1			46.7400			100.0000	4674.0000 (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) = 20587.9000 (34)
411.7580 (35)
10.4474 (36)
(33) + (36) = 38.7821 (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	23.8374	23.6806	23.5269	22.8051	22.6701	22.0414	22.0414	21.9250	22.2836	22.6701	22.9433	23.2289 (38)
Heat transfer coeff	62.6195	62.4627	62.3090	61.5872	61.4522	60.8235	60.8235	60.7071	61.0657	61.4522	61.7254	62.0110 (39)
Average = Sum(39)m / 12 =												61.5866 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2524	1.2493	1.2462	1.2317	1.2290	1.2165	1.2165	1.2141	1.2213	1.2290	1.2345	1.2402 (40)
HLP (average)												1.2317 (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)
1.6901 (42)
74.3399 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	81.7739	78.8003	75.8267	72.8531	69.8795	66.9059	66.9059	69.8795	72.8531	75.8267	78.8003	81.7739 (44)
Energy conte	121.2683	106.0620	109.4465	95.4181	91.5560	79.0058	73.2105	84.0101	85.0135	99.0750	108.1481	117.4419 (45)
Energy content (annual)												Total = Sum(45)m = 1169.6560 (45)
Distribution loss (46)m = 0.15 x (45)m	18.1902	15.9093	16.4170	14.3127	13.7334	11.8509	10.9816	12.6015	12.7520	14.8613	16.2222	17.6163 (46)

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	361.3619	284.6528	229.4176	112.7168	33.1315	0.0000	0.0000	0.0000	0.0000	104.0908	241.0049	370.3785 (98)
Space heating												1736.7549 (98)
Space heating per m2											(98) / (4) =	34.7351 (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 %)												222.7832 (206)
Efficiency of secondary/supplementary heating system, %												100.0000 (208)
Space heating requirement												779.5718 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	361.3619	284.6528	229.4176	112.7168	33.1315	0.0000	0.0000	0.0000	0.0000	104.0908	241.0049	370.3785 (98)
Space heating efficiency (main heating system 1)	222.7832	222.7832	222.7832	222.7832	222.7832	0.0000	0.0000	0.0000	0.0000	222.7832	222.7832	222.7832 (210)
Space heating fuel (main heating system)	162.2034	127.7712	102.9780	50.5949	14.8716	0.0000	0.0000	0.0000	0.0000	46.7229	108.1791	166.2506 (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	175.6671	155.1964	163.8453	148.0621	145.9548	131.6498	127.6093	138.4089	137.6575	153.4738	160.7921	171.8407 (64)
Efficiency of water heater	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400 (216)
Fuel for water heating, kWh/month	103.6751	91.5937	96.6981	87.3832	86.1395	77.6970	75.3124	81.6861	81.2426	90.5771	94.8962	101.4168 (219)
Water heating fuel used												1068.3180 (219)
Annual totals kWh/year												
Space heating fuel - main system												779.5718 (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) 256.9219 (232)

Energy saving/generation technologies (Appendices M ,N and Q)
Total delivered energy for all uses 2104.8117 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	779.5718	13.1900	102.8255 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1068.3180	13.1900	140.9111 (247)
Pumps and fans for heating	0.0000	0.0000	0.0000 (249)
Energy for lighting	256.9219	13.1900	33.8880 (250)
Additional standing charges			0.0000 (251)

Energy saving/generation technologies
PV Unit 0.0000 13.1900 0.0000 (252)
Total energy cost 277.6247 (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] = 1.2274 (257)
SAP value 82.8779
SAP rating (Section 12) 83 (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	779.5718	0.5190	404.5978 (261)
Space heating - secondary	0.0000	0.5190	0.0000 (263)
Water heating (other fuel)	1068.3180	0.5190	554.4570 (264)
Space and water heating			959.0548 (265)
Pumps and fans	0.0000	0.0000	0.0000 (267)
Energy for lighting	256.9219	0.5190	133.3425 (268)

Energy saving/generation technologies
PV Unit -300.0000 0.5190 -155.7000 (269)
Total kg/year 936.6973 (272)
CO2 emissions per m2 18.7300 (273)
EI value 86.7876
EI rating 87 (274)
EI band B

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Calculation of stars for heating and DHW

Main heating energy efficiency	$13.19 \times (1 + 0.29 \times 0.25) / 2.2278 = 6.350$, stars = 3
Main heating environmental impact	$0.519 \times (1 + 0.29 \times 0.25) / 2.2278 = 0.2499$, stars = 4
Water heating energy efficiency	$13.19 / 1.6944 = 7.784$, stars = 2
Water heating environmental impact	$0.519 / 1.6944 = 0.3063$, stars = 4

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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	50.0000 (1b)	x 2.4000 (2b)	= 120.0000 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 120.0000 (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) = 0.1667 (8)
Measured/design AP50					Yes
Infiltration rate					5.0000
Number of sides sheltered					0.4167 (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) =	0.3542 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.4000	4.1000	4.1000	3.9000	3.9000	3.4000	3.4000	3.3000	3.4000	3.8000	3.7000	4.0000 (22)
Wind factor	1.1000	1.0250	1.0250	0.9750	0.9750	0.8500	0.8500	0.8250	0.8500	0.9500	0.9250	1.0000 (22a)
Adj infilt rate												
Effective ac	0.3896	0.3630	0.3630	0.3453	0.3453	0.3010	0.3010	0.2922	0.3010	0.3365	0.3276	0.3542 (22b)
	0.5759	0.5659	0.5659	0.5596	0.5596	0.5453	0.5453	0.5427	0.5453	0.5566	0.5537	0.5627 (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)			6.0400	1.3258	8.0076		(27)
Main Floor			50.0000	0.1400	7.0000	110.0000	5500.0000 (28a)
Main Wall	47.2300	8.1400	39.0900	0.2200	8.5998	60.0000	2345.4000 (29a)
wall to Stairs	6.5100		6.5100	0.1864	1.2133	60.0000	390.6000 (29a)
Flat roof	4.1000		4.1000	0.1400	0.5740	9.0000	36.9000 (30)
Total net area of external elements Aum(A, m ²)			107.8400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	28.3347		(33)
Party Wall 1			32.2500	0.0000	0.0000	180.0000	5805.0000 (32)
Party Ceilings 1			45.9000			40.0000	1836.0000 (32b)
Internal Wall 1			46.7400			100.0000	4674.0000 (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) = 20587.9000 (34)
411.7580 (35)
10.4474 (36)
(33) + (36) = 38.7821 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	22.8051	22.4093	22.4093	22.1610	22.1610	21.5944	21.5944	21.4904	21.5944	22.0414	21.9250	22.2836 (38)
Heat transfer coeff	61.5872	61.1914	61.1914	60.9431	60.9431	60.3765	60.3765	60.2725	60.3765	60.8235	60.7071	61.0657 (39)
Average = Sum(39)m / 12 =												60.8212 (39)
HLP	1.2317	1.2238	1.2238	1.2189	1.2189	1.2075	1.2075	1.2054	1.2075	1.2165	1.2141	1.2213 (40)
HLP (average)												1.2164 (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												1.6901 (42)
Average daily hot water use (litres/day)												74.3399 (43)
Daily hot water use	81.7739	78.8003	75.8267	72.8531	69.8795	66.9059	66.9059	69.8795	72.8531	75.8267	78.8003	81.7739 (44)
Energy conte	121.2683	106.0620	109.4465	95.4181	91.5560	79.0058	73.2105	84.0101	85.0135	99.0750	108.1481	117.4419 (45)
Energy content (annual)												1169.6560 (45)
Distribution loss (46)m = 0.15 x (45)m	18.1902	15.9093	16.4170	14.3127	13.7334	11.8509	10.9816	12.6015	12.7520	14.8613	16.2222	17.6163 (46)

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Water storage loss:												210.0000 (47)
Store volume												
a) If manufacturer declared loss factor is known (kWh/day):												1.8600 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.0044 (55)
Total storage loss												
	31.1364	28.1232	31.1364	30.1320	31.1364	30.1320	31.1364	31.1364	30.1320	31.1364	30.1320	31.1364 (56)
If cylinder contains dedicated solar storage	31.1364	28.1232	31.1364	30.1320	31.1364	30.1320	31.1364	31.1364	30.1320	31.1364	30.1320	31.1364 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (58)
Total heat required for water heating calculated for each month	175.6671	155.1964	163.8453	148.0621	145.9548	131.6498	127.6093	138.4089	137.6575	153.4738	160.7921	171.8407 (59)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input	(sum of months) =	Sum(63)m =		0.0000 (63)
Output from w/h	175.6671	155.1964	163.8453	148.0621	145.9548	131.6498	127.6093	138.4089	137.6575	153.4738	160.7921	171.8407 (64)
								Total per year (kWh/year) =	Sum(64)m =			1810.1580 (64)
Heat gains from water heating, kWh/month	83.8408	74.5731	79.9100	73.8417	73.9614	68.3846	67.8615	71.4524	70.3822	76.4615	78.0745	82.5685 (65)

[illegible]

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Space heating	320.7972	248.6748	184.8849	79.4487	15.3846	0.0000	0.0000	0.0000	0.0000	69.7179	200.3220	327.2756 (98)
Space heating per m2										(98) / (4) =		28.9301 (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 %)												220.5443 (206)
Efficiency of secondary/supplementary heating system, %												100.0000 (208)
Space heating requirement												655.8801 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	320.7972	248.6748	184.8849	79.4487	15.3846	0.0000	0.0000	0.0000	0.0000	69.7179	200.3220	327.2756 (98)
Space heating efficiency (main heating system 1)	220.5443	220.5443	220.5443	220.5443	220.5443	0.0000	0.0000	0.0000	0.0000	220.5443	220.5443	220.5443 (210)
Space heating fuel (main heating system)	145.4571	112.7551	83.8312	36.0239	6.9757	0.0000	0.0000	0.0000	0.0000	31.6118	90.8308	148.3945 (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	175.6671	155.1964	163.8453	148.0621	145.9548	131.6498	127.6093	138.4089	137.6575	153.4738	160.7921	171.8407 (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	103.6751	91.5937	96.6981	87.3832	86.1395	77.6970	75.3124	81.6861	81.2426	90.5771	94.8962	101.4168 (219)
Water heating fuel used												1068.3180 (219)
Annual totals kWh/year												
Space heating fuel - main system												655.8801 (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)												256.9219 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
Total delivered energy for all uses												1981.1200 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	655.8801	19.1200	125.4043 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1068.3180	19.1200	204.2624 (247)
Pumps and fans for heating	0.0000	0.0000	0.0000 (249)
Energy for lighting	256.9219	19.1200	49.1235 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit	0.0000	19.1200	0.0000 (252)
Total energy cost			378.7901 (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	655.8801	0.5190	340.4018 (261)
Space heating - secondary	0.0000	0.5190	0.0000 (263)
Water heating (other fuel)	1068.3180	0.5190	554.4570 (264)
Space and water heating			894.8588 (265)
Pumps and fans	0.0000	0.0000	0.0000 (267)
Energy for lighting	256.9219	0.5190	133.3425 (268)
Energy saving/generation technologies			
PV Unit	-300.0000	0.5190	-155.7000 (269)
Total kg/year			872.5013 (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	655.8801	3.0700	2013.5519 (261)
Space heating - secondary	0.0000	3.0700	0.0000 (263)
Water heating (other fuel)	1068.3180	3.0700	3279.7363 (264)
Space and water heating			5293.2881 (265)
Pumps and fans	0.0000	0.0000	0.0000 (267)
Energy for lighting	256.9219	3.0700	788.7502 (268)
Energy saving/generation technologies			

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Energy Calculations Ltd
SAP ♦ CODE ♦ SBEM ♦ DESIGN

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

PV Unit	-300.0000	3.0700	-921.0000 (269)
Primary energy kWh/year			5161.0384 (272)
Primary energy kWh/m ² /year			103.2208 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating:	B 83
Current environmental impact rating:	B 87

(For testing purposes):

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

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

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

Potential energy efficiency rating:	B 83
Potential environmental impact rating:	B 87

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

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

	Current	Potential	Saving
Electricity	£379	£379	£0
Space heating	£125	£125	£0
Water heating	£204	£204	£0
Lighting	£49	£49	£0
Total cost of fuels	£379	£379	£0
Total cost of uses	£378	£378	£0
Delivered energy	40 kWh/m ²	40 kWh/m ²	0 kWh/m ²
Carbon dioxide emissions	0.9 tonnes	0.9 tonnes	0.0 tonnes
CO2 emissions per m ²	17 kg/m ²	17 kg/m ²	0 kg/m ²
Primary energy	103 kWh/m ²	103 kWh/m ²	0 kWh/m ²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Energy Calculations Ltd
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CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

No improvements selected / applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Energy Calculations Ltd
SAP ♦ CODE ♦ SBEM ♦ DESIGN

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

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

No improvements selected / applicable

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Designed) 9.92

Overheating Calculation Input Data

Dwelling type	MidTerrace Flat
Number of storeys	1
Cross ventilation possible	Yes
SAP Region	Thames Valley
Front of dwelling faces	West
Overshading	Average or unknown
Thermal mass parameter	411.8 (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	237.60 (P1)
Transmission heat loss coefficient	38.78 (37)
Summer heat loss coefficient	276.38 (P2)

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

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

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	0.9200	81.1852	0.6300	0.7000	0.9000	26.6801
East	5.1200	117.5071	0.6300	0.7000	0.9000	214.9105
total:						241.5906

	Jun	Jul	Aug	
Solar gains	257	242	211	(P3)
Internal gains	362	350	356	
Total summer gains	619	591	567	(P5)
Summer gain/loss ratio	2.24	2.14	2.05	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 411.8)	0.00	0.00	0.00	
Threshold temperature	18.24	20.04	19.85	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	
Assessment of likelihood of high internal temperature:	Not significant			

BASIC COMPLIANCE REPORT

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

Property Reference	015723	Issued on Date	16/08/2021
Assessment Reference	004	Prop Type Ref	
Property	Flat 2, 18, Parkside Road, READING, RG30 2DB		
SAP Rating	83 B	DER	21.33
Environmental	87 B	TER	31.34
CO ₂ Emissions (t/year)	0.87	% DER<TER	31.93
General Requirements Compliance	Pass	DFEE	54.32
		TFEE	54.44
		% DFEE<TFEE	0.22
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)	31.34	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	21.33	kgCO ₂ /m ²	Pass
	-10.01 (-31.9%)	kgCO ₂ /m ²	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	54.44	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DFEE)	54.32	kWh/m ² /yr	
	-0.1 (-0.2%)	kWh/m ² /yr	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

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

Not significant

Pass

Based on:

Overshading

Average

Windows facing North

0.92 m², No overhang

Windows facing East

5.12 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	16/08/2021
Assessment Reference	004	Prop Type Ref	
Property	Flat 2, 18, Parkside Road, READING, RG30 2DB		
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CO ₂ Emissions (t/year)	0.87	% DER<TER	31.93
General Requirements Compliance	Pass	DFEE	54.32
		TFEE	54.44
		% DFEE<TFEE	0.22
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
		22.39 m		50.00 m²		2.40 m
7.0 Living Area	22.83		m²			
8.0 Thermal Mass Parameter	Precise calculation					
Thermal Mass	411.76		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	47.23
wall to Stairs	Cavity Wall	Cavity wall : plasterboard on dabs, AAC block, filled cavity, any outside structure		0.22	60.00	6.51
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	32.25
9.2 Internal Walls						
Description	Construction				Kappa (kJ/m²K)	Area (m²)
Internal Wall 1	Dense block, dense plaster				100.00	46.74
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	4.10
10.1 Party Ceilings						

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

Description	Construction	Kappa (kJ/m²K)	Area (m²)
Party Ceilings 1	Precast concrete planks floor, screed, carpeted	30.00	45.90

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	50.00

12.0 Opening Types

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

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
Door	Half Glazed Door	[1] Main Wall	North							2.10	
Windows	Window	[1] Main Wall	North	None	0.00					0.92	
Windows	Window	[1] Main Wall	East	None	0.00					5.12	

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)	4.56	0.300	No
Table K1 - Approved	E3 Sill	1.60	0.040	No
Table K1 - Approved	E4 Jamb	13.00	0.050	No
Table K1 - Approved	E5 Ground floor (normal)	22.39	0.160	No
Table K1 - Approved	E7 Party floor between dwellings (in blocks of flats)	22.39	0.070	No
Table K1 - Default	E14 Flat roof	5.90	0.080	No
Table K1 - Approved	E16 Corner (normal)	4.71	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	13.61	0.160	No

Y-value

0.097

W/m²K

18.0 Pressure Testing

Yes

Designed AP₅₀

5.00

m³/(h.m²) @ 50 Pa

Property Tested ?

As Built AP₅₀

m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather

Windows fully open

Cross ventilation possible

Yes

Night Ventilation

No

Air change rate

6.00

Mechanical Ventilation

Mechanical Ventilation System Present

No

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

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
Water use <= 125 litres/person/day	Yes

SUMMARY FOR INPUT DATA

Energy Calculations Ltd
SAP ♦ CODE ♦ SBEM ♦ DESIGN

Calculation Type: New Build (As Designed)

SAP Code	901	
Immersion Only Heating Hot Water	Yes	
29.0 Hot Water Cylinder	Hot Water Cylinder	
Cylinder Stat	Yes	
Cylinder In Heated Space	Yes	
Independent Time Control	Yes	
Insulation Type	Measured Loss	
Cylinder Volume	210.00	L
Loss	1.86	kWh/day
Pipes insulation	Fully insulated primary pipework	
31.0 Thermal Store	None	
32.0 Photovoltaic Unit	More Dwellings, One Block	
Apportioned	300.00	kWh/Year
Recommendations		
Lower cost measures		
None		
Further measures to achieve even higher standards		
None		

BLOCK COMPLIANCE

Energy Calculations Ltd
SAP • CODE • SBEM • DESIGN

Calculation Type: New Build (As Designed)

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

Block Compliance Report - DER

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

Block Compliance Report - DFEE

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