

Energy Assessment
For the proposed development at:
Flats 1- 11, 18 Parkside Road, Reading, RG30 2DB

Energy Calculations Ltd

SAP ♦ CODE ♦ SBEM ♦ DESIGN

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Flats 1- 13, 18 Parkside Road, Reading, RG30 2DB

Ref:015722-015734

16th August 2021

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- 2: Planning Requirements
- 3: Building services and u – values
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- 5: Design Considerations

Appendix 1 SAP calculations

1. Background

The proposed development is to build 11 new flats with parking, cycle storage and bin storage at 18 Parkside Road, Reading, RG30 2DB . The SAP calculations have been completed on SAP 2012 have been completed to achieve compliance with L1A.

The calculations have been completed using the plans supplied by Colony Architects

The U - values and the services applied are required to be confirmed that they are suitable of the proposed new dwellings.

The requirement for of this development to obtain a reduction in the Co2 from the standards in L1A 35% reduction in the CO² emissions from the standard L1A, in line with policy DM2 and carbon off set payments for the development to achieve carbon neutral.

A search has been carried out for any local existing decentralised energy network but none could be located. The use of air to water heat pumps and PV will achieve an overall reduction of 36.88 5 reduction in Co2 – see 4.10 table 1

2. PLANNING REQUIREMENTS

Local

Policy DM2 requires that any development of more than 20 dwellings and/ or non residential development of over 1,000 sq m will be required to consider the inclusion of a CHP plant, or biomass-fuelled heating scheme, or other form of decentralised energy provision, within the site, unless it can be demonstrated that the scheme is not suitable or feasible for this form of energy provision. Where there is existing decentralised energy provision, including a CHP plant or a district energy network present within the vicinity of an application site, further developments of over 10 dwellings or non-residential development of 1,000 sqm will be expected to link into the existing decentralised energy network or demonstrate why this is not feasible. Where the development meets the DM2 trigger as set out above, it will be expected that the Energy Statement appropriately addresses the decentralised energy requirement. Decentralised energy is a term used in the NPPF to denote ‘Local renewable energy and local low-carbon energy usually but not always on a relatively small scale encompassing a diverse range of technologies’. A decentralised energy generating system provides a more sustainable energy solution that helps to combat climate change and provides future generations with more security over energy provision than a centralised energy Planning Application Validation Information Requirements.

Para 4.4.46 of the Reading Borough Local Plan states “Therefore, the requirement will be that major new housing is built to zero carbon homes standard. A revised Sustainable Design and Construction SPD to be produced in 2019 will contain more detail on achieving this requirement, but in general, where homes are not designed to be carbon neutral, this will mean as a minimum a 35% improvement in the dwelling emission rate over the 2013 Building Regulations⁸³ plus a contribution of £1,800 per tonne towards carbon offsetting within Reading (calculated as £60 per tonne over a 30 year period). Where it is proposed to meet the zero carbon homes requirement in another way, clear evidence should be provided to demonstrate how it will be achieved at planning application stage.”

The development shall be carried out in accordance with the proposals of the approved energy audit.

2.1 National Policy

3.1.1 KYOTO PROTOCOL

The Kyoto Protocol is an international agreement linked to the United Nations Framework Convention on Climate Change. The major feature of the Kyoto Protocol is that it sets binding targets for 37 industrialized countries and the European community for reducing greenhouse gas (GHG) emissions. These amount to an average of five per cent against 1990 levels over the five-year period 2008-2012. The major distinction between the Protocol and the Convention is that while the Convention encouraged industrialised countries to stabilize GHG emissions, the Protocol commits them to do so.

3.1.2 BUILDING REGULATIONS – PART L 2013

This section of the building regulations deals with the conservation of energy in new domestic and commercial buildings; specifically the energy used for space heating/cooling, water heating, cooking, lighting and appliances. The methodology for the assessment of such has been adopted from the Building Research Establishment's Domestic Energy Model energy assessment method for the domestic portion of the building and Simplified Building Energy Model (SBEM) for the commercial units.

This method requires the calculation of a target emissions rate (TER), which assumes standard or typical building components and the calculation of the buildings actual emissions (DER for SAP). It is a requirement that the building's actual emissions will be lower than the target emission rate.

3.10: Building Services

Services Applied to the calculations are as follows

Please note the details below have been applied for the dwelling to comply with L1A building regulations and a minimum of 35 % reduction in Co2 certain assumptions have been made and require to be confirmed. Please note these suggestions need to be clarified that they are suitable for the build, as they have only been applied for Part L building regulations, and for the purpose of efficiency only. Please could you confirm the details or forward any amendments required.

- Accredited construction details applied to table K1 (*can be downloaded from the planning portal to be uploaded and signed off during the construction of the build, completed forms are required for the as built SAP calculations, the ACDs that have been applied can be found within the calculations*)
- 100 % Low energy lighting
- Air pressure test to achieve 5.00 or less per unit
- Intermittent extract fans
- Time and temperature zone controls,
- Emitters- under floor
- Air to water heat pump – Panasonic WH- MDCo5F3ES
- Water cylinder minimum heat loss

With reference to the heat pump this has been chosen for the efficiency only and needs to be clarified that its suitable for use, if an alternative is used please inform us and we will check the efficiencies as an alternative boiler could make the calculations fail L1A building regulations.

3.10: The U - Values below have been applied to the dwellings

Element	U – Value W/m2K	Element	U – Value W/m2K
Main Wall	0.22	Floor	0.14
Roof plane	0.10	Doors	1.40
Windows and R lights (g value 0.63)	1.40	Wall to stairs	0.22
Wall to garage	0.22	Wall to hall	0.22
Roof Slope	0.14		

3.20: Renewables

Apportioned Photovoltaic Panels 3,300 kWh/year

For the dwellings to achieve the 35 % reduction in Co2 required for planning it is proposed, the use of heat pumps and photovoltaic panels to reduce the Co2 requirements, achieving an overall reduction in Co2 of 36.88 % and carbon off set payments for the development to achieve carbon neutral

4.10 : Table1 : Results

Flat	SAP rating	Environmental	TFEE kWh/m ² /yr	DFEE kWh/m ² /yr	% Reduction	TER kgCO ₂ /yr/m ²	DER kgCO ₂ /yr/m ²	% Reduction
1	83 B	87 B	58.58	58.41	0.29	29.47	17.89	39.29
2	83 B	87 B	54.44	54.32	0.22	31.34	21.33	31.93
3	83 B	87 B	55.97	55.45	0.94	33.10	22.37	32.41
4	85 B	88 B	43.82	43.28	1.21	25.77	16.86	34.58
5	85 B	87 B	48.35	45.82	5.22	25.88	15.49	40.14
6	85 B	88 B	40.24	38.64	3.99	24.80	16.64	32.90
7	85 B	88 B	49.93	47.54	4.79	26.08	15.36	41.11
8	84 B	87 B	51.12	46.03	9.95	27.75	17.18	38.08
9	85 B	88 B	44.39	41.9	5.61	26.03	14.67	35.95
10	85 B	89 B	39.96	36.75	8.04	26.84	18.50	31.08
11	84 B	87 B	56.40	52.10	7.62	28.08	16.15	42.48
Block compliance	-	-	49.35	47.15	4.46	27.44	17.32	36.88

4.20 Carbon off set

Flat	Co2 (tonnes)	Flat	Co2 (tonnes)
1	1.06	7	1.01
2	0.87	8	1.01
3	0.79	9	0.88
4	0.88	10	0.76
5	1.03	11	1.07
6	0.97		

Total 10.44 tonnes

£1,800 per tonne towards carbon offsetting within Reading (calculated as £60 per tonne over a 30 year period).

Carbon off set payment £18,792

5: Design Considerations

The first consideration is for fabric first, to reduce the Co2 emission being produced / loss through the fabric of the building and through high efficient heat pumps and heating controls.

Within the design the following consideration have been made that can affect the energy use of the development .

The orientation:

of the building is North West - South East with openings on the front and rear elevations , this giving the advantage of solar gains, therefore reducing the heating requirements.

The proposed Materials

The development will achieve a rating of A - D in at least 3 elements following the criteria set in code for sustainable homes. (new elements)

Online Green Guide Calculator Tool

BRE Global have created the Green Guide Calculator tool to enable BREEAM and Code assessors to quickly and efficiently generate Green Guide ratings for a significant proportion of specifications not listed in the Green Guide Online. The Green Guide Calculator database is based on the components currently used to create specifications within the Green Guide Online. These components can be selected and combined to generate instant Green Guide ratings for a multitude of different specifications.

Global Warming Potential (GWP)

With the building / insulation of the products used we propose that all the insulation materials used will achieve a GWP < 5

Global Warming Potential is defined as the potential for global warming that a chemical has relative to 1 unit of carbon dioxide, the primary greenhouse gas. In determining the GWP of the blowing agent, the Intergovernmental Panel on Climate Change (*IPCC*) methodology using a 100-year Integrated Time Horizon (ITH) must be applied.

Water use.

External water use. (provision of water but)

The dwellings will provide external water collection system (water butt) The aim is to promote the recycling of rainwater and reduce the amount of mains water used for external water use.

- No open access at the top of the collector (a child-proof lid is allowed)
- Provision of a tap or other arrangement for drawing off water
- Connection to the rainwater downpipes with an automatic overflow into the conventional rainwater drainage system
- A means of detaching the rainwater downpipe and access provision to enable the interior to be cleaned. Where the collection system is to be sited outside, and not buried, it must be stable and adequately supported; the material used for the container shall be durable and opaque to sunlight

Cycle Storage

To promote the wider use of bicycles as transport by providing adequate and secure cycle storage facilities, thus reducing the need for short car journeys and the associated CO₂ emissions.

Appendix 1

Flat 1 SAP calculations

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01754-761035



SAP Report Submission for Building Regulations Compliance

Client:

Project: Flat 1 , 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

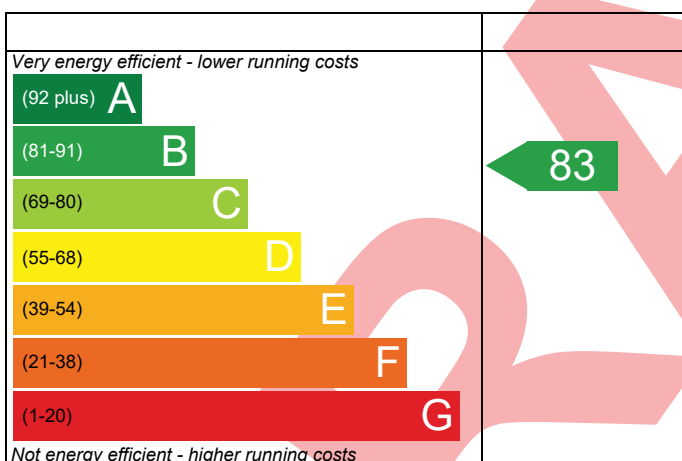
Flat 1 , 18, Parkside Road,
READING,
RG30 2DB

Dwelling type: Flat, End-Terrace
Date of assessment: 16/08/2021
Produced by: Energy Calculations Limited
Total floor area: 70 m²

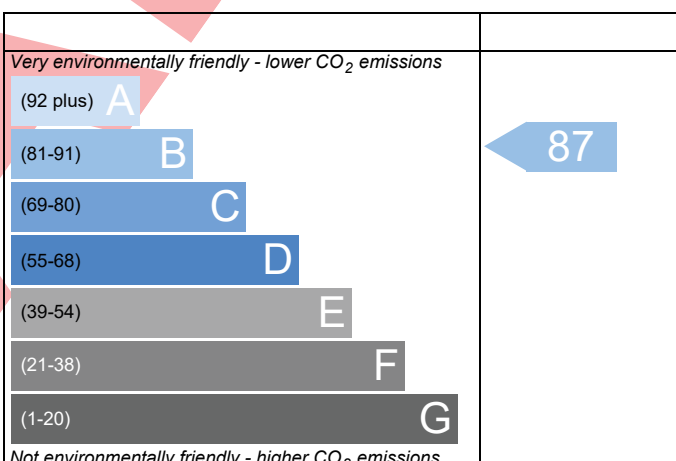
This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance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



Environmental Impact (CO₂) 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.

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	015722	Issued on Date	16/08/2021
Assessment Reference	004	Prop Type Ref	
Property	Flat 1 , 18, Parkside Road, READING, RG30 2DB		
SAP Rating	83 B	DER	17.89
Environmental	87 B	TER	29.47
CO ₂ Emissions (t/year)	1.06	% DER<TER	39.29
General Requirements Compliance	Pass	DFEE	58.41
		TFEE	58.58
		% DFEE<TFEE	0.29
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	11.80	3.54	
External wall	E3 Sill	Table K1 - Approved	0.040	11.80	0.47	
External wall	E4 Jamb	Table K1 - Approved	0.050	32.20	1.61	
External wall	E5 Ground floor (normal)	Table K1 - Approved	0.160	30.46	4.87	
External wall	E7 Party floor between dwellings (in blocks of flats)	Table K1 - Approved	0.070	30.46	2.13	
External wall	E14 Flat roof	Table K1 - Default	0.080	8.50	0.68	
External wall	E16 Corner (normal)	Table K1 - Approved	0.090	7.40	0.67	
External wall	E17 Corner (inverted – internal area greater than external area)	Table K1 - Approved	-0.090	2.37	-0.21	
Party wall	P1 Party wall - Ground floor	Table K1 - Default	0.160	5.11	0.82	

Total: **14.58** W/mK:
Y-Value: **0.099** W/m²K:

FULL SAP CALCULATION PRINTOUT

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Property Reference	015722			Issued on Date	16/08/2021
Assessment Reference	004	Prop Type Ref			
Property	Flat 1 , 18, Parkside Road, READING, RG30 2DB				
SAP Rating	83 B	DER	17.89	TER	29.47
Environmental	87 B	% DER<TER	39.29		
CO ₂ Emissions (t/year)	1.06	DFEE	58.41	TFEE	58.58
General Requirements Compliance	Pass	% DFEE<TFEE	0.29		
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 70 m²

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

1a TER and DER

Fuel for main heating:Electricity

Fuel factor:1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER) 29.47 kgCO₂/m²

Dwelling Carbon Dioxide Emission Rate (DER) 17.89 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)58.6 kWh/m²/yr

Dwelling Fabric Energy Efficiency (DFEE)58.4 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.22 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.14 (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
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Based on:

Overshading:	Average
Windows facing North:	9.33 m ² , No overhang
Windows facing East:	5.12 m ² , No overhang
Windows facing West:	6.24 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	70.0000 (1b)	x 2.4000 (2b)	= 168.0000 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 168.0000 (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					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1786 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4286 (18)
Number of sides sheltered					1 (19)
Shelter factor					(20) = 1 - [0.075 x (19)] = 0.9250 (20)
Infiltration rate adjusted to include shelter factor					(21) = (18) x (20) = 0.3964 (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												
	0.5054	0.4955	0.4856	0.4361	0.4262	0.3766	0.3766	0.3667	0.3964	0.4262	0.4460	0.4658 (22b)
Effective ac	0.6277	0.6228	0.6179	0.5951	0.5908	0.5709	0.5709	0.5672	0.5786	0.5908	0.5995	0.6085 (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			2.1200	1.4000	2.9680		(26a)
Windows (Uw = 1.40)			20.6900	1.3258	27.4299		(27)
Main Floor			70.0000	0.1400	9.8000	110.0000	7700.0000 (28a)
Main Wall	59.9500	22.8100	37.1400	0.2200	8.1708	60.0000	2228.4000 (29a)
wall to Stairs	13.1500		13.1500	0.1864	2.4509	60.0000	789.0000 (29a)
Flat roof	4.1700		4.1700	0.1400	0.5838	9.0000	37.5300 (30)
Total net area of external elements Aum(A, m ²)			147.2700				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	51.4034		(33)
Party Wall 1			9.3300	0.0000	0.0000	180.0000	1679.4000 (32)
Party Ceilings 1			66.0000			40.0000	2640.0000 (32b)
Internal Wall 1			66.5900			100.0000	6659.0000 (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) = 21733.3300 (34)
310.4761 (35)
14.5781 (36)
(33) + (36) = 65.9815 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	34.8018	34.5268	34.2573	32.9912	32.7543	31.6516	31.6516	31.4474	32.0764	32.7543	33.2335	33.7345 (38)
Heat transfer coeff	100.7833	100.5083	100.2387	98.9727	98.7358	97.6331	97.6331	97.4289	98.0578	98.7358	99.2150	99.7160 (39)
Average = Sum(39)m / 12 =												98.9715 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.4398	1.4358	1.4320	1.4139	1.4105	1.3948	1.3948	1.3918	1.4008	1.4105	1.4174	1.4245 (40)
HLP (average)												1.4139 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy
Average daily hot water use (litres/day)
2.2461 (42)
87.5455 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	96.3000	92.7982	89.2964	85.7946	82.2927	78.7909	78.7909	82.2927	85.7946	89.2964	92.7982	96.3000 (44)
Energy conte	142.8101	124.9027	128.8884	112.3680	107.8198	93.0403	86.2155	98.9335	100.1151	116.6745	127.3593	138.3040 (45)
Energy content (annual)										Total = Sum(45)m =		1377.4311 (45)
Distribution loss (46)m = 0.15 x (45)m	21.4215	18.7354	19.3333	16.8552	16.1730	13.9560	12.9323	14.8400	15.0173	17.5012	19.1039	20.7456 (46)

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Water storage loss:												
Store volume												210.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.8600 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.0044 (55)
Total storage loss												
31.1364	28.1232	31.1364	30.1320	31.1364	30.1320	31.1364	31.1364	30.1320	31.1364	30.1320	31.1364	(56)
If cylinder contains dedicated solar storage												
31.1364	28.1232	31.1364	30.1320	31.1364	30.1320	31.1364	31.1364	30.1320	31.1364	30.1320	31.1364	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month												
197.2089	174.0371	183.2872	165.0120	162.2186	145.6843	140.6143	153.3323	152.7591	171.0733	180.0033	192.7028	(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 =												
Output from w/h												
197.2089	174.0371	183.2872	165.0120	162.2186	145.6843	140.6143	153.3323	152.7591	171.0733	180.0033	192.7028	(64)
Heat gains from water heating, kWh/month												
91.0034	80.8377	86.3744	79.4776	79.3691	73.0511	72.1857	76.4144	75.4035	82.3133	84.4622	89.5051	(65)

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

Metabolic gains (Table 5), Watts												
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
17.5892	15.6226	12.7051	9.6186	7.1900	6.0701	6.5590	8.5256	11.4430	14.5296	16.9581	18.0780	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
197.2971	199.3444	194.1852	183.2019	169.3374	156.3068	147.6015	145.5542	150.7134	161.6967	175.5612	188.5918	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)												
-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	(71)
Water heating gains (Table 5)												
122.3164	120.2941	116.0946	110.3855	106.6789	101.4598	97.0238	102.7076	104.7270	110.6362	117.3086	120.3026	(72)
Total internal gains												
393.8945	391.9529	379.6768	359.8978	339.8982	320.5286	307.8761	313.4792	323.5753	343.5543	366.5197	383.6643	(73)

6. Solar gains

[Jan]		Area	Solar flux									
		m2	Table 6a	Specific data	g	FF		Access				
			W/m2	or Table 6b				factor				
								Table 6d				
North		9.3300	10.6334	0.6300		0.7000		0.7700			30.3197	(74)
East		5.1200	19.6403	0.6300		0.7000		0.7700			30.7319	(76)
West		6.2400	19.6403	0.6300		0.7000		0.7700			37.4545	(80)
Solar gains												
98.5061	191.3295	318.1279	478.5243	605.6733	629.9957	595.5822	497.6254	373.8636	227.2479	122.4237	81.3492	(83)
Total gains												
492.4006	583.2825	697.8047	838.4222	945.5715	950.5243	903.4583	811.1046	697.4389	570.8022	488.9434	465.0134	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												
Utilisation factor for gains for living area, nil,m (see Table 9a)												
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.9012	60.0651	60.2266	60.9970	61.1433	61.8339	61.8339	61.9635	61.5661	61.1433	60.8480	60.5423
alpha	4.9934	5.0043	5.0151	5.0665	5.0762	5.1223	5.1223	5.1309	5.1044	5.0762	5.0565	5.0362
util living area												
0.9985	0.9961	0.9867	0.9443	0.8229	0.6289	0.4699	0.5404	0.8232	0.9768	0.9966	0.9989	(86)
Tweekday												
18.3928	18.5765	18.8974	19.3137	19.5809	19.6785	19.6887	19.6898	19.6287	19.2547	18.7578	18.3764	
Tweekend												
20.3419	20.4223	20.5646	20.7524	20.8919	20.9515	20.9631	20.9606	20.9117	20.7190	20.4974	20.3306	
24 / 16												
0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9												
0	0	0	0	0	0	0	0	0	0	0	0	
16 / 9												
0	0	0	0	0	0	0	0	0	0	0	0	
MIT												
19.9843	20.1064	20.3280	20.6133	20.8331	20.9255	20.9430	20.9392	20.8622	20.5663	20.2153	19.9669	(87)
Th 2												
19.7330	19.7360	19.7389	19.7527	19.7553	19.7674	19.7674	19.7696	19.7627	19.7553	19.7501	19.7446	(88)
util rest of house												
0.9978	0.9944	0.9807	0.9196	0.7558	0.5209	0.3414	0.4024	0.7287	0.9619	0.9948	0.9984	(89)
Tweekday												
18.3928	18.5765	18.8974	19.3137	19.5809	19.6785	19.6887	19.6898	19.6287	19.2547	18.7578	18.3764	
Tweekend												
18.3928	18.5765	18.8974	19.3137	19.5809	19.6785	19.6887	19.6898	19.6287	19.2547	18.7578	18.3764	
MIT 2												
18.3928	18.5765	18.8974	19.3137	19.5809	19.6785	19.6887	19.6898	19.6287	19.2547	18.7578	18.3764	(90)
Living area fraction												
fLA = Living area / (4) =												
19.1430	19.2977	19.5718	19.9264	20.1712	20.2664	20.2800	20.2788	20.2102	19.8730	19.4449	19.1262	(92)
Temperature adjustment												
0.0000												
adjusted MIT												
19.1430	19.2977	19.5718	19.9264	20.1712	20.2664	20.2800	20.2788	20.2102	19.8730	19.4449	19.1262	(93)

8. Space heating requirement

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
0.9974	0.9936	0.9797	0.9236	0.7803	0.5662	0.3956	0.4609	0.7668	0.9637	0.9942	0.9980	(94)
491.1132	579.5768	683.6444	774.3848	737.8228	538.2251	357.3635	373.8637	534.8119	550.1031	486.1049	464.1001	(95)
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												
1495.9311	1447.0914	1310.3010	1091.3114	836.4148	553.2257	359.2934	377.9112	599.1557	915.5812	1224.7967	1488.3855	(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	747.5845	582.9698	466.2325	228.1872	73.3525	0.0000	0.0000	0.0000	0.0000	271.9157	531.8581	762.0684 (98)
Space heating												3664.1686 (98)
Space heating per m2											(98) / (4) =	52.3453 (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 %)												302.4894 (206)
Efficiency of secondary/supplementary heating system, %												100.0000 (208)
Space heating requirement												1211.3378 (211)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	747.5845	582.9698	466.2325	228.1872	73.3525	0.0000	0.0000	0.0000	0.0000	271.9157	531.8581	762.0684 (98)
Space heating efficiency (main heating system 1)	302.4894	302.4894	302.4894	302.4894	302.4894	0.0000	0.0000	0.0000	0.0000	302.4894	302.4894	302.4894 (210)
Space heating fuel (main heating system)	247.1440	192.7240	154.1318	75.4364	24.2496	0.0000	0.0000	0.0000	0.0000	89.8926	175.8270	251.9322 (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	197.2089	174.0371	183.2872	165.0120	162.2186	145.6843	140.6143	153.3323	152.7591	171.0733	180.0033	192.7028 (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	116.3887	102.7131	108.1723	97.3867	95.7381	85.9798	82.9877	90.4936	90.1553	100.9639	106.2343	113.7292 (219)
Water heating fuel used												1190.9426 (219)
Annual totals kWh/year												
Space heating fuel - main system												1211.3378 (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)												310.6304 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
Total delivered energy for all uses												2712.9107 (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	1211.3378	0.5190	628.6843 (261)
Space heating - secondary	0.0000	0.5190	0.0000 (263)
Water heating (other fuel)	1190.9426	0.5190	618.0992 (264)
Space and water heating			1246.7835 (265)
Pumps and fans	0.0000	0.0000	0.0000 (267)
Energy for lighting	310.6304	0.5190	161.2172 (268)
Energy saving/generation technologies			
PV Unit	-300.0000	0.5190	-155.7000 (269)
Total CO2, kg/year			1252.3006 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			17.8900 (273)

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

DER		17.8900 ZC1
Total Floor Area	TFA	70.0000
Assumed number of occupants	N	2.2461
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190
CO2 emissions from appliances, equation (L14)		16.7020 ZC2
CO2 emissions from cooking, equation (L16)		2.4701 ZC3
Total CO2 emissions		37.0621 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		37.0621 ZC8

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	70.0000 (1b)	x 2.4000 (2b)	= 168.0000 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 168.0000 (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) = 0.1190 (8)
Measured/design AP50					Yes
Infiltration rate					5.0000
Number of sides sheltered					0.3690 (18)
					1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3414 (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	0.4352	0.4267	0.4182	0.3755	0.3670	0.3243	0.3243	0.3158	0.3414	0.3670	0.3840	0.4011 (22b)
Effective ac	0.5947	0.5910	0.5874	0.5705	0.5673	0.5526	0.5526	0.5499	0.5583	0.5673	0.5737	0.5804 (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			2.1200	1.2000	2.5440		(26a)
TER Opening Type (Uw = 1.40)			15.3900	1.3258	20.4034		(27)
Main Floor			70.0000	0.1300	9.1000		(28a)
Main Wall	59.9500	17.5100	42.4400	0.1800	7.6392		(29a)
wall to Stairs	13.1500		13.1500	0.1800	2.3670		(29a)
Flat roof	4.1700		4.1700	0.1300	0.5421		(30)
Total net area of external elements Aum(A, m ²)			147.2700				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	42.5957		(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)							11.3373 (36)
Total fabric heat loss						(33) + (36) =	53.9330 (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	32.9712	32.7673	32.5675	31.6287	31.4530	30.6353	30.6353	30.4839	30.9503	31.4530	31.8083	32.1798 (38)
Heat transfer coeff	86.9042	86.7003	86.5005	85.5617	85.3860	84.5683	84.5683	84.4169	84.8833	85.3860	85.7413	86.1128 (39)
Average = Sum(39)m / 12 =												85.5608 (39)
HLP	1.2415	1.2386	1.2357	1.2223	1.2198	1.2081	1.2081	1.2060	1.2126	1.2198	1.2249	1.2302 (40)
HLP (average)												1.2223 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.2461 (42)
Average daily hot water use (litres/day)												87.5455 (43)
Daily hot water use	96.3000	92.7982	89.2964	85.7946	82.2927	78.7909	78.7909	82.2927	85.7946	89.2964	92.7982	96.3000 (44)
Energy conte	142.8101	124.9027	128.8884	112.3680	107.8198	93.0403	86.2155	98.9335	100.1151	116.6745	127.3593	138.3040 (45)
Energy content (annual)										Total = Sum(45)m =		1377.4311 (45)
Distribution loss (46)m = 0.15 x (45)m												
	21.4215	18.7354	19.3333	16.8552	16.1730	13.9560	12.9323	14.8400	15.0173	17.5012	19.1039	20.7456 (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 (58)
Total heat required for water heating calculated for each month	194.5567	171.6415	180.6349	162.4453	159.5664	143.1176	137.9621	150.6801	150.1924	168.4211	177.4367	190.0506 (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)
Output from w/h	194.5567	171.6415	180.6349	162.4453	159.5664	143.1176	137.9621	Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Heat gains from water heating, kWh/month	88.8816	78.9212	84.2526	77.4242	77.2473	70.9978	70.0639	74.2927	73.3501	80.1915	82.4089	87.3833 (65)

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	17.5956	15.6283	12.7098	9.6221	7.1926	6.0723	6.5614	8.5287	11.4472	14.5349	16.9643	18.0846 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	197.2971	199.3444	194.1852	183.2019	169.3374	156.3068	147.6015	145.5542	150.7134	161.6967	175.5612	188.5918 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306 (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)	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450 (71)
Water heating gains (Table 5)	119.4646	117.4423	113.2428	107.5337	103.8271	98.6080	94.1719	99.8557	101.8752	107.7843	114.4567	117.4507 (72)
Total internal gains	394.0491	392.1068	379.8296	360.0495	340.0490	320.6790	308.0267	313.6305	323.7277	343.7078	366.6741	383.8190 (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					6.9400	10.6334	0.6300		0.7000	0.7700		22.5529 (74)
East					3.8100	19.6403	0.6300		0.7000	0.7700		22.8688 (76)
West					4.6400	19.6403	0.6300		0.7000	0.7700		27.8508 (80)
Solar gains	73.2725	142.3181	236.6355	355.9444	450.5226	468.6146	443.0165	370.1525	278.0939	169.0356	91.0633	60.5106 (83)
Total gains	467.3217	534.4249	616.4652	715.9940	790.5716	789.2936	751.0432	683.7830	601.8215	512.7433	457.7374	444.3296 (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	55.9364	56.0680	56.1975	56.8141	56.9310	57.4814	57.4814	57.5846	57.2682	56.9310	56.6951	56.4505
alpha	4.7291	4.7379	4.7465	4.7876	4.7954	4.8321	4.8321	4.8390	4.8179	4.7954	4.7797	4.7634
util living area	0.9968	0.9934	0.9822	0.9401	0.8293	0.6466	0.4869	0.5514	0.8167	0.9683	0.9936	0.9975 (86)
MIT	19.6995	19.8580	20.1430	20.5204	20.8165	20.9590	20.9915	20.9850	20.8750	20.4813	20.0245	19.6731 (87)
Th 2	19.8870	19.8893	19.8915	19.9022	19.9042	19.9135	19.9135	19.9152	19.9099	19.9042	19.9002	19.8959 (88)
util rest of house	0.9957	0.9912	0.9759	0.9187	0.7739	0.5526	0.3711	0.4296	0.7368	0.9528	0.9910	0.9966 (89)
MIT 2	18.1682	18.4005	18.8143	19.3522	19.7321	19.8878	19.9106	19.9094	19.8133	19.3107	18.6519	18.1358 (90)
Living area fraction												0.4714 (91)
MIT	18.8901	19.0876	19.4407	19.9030	20.2433	20.3928	20.4202	20.4165	20.3138	19.8625	19.2990	18.8605 (92)
Temperature adjustment												0.0000
adjusted MIT	18.8901	19.0876	19.4407	19.9030	20.2433	20.3928	20.4202	20.4165	20.3138	19.8625	19.2990	18.8605 (93)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9944	0.9890	0.9726	0.9188	0.7926	0.5956	0.4260	0.4873	0.7694	0.9521	0.9891	0.9955 (94)
Useful gains	464.6830	528.5543	599.5962	657.8254	626.5902	470.1192	319.9173	333.2269	463.0147	488.1831	452.7382	442.3338 (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	1267.9403	1230.0678	1119.3754	941.4313	729.4820	489.8866	323.0641	339.0610	527.4508	790.8918	1045.9592	1262.4588 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	1.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	597.6234	471.4171	386.7157	204.1963	76.5515	0.0000	0.0000	0.0000	0.0000	225.2152	427.1191	610.1730 (98)
Space heating												2999.0114 (98)
Space heating per m2											(98) / (4) =	42.8430 (99)

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Energy Calculations Ltd
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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													3207.4988 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	597.6234	471.4171	386.7157	204.1963	76.5515	0.0000	0.0000	0.0000	0.0000	225.2152	427.1191	610.1730	(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)	639.1695	504.1894	413.5997	218.3917	81.8733	0.0000	0.0000	0.0000	0.0000	240.8719	456.8119	652.5914	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	194.5567	171.6415	180.6349	162.4453	159.5664	143.1176	137.9621	150.6801	150.1924	168.4211	177.4367	190.0506	(64)
Efficiency of water heater	87.6148	87.3730	86.7947	85.4251	82.9808	79.8000	79.8000	79.8000	79.8000	85.5897	87.0733	79.8000	(216)
(217)m	87.6148	87.3730	86.7947	85.4251	82.9808	79.8000	79.8000	79.8000	79.8000	85.5897	87.0733	79.8000	(217)
Fuel for water heating, kWh/month	222.0593	196.4469	208.1175	190.1612	192.2931	179.3454	172.8848	188.8222	188.2111	196.7772	203.7785	216.6881	(219)
Water heating fuel used												2355.5851	(219)
Annual totals kWh/year													
Space heating fuel - main system												3207.4988	(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)												310.7438	(232)
Total delivered energy for all uses												5948.8277	(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	3207.4988	0.2160	692.8197 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2355.5851	0.2160	508.8064 (264)
Space and water heating			1201.6261 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	310.7438	0.5190	161.2761 (268)
Total CO2, kg/m2/year			1401.8272 (272)
Emissions per m2 for space and water heating			17.1661 (272a)
Fuel factor (electricity)			1.5500
Emissions per m2 for lighting			2.3039 (272b)
Emissions per m2 for pumps and fans			0.5561 (272c)
Target Carbon Dioxide Emission Rate (TER) = (17.1661 * 1.55) + 2.3039 + 0.5561, rounded to 2 d.p.			29.4700 (273)

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CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	70.0000 (1b)	x 2.4000 (2b)	= 168.0000 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 168.0000 (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) = 0.1190 (8)
Measured/design AP50					Yes
Infiltration rate					5.0000
Number of sides sheltered					0.3690 (18)
					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3414 (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												
	0.4352	0.4267	0.4182	0.3755	0.3670	0.3243	0.3243	0.3158	0.3414	0.3670	0.3840	0.4011 (22b)
Effective ac	0.5947	0.5910	0.5874	0.5705	0.5673	0.5526	0.5526	0.5499	0.5583	0.5673	0.5737	0.5804 (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			2.1200	1.4000	2.9680		(26a)
Windows (Uw = 1.40)			20.6900	1.3258	27.4299		(27)
Main Floor			70.0000	0.1400	9.8000	110.0000	7700.0000 (28a)
Main Wall	59.9500	22.8100	37.1400	0.2200	8.1708	60.0000	2228.4000 (29a)
wall to Stairs	13.1500		13.1500	0.1864	2.4509	60.0000	789.0000 (29a)
Flat roof	4.1700		4.1700	0.1400	0.5838	9.0000	37.5300 (30)
Total net area of external elements Aum(A, m ²)			147.2700				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	51.4034		(33)
Party Wall 1			9.3300	0.0000	0.0000	180.0000	1679.4000 (32)
Party Ceilings 1			66.0000			30.0000	1980.0000 (32b)
Internal Wall 1			66.5900			100.0000	6659.0000 (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) = 21073.3300 (34)
301.0476 (35)
14.5781 (36)
(33) + (36) = 65.9815 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	32.9712	32.7673	32.5675	31.6287	31.4530	30.6353	30.6353	30.4839	30.9503	31.4530	31.8083	32.1798 (38)
Heat transfer coeff	98.9527	98.7488	98.5489	97.6101	97.4345	96.6168	96.6168	96.4654	96.9318	97.4345	97.7898	98.1613 (39)
Average = Sum(39)m / 12 =												97.6093 (39)
HLP	1.4136	1.4107	1.4078	1.3944	1.3919	1.3802	1.3802	1.3781	1.3847	1.3919	1.3970	1.4023 (40)
HLP (average)												1.3944 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.2461 (42)
Average daily hot water use (litres/day)												87.5455 (43)
Daily hot water use	96.3000	92.7982	89.2964	85.7946	82.2927	78.7909	78.7909	82.2927	85.7946	89.2964	92.7982	96.3000 (44)
Energy conte	142.8101	124.9027	128.8884	112.3680	107.8198	93.0403	86.2155	98.9335	100.1151	116.6745	127.3593	138.3040 (45)
Energy content (annual)										Total = Sum(45)m =		1377.4311 (45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)

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Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month	30.3472	26.5418	27.3888	23.8782	22.9117	19.7711	18.3208	21.0234	21.2745	24.7933	27.0639	29.3896	(65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	17.5892	15.6226	12.7051	9.6186	7.1900	6.0701	6.5590	8.5256	11.4430	14.5296	16.9581	18.0780	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	197.2971	199.3444	194.1852	183.2019	169.3374	156.3068	147.6015	145.5542	150.7134	161.6967	175.5612	188.5918	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	(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)	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	(71)
Water heating gains (Table 5)	40.7892	39.4967	36.8129	33.1642	30.7953	27.4598	24.6247	28.2572	29.5479	33.3244	37.5887	39.5021	(72)
Total internal gains	312.3673	311.1556	300.3951	282.6765	264.0146	246.5285	235.4771	239.0289	248.3961	266.2425	286.7999	302.8639	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	FF	Access factor Table 6d	Gains W	
North	9.3300	10.6334	0.6300		0.7000	0.7700	30.3197	(74)
East	5.1200	19.6403	0.6300		0.7000	0.7700	30.7319	(76)
West	6.2400	19.6403	0.6300		0.7000	0.7700	37.4545	(80)

Solar gains	98.5061	191.3295	318.1279	478.5243	605.6733	629.9957	595.5822	497.6254	373.8636	227.2479	122.4237	81.3492	(83)
Total gains	410.8734	502.4851	618.5230	761.2008	869.6879	876.5243	831.0593	736.6542	622.2598	493.4904	409.2235	384.2130	(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	59.1566	59.2787	59.3989	59.9702	60.0783	60.5868	60.5868	60.6819	60.3899	60.0783	59.8600	59.6335		
alpha	4.9438	4.9519	4.9599	4.9980	5.0052	5.0391	5.0391	5.0455	5.0260	5.0052	4.9907	4.9756		
util living area	0.9992	0.9977	0.9910	0.9574	0.8501	0.6647	0.5029	0.5829	0.8626	0.9858	0.9983	0.9995	(86)	
MIT	19.6223	19.7919	20.0940	20.4968	20.8143	20.9602	20.9920	20.9840	20.8529	20.4137	19.9426	19.5942	(87)	
Th 2	19.7529	19.7551	19.7573	19.7676	19.7695	19.7785	19.7785	19.7802	19.7751	19.7695	19.7656	19.7616	(88)	
util rest of house	0.9989	0.9967	0.9869	0.9377	0.7888	0.5558	0.3680	0.4386	0.7788	0.9764	0.9973	0.9992	(89)	
MIT 2	18.5119	18.6830	18.9845	19.3816	19.6580	19.7638	19.7771	19.7768	19.7021	19.3114	18.8421	18.4907	(90)	
Living area fraction									fLA = Living area / (4) =			0.4714	(91)	
MIT	19.0354	19.2058	19.5076	19.9073	20.2031	20.3278	20.3498	20.3459	20.2446	19.8311	19.3609	19.0109	(92)	
Temperature adjustment												0.0000		
adjusted MIT	19.0354	19.2058	19.5076	19.9073	20.2031	20.3278	20.3498	20.3459	20.2446	19.8311	19.3609	19.0109	(93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Useful gains	410.3101	500.5436	609.7901	715.8223	706.7294	531.9684	359.1591	373.9458	507.3131	482.1415	407.9605	383.8365	(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	1458.1052	1412.6781	1281.8817	1074.4243	828.4978	553.4028	362.2947	380.6457	595.6068	899.4237	1198.9937	1453.8613	(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	779.5596	612.9544	500.0362	258.1934	90.5957	0.0000	0.0000	0.0000	0.0000	310.4580	569.5439	796.0984	(98)	
Space heating												3917.4396	(98)	
Space heating per m2												55.9634	(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	908.1982	714.9645	733.1371	0.0000	0.0000	0.0000	0.0000	(100)	
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9053	0.9495	0.9204	0.0000	0.0000	0.0000	0.0000	(101)	
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	822.1725	678.8697	674.7485	0.0000	0.0000	0.0000	0.0000	(102)	
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1107.9328	1053.1033	944.1016	0.0000	0.0000	0.0000	0.0000	(103)	

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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	205.7474	278.4298	200.3987	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												684.5759 (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	51.4368	69.6074	50.0997	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												171.1440 (107)
Space cooling per m2												2.4449 (108)
Energy for space heating												55.9634 (99)
Energy for space cooling												2.4449 (108)
Total												58.4083 (109)
Dwelling Fabric Energy Efficiency (DFEE)												58.4 (109)

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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	70.0000 (1b)	x 2.4000 (2b)	= 168.0000 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 168.0000 (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) =
Measured/design AP50					Yes
Infiltration rate					5.0000
Number of sides sheltered					0.3690 (18)
					1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3414 (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	0.4352	0.4267	0.4182	0.3755	0.3670	0.3243	0.3243	0.3158	0.3414	0.3670	0.3840	0.4011 (22b)
Effective ac	0.5947	0.5910	0.5874	0.5705	0.5673	0.5526	0.5526	0.5499	0.5583	0.5673	0.5737	0.5804 (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			2.1200	1.2000	2.5440		(26a)
TER Opening Type (Uw = 1.40)			15.3900	1.3258	20.4034		(27)
Main Floor			70.0000	0.1300	9.1000		(28a)
Main Wall	59.9500	17.5100	42.4400	0.1800	7.6392		(29a)
wall to Stairs	13.1500		13.1500	0.1800	2.3670		(29a)
Flat roof	4.1700		4.1700	0.1300	0.5421		(30)
Total net area of external elements Aum(A, m ²)			147.2700				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	42.5957		(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)							11.3373 (36)
Total fabric heat loss						(33) + (36) =	53.9330 (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	32.9712	32.7673	32.5675	31.6287	31.4530	30.6353	30.6353	30.4839	30.9503	31.4530	31.8083	32.1798 (38)
Heat transfer coeff	86.9042	86.7003	86.5005	85.5617	85.3860	84.5683	84.5683	84.4169	84.8833	85.3860	85.7413	86.1128 (39)
Average = Sum(39)m / 12 =												85.5608 (39)
HLP	1.2415	1.2386	1.2357	1.2223	1.2198	1.2081	1.2081	1.2060	1.2126	1.2198	1.2249	1.2302 (40)
HLP (average)												1.2223 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.2461 (42)
Average daily hot water use (litres/day)												87.5455 (43)
Daily hot water use	96.3000	92.7982	89.2964	85.7946	82.2927	78.7909	78.7909	82.2927	85.7946	89.2964	92.7982	96.3000 (44)
Energy conte	142.8101	124.9027	128.8884	112.3680	107.8198	93.0403	86.2155	98.9335	100.1151	116.6745	127.3593	138.3040 (45)
Energy content (annual)										Total = Sum(45)m =		1377.4311 (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	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	0.0000 (59)
	30.3472	26.5418	27.3888	23.8782	22.9117	19.7711	18.3208	21.0234	21.2745	24.7933	27.0639	29.3896	(65)

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

Metabolic gains (Table 5), Watts													
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	17.5956	15.6283	12.7098	9.6221	7.1926	6.0723	6.5614	8.5287	11.4472	14.5349	16.9643	18.0846	(67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	197.2971	199.3444	194.1852	183.2019	169.3374	156.3068	147.6015	145.5542	150.7134	161.6967	175.5612	188.5918	(68)
Pumps, fans	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	(69)
Losses e.g. evaporation (negative values) (Table 5)	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)
Water heating gains (Table 5)	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	(71)
Total internal gains	40.7892	39.4967	36.8129	33.1642	30.7953	27.4598	24.6247	28.2572	29.5479	33.3244	37.5887	39.5021	(72)
	312.3737	311.1613	300.3997	282.6800	264.0172	246.5308	235.4795	239.0320	248.4003	266.2478	286.8060	302.8705	(73)

6. Solar gains													

[Jan]				Area	Solar flux		g	FF		Access		Gains	
				m2	Table 6a		Specific data	Specific data		factor		W	
					W/m2		or Table 6b	or Table 6c		Table 6d			
North				6.9400	10.6334		0.6300	0.7000		0.7700		22.5529	(74)
East				3.8100	19.6403		0.6300	0.7000		0.7700		22.8688	(76)
West				4.6400	19.6403		0.6300	0.7000		0.7700		27.8508	(80)

Solar gains	73.2725	142.3181	236.6355	355.9444	450.5226	468.6146	443.0165	370.1525	278.0939	169.0356	91.0633	60.5106	(83)
Total gains	385.6463	453.4794	537.0352	638.6245	714.5398	715.1453	678.4960	609.1845	526.4942	435.2834	377.8694	363.3810	(84)

7. Mean internal temperature (heating season)													

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
tau	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
alpha	55.9364	56.0680	56.1975	56.8141	56.9310	57.4814	57.4814	57.5846	57.2682	56.9310	56.6951	56.4505	
util living area	4.7291	4.7379	4.7465	4.7876	4.7954	4.8321	4.8321	4.8390	4.8179	4.7954	4.7797	4.7634	
	0.9986	0.9967	0.9897	0.9596	0.8680	0.6972	0.5344	0.6093	0.8691	0.9830	0.9972	0.9990	(86)
MIT	19.5930	19.7537	20.0452	20.4406	20.7697	20.9434	20.9874	20.9772	20.8300	20.3904	19.9213	19.5670	(87)
Th 2	19.8870	19.8893	19.8915	19.9022	19.9042	19.9135	19.9135	19.9152	19.9099	19.9042	19.9002	19.8959	(88)
util rest of house													
	0.9981	0.9956	0.9859	0.9439	0.8192	0.6018	0.4096	0.4793	0.8000	0.9740	0.9960	0.9986	(89)
MIT 2	18.6073	18.7695	19.0607	19.4538	19.7516	19.8884	19.9104	19.9089	19.8144	19.4133	18.9456	18.5885	(90)
Living area fraction													
MIT	19.0720	19.2335	19.5248	19.9190	20.2315	20.3857	20.4181	20.4125	20.2932	19.8740	19.4056	19.0498	(91)
Temperature adjustment													
adjusted MIT	19.0720	19.2335	19.5248	19.9190	20.2315	20.3857	20.4181	20.4125	20.2932	19.8740	19.4056	19.0498	(92)

8. Space heating requirement													

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9976	0.9946	0.9842	0.9442	0.8353	0.6454	0.4689	0.5411	0.8275	0.9736	0.9952	0.9982	(94)
Ext temp.	384.7311	451.0448	528.5706	602.9674	596.8844	461.5682	318.1524	329.6459	435.6688	423.8069	376.0728	362.7314	(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	1283.7493	1242.7168	1126.6543	942.8049	728.4741	489.2896	322.8941	338.7259	525.6999	791.8676	1055.0960	1278.7553	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	(98)
Space heating per m2	668.8696	532.0036	444.9743	244.6830	97.9027	0.0000	0.0000	0.0000	0.0000	273.8371	488.8967	681.5218	(99)
												3432.6888	(98)
												49.0384	(99)

8c. Space cooling requirement													

Calculated for June, July and August. See Table 10b													
Ext. temp.	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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	
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	794.9425	625.8058	641.5686	0.0000	0.0000	0.0000	0.0000	(100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.8827	0.9343	0.9043	0.0000	0.0000	0.0000	0.0000	(101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	701.7354	584.6697	580.1594	0.0000	0.0000	0.0000	0.0000	(102)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	919.3110	874.7857	795.1152	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	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	0.0000	0.0000	0.0000	0.0000	0.0000	156.6544	215.8463	159.9271	0.0000	0.0000	0.0000	0.0000	(104)
												532.4278	(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 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	39.1636	53.9616	39.9818	0.0000	0.0000	0.0000 (107)
Space cooling											133.1070 (107)
Space cooling per m2											1.9015 (108)
Energy for space heating											49.0384 (99)
Energy for space cooling											1.9015 (108)
Total											50.9399 (109)
Target Fabric Energy Efficiency (TFEE)											58.6 (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	70.0000 (1b)	x 2.4000 (2b)	= 168.0000 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 168.0000 (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					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				30.0000 / (5) = 0.1786 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4286 (18)
Number of sides sheltered					1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3964 (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	0.4361	0.4063	0.4063	0.3865	0.3865	0.3370	0.3370	0.3271	0.3370	0.3766	0.3667	0.3964 (22b)
Effective ac	0.5951	0.5826	0.5826	0.5747	0.5747	0.5568	0.5568	0.5535	0.5568	0.5709	0.5672	0.5786 (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			2.1200	1.4000	2.9680		(26a)
Windows (Uw = 1.40)			20.6900	1.3258	27.4299		(27)
Main Floor			70.0000	0.1400	9.8000	110.0000	7700.0000 (28a)
Main Wall	59.9500	22.8100	37.1400	0.2200	8.1708	60.0000	2228.4000 (29a)
wall to Stairs	13.1500		13.1500	0.1864	2.4509	60.0000	789.0000 (29a)
Flat roof	4.1700		4.1700	0.1400	0.5838	9.0000	37.5300 (30)
Total net area of external elements Aum(A, m ²)			147.2700				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	51.4034		(33)
Party Wall 1			9.3300	0.0000	0.0000	180.0000	1679.4000 (32)
Party Ceilings 1			66.0000			40.0000	2640.0000 (32b)
Internal Wall 1			66.5900			100.0000	6659.0000 (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) = 21733.3300 (34)
310.4761 (35)
14.5781 (36)
(33) + (36) = 65.9815 (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	32.9912	32.2969	32.2969	31.8613	31.8613	30.8675	30.8675	30.6850	30.8675	31.6516	31.4474	32.0764 (38)
Heat transfer coeff	98.9727	98.2784	98.2784	97.8427	97.8427	96.8490	96.8490	96.6665	96.8490	97.6331	97.4289	98.0578 (39)
Average = Sum(39)m / 12 =												97.6290 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.4139	1.4040	1.4040	1.3978	1.3978	1.3836	1.3836	1.3810	1.3836	1.3948	1.3918	1.4008 (40)
HLP (average)												1.3947 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy
Average daily hot water use (litres/day)
2.2461 (42)
87.5455 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	96.3000	92.7982	89.2964	85.7946	82.2927	78.7909	78.7909	82.2927	85.7946	89.2964	92.7982	96.3000 (44)
Energy conte	142.8101	124.9027	128.8884	112.3680	107.8198	93.0403	86.2155	98.9335	100.1151	116.6745	127.3593	138.3040 (45)
Energy content (annual)										Total = Sum(45)m =		1377.4311 (45)
Distribution loss (46)m = 0.15 x (45)m	21.4215	18.7354	19.3333	16.8552	16.1730	13.9560	12.9323	14.8400	15.0173	17.5012	19.1039	20.7456 (46)

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Water storage loss:											210.0000	(47)	
Store volume													
a) If manufacturer declared loss factor is known (kWh/day):											1.8600	(48)	
Temperature factor from Table 2b											0.5400	(49)	
Enter (49) or (54) in (55)											1.0044	(55)	
Total storage loss													
	31.1364	28.1232	31.1364	30.1320	31.1364	30.1320	31.1364	30.1320	31.1364	30.1320	31.1364	(56)	
If cylinder contains dedicated solar storage													
	31.1364	28.1232	31.1364	30.1320	31.1364	30.1320	31.1364	30.1320	31.1364	30.1320	31.1364	(57)	
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	(59)	
Total heat required for water heating calculated for each month													
	197.2089	174.0371	183.2872	165.0120	162.2186	145.6843	140.6143	153.3323	152.7591	171.0733	180.0033	192.7028	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Solar input (sum of months) = Sum(63)m =											0.0000	(63)	
Output from w/h													
	197.2089	174.0371	183.2872	165.0120	162.2186	145.6843	140.6143	153.3323	152.7591	171.0733	180.0033	192.7028	(64)
Total per year (kWh/year) = Sum(64)m =											2017.9331	(64)	
RHI water heating demand											2018	(64)	
Heat gains from water heating, kWh/month													
	91.0034	80.8377	86.3744	79.4776	79.3691	73.0511	72.1857	76.4144	75.4035	82.3133	84.4622	89.5051	(65)

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	134.7675	134.7675	134.7675	134.7675	134.7675	134.7675	134.7675	134.7675	134.7675	134.7675	134.7675	134.7675 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	43.9729	39.0564	31.7628	24.0465	17.9750	15.1753	16.3974	21.3140	28.6076	36.3239	42.3953	45.1951 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	294.4732	297.5289	289.8286	273.4356	252.7424	233.2937	220.3007	217.2450	224.9453	241.3383	262.0316	281.4803 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.7229	50.7229	50.7229	50.7229	50.7229	50.7229	50.7229	50.7229	50.7229	50.7229	50.7229	50.7229 (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)	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450 (71)
Water heating gains (Table 5)	122.3164	120.2941	116.0946	110.3855	106.6789	101.4598	97.0238	102.7076	104.7270	110.6362	117.3086	120.3026 (72)
Total internal gains	556.4080	552.5248	533.3315	503.5130	473.0417	445.5742	429.3673	436.9120	453.9253	483.9438	517.3809	542.6233 (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	9.3300	12.7500	0.6300	0.7000	0.7700	36.3549 (74)
East	5.1200	23.7835	0.6300	0.7000	0.7700	37.2149 (76)
West	6.2400	23.7835	0.6300	0.7000	0.7700	45.3557 (80)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9883	0.9786	0.9435	0.8374	0.6381	0.3964	0.2413	0.2816	0.5873	0.8867	0.9749	0.9905 (94)
Useful gains	667.4444	738.7965	819.2078	850.1506	704.0044	451.3351	260.1283	278.9000	513.1024	658.1253	646.4744	635.2242 (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												
	1436.8313	1382.0963	1231.0579	1017.6556	738.2383	453.7205	260.2579	279.1904	529.6629	847.2823	1160.4027	1422.0581 (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													
	572.4238	432.2974	306.4165	120.6036	25.4700	0.0000	0.0000	0.0000	0.0000	140.7328	370.0284	585.4045	(98)
Space heating												2553.3769	(98)
RHI space heating demand												2553	(98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	70.0000 (1b)	x 2.4000 (2b)	= 168.0000 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 168.0000 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)
Number of intermittent fans				3 * 10 =	30.0000 (7a)
Number of passive vents				0 * 10 =	0.0000 (7b)
Number of flueless gas fires				0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				Air changes per hour
Pressure test					30.0000 / (5) = 0.1786 (8)
Measured/design AP50					Yes
Infiltration rate					5.0000
Number of sides sheltered					0.4286 (18)
					1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3964 (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												
	0.5054	0.4955	0.4856	0.4361	0.4262	0.3766	0.3766	0.3667	0.3964	0.4262	0.4460	0.4658 (22b)
Effective ac	0.6277	0.6228	0.6179	0.5951	0.5908	0.5709	0.5709	0.5672	0.5786	0.5908	0.5995	0.6085 (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			2.1200	1.4000	2.9680		(26a)
Windows (Uw = 1.40)			20.6900	1.3258	27.4299		(27)
Main Floor			70.0000	0.1400	9.8000	110.0000	7700.0000 (28a)
Main Wall	59.9500	22.8100	37.1400	0.2200	8.1708	60.0000	2228.4000 (29a)
wall to Stairs	13.1500		13.1500	0.1864	2.4509	60.0000	789.0000 (29a)
Flat roof	4.1700		4.1700	0.1400	0.5838	9.0000	37.5300 (30)
Total net area of external elements Aum(A, m ²)			147.2700				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	51.4034		(33)
Party Wall 1			9.3300	0.0000	0.0000	180.0000	1679.4000 (32)
Party Ceilings 1			66.0000			40.0000	2640.0000 (32b)
Internal Wall 1			66.5900			100.0000	6659.0000 (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) = 21733.3300 (34)
310.4761 (35)
14.5781 (36)
(33) + (36) = 65.9815 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	34.8018	34.5268	34.2573	32.9912	32.7543	31.6516	31.6516	31.4474	32.0764	32.7543	33.2335	33.7345 (38)
Heat transfer coeff	100.7833	100.5083	100.2387	98.9727	98.7358	97.6331	97.6331	97.4289	98.0578	98.7358	99.2150	99.7160 (39)
Average = Sum(39)m / 12 =												98.9715 (39)
HLP	1.4398	1.4358	1.4320	1.4139	1.4105	1.3948	1.3948	1.3918	1.4008	1.4105	1.4174	1.4245 (40)
HLP (average)												1.4139 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.2461 (42)
Average daily hot water use (litres/day)												87.5455 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	96.3000	92.7982	89.2964	85.7946	82.2927	78.7909	78.7909	82.2927	85.7946	89.2964	92.7982	96.3000 (44)
Energy conte	142.8101	124.9027	128.8884	112.3680	107.8198	93.0403	86.2155	98.9335	100.1151	116.6745	127.3593	138.3040 (45)
Energy content (annual)										Total = Sum(45)m =		1377.4311 (45)
Distribution loss (46)m = 0.15 x (45)m	21.4215	18.7354	19.3333	16.8552	16.1730	13.9560	12.9323	14.8400	15.0173	17.5012	19.1039	20.7456 (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	31.1364	30.1320	31.1364	30.1320	31.1364 (56)
If cylinder contains dedicated solar storage	31.1364	28.1232	31.1364	30.1320	31.1364	30.1320	31.1364	31.1364	30.1320	31.1364	30.1320	31.1364 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month												
	197.2089	174.0371	183.2872	165.0120	162.2186	145.6843	140.6143	153.3323	152.7591	171.0733	180.0033	192.7028 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
	Solar input (sum of months) = Sum(63)m = 0.0000 (63)											
Output from w/h	197.2089	174.0371	183.2872	165.0120	162.2186	145.6843	140.6143	153.3323	152.7591	171.0733	180.0033	192.7028 (64)
	Total per year (kWh/year) = Sum(64)m = 2017.9331 (64)											
Heat gains from water heating, kWh/month												
	91.0034	80.8377	86.3744	79.4776	79.3691	73.0511	72.1857	76.4144	75.4035	82.3133	84.4622	89.5051 (65)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9913	0.9830	0.9580	0.8788	0.7166	0.5064	0.3496	0.4023	0.6817	0.9240	0.9826	0.9930 (94)
Useful gains	649.1856	731.2351	815.7290	862.9676	773.0200	544.7169	358.3062	375.9526	564.2760	657.1762	628.6664	619.6052 (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	1512.0573	1462.6000	1323.8371	1100.2550	839.7908	553.8415	359.3963	378.1299	601.9725	926.3781	1239.2714	1504.1021 (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 ENERGY RATINGS 09 Jan 2014

Space heating kWh
641.9766 491.4772 378.0324 170.8470 49.6775 0.0000 0.0000 0.0000 0.0000 200.2862 439.6356 658.0657 (98)
Space heating
3029.9981 (98)
Space heating per m2 (98) / (4) = 43.2857 (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 %) 302.4894 (206)
Efficiency of secondary/supplementary heating system, % 100.0000 (208)
Space heating requirement 1001.6873 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	641.9766	491.4772	378.0324	170.8470	49.6775	0.0000	0.0000	0.0000	0.0000	200.2862	439.6356	658.0657	(98)
Space heating efficiency (main heating system 1)	302.4894	302.4894	302.4894	302.4894	302.4894	0.0000	0.0000	0.0000	0.0000	302.4894	302.4894	302.4894	(210)
Space heating fuel (main heating system)	212.2311	162.4775	124.9738	56.4803	16.4229	0.0000	0.0000	0.0000	0.0000	66.2126	145.3392	217.5500	(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	197.2089	174.0371	183.2872	165.0120	162.2186	145.6843	140.6143	153.3323	152.7591	171.0733	180.0033	192.7028	(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	116.3887	102.7131	108.1723	97.3867	95.7381	85.9798	82.9877	90.4936	90.1553	100.9639	106.2343	113.7292	(219)
Water heating fuel used												1190.9426	(219)
Annual totals kWh/year													
Space heating fuel - main system												1001.6873	(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)												310.6304	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
Total delivered energy for all uses												2503.2602	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1001.6873	13.1900	132.1226	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1190.9426	13.1900	157.0853	(247)
Pumps and fans for heating	0.0000	0.0000	0.0000	(249)
Energy for lighting	310.6304	13.1900	40.9721	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit	0.0000	13.1900	0.0000	(252)
Total energy cost			330.1800	(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] = 1.2059 (257)
SAP value 83.1780
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	1001.6873	0.5190	519.8757	(261)
Space heating - secondary	0.0000	0.5190	0.0000	(263)
Water heating (other fuel)	1190.9426	0.5190	618.0992	(264)
Space and water heating			1137.9749	(265)
Pumps and fans	0.0000	0.0000	0.0000	(267)
Energy for lighting	310.6304	0.5190	161.2172	(268)
Energy saving/generation technologies				
PV Unit	-300.0000	0.5190	-155.7000	(269)
Total kg/year			1143.4920	(272)
CO2 emissions per m2			16.3400	(273)
EI value			86.6758	
EI rating			87	(274)
EI band			B	

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Calculation of stars for heating and DHW

Main heating energy efficiency	$13.19 \times (1 + 0.29 \times 0.25) / 3.0249 = 4.677$	stars = 4
Main heating environmental impact	$0.519 \times (1 + 0.29 \times 0.25) / 3.0249 = 0.1840$	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	70.0000 (1b)	x 2.4000 (2b)	= 168.0000 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 168.0000 (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					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
					Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1786 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4286 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3964 (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												
	0.4361	0.4063	0.4063	0.3865	0.3865	0.3370	0.3370	0.3271	0.3370	0.3766	0.3667	0.3964 (22b)
Effective ac	0.5951	0.5826	0.5826	0.5747	0.5747	0.5568	0.5568	0.5535	0.5568	0.5709	0.5672	0.5786 (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			2.1200	1.4000	2.9680		(26a)
Windows (Uw = 1.40)			20.6900	1.3258	27.4299		(27)
Main Floor			70.0000	0.1400	9.8000	110.0000	7700.0000 (28a)
Main Wall	59.9500	22.8100	37.1400	0.2200	8.1708	60.0000	2228.4000 (29a)
wall to Stairs	13.1500		13.1500	0.1864	2.4509	60.0000	789.0000 (29a)
Flat roof	4.1700		4.1700	0.1400	0.5838	9.0000	37.5300 (30)
Total net area of external elements Aum(A, m ²)			147.2700				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	51.4034		(33)
Party Wall 1			9.3300	0.0000	0.0000	180.0000	1679.4000 (32)
Party Ceilings 1			66.0000			40.0000	2640.0000 (32b)
Internal Wall 1			66.5900			100.0000	6659.0000 (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) = 21733.3300 (34)
310.4761 (35)
14.5781 (36)
(33) + (36) = 65.9815 (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	32.9912	32.2969	32.2969	31.8613	31.8613	30.8675	30.8675	30.6850	30.8675	31.6516	31.4474	32.0764 (38)
Heat transfer coeff	98.9727	98.2784	98.2784	97.8427	97.8427	96.8490	96.8490	96.6665	96.8490	97.6331	97.4289	98.0578 (39)
Average = Sum(39)m / 12 =												97.6290 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.4139	1.4040	1.4040	1.3978	1.3978	1.3836	1.3836	1.3810	1.3836	1.3948	1.3918	1.4008 (40)
HLP (average)												1.3947 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy
Average daily hot water use (litres/day)
2.2461 (42)
87.5455 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	96.3000	92.7982	89.2964	85.7946	82.2927	78.7909	78.7909	82.2927	85.7946	89.2964	92.7982	96.3000 (44)
Energy conte	142.8101	124.9027	128.8884	112.3680	107.8198	93.0403	86.2155	98.9335	100.1151	116.6745	127.3593	138.3040 (45)
Energy content (annual)										Total = Sum(45)m =		1377.4311 (45)
Distribution loss (46)m = 0.15 x (45)m	21.4215	18.7354	19.3333	16.8552	16.1730	13.9560	12.9323	14.8400	15.0173	17.5012	19.1039	20.7456 (46)

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Water storage loss:												
Store volume												
a) If manufacturer declared loss factor is known (kWh/day):	210.0000 (47)											
Temperature factor from Table 2b	1.8600 (48)											
Enter (49) or (54) in (55)	0.5400 (49)											
Total storage loss	1.0044 (55)											
	31.1364	28.1232	31.1364	30.1320	31.1364	30.1320	31.1364	31.1364	30.1320	31.1364	30.1320	31.1364 (56)
If cylinder contains dedicated solar storage	31.1364	28.1232	31.1364	30.1320	31.1364	30.1320	31.1364	31.1364	30.1320	31.1364	30.1320	31.1364 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	197.2089	174.0371	183.2872	165.0120	162.2186	145.6843	140.6143	153.3323	152.7591	171.0733	180.0033	192.7028 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h	197.2089	174.0371	183.2872	165.0120	162.2186	145.6843	140.6143	153.3323	152.7591	171.0733	180.0033	192.7028 (64)
								Total per year (kWh/year) = Sum(64)m =				2017.9331 (64)
Heat gains from water heating, kWh/month	91.0034	80.8377	86.3744	79.4776	79.3691	73.0511	72.1857	76.4144	75.4035	82.3133	84.4622	89.5051 (65)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9883	0.9786	0.9435	0.8374	0.6381	0.3964	0.2413	0.2816	0.5873	0.8867	0.9749	0.9905 (94)
Useful gains	667.4444	738.7965	819.2078	850.1506	704.0044	451.3351	260.1283	278.9000	513.1024	658.1253	646.4744	635.2242 (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	1436.8313	1382.0963	1231.0579	1017.6556	738.2383	453.7205	260.2579	279.1904	529.6629	847.2823	1160.4027	1422.0581 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Space heating kWh	572.4238	432.2974	306.4165	120.6036	25.4700	0.0000	0.0000	0.0000	0.0000	140.7328	370.0284	585.4045 (98)
Space heating												2553.3769 (98)
Space heating per m2												(98) / (4) = 36.4768 (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 %)												302.9046 (206)
Efficiency of secondary/supplementary heating system, %												100.0000 (208)
Space heating requirement												842.9640 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	572.4238	432.2974	306.4165	120.6036	25.4700	0.0000	0.0000	0.0000	0.0000	140.7328	370.0284	585.4045 (98)
Space heating efficiency (main heating system 1)	302.9046	302.9046	302.9046	302.9046	302.9046	0.0000	0.0000	0.0000	0.0000	302.9046	302.9046	302.9046 (210)
Space heating fuel (main heating system)	188.9782	142.7173	101.1594	39.8157	8.4086	0.0000	0.0000	0.0000	0.0000	46.4611	122.1600	193.2636 (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	197.2089	174.0371	183.2872	165.0120	162.2186	145.6843	140.6143	153.3323	152.7591	171.0733	180.0033	192.7028 (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	116.3887	102.7131	108.1723	97.3867	95.7381	85.9798	82.9877	90.4936	90.1553	100.9639	106.2343	113.7292 (219)
Water heating fuel used												1190.9426 (219)
Annual totals kWh/year												
Space heating fuel - main system												842.9640 (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)												310.6304 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
Total delivered energy for all uses												2344.5369 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	842.9640	19.1200	161.1747 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1190.9426	19.1200	227.7082 (247)
Pumps and fans for heating	0.0000	0.0000	0.0000 (249)
Energy for lighting	310.6304	19.1200	59.3925 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit	0.0000	19.1200	0.0000 (252)
Total energy cost			448.2755 (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	842.9640	0.5190	437.4983 (261)
Space heating - secondary	0.0000	0.5190	0.0000 (263)
Water heating (other fuel)	1190.9426	0.5190	618.0992 (264)
Space and water heating			1055.5975 (265)
Pumps and fans	0.0000	0.0000	0.0000 (267)
Energy for lighting	310.6304	0.5190	161.2172 (268)
Energy saving/generation technologies			
PV Unit	-300.0000	0.5190	-155.7000 (269)
Total kg/year			1061.1147 (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	842.9640	3.0700	2587.8994 (261)
Space heating - secondary	0.0000	3.0700	0.0000 (263)
Water heating (other fuel)	1190.9426	3.0700	3656.1936 (264)
Space and water heating			6244.0931 (265)
Pumps and fans	0.0000	0.0000	0.0000 (267)
Energy for lighting	310.6304	3.0700	953.6352 (268)

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

Energy saving/generation technologies			
PV Unit	-300.0000	3.0700	-921.0000 (269)
Primary energy kWh/year			6276.7283 (272)
Primary energy kWh/m2/year			89.6675 (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/m²

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	£448	£448	£0
Space heating	£161	£161	£0
Water heating	£228	£228	£0
Lighting	£59	£59	£0
Total cost of fuels	£448	£448	£0
Total cost of uses	£448	£448	£0
Delivered energy	33 kWh/m²	33 kWh/m²	0 kWh/m²
Carbon dioxide emissions	1.1 tonnes	1.1 tonnes	0.0 tonnes
CO2 emissions per m²	15 kg/m²	15 kg/m²	0 kg/m²
Primary energy	90 kWh/m²	90 kWh/m²	0 kWh/m²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Energy Calculations Ltd
SAP ♦ CODE ♦ SBEM ♦ DESIGN

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	EndTerrace 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	310.5 (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	332.64 (P1)
Transmission heat loss coefficient	65.98 (37)
Summer heat loss coefficient	398.62 (P2)

Overhangs	Ratio	Z_overhangs	Overhang type
Orientation			
North	0.000	1.000	None
East	0.000	1.000	None
West	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)
West	1.000	0.90	1.000	0.900 (P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	9.3300	81.1852	0.6300	0.7000	0.9000	270.5715
East	5.1200	117.5071	0.6300	0.7000	0.9000	214.9105
West	6.2400	117.5071	0.6300	0.7000	0.9000	261.9221
total:						747.4040

	Jun	Jul	Aug	
Solar gains	799	747	639	(P3)
Internal gains	446	429	437	
Total summer gains	1244	1177	1076	(P5)
Summer gain/loss ratio	3.12	2.95	2.70	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 310.5)	0.00	0.00	0.00	
Threshold temperature	19.12	20.85	20.50	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	
Assessment of likelihood of high internal temperature:	Slight			

BASIC COMPLIANCE REPORT

Energy Calculations Ltd
SAP • CODE • SBEM • DESIGN

Calculation Type: New Build (As Designed)

Property Reference	015722	Issued on Date	16/08/2021
Assessment Reference	004	Prop Type Ref	
Property	Flat 1 , 18, Parkside Road, READING, RG30 2DB		
SAP Rating	83 B	DER	17.89
Environmental	87 B	TER	29.47
CO ₂ Emissions (t/year)	1.06	% DER<TER	39.29
General Requirements Compliance	Pass	DFEE	58.41
		TFEE	58.58
		% DFEE<TFEE	0.29
Assessor Details	Mr. Matthew Carter, Energy Calculations Limited, Tel: 01754 761035, mcarter@energycalculations.co.uk		Assessor ID
			7869-0001
Client			

SUMMARY FOR INPUT DATA FOR New Build (As Designed)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Electricity		
Fuel factor	1.55 (electricity)		
Target Carbon Dioxide Emission Rate (TER)	29.47	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	17.89	kgCO ₂ /m ²	Pass
	-11.58 (-39.3%)	kgCO ₂ /m ²	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	58.58	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DFEE)	58.41	kWh/m ² /yr	
	-0.2 (-0.3%)	kWh/m ² /yr	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.22 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.14 (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
SAP • CODE • SBEM • DESIGN

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

9.33 m², No overhang

Windows facing East

5.12 m², No overhang

Windows facing West

6.24 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
SAP • CODE • SBEM • DESIGN

Calculation Type: New Build (As Designed)

Property Reference	015722	Issued on Date	16/08/2021
Assessment Reference	004	Prop Type Ref	
Property	Flat 1 , 18, Parkside Road, READING, RG30 2DB		
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CO ₂ Emissions (t/year)	1.06	% DER<TER	39.29
General Requirements Compliance	Pass	DFEE	58.41
		TFEE	58.58
		% DFEE<TFEE	0.29
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, End-Terrace						
2.0 Number of Storeys	1						
3.0 Date Built	2020						
4.0 Sheltered Sides	1						
5.0 Sunlight/Shade	Average or unknown						
6.0 Measurements							
Ground Floor:		Heat Loss Perimeter		Internal Floor Area		Average Storey Height	
		30.46 m		70.00 m²		2.40 m	
7.0 Living Area	33.00			m²			
8.0 Thermal Mass Parameter	Precise calculation			kJ/m²K			
Thermal Mass	310.48						
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	59.95	37.14
wall to Stairs	Cavity Wall	Cavity wall : plasterboard on dabs, AAC block, filled cavity, any outside structure		0.22	60.00	13.15	13.15
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	9.33	
9.2 Internal Walls							
Description	Construction				Kappa (kJ/m²K)	Area (m²)	
Internal Wall 1	Dense block, dense plaster				100.00	66.59	
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	4.17	4.17
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	66.00

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	70.00

12.0 Opening Types

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

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							2.12	
Windows	Window	[1] Main Wall	West	None	0.00					6.24	
Windows	Window	[1] Main Wall	East	None	0.00					5.12	
Windows	Window	[1] Main Wall	North	None	0.00					9.33	

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)	11.80	0.300	No
Table K1 - Approved	E3 Sill	11.80	0.040	No
Table K1 - Approved	E4 Jamb	32.20	0.050	No
Table K1 - Approved	E5 Ground floor (normal)	30.46	0.160	No
Table K1 - Approved	E7 Party floor between dwellings (in blocks of flats)	30.46	0.070	No
Table K1 - Default	E14 Flat roof	8.50	0.080	No
Table K1 - Approved	E16 Corner (normal)	7.40	0.090	No
Table K1 - Approved	E17 Corner (inverted – internal area greater than external area)	2.37	-0.090	No
Table K1 - Default	P1 Party wall - Ground floor	5.11	0.160	No

Y-value

0.099

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				3
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
-------------------	------

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 %			