

Energy Calculations Ltd

SAP ♦ CODE ♦ SBEM ♦ DESIGN

01754-761035



SAP Report Submission for Building Regulations Compliance

Client:

Project: Flat 20, Wesley Gate
1-2 Queens Road, READING, RG1 4FR

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

Report Issue Date: 08/11/2021

EXCELLENCE
IN ENERGY
ASSESSMENT

BUILDING REGULATION COMPLIANCE

Calculation Type: New Build (As Built)

Energy Calculations Ltd
SAP • CODE • SBEM • DESIGN

Property Reference	015387	Issued on Date	08/11/2021
Assessment Reference	003	Prop Type Ref	
Property	Flat 20, Wesley Gate, 1-2 Queens Road, READING, RG1 4FR		
SAP Rating	84 B	DER	17.25
Environmental	91 B	TER	28.36
CO ₂ Emissions (t/year)	0.48	% DER<TER	39.17
General Requirements Compliance	Pass	DFEE	33.43
		TFEE	35.04
		% DFEE<TFEE	4.60
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 Built)

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)	28.36	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	17.25	kgCO ₂ /m ²	Pass
	-11.11 (-39.2%)	kgCO ₂ /m ²	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	35.04	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DFEE)	33.43	kWh/m ² /yr	
	-1.6 (-4.6%)	kWh/m ² /yr	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.22 (max. 0.30)	0.26 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Roof	0.08 (max. 0.20)	0.08 (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	6.63 (measured in this dwelling)	m ³ /(h.m ²) @ 50 Pa	
Maximum	10.0	m ³ /(h.m ²) @ 50 Pa	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Room heaters - Electric Panel, convector or radiant heaters	
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This report has been produced by an accredited Elmhurst member whose work is subject to quality assurance audits. The data used to produce the report has been verified by the Elmhurst members' portal.



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Secondary heating system

None

5 Cylinder insulation

Hot water storage

No cylinder

6 Controls

Space heating controls

Programmer and appliance thermostats

Pass

Hot water controls

No cylinder

7 Low energy lights

Percentage of fixed lights with low-energy fittings

100

%

Minimum

75

%

Pass

8 Mechanical ventilation

Continuous supply and extract system

Specific fan power

0.52

Maximum

1.5

Pass

MVHR efficiency

90

%

Minimum

70

%

Pass

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Thames Valley)

Medium

Pass

Based on:

Overshading

Average

Windows facing South East

5.72 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

Filled Cavity with Edge Sealing

0.00

W/m²K

Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals

6.63 (measured in this dwelling)

m³/(h.m²) @ 50 Pa

Maximum

10.0

m³/(h.m²) @ 50 Pa

Pass

10 Key features

Party wall U-value

0.00

W/m²K

Roof U-value

0.08

W/m²K

Thermal bridging y-value

0.028

W/m²K

Photovoltaic array

663.30

kWh/Year

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THERMAL BRIDGING

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Environmental	91 B	TER	28.36
CO ₂ Emissions (t/year)	0.48	% DER<TER	39.17
General Requirements Compliance	Pass	DFEE	33.43
		TFEE	35.04
		% DFEE<TFEE	4.60
Assessor Details	Mr. Matthew Carter, Energy Calculations Limited, Tel: 01754 761035, mcarter@energycalculations.co.uk		Assessor ID
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	Junction detail	Source Type	Psi (W/mK)	Length (m)	Result	Reference
External wall	E2 Other lintels (including other steel lintels)	Table K1 - Approved	0.300	2.72	0.82	
External wall	E3 Sill	Table K1 - Approved	0.040	2.72	0.11	
External wall	E4 Jamb	Table K1 - Approved	0.050	8.40	0.42	
External wall	E7 Party floor between dwellings (in blocks of flats)	Independently assessed	0.000	9.46	0.00	
External wall	E14 Flat roof	Table K1 - Default	0.080	9.46	0.76	
External wall	E16 Corner (normal)	Table K1 - Approved	0.090	2.36	0.21	
External wall	E17 Corner (inverted – internal area greater than external area)	Table K1 - Approved	-0.090	7.08	-0.64	

Total: **1.68** W/mK:
Y-Value: **0.028** W/m²K:

FULL SAP CALCULATION PRINTOUT

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CO ₂ Emissions (t/year)	0.48	DFEE	33.43	TFEE	35.04
General Requirements Compliance	Pass	% DFEE<TFEE	4.60		
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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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

DWELLING AS BUILT

Top-floor flat, total floor area 37 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) 28.36 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 17.25 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)35.0 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)33.4 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.22 (max. 0.30)	0.26 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	(no floor)		
Roof	0.08 (max. 0.20)	0.08 (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: 6.63 (measured in this dwelling)
Maximum 10.0 OK

4 Heating efficiency

Main heating system: Room heaters - Electric
Panel, convector or radiant heaters

Secondary heating system: None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls: Programmer and appliance thermostats OK

Hot water controls: No cylinder

7 Low energy lights

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

8 Mechanical ventilation

Continuous supply and extract system
Specific fan power: 0.52
Maximum 1.5 OK
MVHR efficiency: 90%
Minimum: 70% OK

9 Summertime temperature

Overheating risk (Thames Valley): Medium OK
Based on:
Overshading: Average
Windows facing South East: 5.72 m², No overhang
Air change rate: 6.00 ach
Blinds/curtains: None

10 Key features

Party wall U-value 0.00 W/m²K
Roof U-value 0.08 W/m²K
Thermal bridging y-value 0.028 W/m²K
Photovoltaic array 663.30 kWh/Year

FULL SAP CALCULATION PRINTOUT

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (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	36.8500 (1b)	x 2.3500 (2b)	= 86.5975 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	36.8500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 86.5975 (5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 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							0 * 10 =	0.0000 (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) =						0.0000 / (5) =	0.0000 (8)				
Pressure test							Yes					
Measured/design AP50							6.6300					
Infiltration rate							0.3315	(18)				
Number of sides sheltered							3	(19)				
Shelter factor							(20) = 1 - [0.075 x (19)] =	0.7750 (20)				
Infiltration rate adjusted to include shelter factor							(21) = (18) x (20) =	0.2569 (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	0.3276	0.3211	0.3147	0.2826	0.2762	0.2441	0.2441	0.2376	0.2569	0.2762	0.2890	0.3019 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation:												0.5000 (23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												76.5000 (23c)
Effective ac	0.4451	0.4386	0.4322	0.4001	0.3937	0.3616	0.3616	0.3551	0.3744	0.3937	0.4065	0.4194 (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
Door to Hall			1.8900	1.4000	2.6460		(26)
Windows (Uw = 1.40)			5.7200	1.3258	7.5833		(27)
Roof lights (Uw = 1.40)			0.7200	1.3258	0.9545		(27a)
Main Walls	13.1700	5.7200	7.4500	0.1800	1.3410	0.0000	0.0000 (29a)
Wall to Hall	9.0600	1.8900	7.1700	0.2600	1.8642	18.0000	129.0600 (29a)
External Roof 1	36.8500	0.7200	36.1300	0.0800	2.8904	9.0000	325.1700 (30)
Total net area of external elements Aum(A, m ²)			59.0800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	17.2795		(33)
Party Wall 1			34.3200	0.0000	0.0000	20.0000	686.4000 (32)
Party Floor 1			36.8400			30.0000	1105.2000 (32d)
Internal Wall 1			54.0000			9.0000	486.0000 (32c)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 2731.8300 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							74.1338 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							1.6768 (36)
Total fabric heat loss							(33) + (36) = 18.9563 (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	12.7187	12.5351	12.3516	11.4338	11.2503	10.3326	10.3326	10.1490	10.6997	11.2503	11.6174	11.9845 (38)
Heat transfer coeff	31.6749	31.4914	31.3078	30.3901	30.2066	29.2888	29.2888	29.1053	29.6559	30.2066	30.5737	30.9408 (39)
Average = Sum(39)m / 12 =												30.3442 (39)
HLP	0.8596	0.8546	0.8496	0.8247	0.8197	0.7948	0.7948	0.7898	0.8048	0.8197	0.8297	0.8396 (40)
HLP (average)												0.8235 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.3254 (42)
Average daily hot water use (litres/day)												65.6774 (43)
Daily hot water use	Jan 72.2451	Feb 69.6180	Mar 66.9909	Apr 64.3638	May 61.7367	Jun 59.1096	Jul 59.1096	Aug 61.7367	Sep 64.3638	Oct 66.9909	Nov 69.6180	Dec 72.2451 (44)

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Energy conte	107.1374	93.7031	96.6932	84.2995	80.8873	69.7996	64.6796	74.2208	75.1072	87.5302	95.5461	103.7569 (45)
Energy content (annual)										Total =	Sum (45)m =	1033.3609 (45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
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)
Total heat required for water heating calculated for each month												
Solar input	91.0668	79.6476	82.1892	71.6545	68.7542	59.3297	54.9777	63.0877	63.8411	74.4007	81.2142	88.1933 (62)
	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	91.0668	79.6476	82.1892	71.6545	68.7542	59.3297	54.9777	63.0877	63.8411	74.4007	81.2142	88.1933 (64)
Heat gains from water heating, kWh/month	22.7667	19.9119	20.5473	17.9136	17.1886	14.8324	13.7444	15.7719	15.9603	18.6002	20.3035	22.0483 (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	66.2682	66.2682	66.2682	66.2682	66.2682	66.2682	66.2682	66.2682	66.2682	66.2682	66.2682	66.2682 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	10.3645	9.2056	7.4865	5.6678	4.2367	3.5768	3.8649	5.0237	6.7428	8.5616	9.9926	10.6525 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	113.7006	114.8805	111.9073	105.5777	97.5877	90.0783	85.0615	83.8816	86.8548	93.1844	101.1744	108.6838 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	29.6268	29.6268	29.6268	29.6268	29.6268	29.6268	29.6268	29.6268	29.6268	29.6268	29.6268	29.6268 (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)	-53.0145	-53.0145	-53.0145	-53.0145	-53.0145	-53.0145	-53.0145	-53.0145	-53.0145	-53.0145	-53.0145	-53.0145 (71)
Water heating gains (Table 5)	30.6004	29.6308	27.6173	24.8800	23.1029	20.6006	18.4737	21.1988	22.1671	25.0002	28.1994	29.6349 (72)
Total internal gains	197.5459	196.5973	189.8916	179.0059	167.8078	157.1361	150.2805	152.9846	158.6452	169.6267	182.2468	191.8517 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
Southeast				5.7200	36.7938	0.6300		0.7000		0.7700		64.3195
Horizontal				0.7200	26.0000	0.6300		0.7000		1.0000		7.4300 (77)
Solar gains	71.7495	124.9914	177.3384	228.6044	262.9109	263.6925	253.1357	227.3512	195.1784	139.9478	86.4703	61.0452 (83)
Total gains	269.2954	321.5888	367.2300	407.6103	430.7186	420.8286	403.4162	380.3358	353.8236	309.5744	268.7171	252.8969 (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	23.9572	24.0968	24.2381	24.9700	25.1217	25.9089	25.9089	26.0723	25.5882	25.1217	24.8201	24.5256
alpha	2.5971	2.6065	2.6159	2.6647	2.6748	2.7273	2.7273	2.7382	2.7059	2.6748	2.6547	2.6350
util living area	0.9068	0.8616	0.7951	0.6887	0.5609	0.4168	0.3096	0.3387	0.5145	0.7332	0.8660	0.9170 (86)
MIT	19.1436	19.4976	19.9392	20.4235	20.7388	20.9190	20.9734	20.9658	20.8490	20.4210	19.7291	19.1058 (87)
Th 2	20.2020	20.2063	20.2105	20.2320	20.2363	20.2578	20.2578	20.2622	20.2492	20.2363	20.2277	20.2191 (88)
util rest of house	0.8977	0.8490	0.7772	0.6634	0.5268	0.3744	0.2603	0.2881	0.4699	0.7051	0.8519	0.9089 (89)
MIT 2	17.7012	18.2064	18.8310	19.5140	19.9354	20.1775	20.2369	20.2341	20.0916	19.5281	18.5581	17.6579 (90)
Living area fraction	18.4265	18.8557	19.3883	19.9714	20.3394	20.5504	20.6072	20.6020	20.4725	19.9771	19.1469	0.5028 (91)
MIT	18.4265	18.8557	19.3883	19.9714	20.3394	20.5504	20.6072	20.6020	20.4725	19.9771	19.1469	18.3860 (92)
Temperature adjustment												0.0000
adjusted MIT	18.4265	18.8557	19.3883	19.9714	20.3394	20.5504	20.6072	20.6020	20.4725	19.9771	19.1469	18.3860 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.8731	0.8241	0.7566	0.6543	0.5316	0.3914	0.2837	0.3117	0.4836	0.6948	0.8288	0.8854 (94)
Ext temp.	235.1143	265.0314	277.8416	266.6919	228.9663	164.6978	114.4679	118.5340	171.0988	215.0890	222.7203	223.9203 (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	447.4569	439.4849	403.5040	336.4607	260.9666	174.2796	117.3668	122.3015	188.9818	283.2501	368.3184	438.9258 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating	157.9830	117.2328	93.4928	50.2335	23.8082	0.0000	0.0000	0.0000	0.0000	50.7118	104.8307	159.9641 (98)
Space heating per m2												758.2568 (98)
										(98) / (4) =		20.5768 (99)

FULL SAP CALCULATION PRINTOUT

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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 %)

100.0000 (206)

Efficiency of secondary/supplementary heating system, %

0.0000 (208)

Space heating requirement

758.2568 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	157.9830	117.2328	93.4928	50.2335	23.8082	0.0000	0.0000	0.0000	0.0000	50.7118	104.8307	159.9641	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	157.9830	117.2328	93.4928	50.2335	23.8082	0.0000	0.0000	0.0000	0.0000	50.7118	104.8307	159.9641	(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	91.0668	79.6476	82.1892	71.6545	68.7542	59.3297	54.9777	63.0877	63.8411	74.4007	81.2142	88.1933	(64)
Efficiency of water heater (217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(216)
Fuel for water heating, kWh/month	91.0668	79.6476	82.1892	71.6545	68.7542	59.3297	54.9777	63.0877	63.8411	74.4007	81.2142	88.1933	(219)
Water heating fuel used												878.3567	(219)
Annual totals kWh/year													
Space heating fuel - main system												758.2568	(211)
Space heating fuel - secondary												0.0000	(215)

Electricity for pumps and fans:

(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.6500)

mechanical ventilation fans (SFP = 0.6500)

68.6718 (230a)

Total electricity for the above, kWh/year

68.6718 (231)

Electricity for lighting (calculated in Appendix L)

183.0396 (232)

Energy saving/generation technologies (Appendices M,N and Q)

Total delivered energy for all uses

1888.3249 (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	758.2568	0.5190	393.5353	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	878.3567	0.5190	455.8671	(264)
Space and water heating			849.4024	(265)
Pumps and fans	68.6718	0.5190	35.6407	(267)
Energy for lighting	183.0396	0.5190	94.9975	(268)
Energy saving/generation technologies				
PV Unit	-663.3000	0.5190	-344.2527	(269)
Total CO2, kg/year			635.7879	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			17.2500	(273)

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

DER		17.2500	ZC1
Total Floor Area		36.8500	
Assumed number of occupants	TFA	1.3254	
CO2 emission factor in Table 12 for electricity displaced from grid	N	0.5190	
CO2 emissions from appliances, equation (L14)	EF	18.2840	ZC2
CO2 emissions from cooking, equation (L16)		4.0925	ZC3
Total CO2 emissions		39.6265	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		39.6265	ZC8

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1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	36.8500 (1b)	x 2.3500 (2b)	= 86.5975 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	36.8500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 86.5975 (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				2 * 10 =	20.0000 (7a)
Number of passive vents				0 * 10 =	0.0000 (7b)
Number of flueless gas fires				0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					20.0000 / (5) = 0.2310 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4810 (18)
Number of sides sheltered					3 (19)
Shelter factor					(20) = 1 - [0.075 x (19)] = 0.7750 (20)
Infiltration rate adjusted to include shelter factor					(21) = (18) x (20) = 0.3727 (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	0.4752	0.4659	0.4566	0.4100	0.4007	0.3541	0.3541	0.3448	0.3727	0.4007	0.4193	0.4380 (22b)
Effective ac	0.6129	0.6085	0.6042	0.5841	0.5803	0.5627	0.5627	0.5594	0.5695	0.5803	0.5879	0.5959 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			1.8900	1.0000	1.8900		(26)
TER Opening Type (Uw = 1.40)			5.7200	1.3258	7.5833		(27)
TER Room Window (Uw = 1.70)			0.7200	1.5918	1.1461		(27a)
Main Walls	13.1700	5.7200	7.4500	0.1800	1.3410		(29a)
Wall to Hall	9.0600	1.8900	7.1700	0.1800	1.2906		(29a)
External Roof 1	36.8500	0.7200	36.1300	0.1300	4.6969		(30)
Total net area of external elements Aum(A, m ²)			59.0800				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		17.9479		(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)							1.6862 (36)
Total fabric heat loss							(33) + (36) = 19.6341 (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	17.5157	17.3904	17.2676	16.6907	16.5827	16.0802	16.0802	15.9872	16.2738	16.5827	16.8011	17.0294 (38)
Heat transfer coeff	37.1498	37.0245	36.9017	36.3248	36.2168	35.7143	35.7143	35.6213	35.9079	36.2168	36.4352	36.6635 (39)
Average = Sum(39)m / 12 =												36.3242 (39)
HLP	1.0081	1.0047	1.0014	0.9857	0.9828	0.9692	0.9692	0.9667	0.9744	0.9828	0.9887	0.9949 (40)
HLP (average)												0.9857 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.3254 (42)
Average daily hot water use (litres/day)												65.6774 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	72.2451	69.6180	66.9909	64.3638	61.7367	59.1096	59.1096	61.7367	64.3638	66.9909	69.6180	72.2451 (44)
Energy conte	107.1374	93.7031	96.6932	84.2995	80.8873	69.7996	64.6796	74.2208	75.1072	87.5302	95.5461	103.7569 (45)
Energy content (annual)										Total = Sum(45)m =		1033.3609 (45)
Distribution loss (46)m = 0.15 x (45)m												
	16.0706	14.0555	14.5040	12.6449	12.1331	10.4699	9.7019	11.1331	11.2661	13.1295	14.3319	15.5635 (46)
Water storage loss:												
Store volume												150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3938 (48)
Temperature factor from Table 2b												0.5400 (49)

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Enter (49) or (54) in (55)												0.7527 (55)
Total storage loss	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (56)
If cylinder contains dedicated solar storage	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (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	153.7323	135.7888	143.2881	129.3913	127.4822	114.8915	111.2745	120.8157	120.1991	134.1251	140.6379	150.3518 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	153.7323	135.7888	143.2881	129.3913	127.4822	114.8915	111.2745	120.8157	120.1991	134.1251	140.6379	150.3518 (64)
Heat gains from water heating, kWh/month	72.8991	64.8248	69.4264	64.1030	64.1710	59.2818	58.7819	61.9543	61.0466	66.3797	67.8425	71.7751 (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	66.2682	66.2682	66.2682	66.2682	66.2682	66.2682	66.2682	66.2682	66.2682	66.2682	66.2682	66.2682 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	10.3645	9.2056	7.4865	5.6678	4.2367	3.5768	3.8649	5.0237	6.7428	8.5616	9.9926	10.6525 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	113.7006	114.8805	111.9073	105.5777	97.5877	90.0783	85.0615	83.8816	86.8548	93.1844	101.1744	108.6838 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	29.6268	29.6268	29.6268	29.6268	29.6268	29.6268	29.6268	29.6268	29.6268	29.6268	29.6268	29.6268 (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)	-53.0145	-53.0145	-53.0145	-53.0145	-53.0145	-53.0145	-53.0145	-53.0145	-53.0145	-53.0145	-53.0145	-53.0145 (71)
Water heating gains (Table 5)	97.9827	96.4655	93.3151	89.0320	86.2513	82.3359	79.0079	83.2720	84.7870	89.2201	94.2258	96.4719 (72)
Total internal gains	267.9282	266.4321	258.5893	246.1579	233.9562	221.8714	213.8147	218.0577	224.2651	236.8465	251.2732	261.6887 (73)

6. Solar gains

[Jan]			Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W				
Southeast			5.7200	36.7938	0.6300	0.7000	0.7700	64.3195 (77)				
Horizontal			0.7200	26.0000	0.6300	0.7000	1.0000	7.4300 (82)				
Solar gains	71.7495	124.9914	177.3384	228.6044	262.9109	263.6925	253.1357	227.3512	195.1784	139.9478	86.4703	61.0452 (83)
Total gains	339.6777	391.4235	435.9277	474.7623	496.8670	485.5640	466.9505	445.4090	419.4435	376.7943	337.7435	322.7339 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	68.8840	69.1171	69.3472	70.4486	70.6586	71.6527	71.6527	71.8399	71.2665	70.6586	70.2351	69.7977
alpha	5.5923	5.6078	5.6231	5.6966	5.7106	5.7768	5.7768	5.7893	5.7511	5.7106	5.6823	5.6532
util living area	0.9841	0.9654	0.9212	0.8160	0.6523	0.4675	0.3361	0.3672	0.5786	0.8508	0.9643	0.9875 (86)
MIT	20.2515	20.4287	20.6503	20.8631	20.9666	20.9959	20.9995	20.9992	20.9867	20.8526	20.5254	20.2204 (87)
Th 2	20.0766	20.0794	20.0822	20.0952	20.0977	20.1091	20.1091	20.1112	20.1047	20.0977	20.0927	20.0876 (88)
util rest of house	0.9795	0.9561	0.9015	0.7778	0.5972	0.4039	0.2683	0.2966	0.5086	0.8096	0.9530	0.9839 (89)
MIT 2	19.1057	19.3594	19.6669	19.9513	20.0691	20.1066	20.1089	20.1109	20.0958	19.9478	19.5100	19.0697 (90)
Living area fraction	19.6818	19.8971	20.1614	20.4098	20.5204	20.5538	20.5567	20.5576	20.5438	20.4028	20.0206	19.6484 (92)
Temperature adjustment	19.6818	19.8971	20.1614	20.4098	20.5204	20.5538	20.5567	20.5576	20.5438	20.4028	20.0206	19.6484 (93)
adjusted MIT	19.6818	19.8971	20.1614	20.4098	20.5204	20.5538	20.5567	20.5576	20.5438	20.4028	20.0206	19.6484 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9771	0.9539	0.9034	0.7917	0.6235	0.4358	0.3024	0.3321	0.5434	0.8245	0.9520	0.9817 (94)
Ext temp.	331.9123	373.3767	393.7967	375.8780	309.7936	211.6183	141.2134	147.9290	227.9302	310.6764	321.5179	316.8181 (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	571.4328	555.2602	504.1291	418.0892	319.4461	212.6355	141.3123	148.0975	231.3824	355.0262	470.7636	566.3902 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating per m ²	178.2033	122.2257	82.0873	30.3921	7.1814	0.0000	0.0000	0.0000	0.0000	32.9962	107.4569	185.6816 (98)
Space heating per m ²												746.2246 (98)
Space heating per m ²												20.2503 (99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													798.1012 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	178.2033	122.2257	82.0873	30.3921	7.1814	0.0000	0.0000	0.0000	0.0000	32.9962	107.4569	185.6816	(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)	190.5917	130.7227	87.7939	32.5049	7.6807	0.0000	0.0000	0.0000	0.0000	35.2901	114.9272	198.5900	(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	153.7323	135.7888	143.2881	129.3913	127.4822	114.8915	111.2745	120.8157	120.1991	134.1251	140.6379	150.3518	(64)
Efficiency of water heater (217)m	85.2085	84.5347	83.3911	81.6359	80.3063	79.8000	79.8000	79.8000	79.8000	81.7073	84.1071	85.3779	(216)
Fuel for water heating, kWh/month	180.4189	160.6309	171.8266	158.4981	158.7449	143.9743	139.4417	151.3981	150.6254	164.1531	167.2129	176.1016	(219)
Water heating fuel used												1923.0265	(219)
Annual totals kWh/year													
Space heating fuel - main system												798.1012	(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)												183.0396	(232)
Total delivered energy for all uses												2979.1673	(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	798.1012	0.2160	172.3899 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1923.0265	0.2160	415.3737 (264)
Space and water heating			587.7636 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	183.0396	0.5190	94.9975 (268)
Total CO2, kg/m2/year			721.6861 (272)
Emissions per m2 for space and water heating			15.9502 (272a)
Fuel factor (electricity)			1.5500
Emissions per m2 for lighting			2.5780 (272b)
Emissions per m2 for pumps and fans			1.0563 (272c)
Target Carbon Dioxide Emission Rate (TER) = (15.9502 * 1.55) + 2.5780 + 1.0563, rounded to 2 d.p.			28.3600 (273)

FULL SAP CALCULATION PRINTOUT

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CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (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	36.8500 (1b)	x 2.3500 (2b)	= 86.5975 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	36.8500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 86.5975 (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) = 0.2310 (8)
Measured/design AP50					Yes
Infiltration rate					6.6300
Number of sides sheltered					0.5625 (18)
					3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.4359 (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	0.5558	0.5449	0.5340	0.4795	0.4686	0.4141	0.4141	0.4032	0.4359	0.4686	0.4904	0.5122 (22b)
Effective ac	0.6544	0.6484	0.6426	0.6150	0.6098	0.5857	0.5857	0.5813	0.5950	0.6098	0.6202	0.6312 (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
Door to Hall			1.8900	1.4000	2.6460		(26)
Windows (Uw = 1.40)			5.7200	1.3258	7.5833		(27)
Roof lights (Uw = 1.40)			0.7200	1.3258	0.9545		(27a)
Main Walls	13.1700	5.7200	7.4500	0.1800	1.3410	0.0000	0.0000 (29a)
Wall to Hall	9.0600	1.8900	7.1700	0.2600	1.8642	18.0000	129.0600 (29a)
External Roof 1	36.8500	0.7200	36.1300	0.0800	2.8904	9.0000	325.1700 (30)
Total net area of external elements Aum(A, m ²)			59.0800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	17.2795		(33)
Party Wall 1			34.3200	0.0000	0.0000	20.0000	686.4000 (32)
Party Floor 1			36.8400			30.0000	1105.2000 (32d)
Internal Wall 1			54.0000			9.0000	486.0000 (32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	2731.8300 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K		74.1338 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		1.6768 (36)
Total fabric heat loss	(33) + (36) =	18.9563 (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	18.7021	18.5307	18.3627	17.5737	17.4261	16.7389	16.7389	16.6116	17.0036	17.4261	17.7247	18.0370 (38)
Heat transfer coeff	37.6584	37.4870	37.3190	36.5300	36.3824	35.6951	35.6951	35.5679	35.9598	36.3824	36.6810	36.9932 (39)
Average = Sum(39)m / 12 =												36.5293 (39)
HLP	1.0219	1.0173	1.0127	0.9913	0.9873	0.9687	0.9687	0.9652	0.9758	0.9873	0.9954	1.0039 (40)
HLP (average)												0.9913 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.3254 (42)
Average daily hot water use (litres/day)												65.6774 (43)
Daily hot water use	72.2451	69.6180	66.9909	64.3638	61.7367	59.1096	59.1096	61.7367	64.3638	66.9909	69.6180	72.2451 (44)
Energy conte	107.1374	93.7031	96.6932	84.2995	80.8873	69.7996	64.6796	74.2208	75.1072	87.5302	95.5461	103.7569 (45)
Energy content (annual)										Total = Sum(45)m =		1033.3609 (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	22.7667	19.9119	20.5473	17.9136	17.1886	14.8324	13.7444	15.7719	15.9603	18.6002	20.3035	22.0483	(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	66.2682	66.2682	66.2682	66.2682	66.2682	66.2682	66.2682	66.2682	66.2682	66.2682	66.2682	66.2682	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	10.3645	9.2056	7.4865	5.6678	4.2367	3.5768	3.8649	5.0237	6.7428	8.5616	9.9926	10.6525	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	113.7006	114.8805	111.9073	105.5777	97.5877	90.0783	85.0615	83.8816	86.8548	93.1844	101.1744	108.6838	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	29.6268	29.6268	29.6268	29.6268	29.6268	29.6268	29.6268	29.6268	29.6268	29.6268	29.6268	29.6268	(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)	-53.0145	-53.0145	-53.0145	-53.0145	-53.0145	-53.0145	-53.0145	-53.0145	-53.0145	-53.0145	-53.0145	-53.0145	(71)
Water heating gains (Table 5)	30.6004	29.6308	27.6173	24.8800	23.1029	20.6006	18.4737	21.1988	22.1671	25.0002	28.1994	29.6349	(72)
Total internal gains	197.5459	196.5973	189.8916	179.0059	167.8078	157.1361	150.2805	152.9846	158.6452	169.6267	182.2468	191.8517	(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				
Southeast			5.7200	36.7938	0.6300	0.7000	0.7700	64.3195	(77)				
Horizontal			0.7200	26.0000	0.6300	0.7000	1.0000	7.4300	(82)				
Solar gains	71.7495	124.9914	177.3384	228.6044	262.9109	263.6925	253.1357	227.3512	195.1784	139.9478	86.4703	61.0452	(83)
Total gains	269.2954	321.5888	367.2300	407.6103	430.7186	420.8286	403.4162	380.3358	353.8236	309.5744	268.7171	252.8969	(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	20.1507	20.2428	20.3339	20.7731	20.8574	21.2590	21.2590	21.3350	21.1025	20.8574	20.6876	20.5130		
alpha	2.3434	2.3495	2.3556	2.3849	2.3905	2.4173	2.4173	2.4223	2.4068	2.3905	2.3792	2.3675		
util living area	0.9168	0.8789	0.8228	0.7325	0.6163	0.4782	0.3640	0.3965	0.5741	0.7720	0.8836	0.9258	(86)	
MIT	18.6850	19.0513	19.5460	20.1192	20.5514	20.8311	20.9366	20.9205	20.7219	20.1425	19.3299	18.6342	(87)	
Th 2	20.0651	20.0690	20.0727	20.0906	20.0939	20.1095	20.1095	20.1124	20.1035	20.0939	20.0872	20.0801	(88)	
util rest of house	0.9077	0.8663	0.8047	0.7056	0.5773	0.4246	0.2976	0.3292	0.5212	0.7426	0.8695	0.9178	(89)	
MIT 2	17.9487	18.3078	18.7888	19.3463	19.7448	19.9979	20.0772	20.0700	19.9089	19.3832	18.5991	17.9096	(90)	
Living area fraction														
MIT	18.3189	18.6817	19.1696	19.7349	20.1504	20.4169	20.5094	20.4977	20.3177	19.7650	18.9666	18.2740	(92)	
Temperature adjustment												0.0000		
adjusted MIT	18.3189	18.6817	19.1696	19.7349	20.1504	20.4169	20.5094	20.4977	20.3177	19.7650	18.9666	18.2740	(93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	238.8447	271.4917	288.1406	282.9394	249.7488	186.6919	132.3413	136.5988	189.1022	226.2257	228.1239	227.0961	(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	527.9305	516.6339	472.8173	395.8005	307.4457	207.6346	139.5459	145.7457	223.5877	333.4441	435.2779	520.6418	(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	215.0798	164.7356	137.3994	81.2599	42.9265	0.0000	0.0000	0.0000	0.0000	79.7704	149.1509	218.3980	(98)
Space heating												1088.7206	(98)
Space heating per m2												29.5447	(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	335.5342	264.1440	270.3158	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8478	0.8911	0.8770	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	284.4586	235.3820	237.0742	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	533.3353	512.6325	487.8999	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)

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Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	179.1912	206.2743	186.6143	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												572.0799 (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	44.7978	51.5686	46.6536	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												143.0200 (107)
Space cooling per m2												3.8811 (108)
Energy for space heating												29.5447 (99)
Energy for space cooling												3.8811 (108)
Total												33.4258 (109)
Dwelling Fabric Energy Efficiency (DFEE)												33.4 (109)

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CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (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	36.8500 (1b)	x 2.3500 (2b)	= 86.5975 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	36.8500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	86.5975 (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				2 * 10 =	20.0000 (7a)
Number of passive vents				0 * 10 =	0.0000 (7b)
Number of flueless gas fires				0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					20.0000 / (5) = 0.2310 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4810 (18)
Number of sides sheltered					3 (19)
Shelter factor					(20) = 1 - [0.075 x (19)] = 0.7750 (20)
Infiltration rate adjusted to include shelter factor					(21) = (18) x (20) = 0.3727 (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	0.4752	0.4659	0.4566	0.4100	0.4007	0.3541	0.3541	0.3448	0.3727	0.4007	0.4193	0.4380 (22b)
Effective ac	0.6129	0.6085	0.6042	0.5841	0.5803	0.5627	0.5627	0.5594	0.5695	0.5803	0.5879	0.5959 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			1.8900	1.0000	1.8900		(26)
TER Opening Type (Uw = 1.40)			5.7200	1.3258	7.5833		(27)
TER Room Window (Uw = 1.70)			0.7200	1.5918	1.1461		(27a)
Main Walls	13.1700	5.7200	7.4500	0.1800	1.3410		(29a)
Wall to Hall	9.0600	1.8900	7.1700	0.1800	1.2906		(29a)
External Roof 1	36.8500	0.7200	36.1300	0.1300	4.6969		(30)
Total net area of external elements Aum(A, m ²)			59.0800				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		17.9479		(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)							1.6862 (36)
Total fabric heat loss							(33) + (36) = 19.6341 (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	17.5157	17.3904	17.2676	16.6907	16.5827	16.0802	16.0802	15.9872	16.2738	16.5827	16.8011	17.0294 (38)
Heat transfer coeff	37.1498	37.0245	36.9017	36.3248	36.2168	35.7143	35.7143	35.6213	35.9079	36.2168	36.4352	36.6635 (39)
Average = Sum(39)m / 12 =												36.3242 (39)
HLP	1.0081	1.0047	1.0014	0.9857	0.9828	0.9692	0.9692	0.9667	0.9744	0.9828	0.9887	0.9949 (40)
HLP (average)												0.9857 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.3254 (42)
Average daily hot water use (litres/day)												65.6774 (43)
Daily hot water use	72.2451	69.6180	66.9909	64.3638	61.7367	59.1096	59.1096	61.7367	64.3638	66.9909	69.6180	72.2451 (44)
Energy conte	107.1374	93.7031	96.6932	84.2995	80.8873	69.7996	64.6796	74.2208	75.1072	87.5302	95.5461	103.7569 (45)
Energy content (annual)										Total = Sum(45)m =		1033.3609 (45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												

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Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Heat gains from water heating, kWh/month	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
	22.7667	19.9119	20.5473	17.9136	17.1886	14.8324	13.7444	15.7719	15.9603	18.6002	20.3035	22.0483 (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	66.2682	66.2682	66.2682	66.2682	66.2682	66.2682	66.2682	66.2682	66.2682	66.2682	66.2682	66.2682 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	10.3645	9.2056	7.4865	5.6678	4.2367	3.5768	3.8649	5.0237	6.7428	8.5616	9.9926	10.6525 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	113.7006	114.8805	111.9073	105.5777	97.5877	90.0783	85.0615	83.8816	86.8548	93.1844	101.1744	108.6838 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	29.6268	29.6268	29.6268	29.6268	29.6268	29.6268	29.6268	29.6268	29.6268	29.6268	29.6268	29.6268 (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)	-53.0145	-53.0145	-53.0145	-53.0145	-53.0145	-53.0145	-53.0145	-53.0145	-53.0145	-53.0145	-53.0145	-53.0145 (71)
Water heating gains (Table 5)	30.6004	29.6308	27.6173	24.8800	23.1029	20.6006	18.4737	21.1988	22.1671	25.0002	28.1994	29.6349 (72)
Total internal gains	197.5459	196.5973	189.8916	179.0059	167.8078	157.1361	150.2805	152.9846	158.6452	169.6267	182.2468	191.8517 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
Southeast				5.7200	36.7938	0.6300		0.7000		0.7700		64.3195
Horizontal				0.7200	26.0000	0.6300		0.7000		1.0000		7.4300 (77)
Solar gains	71.7495	124.9914	177.3384	228.6044	262.9109	263.6925	253.1357	227.3512	195.1784	139.9478	86.4703	61.0452 (83)
Total gains	269.2954	321.5888	367.2300	407.6103	430.7186	420.8286	403.4162	380.3358	353.8236	309.5744	268.7171	252.8969 (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	68.8840	69.1171	69.3472	70.4486	70.6586	71.6527	71.6527	71.8399	71.2665	70.6586	70.2351	69.7977
alpha	5.5923	5.6078	5.6231	5.6966	5.7106	5.7768	5.7768	5.7893	5.7511	5.7106	5.6823	5.6532
util living area	0.9947	0.9853	0.9588	0.8808	0.7302	0.5357	0.3885	0.4289	0.6705	0.9206	0.9870	0.9961 (86)
MIT	20.0777	20.2690	20.5207	20.7885	20.9413	20.9918	20.9989	20.9981	20.9723	20.7591	20.3666	20.0453 (87)
Th 2	20.0766	20.0794	20.0822	20.0952	20.0977	20.1091	20.1091	20.1112	20.1047	20.0977	20.0927	20.0876 (88)
util rest of house	0.9930	0.9808	0.9467	0.8497	0.6746	0.4644	0.3104	0.3471	0.5951	0.8919	0.9823	0.9949 (89)
MIT 2	19.2428	19.4339	19.6800	19.9367	20.0620	20.1057	20.1088	20.1107	20.0914	19.9193	19.5428	19.2198 (90)
Living area fraction	19.6626	19.8538	20.1027	20.3650	20.5042	20.5512	20.5564	20.5569	20.5344	20.3416	19.9571	19.6349 (92)
MIT	19.6626	19.8538	20.1027	20.3650	20.5042	20.5512	20.5564	20.5569	20.5344	20.3416	19.9571	19.6349 (93)
Temperature adjustment												0.0000
adjusted MIT	19.6626	19.8538	20.1027	20.3650	20.5042	20.5512	20.5564	20.5569	20.5344	20.3416	19.9571	19.6349 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9920	0.9795	0.9470	0.8597	0.7005	0.5002	0.3497	0.3883	0.6323	0.9005	0.9814	0.9941 (94)
Ext temp.	267.1480	315.0012	347.7732	350.4040	301.7098	210.4908	141.0859	147.6907	223.7206	278.7872	263.7252	251.4166 (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	570.7185	553.6576	501.9637	416.4643	318.8595	212.5444	141.3003	148.0755	231.0439	352.8085	468.4491	565.8960 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating per m2	225.8564	160.3771	114.7177	47.5634	12.7594	0.0000	0.0000	0.0000	0.0000	55.0719	147.4012	233.9727 (98)
												997.7198 (98)
												27.0752 (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	335.7145	264.2859	270.7215	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9733	0.9893	0.9850	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	326.7452	261.4672	266.6656	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	533.3353	512.6325	487.8999	0.0000	0.0000	0.0000	0.0000 (103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	148.7449	186.8669	164.5983	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												500.2101 (104)
Cooled fraction												1.0000 (105)

fC = cooled area / (4) =

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CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	37.1862	46.7167	41.1496	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling											125.0525 (107)
Space cooling per m2											3.3936 (108)
Energy for space heating											27.0752 (99)
Energy for space cooling											3.3936 (108)
Total											30.4687 (109)
Target Fabric Energy Efficiency (TFEE)											35.0 (109)

FULL SAP CALCULATION PRINTOUT

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CALCULATION OF HEAT DEMAND 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	36.8500 (1b)	x 2.3500 (2b)	= 86.5975 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	36.8500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 86.5975 (5)

2. Ventilation rate

	main heating		secondary heating		other		=	total	m3 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								0 * 10 =	0.0000 (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) =							0.0000 / (5) =	0.0000 (8)			
Pressure test									Yes			
Measured/design AP50									6.6300			
Infiltration rate									0.3315 (18)			
Number of sides sheltered									3 (19)			
Shelter factor								(20) = 1 - [0.075 x (19)] =	0.7750 (20)			
Infiltration rate adjusted to include shelter factor								(21) = (18) x (20) =	0.2569 (21)			
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.3000	4.1000	4.1000	3.8000	3.9000	3.4000	3.4000	3.3000	3.4000	3.8000	3.7000	4.0000 (22)
Wind factor	1.0750	1.0250	1.0250	0.9500	0.9750	0.8500	0.8500	0.8250	0.8500	0.9500	0.9250	1.0000 (22a)
Adj infilt rate	0.2762	0.2633	0.2633	0.2441	0.2505	0.2184	0.2184	0.2120	0.2184	0.2441	0.2376	0.2569 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation:												0.5000 (23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												76.5000 (23c)
Effective ac	0.3937	0.3808	0.3808	0.3616	0.3680	0.3359	0.3359	0.3295	0.3359	0.3616	0.3551	0.3744 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Door to Hall			1.8900	1.4000	2.6460		(26)
Windows (Uw = 1.40)			5.7200	1.3258	7.5833		(27)
Roof lights (Uw = 1.40)			0.7200	1.3258	0.9545		(27a)
Main Walls	13.1700	5.7200	7.4500	0.1800	1.3410	0.0000	0.0000 (29a)
Wall to Hall	9.0600	1.8900	7.1700	0.2600	1.8642	18.0000	129.0600 (29a)
External Roof 1	36.8500	0.7200	36.1300	0.0800	2.8904	9.0000	325.1700 (30)
Total net area of external elements Aum(A, m2)			59.0800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	17.2795		(33)
Party Wall 1			34.3200	0.0000	0.0000	20.0000	686.4000 (32)
Party Floor 1			36.8400			30.0000	1105.2000 (32d)
Internal Wall 1			54.0000			9.0000	486.0000 (32c)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	2731.8300 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							74.1338 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							1.6768 (36)
Total fabric heat loss						(33) + (36) =	18.9563 (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	11.2503	10.8832	10.8832	10.3326	10.5161	9.5984	9.5984	9.4148	9.5984	10.3326	10.1490	10.6997 (38)
Heat transfer coeff	30.2066	29.8395	29.8395	29.2888	29.4724	28.5547	28.5547	28.3711	28.5547	29.2888	29.1053	29.6559 (39)
Average = Sum(39)m / 12 =												29.2277 (39)
HLP	0.8197	0.8098	0.8098	0.7948	0.7998	0.7749	0.7749	0.7699	0.7749	0.7948	0.7898	0.8048 (40)
HLP (average)												0.7932 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.3254 (42)
Average daily hot water use (litres/day)												65.6774 (43)
Daily hot water use	Jan 72.2451	Feb 69.6180	Mar 66.9909	Apr 64.3638	May 61.7367	Jun 59.1096	Jul 59.1096	Aug 61.7367	Sep 64.3638	Oct 66.9909	Nov 69.6180	Dec 72.2451 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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CALCULATION OF HEAT DEMAND 09 Jan 2014

Energy content (annual)	107.1374	93.7031	96.6932	84.2995	80.8873	69.7996	64.6796	74.2208	75.1072	87.5302	95.5461	103.7569 (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	1033.3609 (45)
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)
Total heat required for water heating calculated for each month												
Solar input	91.0668	79.6476	82.1892	71.6545	68.7542	59.3297	54.9777	63.0877	63.8411	74.4007	81.2142	88.1933 (62)
	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	91.0668	79.6476	82.1892	71.6545	68.7542	59.3297	54.9777	63.0877	63.8411	74.4007	81.2142	88.1933 (64)
RHI water heating demand												878 (64)
Heat gains from water heating, kWh/month	22.7667	19.9119	20.5473	17.9136	17.1886	14.8324	13.7444	15.7719	15.9603	18.6002	20.3035	22.0483 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	79.5218	79.5218	79.5218	79.5218	79.5218	79.5218	79.5218	79.5218	79.5218	79.5218	79.5218	79.5218 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.9111	23.0141	18.7163	14.1694	10.5918	8.9421	9.6622	12.5593	16.8571	21.4039	24.9815	26.6313 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	169.7024	171.4634	167.0258	157.5786	145.6533	134.4452	126.9574	125.1965	129.6341	139.0812	151.0065	162.2147 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	44.2775	44.2775	44.2775	44.2775	44.2775	44.2775	44.2775	44.2775	44.2775	44.2775	44.2775	44.2775 (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)	-53.0145	-53.0145	-53.0145	-53.0145	-53.0145	-53.0145	-53.0145	-53.0145	-53.0145	-53.0145	-53.0145	-53.0145 (71)
Water heating gains (Table 5)	30.6004	29.6308	27.6173	24.8800	23.1029	20.6006	18.4737	21.1988	22.1671	25.0002	28.1994	29.6349 (72)
Total internal gains	296.9988	294.8930	284.1442	267.4129	250.1328	234.7726	225.8781	229.7394	239.4430	256.2702	274.9723	289.2656 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
Southeast				5.7200	43.0593	0.6300		0.7000		0.7700		75.2722
Horizontal				0.7200	32.0000	0.6300		0.7000		1.0000		9.1446 (77)
Solar gains	84.4168	128.5767	181.5622	238.8057	268.8103	285.7779	271.3905	248.9708	213.3967	154.6197	100.2290	72.2373 (83)
Total gains	381.4155	423.4698	465.7064	506.2186	518.9431	520.5505	497.2686	478.7102	452.8397	410.8898	375.2012	361.5029 (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	25.1217	25.4308	25.4308	25.9089	25.7475	26.5751	26.5751	26.7470	26.5751	25.9089	26.0723	25.5882
alpha	2.6748	2.6954	2.6954	2.7273	2.7165	2.7717	2.7717	2.7831	2.7717	2.7273	2.7382	2.7059
util living area	0.8055	0.7562	0.6775	0.5572	0.4281	0.2789	0.1880	0.1996	0.3620	0.5786	0.7356	0.8185 (86)
MIT	19.8506	20.0903	20.3973	20.7108	20.8889	20.9775	20.9948	20.9939	20.9498	20.7278	20.3102	19.8251 (87)
Th 2	20.2363	20.2449	20.2449	20.2578	20.2535	20.2751	20.2751	20.2795	20.2751	20.2578	20.2622	20.2492 (88)
util rest of house	0.7901	0.7383	0.6551	0.5295	0.3940	0.2417	0.1472	0.1580	0.3220	0.5458	0.7139	0.8039 (89)
MIT 2	18.7200	19.0587	19.4806	19.9101	20.1332	20.2555	20.2720	20.2757	20.2271	19.9406	19.3836	18.6947 (90)
Living area fraction									fLA = Living area / (4) =			0.5028 (91)
MIT	19.2885	19.5774	19.9415	20.3127	20.5132	20.6186	20.6355	20.6368	20.5905	20.3365	19.8495	19.2631 (92)
Temperature adjustment												0.0000
adjusted MIT	19.2885	19.5774	19.9415	20.3127	20.5132	20.6186	20.6355	20.6368	20.5905	20.3365	19.8495	19.2631 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.7688	0.7212	0.6456	0.5316	0.4060	0.2594	0.1676	0.1787	0.3396	0.5494	0.7009	0.7823 (94)
Ext temp.	293.2355	305.3969	300.6793	269.1110	210.7162	135.0432	83.3201	85.5603	153.7759	225.7523	262.9896	282.8180 (95)
Heat loss rate W	5.1000	5.7000	7.4000	9.9000	12.9000	15.8000	17.7000	17.6000	15.0000	11.5000	8.0000	5.1000 (96)
Month fracti	428.5863	414.0954	374.2327	304.9771	224.3795	137.5931	83.8220	86.1587	159.6359	258.8094	344.8843	420.0208 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
RHI space heating demand	100.7009	73.0454	54.7237	25.8236	10.1655	0.0000	0.0000	0.0000	0.0000	24.5944	58.9642	102.0789 (98)
												450.0966 (98)
												450 (98)

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CALCULATION OF HEAT DEMAND 09 Jan 2014

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CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (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	36.8500 (1b)	x 2.3500 (2b)	= 86.5975 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	36.8500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 86.5975 (5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 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							0 * 10 =	0.0000 (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) =						0.0000 / (5) =	0.0000 (8)				
Pressure test								Yes				
Measured/design AP50								6.6300				
Infiltration rate								0.3315 (18)				
Number of sides sheltered								3 (19)				
Shelter factor							(20) = 1 - [0.075 x (19)] =	0.7750 (20)				
Infiltration rate adjusted to include shelter factor							(21) = (18) x (20) =	0.2569 (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	0.3276	0.3211	0.3147	0.2826	0.2762	0.2441	0.2441	0.2376	0.2569	0.2762	0.2890	0.3019 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation:												0.5000 (23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												76.5000 (23c)
Effective ac	0.4451	0.4386	0.4322	0.4001	0.3937	0.3616	0.3616	0.3551	0.3744	0.3937	0.4065	0.4194 (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
Door to Hall			1.8900	1.4000	2.6460		(26)
Windows (Uw = 1.40)			5.7200	1.3258	7.5833		(27)
Roof lights (Uw = 1.40)			0.7200	1.3258	0.9545		(27a)
Main Walls	13.1700	5.7200	7.4500	0.1800	1.3410	0.0000	0.0000 (29a)
Wall to Hall	9.0600	1.8900	7.1700	0.2600	1.8642	18.0000	129.0600 (29a)
External Roof 1	36.8500	0.7200	36.1300	0.0800	2.8904	9.0000	325.1700 (30)
Total net area of external elements Aum(A, m ²)			59.0800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	17.2795		(33)
Party Wall 1			34.3200	0.0000	0.0000	20.0000	686.4000 (32)
Party Floor 1			36.8400			30.0000	1105.2000 (32d)
Internal Wall 1			54.0000			9.0000	486.0000 (32c)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	2731.8300 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							74.1338 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							1.6768 (36)
Total fabric heat loss						(33) + (36) =	18.9563 (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	12.7187	12.5351	12.3516	11.4338	11.2503	10.3326	10.3326	10.1490	10.6997	11.2503	11.6174	11.9845 (38)
Heat transfer coeff	31.6749	31.4914	31.3078	30.3901	30.2066	29.2888	29.2888	29.1053	29.6559	30.2066	30.5737	30.9408 (39)
Average = Sum(39)m / 12 =												30.3442 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.8596	0.8546	0.8496	0.8247	0.8197	0.7948	0.7948	0.7898	0.8048	0.8197	0.8297	0.8396 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.3254 (42)
Average daily hot water use (litres/day)												65.6774 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	72.2451	69.6180	66.9909	64.3638	61.7367	59.1096	59.1096	61.7367	64.3638	66.9909	69.6180	72.2451 (44)

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CALCULATION OF ENERGY RATINGS 09 Jan 2014

Energy conte	107.1374	93.7031	96.6932	84.2995	80.8873	69.7996	64.6796	74.2208	75.1072	87.5302	95.5461	103.7569 (45)
Energy content (annual)										Total =	Sum (45)m =	1033.3609 (45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
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)
Total heat required for water heating calculated for each month												
Solar input	91.0668	79.6476	82.1892	71.6545	68.7542	59.3297	54.9777	63.0877	63.8411	74.4007	81.2142	88.1933 (62)
	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	91.0668	79.6476	82.1892	71.6545	68.7542	59.3297	54.9777	63.0877	63.8411	74.4007	81.2142	88.1933 (64)
Heat gains from water heating, kWh/month	22.7667	19.9119	20.5473	17.9136	17.1886	14.8324	13.7444	15.7719	15.9603	18.6002	20.3035	22.0483 (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	79.5218	79.5218	79.5218	79.5218	79.5218	79.5218	79.5218	79.5218	79.5218	79.5218	79.5218	79.5218 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.9111	23.0141	18.7163	14.1694	10.5918	8.9421	9.6622	12.5593	16.8571	21.4039	24.9815	26.6313 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	169.7024	171.4634	167.0258	157.5786	145.6533	134.4452	126.9574	125.1965	129.6341	139.0812	151.0065	162.2147 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	44.2775	44.2775	44.2775	44.2775	44.2775	44.2775	44.2775	44.2775	44.2775	44.2775	44.2775	44.2775 (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)	-53.0145	-53.0145	-53.0145	-53.0145	-53.0145	-53.0145	-53.0145	-53.0145	-53.0145	-53.0145	-53.0145	-53.0145 (71)
Water heating gains (Table 5)	30.6004	29.6308	27.6173	24.8800	23.1029	20.6006	18.4737	21.1988	22.1671	25.0002	28.1994	29.6349 (72)
Total internal gains	296.9988	294.8930	284.1442	267.4129	250.1328	234.7726	225.8781	229.7394	239.4430	256.2702	274.9723	289.2656 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
Southeast				5.7200	36.7938	0.6300		0.7000		0.7700		64.3195
Horizontal				0.7200	26.0000	0.6300		0.7000		1.0000		7.4300 (77)
Solar gains	71.7495	124.9914	177.3384	228.6044	262.9109	263.6925	253.1357	227.3512	195.1784	139.9478	86.4703	61.0452 (83)
Total gains	368.7483	419.8845	461.4826	496.0173	513.0437	498.4651	479.0138	457.0906	434.6214	396.2180	361.4426	350.3109 (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	23.9572	24.0968	24.2381	24.9700	25.1217	25.9089	25.9089	26.0723	25.5882	25.1217	24.8201	24.5256
alpha	2.5971	2.6065	2.6159	2.6647	2.6748	2.7273	2.7273	2.7382	2.7059	2.6748	2.6547	2.6350
util living area	0.8368	0.7869	0.7175	0.6117	0.4920	0.3593	0.2635	0.2857	0.4362	0.6390	0.7822	0.8487 (86)
MIT	19.5632	19.8462	20.1954	20.5738	20.8107	20.9440	20.9822	20.9777	20.8995	20.5952	20.0597	19.5361 (87)
Th 2	20.2020	20.2063	20.2105	20.2320	20.2363	20.2578	20.2578	20.2622	20.2492	20.2363	20.2277	20.2191 (88)
util rest of house	0.8232	0.7706	0.6968	0.5854	0.4595	0.3212	0.2207	0.2419	0.3954	0.6086	0.7632	0.8361 (89)
MIT 2	18.2914	18.6898	19.1775	19.7079	20.0210	20.2029	20.2440	20.2441	20.1462	19.7505	19.0126	18.2652 (90)
Living area fraction									fLA =	Living area / (4) =		0.5028 (91)
MIT	18.9309	19.2713	19.6894	20.1433	20.4181	20.5755	20.6152	20.6130	20.5250	20.1753	19.5392	18.9042 (92)
Temperature adjustment												0.0000
adjusted MIT	18.9309	19.2713	19.6894	20.1433	20.4181	20.5755	20.6152	20.6130	20.5250	20.1753	19.5392	18.9042 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.7987	0.7492	0.6821	0.5823	0.4674	0.3377	0.2415	0.2629	0.4107	0.6061	0.7446	0.8117 (94)
Useful gains	294.5041	314.5917	314.7957	288.8182	239.7800	168.3419	115.6649	120.1571	178.4801	240.1366	269.1264	284.3328 (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	463.4329	452.5723	412.9303	341.6855	263.3441	175.0165	117.6011	122.6198	190.5389	289.2357	380.3113	454.9601 (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	125.6831	92.7230	73.0121	38.0645	17.5317	0.0000	0.0000	0.0000	0.0000	36.5297	80.0531	126.9467 (98)
Space heating												590.5439 (98)
Space heating per m2										(98) / (4) =		16.0256 (99)

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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 %)												100.0000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												590.5439	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	125.6831	92.7230	73.0121	38.0645	17.5317	0.0000	0.0000	0.0000	0.0000	36.5297	80.0531	126.9467	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	125.6831	92.7230	73.0121	38.0645	17.5317	0.0000	0.0000	0.0000	0.0000	36.5297	80.0531	126.9467	(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	91.0668	79.6476	82.1892	71.6545	68.7542	59.3297	54.9777	63.0877	63.8411	74.4007	81.2142	88.1933	(64)
Efficiency of water heater	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month	91.0668	79.6476	82.1892	71.6545	68.7542	59.3297	54.9777	63.0877	63.8411	74.4007	81.2142	88.1933	(219)
Water heating fuel used												878.3567	(219)
Annual totals kWh/year													
Space heating fuel - main system												590.5439	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.6500)													
mechanical ventilation fans (SFP = 0.6500)												68.6718	(230a)
Total electricity for the above, kWh/year												68.6718	(231)
Electricity for lighting (calculated in Appendix L)												183.0396	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
Total delivered energy for all uses												1720.6120	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	590.5439	13.1900	77.8927	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	878.3567	13.1900	115.8553	(247)
Mechanical ventilation fans	68.6718	13.1900	9.0578	(249)
Pumps and fans for heating	0.0000	0.0000	0.0000	(249)
Energy for lighting	183.0396	13.1900	24.1429	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit	0.0000	13.1900	0.0000	(252)
Total energy cost			226.9487	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):			0.4200	(256)
Energy cost factor (ECF)			1.1646	(257)
SAP value		$[(255) \times (256)] / [(4) + 45.0] =$	83.7545	
SAP rating (Section 12)			84	(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	590.5439	0.5190	306.4923	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	878.3567	0.5190	455.8671	(264)
Space and water heating			762.3594	(265)
Pumps and fans	68.6718	0.5190	35.6407	(267)
Energy for lighting	183.0396	0.5190	94.9975	(268)
Energy saving/generation technologies				
PV Unit	-663.3000	0.5190	-344.2527	(269)
Total kg/year			548.7450	(272)
CO2 emissions per m2			14.8900	(273)
EI value			91.0163	
EI rating			91	(274)
EI band			B	

Calculation of stars for heating and DHW

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Main heating energy efficiency	$13.19 \times (1 + 0.29 \times 0.00) / 1.0000 = 13.190$, stars = 1
Main heating environmental impact	$0.519 \times (1 + 0.29 \times 0.00) / 1.0000 = 0.5190$, stars = 2
Water heating energy efficiency	$13.19 / 1.0000 = 13.190$, stars = 1
Water heating environmental impact	$0.519 / 1.0000 = 0.5190$, stars = 2

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

SAP 2012 WORKSHEET FOR New Build (As Built) (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	36.8500 (1b)	x 2.3500 (2b)	= 86.5975 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	36.8500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 86.5975 (5)

2. Ventilation rate

	main		secondary		other		total	m3 per hour				
	heating		heating									
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							0 * 10 =	0.0000 (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) =						0.0000 / (5) =	0.0000 (8)				
Pressure test								Yes				
Measured/design AP50								6.6300				
Infiltration rate								0.3315 (18)				
Number of sides sheltered								3 (19)				
Shelter factor							(20) = 1 - [0.075 x (19)] =	0.7750 (20)				
Infiltration rate adjusted to include shelter factor							(21) = (18) x (20) =	0.2569 (21)				
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.3000	4.1000	4.1000	3.8000	3.9000	3.4000	3.4000	3.3000	3.4000	3.8000	3.7000	4.0000 (22)
Wind factor	1.0750	1.0250	1.0250	0.9500	0.9750	0.8500	0.8500	0.8250	0.8500	0.9500	0.9250	1.0000 (22a)
Adj infilt rate	0.2762	0.2633	0.2633	0.2441	0.2505	0.2184	0.2184	0.2120	0.2184	0.2441	0.2376	0.2569 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation:												0.5000 (23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												76.5000 (23c)
Effective ac	0.3937	0.3808	0.3808	0.3616	0.3680	0.3359	0.3359	0.3295	0.3359	0.3616	0.3551	0.3744 (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
Door to Hall			1.8900	1.4000	2.6460		(26)
Windows (Uw = 1.40)			5.7200	1.3258	7.5833		(27)
Roof lights (Uw = 1.40)			0.7200	1.3258	0.9545		(27a)
Main Walls	13.1700	5.7200	7.4500	0.1800	1.3410	0.0000	0.0000 (29a)
Wall to Hall	9.0600	1.8900	7.1700	0.2600	1.8642	18.0000	129.0600 (29a)
External Roof 1	36.8500	0.7200	36.1300	0.0800	2.8904	9.0000	325.1700 (30)
Total net area of external elements Aum(A, m ²)			59.0800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	17.2795		(33)
Party Wall 1			34.3200	0.0000	0.0000	20.0000	686.4000 (32)
Party Floor 1			36.8400			30.0000	1105.2000 (32d)
Internal Wall 1			54.0000			9.0000	486.0000 (32c)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	2731.8300 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							74.1338 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							1.6768 (36)
Total fabric heat loss						(33) + (36) =	18.9563 (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	11.2503	10.8832	10.8832	10.3326	10.5161	9.5984	9.5984	9.4148	9.5984	10.3326	10.1490	10.6997 (38)
Heat transfer coeff	30.2066	29.8395	29.8395	29.2888	29.4724	28.5547	28.5547	28.3711	28.5547	29.2888	29.1053	29.6559 (39)
Average = Sum(39)m / 12 =												29.2277 (39)
HLP	0.8197	0.8098	0.8098	0.7948	0.7998	0.7749	0.7749	0.7699	0.7749	0.7948	0.7898	0.8048 (40)
HLP (average)												0.7932 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.3254 (42)
Average daily hot water use (litres/day)												65.6774 (43)
Daily hot water use	Jan 72.2451	Feb 69.6180	Mar 66.9909	Apr 64.3638	May 61.7367	Jun 59.1096	Jul 59.1096	Aug 61.7367	Sep 64.3638	Oct 66.9909	Nov 69.6180	Dec 72.2451 (44)

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Energy conte	107.1374	93.7031	96.6932	84.2995	80.8873	69.7996	64.6796	74.2208	75.1072	87.5302	95.5461	103.7569 (45)
Energy content (annual)										Total =	Sum (45)m =	1033.3609 (45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
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)
Total heat required for water heating calculated for each month												
Solar input	91.0668	79.6476	82.1892	71.6545	68.7542	59.3297	54.9777	63.0877	63.8411	74.4007	81.2142	88.1933 (62)
	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	91.0668	79.6476	82.1892	71.6545	68.7542	59.3297	54.9777	63.0877	63.8411	74.4007	81.2142	88.1933 (64)
								Total per year (kWh/year) =	Sum (64)m =			878.3567 (64)
Heat gains from water heating, kWh/month												
	22.7667	19.9119	20.5473	17.9136	17.1886	14.8324	13.7444	15.7719	15.9603	18.6002	20.3035	22.0483 (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	79.5218	79.5218	79.5218	79.5218	79.5218	79.5218	79.5218	79.5218	79.5218	79.5218	79.5218	79.5218 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.9111	23.0141	18.7163	14.1694	10.5918	8.9421	9.6622	12.5593	16.8571	21.4039	24.9815	26.6313 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	169.7024	171.4634	167.0258	157.5786	145.6533	134.4452	126.9574	125.1965	129.6341	139.0812	151.0065	162.2147 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	44.2775	44.2775	44.2775	44.2775	44.2775	44.2775	44.2775	44.2775	44.2775	44.2775	44.2775	44.2775 (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)	-53.0145	-53.0145	-53.0145	-53.0145	-53.0145	-53.0145	-53.0145	-53.0145	-53.0145	-53.0145	-53.0145	-53.0145 (71)
Water heating gains (Table 5)	30.6004	29.6308	27.6173	24.8800	23.1029	20.6006	18.4737	21.1988	22.1671	25.0002	28.1994	29.6349 (72)
Total internal gains	296.9988	294.8930	284.1442	267.4129	250.1328	234.7726	225.8781	229.7394	239.4430	256.2702	274.9723	289.2656 (73)

6. Solar gains

[Jan]		Area m2		Solar flux Table 6a W/m2		Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
Southeast		5.7200		43.0593		0.6300		0.7000		0.7700		75.2722 (77)
Horizontal		0.7200		32.0000		0.6300		0.7000		1.0000		9.1446 (82)
Solar gains	84.4168	128.5767	181.5622	238.8057	268.8103	285.7779	271.3905	248.9708	213.3967	154.6197	100.2290	72.2373 (83)
Total gains	381.4155	423.4698	465.7064	506.2186	518.9431	520.5505	497.2686	478.7102	452.8397	410.8898	375.2012	361.5029 (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	25.1217	25.4308	25.4308	25.9089	25.7475	26.5751	26.5751	26.7470	26.5751	25.9089	26.0723	25.5882
alpha	2.6748	2.6954	2.6954	2.7273	2.7165	2.7717	2.7717	2.7831	2.7717	2.7273	2.7382	2.7059
util living area	0.8055	0.7562	0.6775	0.5572	0.4281	0.2789	0.1880	0.1996	0.3620	0.5786	0.7356	0.8185 (86)
MIT	19.8506	20.0903	20.3973	20.7108	20.8889	20.9775	20.9948	20.9939	20.9498	20.7278	20.3102	19.8251 (87)
Th 2	20.2363	20.2449	20.2449	20.2578	20.2535	20.2751	20.2751	20.2795	20.2751	20.2578	20.2622	20.2492 (88)
util rest of house	0.7901	0.7383	0.6551	0.5295	0.3940	0.2417	0.1472	0.1580	0.3220	0.5458	0.7139	0.8039 (89)
MIT 2	18.7200	19.0587	19.4806	19.9101	20.1332	20.2555	20.2720	20.2757	20.2271	19.9406	19.3836	18.6947 (90)
Living area fraction									fLA =	Living area / (4) =		0.5028 (91)
MIT	19.2885	19.5774	19.9415	20.3127	20.5132	20.6186	20.6355	20.6368	20.5905	20.3365	19.8495	19.2631 (92)
Temperature adjustment												0.0000
adjusted MIT	19.2885	19.5774	19.9415	20.3127	20.5132	20.6186	20.6355	20.6368	20.5905	20.3365	19.8495	19.2631 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.7688	0.7212	0.6456	0.5316	0.4060	0.2594	0.1676	0.1787	0.3396	0.5494	0.7009	0.7823 (94)
Useful gains	293.2355	305.3969	300.6793	269.1110	210.7162	135.0432	83.3201	85.5603	153.7759	225.7523	262.9896	282.8180 (95)
Ext temp.	5.1000	5.7000	7.4000	9.9000	12.9000	15.8000	17.7000	17.6000	15.0000	11.5000	8.0000	5.1000 (96)
Heat loss rate W												
	428.5863	414.0954	374.2327	304.9771	224.3795	137.5931	83.8220	86.1587	159.6359	258.8094	344.8843	420.0208 (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												
	100.7009	73.0454	54.7237	25.8236	10.1655	0.0000	0.0000	0.0000	0.0000	24.5944	58.9642	102.0789 (98)
Space heating												450.0966 (98)
Space heating per m2										(98) / (4) =		12.2143 (99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

Energy Calculations Ltd
SAP ♦ CODE ♦ SBEM ♦ DESIGN

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

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 %)													100.0000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													450.0966 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	100.7009	73.0454	54.7237	25.8236	10.1655	0.0000	0.0000	0.0000	0.0000	24.5944	58.9642	102.0789	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	100.7009	73.0454	54.7237	25.8236	10.1655	0.0000	0.0000	0.0000	0.0000	24.5944	58.9642	102.0789	(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	91.0668	79.6476	82.1892	71.6545	68.7542	59.3297	54.9777	63.0877	63.8411	74.4007	81.2142	88.1933	(64)
Efficiency of water heater (217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(216)
Fuel for water heating, kWh/month	91.0668	79.6476	82.1892	71.6545	68.7542	59.3297	54.9777	63.0877	63.8411	74.4007	81.2142	88.1933	(219)
Water heating fuel used													(219)
Annual totals kWh/year													
Space heating fuel - main system													450.0966 (211)
Space heating fuel - secondary													0.0000 (215)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.6500)													
mechanical ventilation fans (SFP = 0.6500)													68.6718 (230a)
Total electricity for the above, kWh/year													68.6718 (231)
Electricity for lighting (calculated in Appendix L)													183.0396 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
Total delivered energy for all uses													1580.1648 (238)

10a. Fuel costs - using BEDF prices (485)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	450.0966	19.1200	86.0585	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	878.3567	19.1200	167.9418	(247)
Mechanical ventilation fans	68.6718	19.1200	13.1301	(249)
Pumps and fans for heating	0.0000	0.0000	0.0000	(249)
Energy for lighting	183.0396	19.1200	34.9972	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit	0.0000	19.1200	0.0000	(252)
Total energy cost			302.1275	(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	450.0966	0.5190	233.6002	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	878.3567	0.5190	455.8671	(264)
Space and water heating			689.4673	(265)
Pumps and fans	68.6718	0.5190	35.6407	(267)
Energy for lighting	183.0396	0.5190	94.9975	(268)
Energy saving/generation technologies				
PV Unit	-663.3000	0.5190	-344.2527	(269)
Total kg/year			475.8528	(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	450.0966	3.0700	1381.7967	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	878.3567	3.0700	2696.5552	(264)
Space and water heating			4078.3519	(265)
Pumps and fans	68.6718	3.0700	210.8225	(267)
Energy for lighting	183.0396	3.0700	561.9315	(268)
Energy saving/generation technologies				
PV Unit	-663.3000	3.0700	-2036.3310	(269)
Primary energy kWh/year			2814.7749	(272)
Primary energy kWh/m2/year			76.3847	(273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 84
Current environmental impact rating: B 91

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

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

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
(none)			

Total Savings £0 0.00 kg/m²

Potential energy efficiency rating: B 84
Potential environmental impact rating: B 91

Fuel prices for cost data on this page from database revision number 485 TEST (29 Oct 2021)
Recommendation texts revision number 4.9c (22 Feb 2014)

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

	Current £302	Potential £302	Saving £0
Electricity			
Space heating	£99	£99	£0
Water heating	£168	£168	£0
Lighting	£35	£35	£0
Total cost of fuels	£302	£302	£0
Total cost of uses	£302	£302	£0
Delivered energy	43 kWh/m²	43 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.5 tonnes	0.5 tonnes	0.0 tonnes
CO2 emissions per m²	13 kg/m²	13 kg/m²	0 kg/m²
Primary energy	76 kWh/m²	76 kWh/m²	0 kWh/m²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

SAP 2012 WORKSHEET FOR New Build (As Built) (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 Built)

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 Built) (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 Built) 9.92

Overheating Calculation Input Data

Dwelling type	MidTerrace Flat
Number of storeys	1
Cross ventilation possible	Yes
SAP Region	Thames Valley
Front of dwelling faces	South East
Overshading	Average or unknown
Thermal mass parameter	74.1 (calculated from construction elements)
Night ventilation	No
Ventilation rate during hot weather (ach)	6.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	171.46 (P1)
Transmission heat loss coefficient	18.96 (37)
Summer heat loss coefficient	190.42 (P2)

Overhangs	Ratio	Z_overhangs	Overhang type
Orientation			
South East	0.000	1.000	None
Solar shading			
Orientation	Z blinds	Solar access	Z overhangs Z summer
South East	1.000	0.90	1.000 0.900 (P8)
Horizontal	1.000	1.00	1.000 1.000 (P8)
[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b
			FF Specific data or Table 6c
South East	5.7200	119.9223	0.6300 0.7000
Horizontal	0.7200	203.0000	0.6300 0.7000
total:			303.0412

Solar gains	Jun	Jul	Aug	
Internal gains	319	303	278	(P3)
Total summer gains	235	226	230	
	554	529	508	(P5)
Summer gain/loss ratio	2.91	2.78	2.67	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 74.1)	1.48	1.48	1.48	
Threshold temperature	20.39	22.16	21.95	(P7)
Likelihood of high internal temperature	Not significant	Medium	Slight	
Assessment of likelihood of high internal temperature:	Medium			

U-VALUE CALCULATOR REPORT

Energy Calculations Ltd
SAP • CODE • SBEM • DESIGN

Property Reference	015387	Issued on Date	08/11/2021
Assessment Reference	003	Prop Type Ref	
Project	Flat 20, Wesley Gate, 1-2 Queens Road, READING, RG1 4FR		
Calculation Type	New Build (As Built)		

SAP Rating	84 B	DER	17.25	TER	28.36
Environmental	91 B	% DER<TER	39.17		
CO ₂ Emissions (t/year)	0.48	DFEE	33.43	TFEE	35.04
General Requirements Compliance	Pass	% DFEE<TFEE	4.60		

Assessor Details	Mr. Matthew Carter, Energy Calculations Limited, Tel: 01754 761035, mcarter@energycalculations.co.uk	Assessor ID	7869-0001
Client			

Building Elements

Roof 000003 - Flat roof inverted

Roof Type: Flat Roof inverted (with corrections)

Layer	Description	Thickness (mm)	Conductivity (W/m ² K)	Resistance (m ² K/W)	Fraction (%)
Ext surface				0.0400	
Layer 1	Membrane				
	Main construction	1	1.0000	0.0010	100.00
Layer 2	TR27				
	Main construction	25	0.0250	1.0000	100.00
	Corrections - Air Gap: Level 1, Fasteners: None or plastic				
Layer 3	OPTIR				
	Main construction	40	0.0070	5.7143	100.00
	Corrections - Air Gap: Level 1, Fasteners: None or plastic				
Layer 4	OPTIR				
	Main construction	40	0.0070	5.7143	100.00
	Corrections - Air Gap: Level 1, Fasteners: None or plastic				
Layer 5	Plywood				
	Main construction	15	0.1300	0.1154	100.00
Layer 6	Standard cavity				
	Main construction	150	0.9375	0.1600	91.67
	Main construction	150	0.1300	1.1538	8.33
	Corrections - Cavity Unventilated, Emissivity: Normal				
Layer 7	Plasterboard, standard				
	Main construction	12.5	0.2100	0.0595	100.00
Layer 8	Plasterboard, standard				
	Main construction	12.5	0.2100	0.0595	100.00
Int surface				0.1000	

Total resistance: Upper limit = 13.041 m² K/W Lower limit = 12.976 m² K/W Average = 13.009 m² K/W
Total correction = 0.0039 m² K/W U-value (unrounded) = 0.08 W/m² K

Unheated space: None

Total thickness: 296 mm

U-value: 0.08 W/m² K

Kappa: n/a

U-VALUE CALCULATOR REPORT

Energy Calculations Ltd
SAP • CODE • SBEM • DESIGN

Property Reference	015387	Issued on Date	08/11/2021
Assessment Reference	003	Prop Type Ref	
Project	Flat 20, Wesley Gate, 1-2 Queens Road, READING, RG1 4FR		
Calculation Type	New Build (As Built)		

SAP Rating	84 B	DER	17.25	TER	28.36
Environmental	91 B	% DER<TER	39.17		
CO ₂ Emissions (t/year)	0.48	DFEE	33.43	TFEE	35.04
General Requirements Compliance	Pass	% DFEE<TFEE	4.60		

Assessor Details	Mr. Matthew Carter, Energy Calculations Limited, Tel: 01754 761035, mcarter@energycalculations.co.uk	Assessor ID	7869-0001
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Client	
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Building Elements

Wall 000001 - Timber Frame

Wall Type: Standard Wall

Layer	Description	Thickness (mm)	Conductivity (W/m ² K)	Resistance (m ² K/W)	Fraction (%)	Density (kg/m ³)	Heat Cap. (J/kgK)
Ext surface				0.0400			
Layer 1	Softwood, dry						
	Main construction	12	0.1300	0.0923	100.00		
Layer 2	airspace/timber battens						
	Main construction	22	0.1222	0.1800	89.63		
	Main construction	22	0.1243	0.1770	10.37		
	Corrections - Cavity Unventilated, Emissivity: Normal						
Layer 3	Plywood						
	Main construction	12	0.1300	0.0923	100.00		
Layer 4	Isover Earthwool						
	Main construction	75	0.0380	1.9737	91.67		
	Main construction	75	0.1300	0.5769	8.33		
	Corrections - Air Gap: Level 1, Fasteners: None or plastic						
Layer 5	Standard cavity						
	Main construction	25	0.1389	0.1800	91.67		
	Main construction	25	0.1300	0.1923	8.33		
	Corrections - Cavity Unventilated, Emissivity: Normal						
Layer 6	K118						
	Main construction	62.5	0.0202	3.1000	100.00		
	Corrections - Air Gap: Level 1, Fasteners: None or plastic						
Int surface				0.1300			

Total resistance: Upper limit = 5.640 m² K/W Lower limit = 5.458 m² K/W Average = 5.549 m² K/W
Total correction = 0.0040 m² K/W U-value (unrounded) = 0.18 W/m² K

Unheated space: None

Total thickness: 209 mm

U-value: 0.18 W/m² K

Kappa: 0.00 kJ/m² K

U-VALUE CALCULATOR REPORT

Energy Calculations Ltd
SAP • CODE • SBEM • DESIGN

Property Reference	015387	Issued on Date	08/11/2021
Assessment Reference	003	Prop Type Ref	
Project	Flat 20, Wesley Gate, 1-2 Queens Road, READING, RG1 4FR		
Calculation Type	New Build (As Built)		

SAP Rating	84 B	DER	17.25	TER	28.36
Environmental	91 B	% DER<TER	39.17		
CO ₂ Emissions (t/year)	0.48	DFEE	33.43	TFEE	35.04
General Requirements Compliance	Pass	% DFEE<TFEE	4.60		

Assessor Details	Mr. Matthew Carter, Energy Calculations Limited, Tel: 01754 761035, mcarter@energycalculations.co.uk	Assessor ID	7869-0001
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Client	
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Building Elements

Wall 000002 - Timber framed insulation between studs

Wall Type: Standard Wall

Layer	Description	Thickness (mm)	Conductivity (W/m ² K)	Resistance (m ² K/W)	Fraction (%)
Ext surface				0.0400	
Layer 1	Plasterboard, standard				
	Main construction	15	0.2100	0.0714	100.00
Layer 2	Plasterboard, standard				
	Main construction	15	0.2100	0.0714	100.00
Layer 3	Standard cavity				
	Main construction	20	0.1111	0.1800	91.67
	Main construction	20	0.1300	0.1538	8.33
	Corrections - Cavity Unventilated, Emissivity: Normal				
Layer 4	Mineral wool batt				
	Main construction	100	0.0380	2.6316	91.67
	Main construction	100	0.1300	0.7692	8.33
	Corrections - Air Gap: Level 1, Fasteners: None or plastic				
Layer 5	Standard cavity				
	Main construction	20	0.1143	0.1750	91.67
	Main construction	20	0.1300	0.1538	8.33
	Corrections - Cavity Unventilated, Emissivity: Normal				
Layer 6	Plasterboard, standard				
	Main construction	15	0.2100	0.0714	100.00
Layer 7	Plasterboard, standard				
	Main construction	15	0.2100	0.0714	100.00
Int surface				0.1300	

Total resistance:	Upper limit = 3.130 m ² K/W	Lower limit = 2.996 m ² K/W	Average = 3.063 m ² K/W
	Total correction = 0.0051 m ² K/W	U-value (unrounded) = 0.26 W/m ² K	

Unheated space: StairwellStairwell1		
Total thickness: 200 mm	U-value: 0.26 W/m² K	Kappa: n/a

BASIC COMPLIANCE REPORT

Calculation Type: New Build (As Built)

Energy Calculations Ltd
SAP • CODE • SBEM • DESIGN

Property Reference	015387	Issued on Date	08/11/2021
Assessment Reference	003	Prop Type Ref	
Property	Flat 20, Wesley Gate, 1-2 Queens Road, READING, RG1 4FR		
SAP Rating	84 B	DER	17.25
Environmental	91 B	TER	28.36
CO ₂ Emissions (t/year)	0.48	% DER<TER	39.17
General Requirements Compliance	Pass	DFEE	33.43
		TFEE	35.04
		% DFEE<TFEE	4.60
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 Built)

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)	28.36	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	17.25	kgCO ₂ /m ²	Pass
	-11.11 (-39.2%)	kgCO ₂ /m ²	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	35.04	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DFEE)	33.43	kWh/m ² /yr	
	-1.6 (-4.6%)	kWh/m ² /yr	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.22 (max. 0.30)	0.26 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Roof	0.08 (max. 0.20)	0.08 (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	6.63 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Room heaters - Electric Panel, convector or radiant heaters	
Secondary heating system	None	

5 Cylinder insulation

BASIC COMPLIANCE REPORT

Calculation Type: New Build (As Built)

Energy Calculations Ltd
SAP • CODE • SBEM • DESIGN

Hot water storage

No cylinder

6 Controls

Space heating controls

Programmer and appliance thermostats

Pass

Hot water controls

No cylinder

7 Low energy lights

Percentage of fixed lights with low-energy fittings

100

%

Minimum

75

%

Pass

8 Mechanical ventilation

Continuous supply and extract system

Specific fan power

0.52

Maximum

1.5

Pass

MVHR efficiency

90

%

Minimum

70

%

Pass

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Thames Valley)

Medium

Pass

Based on:

Overshading

Average

Windows facing South East

5.72 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

Filled Cavity with Edge Sealing

0.00

W/m²K

Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals

6.63 (measured in this dwelling)

Maximum

10.0

Pass

10 Key features

Party wall U-value

0.00

W/m²K

Roof U-value

0.08

W/m²K

Thermal bridging γ -value

0.028

W/m²K

Photovoltaic array

663.30

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

Calculation Type: New Build (As Built)

Energy Calculations Ltd
SAP • CODE • SBEM • DESIGN

Property Reference	015387	Issued on Date	08/11/2021
Assessment Reference	003	Prop Type Ref	
Property	Flat 20, Wesley Gate, 1-2 Queens Road, READING, RG1 4FR		
SAP Rating	84 B	DER	17.25
Environmental	91 B	TER	28.36
CO ₂ Emissions (t/year)	0.48	% DER<TER	39.17
General Requirements Compliance	Pass	DFEE	33.43
		TFEE	35.04
		% DFEE<TFEE	4.60
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 Built)

Orientation	South East
Property Tenure	Owner-occupied
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	Flat, Mid-Terrace
2.0 Number of Storeys	1
3.0 Date Built	2020
4.0 Sheltered Sides	3
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Ground Floor:	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
		9.46 m	36.85 m ²	2.35 m
7.0 Living Area	18.53	m ²		
8.0 Thermal Mass Parameter	Precise calculation			
Thermal Mass	74.13	kJ/m ² K		

9.0 External Walls

Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area (m ²)	Nett Area (m ²)
Main Walls	Timber Frame	Other	0.18	0.00	13.17	7.45
Wall to Hall	Timber Frame	Timber framed wall (two layers of plasterboard)	0.26	18.00	9.06	7.17

9.1 Party Walls

Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Area (m ²)
Party Wall 1	Filled Cavity with Edge Sealing	Double plasterboard on both sides, twin timber f rame with/without sheathing board	0.00	20.00	34.32

9.2 Internal Walls

Description	Construction	Kappa (kJ/m ² K)	Area (m ²)
Internal Wall 1	Plasterboard on timber frame	9.00	54.00

10.0 External Roofs

Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area (m ²)	Nett Area (m ²)
External Roof 1	External Flat Roof	Plasterboard, insulated flat roof	0.08	9.00	36.85	36.13

11.1 Party Floors

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

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Description	Construction	Kappa (kJ/m²K)	Area (m²)
Party Floor 1	Timber I-joists, carpeted	30.00	36.84

12.0 Opening Types

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

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
Door to Hall	Door to Corridor	[2] Wall to Hall	South West							1.89	
Windows	Window	[1] Main Walls	South East	None	0.00					5.72	
Roof lights	Roof Window	[1] External Roof 1	Horizontal	None						0.72	

14.0 Conservatory

None

15.0 Draught Proofing

100 %

16.0 Draught Lobby

Yes

17.0 Thermal Bridging

Calculate Bridges

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Table K1 - Approved	E2 Other lintels (including other steel lintels)	2.72	0.300	No
Table K1 - Approved	E3 Sill	2.72	0.040	No
Table K1 - Approved	E4 Jamb	8.40	0.050	No
Independently assessed	E7 Party floor between dwellings (in blocks of flats)	9.46	0.000	No
Table K1 - Default	E14 Flat roof	9.46	0.080	No
Table K1 - Approved	E16 Corner (normal)	2.36	0.090	No
Table K1 - Approved	E17 Corner (inverted – internal area greater than external area)	7.08	-0.090	No

Y-value	0.028	W/m²K
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18.0 Pressure Testing

Designed AP ₅₀	Yes	
Property Tested ?	7.00	m³/(h.m²) @ 50 Pa
As Built AP ₅₀	Yes	
	6.63	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	Yes
Approved Installation	Yes
Mechanical Ventilation data Type	Database
Type	Balanced mechanical ventilation with heat recovery
MV Reference Number	500500
Configuration	1

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

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MVHR Duct Insulated	Yes
Manufacturer SFP	0.52
Duct Type	Rigid
MVHR Efficiency	90.00
Wet Rooms	1

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				0
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	8	
Total number of L.E.L. fittings	8	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	No
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23.0 Electricity Tariff

Standard

24.0 Main Heating 1

	SAP table	
Percentage of Heat	100	%
Main Heating	REA	
SAP Code	691	
Efficiency (SAP Table)	100.0	%
Controls	CRC Programmer and appliance thermostats	
Sap Code	2603	

25.0 Main Heating 2

None

Community Heating	None
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28.0 Water Heating

	HES Instantaneous at point of use
Water Heating	Independent
Flue Gas Heat Recovery System	No
Waste Water Heat Recovery Instantaneous System 1	No
Waste Water Heat Recovery Instantaneous System 2	No
Waste Water Heat Recovery Storage System	No
Solar Panel	No
Water use <= 125 litres/person/day	Yes
SAP Code	909

29.0 Hot Water Cylinder

None

32.0 Photovoltaic Unit

More Dwellings, One Block

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

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Apportioned 663.30 kWh/Year

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

None