

Energy Calculations Ltd

SAP ♦ CODE ♦ SBEM ♦ DESIGN

01754-761035



SAP Report Submission for Building Regulations Compliance

Client:

Project: Flat 17, 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
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Property Reference	015384	Issued on Date	08/11/2021
Assessment Reference	003	Prop Type Ref	
Property	Flat 17, Wesley Gate, 1-2 Queens Road, READING, RG1 4FR		
SAP Rating	79 C	DER	21.44
Environmental	88 B	TER	29.46
CO ₂ Emissions (t/year)	0.70	% DER<TER	27.23
General Requirements Compliance	Pass	DFEE	43.46
		TFEE	45.42
		% DFEE<TFEE	4.31
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)	29.46	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	21.44	kgCO ₂ /m ²	Pass
	-8.02 (-27.2%)	kgCO ₂ /m ²	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	45.42	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DFEE)	43.46	kWh/m ² /yr	
	-1.9 (-4.2%)	kWh/m ² /yr	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.20 (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	7.01 (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

8.56 m², No overhang

Air change rate

6.00 ach

Blinds/curtains

None

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type

U-value

Solid Wall

0.00

W/m²K

Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals

7.01 (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

Photovoltaic array

770.00

kWh/Year

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THERMAL BRIDGING

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		TFEE	45.42
		% DFEE<TFEE	4.31
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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	4.08	1.22	
External wall	E3 Sill	Table K1 - Approved	0.040	4.08	0.16	
External wall	E4 Jamb	Table K1 - Approved	0.050	12.60	0.63	
External wall	E7 Party floor between dwellings (in blocks of flats)	Table K1 - Approved	0.070	19.31	1.35	
External wall	E12 Gable (insulation at ceiling level)	Table K1 - Approved	0.240	2.40	0.58	
External wall	E14 Flat roof	Table K1 - Default	0.080	19.31	1.54	
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	2.36	-0.21	
External wall	E18 Party wall between dwellings	Table K1 - Approved	0.060	9.44	0.57	
External roof	R1 Head of roof window	Table K1 - Default	0.080	0.69	0.06	
External roof	R2 Sill of roof window	Table K1 - Default	0.060	0.69	0.04	
External roof	R3 Jamb of roof window	Table K1 - Default	0.080	2.00	0.16	

Total: **6.31** W/mK:
Y-Value: **0.072** W/m²K:

FULL SAP CALCULATION PRINTOUT

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

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

DWELLING AS BUILT

Top-floor flat, total floor area 43 m²

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

1a TER and DER

Fuel for main heating:Electricity

Fuel factor:1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER) 29.46 kgCO₂/m²

Dwelling Carbon Dioxide Emission Rate (DER) 21.44 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)45.4 kWh/m²/yr

Dwelling Fabric Energy Efficiency (DFEE)43.5 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.20 (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: 7.01 (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: 8.56 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
Photovoltaic array 770.00 kWh/Year

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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	42.8000 (1b)	x 2.3500 (2b)	= 100.5800 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	42.8000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 100.5800 (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									7.0100			
Infiltration rate									0.3505 (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) =		0.2716 (21)			
Wind speed	Jan 5.1000	Feb 5.0000	Mar 4.9000	Apr 4.4000	May 4.3000	Jun 3.8000	Jul 3.8000	Aug 3.7000	Sep 4.0000	Oct 4.3000	Nov 4.5000	Dec 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	0.3463	0.3395	0.3328	0.2988	0.2920	0.2581	0.2581	0.2513	0.2716	0.2920	0.3056	0.3192 (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	0.4638	0.4570	0.4503	0.4163	0.4095	0.3756	0.3756	0.3688	0.3891	0.4095	0.4231	0.4367 (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)			8.5600	1.3258	11.3485		(27)
Roof lights (Uw = 1.40)			0.7200	1.3258	0.9545		(27a)
Main Walls	33.0100	8.5600	24.4500	0.1800	4.4010	0.0000	0.0000 (29a)
Wall to Hall	7.9100	1.8900	6.0200	0.2600	1.5652	18.0000	108.3600 (29a)
Wall to Stairs	4.4600		4.4600	0.2600	1.1596	18.0000	80.2800 (29a)
External Roof 1	42.8000	0.7200	42.0800	0.0800	3.3664	9.0000	378.7200 (30)
Total net area of external elements Aum(A, m ²)			88.1800				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		25.4412		(33)
Party Wall 1			20.4500	0.0000	0.0000	45.0000	920.2500 (32)
Party Floor 1			42.8000			30.0000	1284.0000 (32d)
Internal Wall 1			33.0700			9.0000	297.6300 (32c)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		3069.2400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							71.7112 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.3127 (36)
Total fabric heat loss						(33) + (36) =	31.7539 (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	15.3954	15.1700	14.9446	13.8176	13.5922	12.4652	12.4652	12.2398	12.9160	13.5922	14.0430	14.4938 (38)
Heat transfer coeff	47.1494	46.9240	46.6986	45.5716	45.3462	44.2191	44.2191	43.9937	44.6699	45.3462	45.7970	46.2478 (39)
Average = Sum(39)m / 12 =												45.5152 (39)
HLP	1.1016	1.0964	1.0911	1.0648	1.0595	1.0332	1.0332	1.0279	1.0437	1.0595	1.0700	1.0806 (40)
HLP (average)												1.0634 (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												1.4826 (42)
Average daily hot water use (litres/day)												69.4114 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

FULL SAP CALCULATION PRINTOUT

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Energy conte	76.3525	73.5761	70.7996	68.0232	65.2467	62.4702	62.4702	65.2467	68.0232	70.7996	73.5761	76.3525	(44)
Energy content (annual)	113.2286	99.0304	102.1905	89.0922	85.4861	73.7680	68.3569	78.4405	79.3774	92.5067	100.9782	109.6558	(45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum (45)m =		1092.1114	(45)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
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	96.2443	84.1759	86.8620	75.7284	72.6632	62.7028	58.1034	66.6744	67.4708	78.6307	85.8315	93.2075	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum (63)m =				0.0000	(63)
Output from w/h	96.2443	84.1759	86.8620	75.7284	72.6632	62.7028	58.1034	66.6744	67.4708	78.6307	85.8315	93.2075	(64)
								Total per year (kWh/year) = Sum (64)m =				928.2947	(64)
Heat gains from water heating, kWh/month	24.0611	21.0440	21.7155	18.9321	18.1658	15.6757	14.5258	16.6686	16.8677	19.6577	21.4579	23.3019	(65)

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

Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
74.1292	74.1292	74.1292	74.1292	74.1292	74.1292	74.1292	74.1292	74.1292	74.1292	74.1292	74.1292	74.1292 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	11.4714	10.1888	8.2861	6.2731	4.6892	3.9588	4.2776	5.5602	7.4629	9.4759	11.0598	11.7902 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	128.6343	129.9691	126.6054	119.4444	110.4051	101.9093	96.2336	94.8988	98.2625	105.4234	114.4628	122.9586 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	30.4129	30.4129	30.4129	30.4129	30.4129	30.4129	30.4129	30.4129	30.4129	30.4129	30.4129	30.4129 (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)	-59.3034	-59.3034	-59.3034	-59.3034	-59.3034	-59.3034	-59.3034	-59.3034	-59.3034	-59.3034	-59.3034	-59.3034 (71)
Water heating gains (Table 5)	32.3402	31.3154	29.1875	26.2946	24.4164	21.7718	19.5240	22.4040	23.4273	26.4216	29.8026	31.3197 (72)
Total internal gains	217.6845	216.7120	209.3177	197.2509	184.7494	172.8787	165.2740	168.1019	174.3916	186.5597	200.5640	211.3072 (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					8.5600	36.7938	0.6300	0.7000			0.7700			96.2544 (77)
Horizontal					0.7200	26.0000	0.6300	0.7000			1.0000			7.4300 (82)
Solar gains	103.6844	179.3883	251.7667	320.8246	366.2051	366.2398	352.0023	317.9560	275.7684	200.0680	124.7209	88.3748	(83)	
Total gains	321.3689	396.1004	461.0843	518.0754	550.9545	539.1185	517.2763	486.0578	450.1600	386.6277	325.2849	299.6821	(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	18.0823	18.1691	18.2568	18.7083	18.8013	19.2805	19.2805	19.3793	19.0859	18.8013	18.6162	18.4348
alpha	2.2055	2.2113	2.2171	2.2472	2.2534	2.2854	2.2854	2.2920	2.2724	2.2534	2.2411	2.2290
util living area	0.9131	0.8695	0.8082	0.7133	0.5962	0.4599	0.3500	0.3818	0.5562	0.7581	0.8775	0.9230 (86)
MIT	18.4640	18.8849	19.4297	20.0515	20.5126	20.8147	20.9284	20.9110	20.6955	20.0669	19.1727	18.4079 (87)
Th 2	19.9995	20.0038	20.0081	20.0297	20.0341	20.0558	20.0558	20.0602	20.0471	20.0341	20.0254	20.0167 (88)
util rest of house	0.9035	0.8559	0.7886	0.6847	0.5556	0.4051	0.2824	0.3132	0.5014	0.7269	0.8625	0.9144 (89)
MIT 2	16.6222	17.2216	17.9924	18.8656	19.4844	19.8789	20.0035	19.9919	19.7391	18.9109	17.6540	16.5495 (90)
Living area fraction									fLA = Living area / (4) =			0.5864 (91)
MIT	17.7023	18.1970	18.8353	19.5611	20.0874	20.4277	20.5459	20.5309	20.3000	19.5888	18.5446	17.6394 (92)
Temperature adjustment												0.0000
adjusted MIT	17.7023	18.1970	18.8353	19.5611	20.0874	20.4277	20.5459	20.5309	20.3000	19.5888	18.5446	17.6394 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8751	0.8258	0.7618	0.6695	0.5579	0.4273	0.3181	0.3483	0.5166	0.7107	0.8345	0.8875 (94)
Useful gains	281.2248	327.1085	351.2345	346.8706	307.3950	230.3822	164.5567	169.3113	232.5610	274.7845	271.4441	265.9554 (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	631.9110	623.9493	576.0423	485.8411	380.3363	257.6954	174.4844	181.7342	276.9542	407.6090	524.1277	621.5400 (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	260.9105	199.4770	167.2570	100.0588	54.2684	0.0000	0.0000	0.0000	0.0000	98.8214	181.9322	264.5550 (98)
Space heating												1327.2803 (98)
Space heating per m2												(98) / (4) = 31.0112 (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													1327.2803 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	260.9105	199.4770	167.2570	100.0588	54.2684	0.0000	0.0000	0.0000	0.0000	98.8214	181.9322	264.5550	(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)	260.9105	199.4770	167.2570	100.0588	54.2684	0.0000	0.0000	0.0000	0.0000	98.8214	181.9322	264.5550	(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	96.2443	84.1759	86.8620	75.7284	72.6632	62.7028	58.1034	66.6744	67.4708	78.6307	85.8315	93.2075	(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	96.2443	84.1759	86.8620	75.7284	72.6632	62.7028	58.1034	66.6744	67.4708	78.6307	85.8315	93.2075	(219)
Water heating fuel used												928.2947	(219)
Annual totals kWh/year													
Space heating fuel - main system												1327.2803	(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)													79.7599 (230a)
Total electricity for the above, kWh/year													79.7599 (231)
Electricity for lighting (calculated in Appendix L)													202.5876 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
Total delivered energy for all uses													2537.9225 (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	1327.2803	0.5190	688.8585	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	928.2947	0.5190	481.7849	(264)
Space and water heating			1170.6434	(265)
Pumps and fans	79.7599	0.5190	41.3954	(267)
Energy for lighting	202.5876	0.5190	105.1430	(268)
Energy saving/generation technologies				
PV Unit	-770.0000	0.5190	-399.6300	(269)
Total CO2, kg/year			917.5518	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			21.4400	(273)

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

DER			21.4400	ZC1
Total Floor Area		TFA	42.8000	
Assumed number of occupants		N	1.4826	
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190	
CO2 emissions from appliances, equation (L14)			17.8098	ZC2
CO2 emissions from cooking, equation (L16)			3.6117	ZC3
Total CO2 emissions			42.8615	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			42.8615	ZC8

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1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	42.8000 (1b)	x 2.3500 (2b)	= 100.5800 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	42.8000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 100.5800 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					2 * 10 = 20.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
					Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					20.0000 / (5) = 0.1988 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4488 (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) =		0.3479 (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	0.4435	0.4348	0.4261	0.3826	0.3739	0.3305	0.3305	0.3218	0.3479	0.3739	0.3913	0.4087 (22b)
Effective ac	0.5984	0.5945	0.5908	0.5732	0.5699	0.5546	0.5546	0.5518	0.5605	0.5699	0.5766	0.5835 (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)			8.1300	1.3258	10.7784		(27)
TER Room Window (Uw = 1.70)			0.6800	1.5918	1.0824		(27a)
Main Walls	33.0100	8.1300	24.8800	0.1800	4.4784		(29a)
Wall to Hall		7.9100	6.0200	0.1800	1.0836		(29a)
Wall to Stairs		4.4600	4.4600	0.1800	0.8028		(29a)
External Roof 1	42.8000	0.6800	42.1200	0.1300	5.4756		(30)
Total net area of external elements Aum(A, m ²)			88.1800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	25.5912		(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)							4.9015 (36)
Total fabric heat loss						(33) + (36) =	30.4927 (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	19.8602	19.7334	19.6092	19.0256	18.9164	18.4081	18.4081	18.3139	18.6038	18.9164	19.1373	19.3682 (38)
Heat transfer coeff	50.3529	50.2261	50.1019	49.5183	49.4091	48.9008	48.9008	48.8066	49.0966	49.4091	49.6300	49.8609 (39)
Average = Sum(39)m / 12 =												49.5177 (39)
HLP	1.1765	1.1735	1.1706	1.1570	1.1544	1.1425	1.1425	1.1403	1.1471	1.1544	1.1596	1.1650 (40)
HLP (average)												1.1570 (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												1.4826 (42)
Average daily hot water use (litres/day)												69.4114 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	76.3525	73.5761	70.7996	68.0232	65.2467	62.4702	62.4702	65.2467	68.0232	70.7996	73.5761	76.3525 (44)
Energy content (annual)	113.2286	99.0304	102.1905	89.0922	85.4861	73.7680	68.3569	78.4405	79.3774	92.5067	100.9782	109.6558 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		1092.1114 (45)
Water storage loss:	16.9843	14.8546	15.3286	13.3638	12.8229	11.0652	10.2535	11.7661	11.9066	13.8760	15.1467	16.4484 (46)
Store volume												150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3938 (48)

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Temperature factor from Table 2b												0.5400 (49)
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	159.8235	141.1162	148.7855	134.1840	132.0810	118.8598	114.9518	125.0354	124.4692	139.1016	146.0701	156.2507 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Solar input (sum of months) = Sum(63)m =												0.0000 (63)
Output from w/h	159.8235	141.1162	148.7855	134.1840	132.0810	118.8598	114.9518	125.0354	124.4692	139.1016	146.0701	156.2507 (64)
Heat gains from water heating, kWh/month	74.9244	66.5962	71.2543	65.6966	65.7000	60.6013	60.0046	63.3574	62.4664	68.0344	69.6487	73.7365 (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	74.1292	74.1292	74.1292	74.1292	74.1292	74.1292	74.1292	74.1292	74.1292	74.1292	74.1292	74.1292	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	11.5029	10.2167	8.3088	6.2903	4.7021	3.9697	4.2894	5.5755	7.4834	9.5019	11.0902	11.8226	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	128.6343	129.9691	126.6054	119.4444	110.4051	101.9093	96.2336	94.8988	98.2625	105.4234	114.4628	122.9586	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	30.4129	30.4129	30.4129	30.4129	30.4129	30.4129	30.4129	30.4129	30.4129	30.4129	30.4129	30.4129	(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)	-59.3034	-59.3034	-59.3034	-59.3034	-59.3034	-59.3034	-59.3034	-59.3034	-59.3034	-59.3034	-59.3034	-59.3034	(71)
Water heating gains (Table 5)	100.7049	99.1015	95.7719	91.2453	88.3065	84.1685	80.6513	85.1578	86.7590	91.4441	96.7344	99.1082	(72)
Total internal gains	289.0808	287.5261	278.9248	265.2188	251.6524	238.2863	229.4131	233.8709	240.7437	254.6082	270.5261	282.1281	(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					8.1300	36.7938	0.6300	0.7000			0.7700	91.4192
Horizontal					0.6800	26.0000	0.6300	0.7000			1.0000	7.0172 (77)
Solar gains	98.4364	170.2949	238.9735	304.4803	347.5173	347.5381	334.0325	301.7451	261.7407	189.9174	118.4056	83.9035 (83)
Total gains	387.5172	457.8210	517.8983	569.6991	599.1697	585.8244	563.4456	535.6160	502.4844	444.5256	388.9317	366.0316 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	59.0278	59.1768	59.3236	60.0228	60.1554	60.7807	60.7807	60.8979	60.5383	60.1554	59.8877	59.6103
alpha	4.9352	4.9451	4.9549	5.0015	5.0104	5.0520	5.0520	5.0599	5.0359	5.0104	4.9925	4.9740
util living area	0.9881	0.9730	0.9381	0.8537	0.7076	0.5235	0.3800	0.4162	0.6409	0.8878	0.9742	0.9908 (86)
MIT	19.9999	20.2065	20.4739	20.7527	20.9221	20.9862	20.9977	20.9965	20.9633	20.7386	20.3189	19.9605 (87)
Th 2	19.9389	19.9413	19.9436	19.9546	19.9566	19.9662	19.9662	19.9680	19.9625	19.9566	19.9525	19.9481 (88)
util rest of house	0.9844	0.9651	0.9205	0.8163	0.6457	0.4436	0.2917	0.3244	0.5575	0.8495	0.9652	0.9879 (89)
MIT 2	18.6404	18.9376	19.3134	19.6902	19.8890	19.9581	19.9655	19.9667	19.9378	19.6848	19.1104	18.5904 (90)
Living area fraction										fLA = Living area / (4) =		0.5864 (91)
MIT	19.4376	19.6818	19.9940	20.3133	20.4948	20.5610	20.5709	20.5706	20.5392	20.3028	19.8191	19.3939 (92)
Temperature adjustment												0.0000
adjusted MIT	19.4376	19.6818	19.9940	20.3133	20.4948	20.5610	20.5709	20.5706	20.5392	20.3028	19.8191	19.3939 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	380.6324	440.7896	477.2327	472.8676	406.6187	287.1271	193.5914	202.6069	304.0374	383.8253	374.8543	360.8888	(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	762.2237	742.4314	676.0745	565.1681	434.5446	291.4991	194.1776	203.5537	316.1431	479.4053	631.2482	757.5812	(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	283.9039	202.7033	147.9383	66.4563	20.7769	0.0000	0.0000	0.0000	0.0000	71.1115	184.6036	295.1392	(98)
Space heating												1272.6330	(98)
Space heating per m2												(98) / (4) =	29.7344 (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													1361.1048 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	283.9039	202.7033	147.9383	66.4563	20.7769	0.0000	0.0000	0.0000	0.0000	71.1115	184.6036	295.1392	(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)	303.6406	216.7950	158.2228	71.0763	22.2213	0.0000	0.0000	0.0000	0.0000	76.0551	197.4370	315.6569	(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	159.8235	141.1162	148.7855	134.1840	132.0810	118.8598	114.9518	125.0354	124.4692	139.1016	146.0701	156.2507	(64)
Efficiency of water heater (217)m	86.3306	85.7793	84.7986	83.0524	81.1034	79.8000	79.8000	79.8000	79.8000	83.1246	85.4394	86.4858	(216)
Fuel for water heating, kWh/month	185.1295	164.5108	175.4573	161.5655	162.8551	148.9472	144.0499	156.6860	155.9764	167.3409	170.9634	180.6663	(219)
Water heating fuel used												1974.1483	(219)
Annual totals kWh/year													
Space heating fuel - main system												1361.1048	(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)												203.1440	(232)
Total delivered energy for all uses												3613.3972	(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	1361.1048	0.2160	293.9986	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1974.1483	0.2160	426.4160	(264)
Space and water heating			720.4147	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	203.1440	0.5190	105.4318	(268)
Total CO2, kg/m2/year			864.7714	(272)
Emissions per m2 for space and water heating			16.8321	(272a)
Fuel factor (electricity)			1.5500	
Emissions per m2 for lighting			2.4634	(272b)
Emissions per m2 for pumps and fans			0.9095	(272c)
Target Carbon Dioxide Emission Rate (TER) = (16.8321 * 1.55) + 2.4634 + 0.9095, rounded to 2 d.p.			29.4600	(273)

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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	42.8000 (1b)	x 2.3500 (2b)	= 100.5800 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	42.8000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 100.5800 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					2 * 10 = 20.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					20.0000 / (5) = 0.1988 (8)
Pressure test					Yes
Measured/design AP50					7.0100
Infiltration rate					0.5493 (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) = 0.4257 (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												
	0.5428	0.5322	0.5215	0.4683	0.4577	0.4045	0.4045	0.3938	0.4257	0.4577	0.4790	0.5002 (22b)
Effective ac	0.6473	0.6416	0.6360	0.6097	0.6047	0.5818	0.5818	0.5775	0.5906	0.6047	0.6147	0.6251 (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)			8.5600	1.3258	11.3485		(27)
Roof lights (Uw = 1.40)			0.7200	1.3258	0.9545		(27a)
Main Walls	33.0100	8.5600	24.4500	0.1800	4.4010	0.0000	0.0000 (29a)
Wall to Hall	7.9100	1.8900	6.0200	0.2600	1.5652	18.0000	108.3600 (29a)
Wall to Stairs	4.4600		4.4600	0.2600	1.1596	18.0000	80.2800 (29a)
External Roof 1	42.8000	0.7200	42.0800	0.0800	3.3664	9.0000	378.7200 (30)
Total net area of external elements Aum(A, m ²)			88.1800				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		25.4412		(33)
Party Wall 1			20.4500	0.0000	0.0000	45.0000	920.2500 (32)
Party Floor 1			42.8000			30.0000	1284.0000 (32d)
Internal Wall 1			33.0700			9.0000	297.6300 (32c)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 3069.2400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							71.7112 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.3127 (36)
Total fabric heat loss							(33) + (36) = 31.7539 (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	21.4857	21.2959	21.1097	20.2355	20.0719	19.3105	19.3105	19.1695	19.6038	20.0719	20.4028	20.7488 (38)
Heat transfer coeff	53.2397	53.0498	52.8637	51.9894	51.8259	51.0644	51.0644	50.9234	51.3577	51.8259	52.1568	52.5027 (39)
Average = Sum(39)m / 12 =												51.9886 (39)
HLP	1.2439	1.2395	1.2351	1.2147	1.2109	1.1931	1.1931	1.1898	1.1999	1.2109	1.2186	1.2267 (40)
HLP (average)												1.2147 (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												1.4826 (42)
Average daily hot water use (litres/day)												69.4114 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	76.3525	73.5761	70.7996	68.0232	65.2467	62.4702	62.4702	65.2467	68.0232	70.7996	73.5761	76.3525 (44)
Energy conte	113.2286	99.0304	102.1905	89.0922	85.4861	73.7680	68.3569	78.4405	79.3774	92.5067	100.9782	109.6558 (45)
Energy content (annual)												Total = Sum(45)m = 1092.1114 (45)
Distribution loss (46)m = 0.15 x (45)m												

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0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (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	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	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												
24.0611	21.0440	21.7155	18.9321	18.1658	15.6757	14.5258	16.6686	16.8677	19.6577	21.4579	23.3019	65)

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

Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
74.1292	74.1292	74.1292	74.1292	74.1292	74.1292	74.1292	74.1292	74.1292	74.1292	74.1292	74.1292	74.1292 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
11.4714	10.1888	8.2861	6.2731	4.6892	3.9588	4.2776	5.5602	7.4629	9.4759	11.0598	11.7902	67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
128.6343	129.9691	126.6054	119.4444	110.4051	101.9093	96.2336	94.8988	98.2625	105.4234	114.4628	122.9586	68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
30.4129	30.4129	30.4129	30.4129	30.4129	30.4129	30.4129	30.4129	30.4129	30.4129	30.4129	30.4129	69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	70)
Losses e.g. evaporation (negative values) (Table 5)												
-59.3034	-59.3034	-59.3034	-59.3034	-59.3034	-59.3034	-59.3034	-59.3034	-59.3034	-59.3034	-59.3034	-59.3034	71)
Water heating gains (Table 5)												
32.3402	31.3154	29.1875	26.2946	24.4164	21.7718	19.5240	22.4040	23.4273	26.4216	29.8026	31.3197	72)
Total internal gains												
217.6845	216.7120	209.3177	197.2509	184.7494	172.8787	165.2740	168.1019	174.3916	186.5597	200.5640	211.3072	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	8.5600				36.7938		0.6300		0.7000		0.7700		96.2544 (77)	
Horizontal	0.7200				26.0000		0.6300		0.7000		1.0000		7.4300 (82)	
Solar gains	103.6844	179.3883	251.7667	320.8246	366.2051	366.2398	352.0023	317.9560	275.7684	200.0680	124.7209	88.3748	(83)	
Total gains	321.3689	396.1004	461.0843	518.0754	550.9545	539.1185	517.2763	486.0578	450.1600	386.6277	325.2849	299.6821	(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	16.0137	16.0711	16.1277	16.3988	16.4506	16.6959	16.6959	16.7421	16.6006	16.4506	16.3462	16.2385
alpha	2.0676	2.0714	2.0752	2.0933	2.0967	2.1131	2.1131	2.1161	2.1067	2.0967	2.0897	2.0826
util living area												
	0.9185	0.8794	0.8244	0.7397	0.6308	0.5012	0.3888	0.4226	0.5943	0.7808	0.8872	0.9277 (86)
MIT	18.1252	18.5476	19.1231	19.7958	20.3406	20.7203	20.8835	20.8572	20.5720	19.8368	18.8661	18.0559 (87)
Th 2	19.8850	19.8885	19.8920	19.9083	19.9113	19.9255	19.9255	19.9282	19.9200	19.9113	19.9051	19.8987 (88)
util rest of house												
	0.9088	0.8657	0.8045	0.7097	0.5866	0.4376	0.3067	0.3399	0.5332	0.7485	0.8721	0.9190 (89)
MIT 2	17.2825	17.6957	18.2549	18.9061	19.4091	19.7476	19.8702	19.8567	19.6299	18.9636	18.0263	17.2237 (90)
Living area fraction												
	fLA = Living area / (4) =											
MIT	17.7767	18.1953	18.7641	19.4278	19.9554	20.3180	20.4645	20.4435	20.1824	19.4757	18.5188	17.7117 (92)
Temperature adjustment												
	0.0000											
adjusted MIT	17.7767	18.1953	18.7641	19.4278	19.9554	20.3180	20.4645	20.4435	20.1824	19.4757	18.5188	17.7117 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8853	0.8401	0.7807	0.6951	0.5885	0.4618	0.3491	0.3810	0.5490	0.7337	0.8484	0.8968 (94)
Useful gains	284.5182	332.7799	359.9875	360.1197	324.2436	248.9807	180.5722	185.2062	247.1299	283.6823	275.9634	268.7430 (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												
	717.4946	705.3108	648.3234	547.3361	427.8429	291.9870	197.3365	205.9065	312.3783	459.9924	595.5676	709.4026 (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												
	322.1344	250.3408	214.5220	134.7958	77.0778	0.0000	0.0000	0.0000	0.0000	131.1747	230.1151	327.8507 (98)
Space heating												1688.0113 (98)
Space heating per m2												39.4395 (99)
(98) / (4) =												

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	480.0057	377.8768	387.0181	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7860	0.8372	0.8187	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	377.2794	316.3542	316.8532	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	677.2253	651.1928	617.0366	0.0000	0.0000	0.0000	0.0000 (103)

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Month fraction	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	215.9610	249.1199	223.3364	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												688.4173 (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	53.9903	62.2800	55.8341	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												172.1043 (107)
Space cooling per m2												4.0211 (108)
Energy for space heating												39.4395 (99)
Energy for space cooling												4.0211 (108)
Total												43.4606 (109)
Dwelling Fabric Energy Efficiency (DFEE)												43.5 (109)

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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	42.8000 (1b)	x 2.3500 (2b)	= 100.5800 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	42.8000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 100.5800 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					2 * 10 = 20.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					Air changes per hour 20.0000 / (5) = 0.1988 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4488 (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) =		0.3479 (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	0.4435	0.4348	0.4261	0.3826	0.3739	0.3305	0.3305	0.3218	0.3479	0.3739	0.3913	0.4087 (22b)
	0.5984	0.5945	0.5908	0.5732	0.5699	0.5546	0.5546	0.5518	0.5605	0.5699	0.5766	0.5835 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opaque door			1.8900	1.0000	1.8900			(26)				
TER Opening Type (Uw = 1.40)			8.1300	1.3258	10.7784			(27)				
TER Room Window (Uw = 1.70)			0.6800	1.5918	1.0824			(27a)				
Main Walls	33.0100	8.1300	24.8800	0.1800	4.4784			(29a)				
Wall to Hall		7.9100	6.0200	0.1800	1.0836			(29a)				
Wall to Stairs		4.4600	4.4600	0.1800	0.8028			(29a)				
External Roof 1	42.8000	0.6800	42.1200	0.1300	5.4756			(30)				
Total net area of external elements Aum(A, m2)			88.1800					(31)				
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	25.5912			(33)				
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								250.0000 (35)				
Thermal bridges (Sum(L x Psi) calculated using Appendix K)								4.9015 (36)				
Total fabric heat loss						(33) + (36) =		30.4927 (37)				
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 19.8602	Feb 19.7334	Mar 19.6092	Apr 19.0256	May 18.9164	Jun 18.4081	Jul 18.4081	Aug 18.3139	Sep 18.6038	Oct 18.9164	Nov 19.1373	Dec 19.3682 (38)
Heat transfer coeff	50.3529	50.2261	50.1019	49.5183	49.4091	48.9008	48.9008	48.8066	49.0966	49.4091	49.6300	49.8609 (39)
Average = Sum(39)m / 12 =												49.5177 (39)
HLP	Jan 1.1765	Feb 1.1735	Mar 1.1706	Apr 1.1570	May 1.1544	Jun 1.1425	Jul 1.1425	Aug 1.1403	Sep 1.1471	Oct 1.1544	Nov 1.1596	Dec 1.1650 (40)
HLP (average)												1.1570 (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												1.4826 (42)
Average daily hot water use (litres/day)												69.4114 (43)
Daily hot water use	Jan 76.3525	Feb 73.5761	Mar 70.7996	Apr 68.0232	May 65.2467	Jun 62.4702	Jul 62.4702	Aug 65.2467	Sep 68.0232	Oct 70.7996	Nov 73.5761	Dec 76.3525 (44)
Energy conte	113.2286	99.0304	102.1905	89.0922	85.4861	73.7680	68.3569	78.4405	79.3774	92.5067	100.9782	109.6558 (45)
Energy content (annual)										Total = Sum(45)m =		1092.1114 (45)
Distribution loss (46)m = 0.15 x (45)m												
Water 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 (46)
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)

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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	24.0611	21.0440	21.7155	18.9321	18.1658	15.6757	14.5258	16.6686	16.8677	19.6577	21.4579	23.3019 (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	74.1292	74.1292	74.1292	74.1292	74.1292	74.1292	74.1292	74.1292	74.1292	74.1292	74.1292	74.1292	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	11.5029	10.2167	8.3088	6.2903	4.7021	3.9697	4.2894	5.5755	7.4834	9.5019	11.0902	11.8226	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	128.6343	129.9691	126.6054	119.4444	110.4051	101.9093	96.2336	94.8988	98.2625	105.4234	114.4628	122.9586	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	30.4129	30.4129	30.4129	30.4129	30.4129	30.4129	30.4129	30.4129	30.4129	30.4129	30.4129	30.4129	(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)	-59.3034	-59.3034	-59.3034	-59.3034	-59.3034	-59.3034	-59.3034	-59.3034	-59.3034	-59.3034	-59.3034	-59.3034	(71)
Water heating gains (Table 5)	32.3402	31.3154	29.1875	26.2946	24.4164	21.7718	19.5240	22.4040	23.4273	26.4216	29.8026	31.3197	(72)
Total internal gains	217.7160	216.7400	209.3404	197.2681	184.7623	172.8896	165.2858	168.1171	174.4121	186.5857	200.5944	211.3396	(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													8.1300	36.7938		0.6300		0.7000		0.7700		91.4192 (77)	
Horizontal													0.6800	26.0000		0.6300		0.7000		1.0000		7.0172 (82)	
Solar gains	98.4364	170.2949	238.9735	304.4803	347.5173	347.5381	334.0325	301.7451	261.7407	189.9174	118.4056	83.9035	(83)										
Total gains	316.1524	387.0349	448.3139	501.7484	532.2796	520.4277	499.3182	469.8623	436.1527	376.5032	318.9999	295.2431	(84)										

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
tau	59.0278	59.1768	59.3236	60.0228	60.1554	60.7807	60.7807	60.8979	60.5383	60.1554	59.8877	59.6103		
alpha	4.9352	4.9451	4.9549	5.0015	5.0104	5.0520	5.0520	5.0599	5.0359	5.0104	4.9925	4.9740		
util living area	0.9950	0.9862	0.9629	0.8978	0.7670	0.5821	0.4274	0.4718	0.7146	0.9335	0.9885	0.9964	(86)	
MIT	19.8506	20.0671	20.3555	20.6742	20.8876	20.9780	20.9962	20.9938	20.9405	20.6439	20.1796	19.8107	(87)	
Th 2	19.9389	19.9413	19.9436	19.9546	19.9566	19.9662	19.9662	19.9680	19.9625	19.9566	19.9525	19.9481	(88)	
util rest of house	0.9933	0.9818	0.9512	0.8675	0.7073	0.4962	0.3289	0.3691	0.6298	0.9064	0.9840	0.9952	(89)	
MIT 2	18.9050	19.1209	19.4034	19.7088	19.8876	19.9571	19.9654	19.9664	19.9337	19.6913	19.2428	18.8728	(90)	
Living area fraction									fLA = Living area / (4) =			0.5864	(91)	
MIT	19.4596	19.6758	19.9618	20.2749	20.4740	20.5558	20.5699	20.5689	20.5242	20.2500	19.7922	19.4228	(92)	
Temperature adjustment												0.0000		
adjusted MIT	19.4596	19.6758	19.9618	20.2749	20.4740	20.5558	20.5699	20.5689	20.5242	20.2500	19.7922	19.4228	(93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Useful gains	0.9924	0.9805	0.9514	0.8776	0.7382	0.5461	0.3868	0.4295	0.6776	0.9150	0.9832	0.9944	(94)	
Ext temp.	313.7496	379.4730	426.5328	440.3474	392.9312	284.2032	193.1225	201.7896	295.5252	344.5088	313.6378	293.5909	(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	763.3288	742.1316	674.4594	563.2668	433.5175	291.2432	194.1292	203.4711	315.4040	476.7951	629.9129	759.0226	(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	334.4869	243.7066	184.4574	88.5020	30.1962	0.0000	0.0000	0.0000	0.0000	98.4210	227.7181	346.2812	(98)	
Space heating per m2												1553.7693	(98)	
										(98) / (4) =		36.3030	(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	459.6671	361.8656	370.9304	0.0000	0.0000	0.0000	0.0000	(100)	
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9438	0.9733	0.9643	0.0000	0.0000	0.0000	0.0000	(101)	
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	433.8445	352.2157	357.6712	0.0000	0.0000	0.0000	0.0000	(102)	
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	655.9294	630.7251	598.5478	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	159.9011	207.2110	179.2122	0.0000	0.0000	0.0000	0.0000	(104)	
Space cooling												546.3243	(104)	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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	39.9753	51.8027	44.8031	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												136.5811 (107)
Space cooling per m2												3.1911 (108)
Energy for space heating												36.3030 (99)
Energy for space cooling												3.1911 (108)
Total												39.4942 (109)
Target Fabric Energy Efficiency (TFEE)												45.4 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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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 (m ²)	Storey height (m)	Volume (m ³)
Ground floor	42.8000 (1b)	x 2.3500 (2b)	= 100.5800 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	42.8000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 100.5800 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					0 * 10 = 0.0000 (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 0.0000 / (5) = 0.0000 (8)
Pressure test					Yes
Measured/design AP50					7.0100
Infiltration rate					0.3505 (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) =		0.2716 (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	0.2920	0.2784	0.2784	0.2581	0.2648	0.2309	0.2309	0.2241	0.2309	0.2581	0.2513	0.2716 (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	0.4095	0.3959	0.3959	0.3756	0.3823	0.3484	0.3484	0.3416	0.3484	0.3756	0.3688	0.3891 (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)			8.5600	1.3258	11.3485		(27)
Roof lights (Uw = 1.40)			0.7200	1.3258	0.9545		(27a)
Main Walls	33.0100	8.5600	24.4500	0.1800	4.4010	0.0000	0.0000 (29a)
Wall to Hall	7.9100	1.8900	6.0200	0.2600	1.5652	18.0000	108.3600 (29a)
Wall to Stairs	4.4600		4.4600	0.2600	1.1596	18.0000	80.2800 (29a)
External Roof 1	42.8000	0.7200	42.0800	0.0800	3.3664	9.0000	378.7200 (30)
Total net area of external elements Aum(A, m ²)			88.1800				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		25.4412		(33)
Party Wall 1			20.4500	0.0000	0.0000	45.0000	920.2500 (32)
Party Floor 1			42.8000			30.0000	1284.0000 (32d)
Internal Wall 1			33.0700			9.0000	297.6300 (32c)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		3069.2400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							71.7112 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.3127 (36)
Total fabric heat loss					(33) + (36) =		31.7539 (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	13.5922	13.1414	13.1414	12.4652	12.6906	11.5636	11.5636	11.3382	11.5636	12.4652	12.2398	12.9160 (38)
Heat transfer coeff	45.3462	44.8953	44.8953	44.2191	44.4445	43.3175	43.3175	43.0921	43.3175	44.2191	43.9937	44.6699 (39)
Average = Sum(39)m / 12 =												44.1440 (39)
HLP	1.0595	1.0490	1.0490	1.0332	1.0384	1.0121	1.0121	1.0068	1.0121	1.0332	1.0279	1.0437 (40)
HLP (average)												1.0314 (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	1.4826 (42)
Average daily hot water use (litres/day)	69.4114 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

Energy Calculations Ltd
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CALCULATION OF HEAT DEMAND 09 Jan 2014

Energy conte	76.3525	73.5761	70.7996	68.0232	65.2467	62.4702	62.4702	65.2467	68.0232	70.7996	73.5761	76.3525 (44)
Energy content (annual)	113.2286	99.0304	102.1905	89.0922	85.4861	73.7680	68.3569	78.4405	79.3774	92.5067	100.9782	109.6558 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum (45)m =		1092.1114 (45)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	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	96.2443	84.1759	86.8620	75.7284	72.6632	62.7028	58.1034	66.6744	67.4708	78.6307	85.8315	93.2075 (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	96.2443	84.1759	86.8620	75.7284	72.6632	62.7028	58.1034	66.6744	67.4708	78.6307	85.8315	93.2075 (64)
RHI water heating demand												
Heat gains from water heating, kWh/month	24.0611	21.0440	21.7155	18.9321	18.1658	15.6757	14.5258	16.6686	16.8677	19.6577	21.4579	23.3019 (65)
												928 (64)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	88.9551	88.9551	88.9551	88.9551	88.9551	88.9551	88.9551	88.9551	88.9551	88.9551	88.9551	88.9551 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	28.6784	25.4719	20.7151	15.6827	11.7230	9.8970	10.6941	13.9006	18.6574	23.6898	27.6495	29.4754 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	191.9914	193.9837	188.9632	178.2753	164.7837	152.1034	143.6323	141.6400	146.6605	157.3484	170.8400	183.5203 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	45.3781	45.3781	45.3781	45.3781	45.3781	45.3781	45.3781	45.3781	45.3781	45.3781	45.3781	45.3781 (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)	-59.3034	-59.3034	-59.3034	-59.3034	-59.3034	-59.3034	-59.3034	-59.3034	-59.3034	-59.3034	-59.3034	-59.3034 (71)
Water heating gains (Table 5)	32.3402	31.3154	29.1875	26.2946	24.4164	21.7718	19.5240	22.4040	23.4273	26.4216	29.8026	31.3197 (72)
Total internal gains	328.0398	325.8008	313.8956	295.2823	275.9528	258.8021	248.8801	252.9744	263.7749	282.4896	303.3219	319.3452 (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			8.5600		43.0593		0.6300		0.7000		0.7700		112.6451 (77)	
Horizontal			0.7200		32.0000		0.6300		0.7000		1.0000		9.1446 (82)	
Solar gains	121.7897	184.1862	257.2363	334.5301	373.8986	396.4530	376.9086	347.6140	300.9038	220.6056	144.3176	104.4143	(83)	
Total gains	449.8294	509.9870	571.1319	629.8124	649.8515	655.2551	625.7887	600.5884	564.6788	503.0952	447.6395	423.7595	(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	18.8013	18.9901	18.9901	19.2805	19.1827	19.6818	19.6818	19.7847	19.6818	19.2805	19.3793	19.0859
alpha	2.2534	2.2660	2.2660	2.2854	2.2788	2.3121	2.3121	2.3190	2.3121	2.2854	2.2920	2.2724
util living area	0.8344	0.7891	0.7166	0.6054	0.4788	0.3241	0.2226	0.2369	0.4155	0.6309	0.7761	0.8470 (86)
MIT	19.1930	19.5060	19.9429	20.4206	20.7423	20.9312	20.9805	20.9773	20.8652	20.4570	19.8101	19.1507 (87)
Th 2	20.0341	20.0427	20.0427	20.0558	20.0514	20.0733	20.0733	20.0776	20.0733	20.0558	20.0602	20.0471 (88)
util rest of house	0.8185	0.7700	0.6917	0.5722	0.4349	0.2714	0.1622	0.1751	0.3611	0.5921	0.7529	0.8320 (89)
MIT 2	17.6694	18.1110	18.7159	19.3691	19.7795	20.0166	20.0629	20.0651	19.9494	19.4328	18.5580	17.6187 (90)
Living area fraction	18.5629	18.9291	19.4355	19.9857	20.3442	20.5529	20.6010	20.6001	20.4865	20.0334	19.2923	18.5171 (92)
MIT	18.5629	18.9291	19.4355	19.9857	20.3442	20.5529	20.6010	20.6001	20.4865	20.0334	19.2923	18.5171 (93)
Temperature adjustment												0.0000
adjusted MIT	18.5629	18.9291	19.4355	19.9857	20.3442	20.5529	20.6010	20.6001	20.4865	20.0334	19.2923	18.5171 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	355.3715	379.8156	385.1565	358.7688	291.6987	195.9589	123.1994	126.3810	217.9284	297.3817	327.4970	340.5214 (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	610.4904	593.9261	540.3371	445.9824	330.8529	205.8858	125.6652	129.2786	237.6607	377.3400	496.7894	599.3427 (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	189.8085	143.8823	115.4543	62.7938	29.1308	0.0000	0.0000	0.0000	0.0000	59.4890	121.8905	192.5630 (98)
Space heating												915.0122 (98)
RHI space heating demand												915 (98)

FULL SAP CALCULATION PRINTOUT

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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	42.8000 (1b)	x 2.3500 (2b)	= 100.5800 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	42.8000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 100.5800 (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								7.0100				
Infiltration rate								0.3505	(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) =	0.2716	(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	0.3463	0.3395	0.3328	0.2988	0.2920	0.2581	0.2581	0.2513	0.2716	0.2920	0.3056	0.3192 (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	0.4638	0.4570	0.4503	0.4163	0.4095	0.3756	0.3756	0.3688	0.3891	0.4095	0.4231	0.4367 (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)			8.5600	1.3258	11.3485		(27)
Roof lights (Uw = 1.40)			0.7200	1.3258	0.9545		(27a)
Main Walls	33.0100	8.5600	24.4500	0.1800	4.4010	0.0000	0.0000 (29a)
Wall to Hall	7.9100	1.8900	6.0200	0.2600	1.5652	18.0000	108.3600 (29a)
Wall to Stairs	4.4600		4.4600	0.2600	1.1596	18.0000	80.2800 (29a)
External Roof 1	42.8000	0.7200	42.0800	0.0800	3.3664	9.0000	378.7200 (30)
Total net area of external elements Aum(A, m ²)			88.1800				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		25.4412		(33)
Party Wall 1			20.4500	0.0000	0.0000	45.0000	920.2500 (32)
Party Floor 1			42.8000			30.0000	1284.0000 (32d)
Internal Wall 1			33.0700			9.0000	297.6300 (32c)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		3069.2400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							71.7112 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.3127 (36)
Total fabric heat loss						(33) + (36) =	31.7539 (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	15.3954	15.1700	14.9446	13.8176	13.5922	12.4652	12.4652	12.2398	12.9160	13.5922	14.0430	14.4938 (38)
Heat transfer coeff	47.1494	46.9240	46.6986	45.5716	45.3462	44.2191	44.2191	43.9937	44.6699	45.3462	45.7970	46.2478 (39)
Average = Sum(39)m / 12 =												45.5152 (39)
HLP	1.1016	1.0964	1.0911	1.0648	1.0595	1.0332	1.0332	1.0279	1.0437	1.0595	1.0700	1.0806 (40)
HLP (average)												1.0634 (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												1.4826 (42)
Average daily hot water use (litres/day)												69.4114 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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Energy conte	76.3525	73.5761	70.7996	68.0232	65.2467	62.4702	62.4702	65.2467	68.0232	70.7996	73.5761	76.3525 (44)
Energy content (annual)	113.2286	99.0304	102.1905	89.0922	85.4861	73.7680	68.3569	78.4405	79.3774	92.5067	100.9782	109.6558 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum (45)m =		1092.1114 (45)
Water 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 (46)
Total storage loss												
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 (56)
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)
Total heat required for water heating calculated for each 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)
Solar input	96.2443	84.1759	86.8620	75.7284	72.6632	62.7028	58.1034	66.6744	67.4708	78.6307	85.8315	93.2075 (62)
Output from w/h	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	Solar input (sum of months) = Sum (63)m =				0.0000 (63)
Heat gains from water heating, kWh/month	96.2443	84.1759	86.8620	75.7284	72.6632	62.7028	58.1034	66.6744	67.4708	78.6307	85.8315	93.2075 (64)
	24.0611	21.0440	21.7155	18.9321	18.1658	15.6757	14.5258	16.6686	16.8677	19.6577	21.4579	23.3019 (65)
								Total per year (kWh/year) = Sum (64)m =				928.2947 (64)

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

Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	88.9551	88.9551	88.9551	88.9551	88.9551	88.9551	88.9551	88.9551	88.9551	88.9551	88.9551	88.9551 (66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	28.6784	25.4719	20.7151	15.6827	11.7230	9.8970	10.6941	13.9006	18.6574	23.6898	27.6495	29.4754 (67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	191.9914	193.9837	188.9632	178.2753	164.7837	152.1034	143.6323	141.6400	146.6605	157.3484	170.8400	183.5203 (68)
Pumps, fans	45.3781	45.3781	45.3781	45.3781	45.3781	45.3781	45.3781	45.3781	45.3781	45.3781	45.3781	45.3781 (69)
Losses e.g. evaporation (negative values) (Table 5)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Water heating gains (Table 5)	-59.3034	-59.3034	-59.3034	-59.3034	-59.3034	-59.3034	-59.3034	-59.3034	-59.3034	-59.3034	-59.3034	-59.3034 (71)
Total internal gains	32.3402	31.3154	29.1875	26.2946	24.4164	21.7718	19.5240	22.4040	23.4273	26.4216	29.8026	31.3197 (72)
	328.0398	325.8008	313.8956	295.2823	275.9528	258.8021	248.8801	252.9744	263.7749	282.4896	303.3219	319.3452 (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					8.5600	36.7938	0.6300	0.7000			0.7700	96.2544 (77)
Horizontal					0.7200	26.0000	0.6300	0.7000			1.0000	7.4300 (82)
Solar gains	103.6844	179.3883	251.7667	320.8246	366.2051	366.2398	352.0023	317.9560	275.7684	200.0680	124.7209	88.3748 (83)
Total gains	431.7241	505.1891	565.6623	616.1069	642.1579	625.0419	600.8824	570.9304	539.5434	482.5575	428.0429	407.7200 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
alpha	18.0823	18.1691	18.2568	18.7083	18.8013	19.2805	19.2805	19.3793	19.0859	18.8013	18.6162	18.4348
util living area	2.2055	2.2113	2.2171	2.2472	2.2534	2.2854	2.2854	2.2920	2.2724	2.2534	2.2411	2.2290
MIT	0.8595	0.8124	0.7485	0.6529	0.5395	0.4090	0.3067	0.3325	0.4896	0.6846	0.8140	0.8710 (86)
Th 2	18.8626	19.2245	19.6916	20.2219	20.6064	20.8554	20.9458	20.9335	20.7680	20.2617	19.5005	18.8147 (87)
util rest of house	19.9995	20.0038	20.0081	20.0297	20.0341	20.0558	20.0558	20.0602	20.0471	20.0341	20.0254	20.0167 (88)
MIT 2	0.8457	0.7950	0.7258	0.6225	0.4993	0.3578	0.2459	0.2707	0.4370	0.6500	0.7941	0.8582 (89)
Living area fraction	17.1834	17.6929	18.3467	19.0857	19.5956	19.9196	20.0167	20.0101	19.8167	19.1606	18.1060	17.1247 (90)
MIT	18.1682	18.5911	19.1354	19.7520	20.1884	20.4684	20.5616	20.5516	20.3746	19.8064	18.9238	18.1158 (92)
Temperature adjustment												0.0000
adjusted MIT	18.1682	18.5911	19.1354	19.7520	20.1884	20.4684	20.5616	20.5516	20.3746	19.8064	18.9238	18.1158 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.8151	0.7665	0.7036	0.6132	0.5060	0.3807	0.2790	0.3036	0.4556	0.6411	0.7680	0.8282 (94)
Ext temp.	351.9187	387.2415	397.9898	377.8254	324.9011	237.9404	167.6260	173.3125	245.8370	309.3889	328.7481	337.6545 (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	653.8750	642.4414	590.0559	494.5433	384.9146	259.4948	175.1779	182.6458	280.2841	417.4730	541.4935	643.5745 (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	224.6555	171.4943	142.8972	84.0369	44.6500	0.0000	0.0000	0.0000	0.0000	80.4145	153.1767	227.6045 (98)
Space heating per m2												1128.9296 (98)
										(98) / (4) =		26.3769 (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													1128.9296 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	224.6555	171.4943	142.8972	84.0369	44.6500	0.0000	0.0000	0.0000	0.0000	80.4145	153.1767	227.6045	(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)	224.6555	171.4943	142.8972	84.0369	44.6500	0.0000	0.0000	0.0000	0.0000	80.4145	153.1767	227.6045	(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	96.2443	84.1759	86.8620	75.7284	72.6632	62.7028	58.1034	66.6744	67.4708	78.6307	85.8315	93.2075	(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	96.2443	84.1759	86.8620	75.7284	72.6632	62.7028	58.1034	66.6744	67.4708	78.6307	85.8315	93.2075	(219)
Water heating fuel used												928.2947	(219)
Annual totals kWh/year													
Space heating fuel - main system												1128.9296	(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)													79.7599 (230a)
Total electricity for the above, kWh/year													79.7599 (231)
Electricity for lighting (calculated in Appendix L)													202.5876 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
Total delivered energy for all uses													2339.5719 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1128.9296	13.1900	148.9058 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	928.2947	13.1900	122.4421 (247)
Mechanical ventilation fans	79.7599	13.1900	10.5203 (249)
Pumps and fans for heating	0.0000	0.0000	0.0000 (249)
Energy for lighting	202.5876	13.1900	26.7213 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit	0.0000	13.1900	0.0000 (252)
Total energy cost			308.5895 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.4762 (257)
SAP value		79.4074
SAP rating (Section 12)		79 (258)
SAP band		C

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	1128.9296	0.5190	585.9145 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	928.2947	0.5190	481.7849 (264)
Space and water heating			1067.6994 (265)
Pumps and fans	79.7599	0.5190	41.3954 (267)
Energy for lighting	202.5876	0.5190	105.1430 (268)
Energy saving/generation technologies			
PV Unit	-770.0000	0.5190	-399.6300 (269)
Total kg/year			814.6078 (272)
CO2 emissions per m2			19.0300 (273)
EI value			87.5675
EI rating			88 (274)
EI band			B

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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	42.8000 (1b)	x 2.3500 (2b)	= 100.5800 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	42.8000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 100.5800 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					0 * 10 = 0.0000 (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) =					0.0000 / (5) = 0.0000 (8)
Pressure test					Yes
Measured/design AP50					7.0100
Infiltration rate					0.3505 (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) =		0.2716 (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	0.2920	0.2784	0.2784	0.2581	0.2648	0.2309	0.2309	0.2241	0.2309	0.2581	0.2513	0.2716 (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	0.4095	0.3959	0.3959	0.3756	0.3823	0.3484	0.3484	0.3416	0.3484	0.3756	0.3688	0.3891 (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)			8.5600	1.3258	11.3485		(27)
Roof lights (Uw = 1.40)			0.7200	1.3258	0.9545		(27a)
Main Walls	33.0100	8.5600	24.4500	0.1800	4.4010	0.0000	0.0000 (29a)
Wall to Hall	7.9100	1.8900	6.0200	0.2600	1.5652	18.0000	108.3600 (29a)
Wall to Stairs	4.4600		4.4600	0.2600	1.1596	18.0000	80.2800 (29a)
External Roof 1	42.8000	0.7200	42.0800	0.0800	3.3664	9.0000	378.7200 (30)
Total net area of external elements Aum(A, m ²)			88.1800				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		25.4412		(33)
Party Wall 1			20.4500	0.0000	0.0000	45.0000	920.2500 (32)
Party Floor 1			42.8000			30.0000	1284.0000 (32d)
Internal Wall 1			33.0700			9.0000	297.6300 (32c)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		3069.2400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							71.7112 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.3127 (36)
Total fabric heat loss					(33) + (36) =		31.7539 (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	13.5922	13.1414	13.1414	12.4652	12.6906	11.5636	11.5636	11.3382	11.5636	12.4652	12.2398	12.9160 (38)
Heat transfer coeff	45.3462	44.8953	44.8953	44.2191	44.4445	43.3175	43.3175	43.0921	43.3175	44.2191	43.9937	44.6699 (39)
Average = Sum(39)m / 12 =												44.1440 (39)
HLP	1.0595	1.0490	1.0490	1.0332	1.0384	1.0121	1.0121	1.0068	1.0121	1.0332	1.0279	1.0437 (40)
HLP (average)												1.0314 (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	1.4826 (42)
Average daily hot water use (litres/day)	69.4114 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												

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Energy conte	76.3525	73.5761	70.7996	68.0232	65.2467	62.4702	62.4702	65.2467	68.0232	70.7996	73.5761	76.3525 (44)
Energy content (annual)	113.2286	99.0304	102.1905	89.0922	85.4861	73.7680	68.3569	78.4405	79.3774	92.5067	100.9782	109.6558 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum (45)m =		1092.1114 (45)
Water 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 (46)
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	96.2443	84.1759	86.8620	75.7284	72.6632	62.7028	58.1034	66.6744	67.4708	78.6307	85.8315	93.2075 (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	96.2443	84.1759	86.8620	75.7284	72.6632	62.7028	58.1034	66.6744	67.4708	78.6307	85.8315	93.2075 (64)
Heat gains from water heating, kWh/month	24.0611	21.0440	21.7155	18.9321	18.1658	15.6757	14.5258	16.6686	16.8677	19.6577	21.4579	23.3019 (65)
Total per year (kWh/year) = Sum (64)m =												

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	88.9551	88.9551	88.9551	88.9551	88.9551	88.9551	88.9551	88.9551	88.9551	88.9551	88.9551	88.9551 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	28.6784	25.4719	20.7151	15.6827	11.7230	9.8970	10.6941	13.9006	18.6574	23.6898	27.6495	29.4754 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	191.9914	193.9837	188.9632	178.2753	164.7837	152.1034	143.6323	141.6400	146.6605	157.3484	170.8400	183.5203 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	45.3781	45.3781	45.3781	45.3781	45.3781	45.3781	45.3781	45.3781	45.3781	45.3781	45.3781	45.3781 (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)	-59.3034	-59.3034	-59.3034	-59.3034	-59.3034	-59.3034	-59.3034	-59.3034	-59.3034	-59.3034	-59.3034	-59.3034 (71)
Water heating gains (Table 5)	32.3402	31.3154	29.1875	26.2946	24.4164	21.7718	19.5240	22.4040	23.4273	26.4216	29.8026	31.3197 (72)
Total internal gains	328.0398	325.8008	313.8956	295.2823	275.9528	258.8021	248.8801	252.9744	263.7749	282.4896	303.3219	319.3452 (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					8.5600	43.0593	0.6300	0.7000	0.7700	112.6451		
Horizontal					0.7200	32.0000	0.6300	0.7000	1.0000	9.1446 (77)		
Solar gains	121.7897	184.1862	257.2363	334.5301	373.8986	396.4530	376.9086	347.6140	300.9038	220.6056	144.3176	104.4143 (83)
Total gains	449.8294	509.9870	571.1319	629.8124	649.8515	655.2551	625.7887	600.5884	564.6788	503.0952	447.6395	423.7595 (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	18.8013	18.9901	18.9901	19.2805	19.1827	19.6818	19.6818	19.7847	19.6818	19.2805	19.3793	19.0859
alpha	2.2534	2.2660	2.2660	2.2854	2.2788	2.3121	2.3121	2.3190	2.3121	2.2854	2.2920	2.2724
util living area	0.8344	0.7891	0.7166	0.6054	0.4788	0.3241	0.2226	0.2369	0.4155	0.6309	0.7761	0.8470 (86)
MIT	19.1930	19.5060	19.9429	20.4206	20.7423	20.9312	20.9805	20.9773	20.8652	20.4570	19.8101	19.1507 (87)
Th 2	20.0341	20.0427	20.0427	20.0558	20.0514	20.0733	20.0733	20.0776	20.0733	20.0558	20.0602	20.0471 (88)
util rest of house	0.8185	0.7700	0.6917	0.5722	0.4349	0.2714	0.1622	0.1751	0.3611	0.5921	0.7529	0.8320 (89)
MIT 2	17.6694	18.1110	18.7159	19.3691	19.7795	20.0166	20.0629	20.0651	19.9494	19.4328	18.5580	17.6187 (90)
Living area fraction	18.5629	18.9291	19.4355	19.9857	20.3442	20.5529	20.6010	20.6001	20.4865	20.0334	19.2923	18.5171 (92)
MIT	18.5629	18.9291	19.4355	19.9857	20.3442	20.5529	20.6010	20.6001	20.4865	20.0334	19.2923	18.5171 (93)
Temperature adjustment												0.0000
adjusted MIT	18.5629	18.9291	19.4355	19.9857	20.3442	20.5529	20.6010	20.6001	20.4865	20.0334	19.2923	18.5171 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	355.3715	379.8156	385.1565	358.7688	291.6987	195.9589	123.1994	126.3810	217.9284	297.3817	327.4970	340.5214 (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	610.4904	593.9261	540.3371	445.9824	330.8529	205.8858	125.6652	129.2786	237.6607	377.3400	496.7894	599.3427 (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	189.8085	143.8823	115.4543	62.7938	29.1308	0.0000	0.0000	0.0000	0.0000	59.4890	121.8905	192.5630 (98)
Space heating												915.0122 (98)
Space heating per m2												(98) / (4) = 21.3788 (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													915.0122 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	189.8085	143.8823	115.4543	62.7938	29.1308	0.0000	0.0000	0.0000	0.0000	59.4890	121.8905	192.5630	(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)	189.8085	143.8823	115.4543	62.7938	29.1308	0.0000	0.0000	0.0000	0.0000	59.4890	121.8905	192.5630	(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	96.2443	84.1759	86.8620	75.7284	72.6632	62.7028	58.1034	66.6744	67.4708	78.6307	85.8315	93.2075	(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	96.2443	84.1759	86.8620	75.7284	72.6632	62.7028	58.1034	66.6744	67.4708	78.6307	85.8315	93.2075	(219)
Water heating fuel used												928.2947	(219)
Annual totals kWh/year													
Space heating fuel - main system												915.0122	(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)													79.7599 (230a)
Total electricity for the above, kWh/year													79.7599 (231)
Electricity for lighting (calculated in Appendix L)													202.5876 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
Total delivered energy for all uses													2125.6544 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	915.0122	19.1200	174.9503 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	928.2947	19.1200	177.4899 (247)
Mechanical ventilation fans	79.7599	19.1200	15.2501 (249)
Pumps and fans for heating	0.0000	0.0000	0.0000 (249)
Energy for lighting	202.5876	19.1200	38.7348 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit	0.0000	19.1200	0.0000 (252)
Total energy cost			406.4251 (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	915.0122	0.5190	474.8913 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	928.2947	0.5190	481.7849 (264)
Space and water heating			956.6762 (265)
Pumps and fans	79.7599	0.5190	41.3954 (267)
Energy for lighting	202.5876	0.5190	105.1430 (268)
Energy saving/generation technologies			
PV Unit	-770.0000	0.5190	-399.6300 (269)
Total kg/year			703.5846 (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	915.0122	3.0700	2809.0873 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	928.2947	3.0700	2849.8646 (264)
Space and water heating			5658.9520 (265)
Pumps and fans	79.7599	3.0700	244.8630 (267)
Energy for lighting	202.5876	3.0700	621.9441 (268)
Energy saving/generation technologies			
PV Unit	-770.0000	3.0700	-2363.9000 (269)
Primary energy kWh/year			4161.8590 (272)
Primary energy kWh/m2/year			97.2397 (273)

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

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: C 79
Current environmental impact rating: B 88

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

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

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

Total Savings £0 0.00 kg/m²

Potential energy efficiency rating: C 79
Potential environmental impact rating: B 88

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	Potential	Saving
Electricity	£406	£406	£0
Space heating	£190	£190	£0
Water heating	£177	£177	£0
Lighting	£39	£39	£0
Total cost of fuels	£406	£406	£0
Total cost of uses	£406	£406	£0
Delivered energy	50 kWh/m²	50 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.7 tonnes	0.7 tonnes	0.0 tonnes
CO2 emissions per m²	16 kg/m²	16 kg/m²	0 kg/m²
Primary energy	97 kWh/m²	97 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
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CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As 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	EndTerrace 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	71.7 (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	199.15 (P1)
Transmission heat loss coefficient	31.75 (37)
Summer heat loss coefficient	230.90 (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	Shading	Gains W
South East	8.5600	119.9223	0.6300	0.7000	0.9000	366.6887
Horizontal	0.7200	203.0000	0.6300	0.7000	1.0000	58.0109
total:						424.6996

Solar gains	Jun	Jul	Aug	
Internal gains	447	425	392	(P3)
Total summer gains	259	249	253	
	706	674	644	(P5)
Summer gain/loss ratio	3.06	2.92	2.79	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 71.7)	1.50	1.50	1.50	
Threshold temperature	20.55	22.32	22.09	(P7)
Likelihood of high internal temperature	Slight	Medium	Medium	
Assessment of likelihood of high internal temperature:	Medium			

U-VALUE CALCULATOR REPORT

Energy Calculations Ltd
SAP • CODE • SBEM • DESIGN

Property Reference	015384	Issued on Date	08/11/2021
Assessment Reference	003	Prop Type Ref	
Project	Flat 17, Wesley Gate, 1-2 Queens Road, READING, RG1 4FR		
Calculation Type	New Build (As Built)		

SAP Rating	79 C	DER	21.44	TER	29.46
Environmental	88 B	% DER<TER	27.23		
CO ₂ Emissions (t/year)	0.70	DFEE	43.46	TFEE	45.42
General Requirements Compliance	Pass	% DFEE<TFEE	4.31		

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

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Project	Flat 17, Wesley Gate, 1-2 Queens Road, READING, RG1 4FR		
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Environmental	88 B	% DER<TER	27.23		
CO ₂ Emissions (t/year)	0.70	DFEE	43.46	TFEE	45.42
General Requirements Compliance	Pass	% DFEE<TFEE	4.31		

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	015384	Issued on Date	08/11/2021
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Project	Flat 17, Wesley Gate, 1-2 Queens Road, READING, RG1 4FR		
Calculation Type	New Build (As Built)		

SAP Rating	79 C	DER	21.44	TER	29.46
Environmental	88 B	% DER<TER	27.23		
CO ₂ Emissions (t/year)	0.70	DFEE	43.46	TFEE	45.42
General Requirements Compliance	Pass	% DFEE<TFEE	4.31		

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

U-VALUE CALCULATOR REPORT

Energy Calculations Ltd
SAP • CODE • SBEM • DESIGN

Property Reference	015384	Issued on Date	08/11/2021
Assessment Reference	003	Prop Type Ref	
Project	Flat 17, Wesley Gate, 1-2 Queens Road, READING, RG1 4FR		
Calculation Type	New Build (As Built)		

SAP Rating	79 C	DER	21.44	TER	29.46
Environmental	88 B	% DER<TER	27.23		
CO ₂ Emissions (t/year)	0.70	DFEE	43.46	TFEE	45.42
General Requirements Compliance	Pass	% DFEE<TFEE	4.31		

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 000004 - 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	015384	Issued on Date	08/11/2021
Assessment Reference	003	Prop Type Ref	
Property	Flat 17, Wesley Gate, 1-2 Queens Road, READING, RG1 4FR		
SAP Rating	79 C	DER	21.44
Environmental	88 B	TER	29.46
CO ₂ Emissions (t/year)	0.70	% DER<TER	27.23
General Requirements Compliance	Pass	DFEE	43.46
		TFEE	45.42
		% DFEE<TFEE	4.31
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)	29.46	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	21.44	kgCO ₂ /m ²	Pass
	-8.02 (-27.2%)	kgCO ₂ /m ²	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	45.42	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DFEE)	43.46	kWh/m ² /yr	
	-1.9 (-4.2%)	kWh/m ² /yr	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.20 (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	7.01 (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)

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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

8.56 m², No overhang

Air change rate

6.00 ach

Blinds/curtains

None

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type

U-value

Solid Wall

0.00

W/m²K

Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals

7.01 (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

Photovoltaic array

770.00

kWh/Year

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

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

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Property Reference	015384	Issued on Date	08/11/2021
Assessment Reference	003	Prop Type Ref	
Property	Flat 17, Wesley Gate, 1-2 Queens Road, READING, RG1 4FR		
SAP Rating	79 C	DER	21.44
Environmental	88 B	TER	29.46
CO ₂ Emissions (t/year)	0.70	% DER<TER	27.23
General Requirements Compliance	Pass	DFEE	43.46
		TFEE	45.42
		% DFEE<TFEE	4.31
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, End-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 19.31 m	Internal Floor Area 42.80 m ²
			Average Storey Height 2.35 m

7.0 Living Area	25.10	m ²
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8.0 Thermal Mass Parameter	Precise calculation	
Thermal Mass	71.71	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	33.01	24.45
Wall to Hall	Timber Frame	Timber framed wall (two layers of plasterboard)	0.26	18.00	7.91	6.02
Wall to Stairs	Timber Frame	Timber framed wall (two layers of plasterboard)	0.26	18.00	4.46	4.46

9.1 Party Walls					
Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Area (m ²)
Party Wall 1	Solid Wall	Plasterboard on dabs mounted on cement render on both sides, AAC blocks, cavity	0.00	45.00	20.45

9.2 Internal Walls					
Description	Construction		Kappa (kJ/m ² K)	Area (m ²)	
Internal Wall 1	Plasterboard on timber frame		9.00	33.07	

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	42.80	42.08

SUMMARY FOR INPUT DATA

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11.1 Party Floors

Description	Construction	Kappa (kJ/m²K)	Area (m²)
Party Floor 1	Timber I-joists, carpeted	30.00	42.80

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	North East							1.89	
Windows	Window	[1] Main Walls	South East	None	0.00					8.56	
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)	4.08	0.300	No
Table K1 - Approved	E3 Sill	4.08	0.040	No
Table K1 - Approved	E4 Jamb	12.60	0.050	No
Table K1 - Approved	E7 Party floor between dwellings (in blocks of flats)	19.31	0.070	No
Table K1 - Approved	E12 Gable (insulation at ceiling level)	2.40	0.240	No
Table K1 - Default	E14 Flat roof	19.31	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)	2.36	-0.090	No
Table K1 - Approved	E18 Party wall between dwellings	9.44	0.060	No
Table K1 - Default	R1 Head of roof window	0.69	0.080	No
Table K1 - Default	R2 Sill of roof window	0.69	0.060	No
Table K1 - Default	R3 Jamb of roof window	2.00	0.080	No

Y-value 0.072 W/m²K

18.0 Pressure Testing

Yes

Designed AP₅₀ 7.01 m³/(h.m²) @ 50 Pa

Property Tested ? Yes

As Built AP₅₀ 7.01 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

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

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Mechanical Ventilation data Type	Database
Type	Balanced mechanical ventilation with heat recovery
MV Reference Number	500500
Configuration	1
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

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

Water Heating	HES Instantaneous at point of use
Flue Gas Heat Recovery System	Independent
Waste Water Heat Recovery Instantaneous System 1	No
Waste Water Heat Recovery Instantaneous System 2	No
Waste Water Heat Recovery Storage System	No
Solar Panel	No

SUMMARY FOR INPUT DATA

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Water use <= 125 litres/person/day	Yes
SAP Code	909
29.0 Hot Water Cylinder	None
32.0 Photovoltaic Unit	More Dwellings, One Block
Apportioned	770.00 kWh/Year

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

None