

Energy Calculations Ltd

SAP ♦ CODE ♦ SBEM ♦ DESIGN

01754-761035



SAP Report Submission for Building Regulations Compliance

Client:

Project: Flat 18, 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	015385	Issued on Date	08/11/2021
Assessment Reference	003	Prop Type Ref	
Property	Flat 18, Wesley Gate, 1-2 Queens Road, READING, RG1 4FR		
SAP Rating	79 C	DER	21.58
Environmental	87 B	TER	29.88
CO ₂ Emissions (t/year)	0.73	% DER<TER	27.79
General Requirements Compliance	Pass	DFEE	44.09
		TFEE	48.91
		% DFEE<TFEE	9.86
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)	29.88	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	21.58	kgCO ₂ /m ²	Pass
	-8.30 (-27.8%)	kgCO ₂ /m ²	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	48.91	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DFEE)	44.09	kWh/m ² /yr	
	-4.8 (-9.8%)	kWh/m ² /yr	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.25 (max. 0.30)	0.26 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Roof	0.08 (max. 0.20)	0.08 (max. 0.35)	Pass
Openings	1.40 (max. 2.00)	1.40 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	6.69 (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)

Slight

Pass

Based on:

Overshading

Average

Windows facing North West

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

Filled Cavity with Edge Sealing

0.00

W/m²K

Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals

6.69 (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

811.80

kWh/Year

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THERMAL BRIDGING

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		TFEE	48.91
		% DFEE<TFEE	9.86
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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	15.38	1.08	
External wall	E14 Flat roof	Table K1 - Default	0.080	15.38	1.23	
External wall	E16 Corner (normal)	Table K1 - Approved	0.090	2.36	0.21	
External wall	E18 Party wall between dwellings	Table K1 - Approved	0.060	7.08	0.42	
External roof	R1 Head of roof window	Table K1 - Default	0.080	0.70	0.06	
External roof	R2 Sill of roof window	Table K1 - Default	0.060	0.70	0.04	
External roof	R3 Jamb of roof window	Table K1 - Default	0.080	1.00	0.08	

Total: **5.14** W/mK:
Y-Value: **0.063** 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 45 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) 29.88 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 21.58 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)48.9 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)44.1 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.25 (max. 0.30)	0.26 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	(no floor)		
Roof	0.08 (max. 0.20)	0.08 (max. 0.35)	OK
Openings	1.40 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals: 6.69 (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): Slight OK
Based on:
Overshading: Average
Windows facing North West: 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 811.80 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 (m2)	Storey height (m)	Volume (m3)
Ground floor	45.1000 (1b)	x 2.3500 (2b)	= 105.9850 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	45.1000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 105.9850 (5)

2. Ventilation rate

	main		secondary		other		total	m3 per hour				
	heating		heating									
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)			
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)			
Number of intermittent fans							0 * 10 =	0.0000	(7a)			
Number of passive vents							0 * 10 =	0.0000	(7b)			
Number of flueless gas fires							0 * 40 =	0.0000	(7c)			
Air changes per hour												
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =						0.0000 / (5) =	0.0000	(8)			
Pressure test								Yes				
Measured/design AP50								6.6900				
Infiltration rate								0.3345	(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) =	0.2592	(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	0.3305	0.3240	0.3176	0.2852	0.2787	0.2463	0.2463	0.2398	0.2592	0.2787	0.2916	0.3046 (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	0.4480	0.4415	0.4351	0.4027	0.3962	0.3638	0.3638	0.3573	0.3767	0.3962	0.4091	0.4221 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Door to Hall			1.8900	1.4000	2.6460		(26)
Windows (Uw = 1.40)			8.5600	1.3258	11.3485		(27)
Roof lights (Uw = 1.40)			0.7200	1.3258	0.9545		(27a)
Main Walls	10.2900	8.5600	1.7300	0.1800	0.3114	0.0000	0.0000 (29a)
Wall to Hall	25.8500	1.8900	23.9600	0.2600	6.2296	18.0000	431.2800 (29a)
External Roof 1	45.1000	0.7200	44.3800	0.0800	3.5504	9.0000	399.4200 (30)
Total net area of external elements Aum(A, m2)			81.2400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	25.0404		(33)
Party Wall 1			34.6600	0.0000	0.0000	20.0000	693.2000 (32)
Party Floor 1			45.1000			30.0000	1353.0000 (32d)
Internal Wall 1			51.3800			9.0000	462.4200 (32c)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	3339.3200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							74.0426 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.1394 (36)
Total fabric heat loss						(33) + (36) =	30.1798 (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	15.6698	15.4431	15.2165	14.0831	13.8564	12.7231	12.7231	12.4964	13.1764	13.8564	14.3098	14.7631 (38)
Heat transfer coeff	45.8496	45.6230	45.3963	44.2629	44.0363	42.9029	42.9029	42.6762	43.3562	44.0363	44.4896	44.9429 (39)
Average = Sum(39)m / 12 =												44.2063 (39)
HLP	Jan 1.0166	Feb 1.0116	Mar 1.0066	Apr 0.9814	May 0.9764	Jun 0.9513	Jul 0.9513	Aug 0.9463	Sep 0.9613	Oct 0.9764	Nov 0.9865	Dec 0.9965 (40)
HLP (average)												0.9802 (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												1.5475 (42)
Average daily hot water use (litres/day)												70.9533 (43)
Daily hot water use	Jan 78.0486	Feb 75.2105	Mar 72.3723	Apr 69.5342	May 66.6961	Jun 63.8580	Jul 63.8580	Aug 66.6961	Sep 69.5342	Oct 72.3723	Nov 75.2105	Dec 78.0486 (44)

FULL SAP CALCULATION PRINTOUT

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Energy conte	115.7438	101.2303	104.4606	91.0713	87.3851	75.4067	69.8754	80.1830	81.1406	94.5616	103.2214	112.0917 (45)
Energy content (annual)										Total =	Sum (45)m =	1116.3714 (45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Total heat required for water heating calculated for each month												
Solar input	98.3823	86.0458	88.7915	77.4106	74.2773	64.0957	59.3941	68.1555	68.9695	80.3774	87.7382	95.2780 (62)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	98.3823	86.0458	88.7915	77.4106	74.2773	64.0957	59.3941	68.1555	68.9695	80.3774	87.7382	95.2780 (64)
Heat gains from water heating, kWh/month	24.5956	21.5114	22.1979	19.3526	18.5693	16.0239	14.8485	17.0389	17.2424	20.0943	21.9345	23.8195 (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	77.3753	77.3753	77.3753	77.3753	77.3753	77.3753	77.3753	77.3753	77.3753	77.3753	77.3753	77.3753 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	12.0311	10.6859	8.6904	6.5792	4.9180	4.1520	4.4864	5.8316	7.8271	9.9383	11.5995	12.3655 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	134.5387	135.9347	132.4166	124.9270	115.4727	106.5870	100.6508	99.2547	102.7728	110.2624	119.7167	128.6024 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	30.7375	30.7375	30.7375	30.7375	30.7375	30.7375	30.7375	30.7375	30.7375	30.7375	30.7375	30.7375 (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)	-61.9003	-61.9003	-61.9003	-61.9003	-61.9003	-61.9003	-61.9003	-61.9003	-61.9003	-61.9003	-61.9003	-61.9003 (71)
Water heating gains (Table 5)	33.0586	32.0111	29.8359	26.8787	24.9588	22.2554	19.9577	22.9017	23.9478	27.0085	30.4646	32.0154 (72)
Total internal gains	225.8409	224.8443	217.1555	204.5975	191.5621	179.2070	171.3074	174.2006	180.7603	193.4219	207.9934	219.1960 (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
Northwest					8.5600	11.2829		0.6300		0.7000	0.7700	29.5167
Horizontal					0.7200	26.0000		0.6300		0.7000	1.0000	7.4300 (81)
Solar gains	36.9467	75.5136	135.6826	220.6409	293.8329	311.9161	292.3352	234.8611	164.7662	92.2858	46.5700	30.1060 (83)
Total gains	262.7876	300.3579	352.8381	425.2384	485.3950	491.1231	463.6427	409.0617	345.5265	285.7076	254.5634	249.3019 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	20.2311	20.3316	20.4331	20.9563	21.0642	21.6207	21.6207	21.7355	21.3946	21.0642	20.8496	20.6393
alpha	2.3487	2.3554	2.3622	2.3971	2.4043	2.4414	2.4414	2.4490	2.4263	2.4043	2.3900	2.3760
util living area	0.9452	0.9243	0.8787	0.7819	0.6442	0.4902	0.3790	0.4350	0.6556	0.8487	0.9258	0.9507 (86)
MIT	18.4309	18.7259	19.2632	19.9757	20.5105	20.8270	20.9332	20.9059	20.6304	19.9107	19.0740	18.4046 (87)
Th 2	20.0695	20.0737	20.0779	20.0988	20.1030	20.1241	20.1241	20.1284	20.1157	20.1030	20.0946	20.0862 (88)
util rest of house	0.9389	0.9157	0.8648	0.7576	0.6059	0.4367	0.3115	0.3645	0.6036	0.8257	0.9160	0.9450 (89)
MIT 2	16.6049	17.0321	17.8039	18.8168	19.5407	19.9554	20.0736	20.0532	19.7263	18.7515	17.5522	16.5758 (90)
Living area fraction									fLA = Living area / (4) =			0.5481 (91)
MIT	17.6058	17.9605	18.6038	19.4520	20.0723	20.4331	20.5447	20.5206	20.2218	19.3869	18.3863	17.5782 (92)
Temperature adjustment												0.0000
adjusted MIT	17.6058	17.9605	18.6038	19.4520	20.0723	20.4331	20.5447	20.5206	20.2218	19.3869	18.3863	17.5782 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9163	0.8902	0.8377	0.7380	0.6045	0.4561	0.3446	0.3971	0.6103	0.8040	0.8920	0.9238 (94)
Ext temp.	240.7844	267.3777	295.5750	313.8048	293.4070	224.0125	159.7683	162.4400	210.8791	229.7207	227.0632	230.3099 (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	610.0637	595.8579	549.4662	467.0629	368.6846	250.2573	169.2411	175.8511	265.4200	386.9410	502.1239	601.2563 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating per m2	274.7438	220.7387	188.8950	110.3459	56.0066	0.0000	0.0000	0.0000	0.0000	116.9719	198.0437	275.9841 (98)
												1441.7296 (98)
										(98) / (4) =		31.9674 (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													1441.7296	(211)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec			
Space heating requirement	274.7438	220.7387	188.8950	110.3459	56.0066	0.0000	0.0000	0.0000	0.0000	116.9719	198.0437	275.9841	(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)	274.7438	220.7387	188.8950	110.3459	56.0066	0.0000	0.0000	0.0000	0.0000	116.9719	198.0437	275.9841	(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	98.3823	86.0458	88.7915	77.4106	74.2773	64.0957	59.3941	68.1555	68.9695	80.3774	87.7382	95.2780	(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	98.3823	86.0458	88.7915	77.4106	74.2773	64.0957	59.3941	68.1555	68.9695	80.3774	87.7382	95.2780	(219)	
Water heating fuel used												948.9157	(219)	
Annual totals kWh/year														
Space heating fuel - main system												1441.7296	(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)													84.0461	(230a)
Total electricity for the above, kWh/year													84.0461	(231)
Electricity for lighting (calculated in Appendix L)													212.4730	(232)
Energy saving/generation technologies (Appendices M,N and Q)														
Total delivered energy for all uses													2687.1644	(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	1441.7296	0.5190	748.2576	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	948.9157	0.5190	492.4873	(264)
Space and water heating			1240.7449	(265)
Pumps and fans	84.0461	0.5190	43.6199	(267)
Energy for lighting	212.4730	0.5190	110.2735	(268)
Energy saving/generation technologies				
PV Unit	-811.8000	0.5190	-421.3242	(269)
Total CO2, kg/year			973.3141	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			21.5800	(273)

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

DER		21.5800	ZC1
Total Floor Area		45.1000	
Assumed number of occupants	TFA	1.5475	
CO2 emission factor in Table 12 for electricity displaced from grid	N	0.5190	
CO2 emissions from appliances, equation (L14)	EF	17.6773	ZC2
CO2 emissions from cooking, equation (L16)		3.4621	ZC3
Total CO2 emissions		42.7194	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		42.7194	ZC8

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

Energy Calculations Ltd
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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	45.1000 (1b)	x 2.3500 (2b)	= 105.9850 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	45.1000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 105.9850 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	0 * 40 =	0.0000 (6a)
Number of open flues	0	+	0	0 * 20 =	0.0000 (6b)
Number of intermittent fans				2 * 10 =	20.0000 (7a)
Number of passive vents				0 * 10 =	0.0000 (7b)
Number of flueless gas fires				0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				Air changes per hour
Pressure test					20.0000 / (5) = 0.1887 (8)
Measured/design AP50					Yes
Infiltration rate					5.0000
Number of sides sheltered					0.4387 (18)
					3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.7750 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3400 (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	0.4335	0.4250	0.4165	0.3740	0.3655	0.3230	0.3230	0.3145	0.3400	0.3655	0.3825	0.3995 (22b)
	0.5940	0.5903	0.5867	0.5699	0.5668	0.5522	0.5522	0.5495	0.5578	0.5668	0.5732	0.5798 (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)			8.5600	1.3258	11.3485		(27)					
TER Room Window (Uw = 1.70)			0.7200	1.5918	1.1461		(27a)					
Main Walls	10.2900	8.5600	1.7300	0.1800	0.3114		(29a)					
Wall to Hall	25.8500	1.8900	23.9600	0.1800	4.3128		(29a)					
External Roof 1	45.1000	0.7200	44.3800	0.1300	5.7694		(30)					
Total net area of external elements Aum(A, m2)			81.2400				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26) ... (30) + (32) =			24.7782	(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.1602 (36)					
Total fabric heat loss						(33) + (36) =	28.9384 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 20.7738	Feb 20.6462	Mar 20.5211	Apr 19.9336	May 19.8236	Jun 19.3119	Jul 19.3119	Aug 19.2172	Sep 19.5090	Oct 19.8236	Nov 20.0460	Dec 20.2785 (38)
Heat transfer coeff	49.7121	49.5845	49.4594	48.8719	48.7620	48.2503	48.2503	48.1555	48.4474	48.7620	48.9844	49.2168 (39)
Average = Sum(39)m / 12 =												48.8714 (39)
HLP	Jan 1.1023	Feb 1.0994	Mar 1.0967	Apr 1.0836	May 1.0812	Jun 1.0699	Jul 1.0699	Aug 1.0678	Sep 1.0742	Oct 1.0812	Nov 1.0861	Dec 1.0913 (40)
HLP (average)												1.0836 (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												1.5475 (42)
Average daily hot water use (litres/day)												70.9533 (43)
Daily hot water use	78.0486	75.2105	72.3723	69.5342	66.6961	63.8580	63.8580	66.6961	69.5342	72.3723	75.2105	78.0486 (44)
Energy conte	115.7438	101.2303	104.4606	91.0713	87.3851	75.4067	69.8754	80.1830	81.1406	94.5616	103.2214	112.0917 (45)
Energy content (annual)										Total = Sum(45)m =		1116.3714 (45)
Distribution loss (46)m = 0.15 x (45)m												
17.3616	15.1845	15.6691	13.6607	13.1078	11.3110	10.4813	12.0274	12.1711	14.1842	15.4832	16.8138	(46)
Water storage loss:												
Store volume												150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3938 (48)
Temperature factor from Table 2b												0.5400 (49)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

Energy Calculations Ltd
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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month												
162.3387	143.3160	151.0555	136.1631	133.9800	120.4985	116.4703	126.7779	126.2325	141.1565	148.3132	158.6866	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
							Solar input (sum of months) = Sum(63)m = 0.0000 (63)					
Output from w/h	162.3387	143.3160	151.0555	136.1631	133.9800	120.4985	116.4703	126.7779	126.2325	141.1565	148.3132	158.6866 (64)
							Total per year (kWh/year) = Sum(64)m = 1664.9888 (64)					
Heat gains from water heating, kWh/month												
75.7607	67.3276	72.0091	66.3547	66.3315	61.1462	60.5095	63.9368	63.0527	68.7177	70.3946	74.5464	(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		
77.3753	77.3753	77.3753	77.3753	77.3753	77.3753	77.3753	77.3753	77.3753	77.3753	77.3753	77.3753	(66)	
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
12.0311	10.6859	8.6904	6.5792	4.9180	4.1520	4.4864	5.8316	7.8271	9.9383	11.5995	12.3655	(67)	
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
134.5387	135.9347	132.4166	124.9270	115.4727	106.5870	100.6508	99.2547	102.7728	110.2624	119.7167	128.6024	(68)	
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
30.7375	30.7375	30.7375	30.7375	30.7375	30.7375	30.7375	30.7375	30.7375	30.7375	30.7375	30.7375	(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	(70)	
Losses e.g. evaporation (negative values) (Table 5)													
-61.9003	-61.9003	-61.9003	-61.9003	-61.9003	-61.9003	-61.9003	-61.9003	-61.9003	-61.9003	-61.9003	-61.9003	(71)	
Water heating gains (Table 5)													
101.8290	100.1900	96.7864	92.1593	89.1552	84.9253	81.3299	85.9365	87.5732	92.3624	97.7702	100.1968	(72)	
Total internal gains													
297.6113	296.0232	287.1060	272.8781	258.7585	244.8768	235.6797	240.2354	247.3857	261.7758	278.2990	290.3773	(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			
Northwest				8.5600	11.2829	0.6300	0.7000	0.7700	29.5167			
Horizontal				0.7200	26.0000	0.6300	0.7000	1.0000	7.4300 (81)			
Solar gains	36.9467	75.5136	135.6826	220.6409	293.8329	311.9161	292.3352	234.8611	164.7662	92.2858	46.5700	30.1060 (83)
Total gains	334.5580	371.5368	422.7886	493.5190	552.5914	556.7929	528.0149	475.0965	412.1520	354.0616	324.8690	320.4833 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
63.0016	63.1638	63.3235	64.0847	64.2292	64.9104	64.9104	65.0381	64.6463	64.2292	63.9376	63.6356		
alpha	5.2001	5.2109	5.2216	5.2723	5.2819	5.3274	5.3274	5.3359	5.3098	5.2819	5.2625	5.2424	
util living area													
0.9947	0.9900	0.9730	0.9060	0.7478	0.5437	0.4002	0.4620	0.7423	0.9495	0.9892	0.9957	(86)	
MIT	19.9551	20.0952	20.3570	20.6960	20.9151	20.9871	20.9979	20.9957	20.9402	20.6395	20.2426	19.9313	(87)
Th 2	19.9990	20.0013	20.0036	20.0142	20.0162	20.0255	20.0255	20.0273	20.0219	20.0162	20.0122	20.0080	(88)
util rest of house													
0.9930	0.9868	0.9642	0.8780	0.6894	0.4657	0.3126	0.3665	0.6617	0.9279	0.9852	0.9944	(89)	
MIT 2	18.6199	18.8248	19.2021	19.6750	19.9403	20.0178	20.0248	20.0256	19.9781	19.6128	19.0480	18.5918	(90)
Living area fraction									fLA = Living area / (4) =			0.5481	(91)
MIT	19.3518	19.5211	19.8351	20.2346	20.4746	20.5491	20.5582	20.5573	20.5054	20.1755	19.7028	19.3260	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.3518	19.5211	19.8351	20.2346	20.4746	20.5491	20.5582	20.5573	20.5054	20.1755	19.7028	19.3260	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9915	0.9848	0.9624	0.8849	0.7177	0.5081	0.3607	0.4190	0.7035	0.9320	0.9836	0.9931	(94)
Useful gains	331.7251	365.8872	406.9037	436.7092	396.5897	282.9057	190.4413	199.0425	289.9302	329.9815	319.5251	318.2718	(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													
748.2551	724.9824	659.5467	553.9451	427.8677	287.0449	190.9832	200.1987	310.3259	466.9225	617.3384	744.4540	(97)	
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)	
Space heating kWh													
309.8983	241.3120	187.9664	84.4099	23.2708	0.0000	0.0000	0.0000	0.0000	101.8841	214.4256	317.0796	(98)	
Space heating												1480.2466	(98)
Space heating per m2										(98) / (4) =		32.8214	(99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													1583.1514 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	309.8983	241.3120	187.9664	84.4099	23.2708	0.0000	0.0000	0.0000	0.0000	101.8841	214.4256	317.0796	(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)	331.4420	258.0877	201.0336	90.2779	24.8886	0.0000	0.0000	0.0000	0.0000	108.9670	229.3322	339.1225	(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	162.3387	143.3160	151.0555	136.1631	133.9800	120.4985	116.4703	126.7779	126.2325	141.1565	148.3132	158.6866	(64)
Efficiency of water heater (217)m	86.5123	86.1936	85.3980	83.5817	81.2211	79.8000	79.8000	79.8000	79.8000	83.9614	85.7963	86.6259	(216)
Fuel for water heating, kWh/month	187.6481	166.2721	176.8841	162.9102	164.9571	151.0006	145.9527	158.8695	158.1861	168.1206	172.8666	183.1862	(219)
Water heating fuel used												1996.8540	(219)
Annual totals kWh/year													
Space heating fuel - main system												1583.1514	(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)												212.4730	(232)
Total delivered energy for all uses												3867.4785	(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	1583.1514	0.2160	341.9607 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1996.8540	0.2160	431.3205 (264)
Space and water heating			773.2812 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	212.4730	0.5190	110.2735 (268)
Total CO2, kg/m2/year			922.4797 (272)
Emissions per m2 for space and water heating			17.1459 (272a)
Fuel factor (electricity)			1.5500
Emissions per m2 for lighting			2.4451 (272b)
Emissions per m2 for pumps and fans			0.8631 (272c)
Target Carbon Dioxide Emission Rate (TER) = (17.1459 * 1.55) + 2.4451 + 0.8631, rounded to 2 d.p.			29.8800 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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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	45.1000 (1b)	x 2.3500 (2b)	= 105.9850 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	45.1000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	105.9850 (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) =	0.1887 (8)
Pressure test					Yes
Measured/design AP50					6.6900
Infiltration rate					0.5232 (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) =		0.4055 (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	0.5170	0.5069	0.4967	0.4460	0.4359	0.3852	0.3852	0.3751	0.4055	0.4359	0.4562	0.4764 (22b)
Effective ac	0.6336	0.6285	0.6234	0.5995	0.5950	0.5742	0.5742	0.5703	0.5822	0.5950	0.6040	0.6135 (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	10.2900	8.5600	1.7300	0.1800	0.3114	0.0000	0.0000 (29a)
Wall to Hall	25.8500	1.8900	23.9600	0.2600	6.2296	18.0000	431.2800 (29a)
External Roof 1	45.1000	0.7200	44.3800	0.0800	3.5504	9.0000	399.4200 (30)
Total net area of external elements Aum(A, m ²)			81.2400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	25.0404		(33)
Party Wall 1			34.6600	0.0000	0.0000	20.0000	693.2000 (32)
Party Floor 1			45.1000			30.0000	1353.0000 (32d)
Internal Wall 1			51.3800			9.0000	462.4200 (32c)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss
(28)...(30) + (32) + (32a)...(32e) = 3339.3200 (34)
74.0426 (35)
5.1394 (36)
(33) + (36) = 30.1798 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	22.1616	21.9801	21.8022	20.9666	20.8102	20.0824	20.0824	19.9477	20.3628	20.8102	21.1265	21.4572 (38)
Heat transfer coeff	52.3414	52.1599	51.9820	51.1464	50.9901	50.2623	50.2623	50.1275	50.5426	50.9901	51.3064	51.6370 (39)
Average = Sum(39)m / 12 =												51.1457 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1606	1.1565	1.1526	1.1341	1.1306	1.1145	1.1145	1.1115	1.1207	1.1306	1.1376	1.1449 (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												1.5475 (42)
Average daily hot water use (litres/day)												70.9533 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	78.0486	75.2105	72.3723	69.5342	66.6961	63.8580	63.8580	66.6961	69.5342	72.3723	75.2105	78.0486 (44)
Energy content (annual)	115.7438	101.2303	104.4606	91.0713	87.3851	75.4067	69.8754	80.1830	81.1406	94.5616	103.2214	112.0917 (45)
Distribution loss (46)m = 0.15 x (45)m												1116.3714 (45)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)

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Calculation Type: New Build (As Built)

Energy Calculations Ltd
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CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month	24.5956	21.5114	22.1979	19.3526	18.5693	16.0239	14.8485	17.0389	17.2424	20.0943	21.9345	23.8195	(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	77.3753	77.3753	77.3753	77.3753	77.3753	77.3753	77.3753	77.3753	77.3753	77.3753	77.3753	77.3753	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	12.0311	10.6859	8.6904	6.5792	4.9180	4.1520	4.4864	5.8316	7.8271	9.9383	11.5995	12.3655	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	134.5387	135.9347	132.4166	124.9270	115.4727	106.5870	100.6508	99.2547	102.7728	110.2624	119.7167	128.6024	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	30.7375	30.7375	30.7375	30.7375	30.7375	30.7375	30.7375	30.7375	30.7375	30.7375	30.7375	30.7375	(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)	-61.9003	-61.9003	-61.9003	-61.9003	-61.9003	-61.9003	-61.9003	-61.9003	-61.9003	-61.9003	-61.9003	-61.9003	(71)
Water heating gains (Table 5)	33.0586	32.0111	29.8359	26.8787	24.9588	22.2554	19.9577	22.9017	23.9478	27.0085	30.4646	32.0154	(72)
Total internal gains	225.8409	224.8443	217.1555	204.5975	191.5621	179.2070	171.3074	174.2006	180.7603	193.4219	207.9934	219.1960	(73)

6. Solar gains

[Jan]		Area m2		Solar flux Table 6a W/m2		Specific data or Table 6b		Specific data or Table 6c		FF		Access factor Table 6d		Gains W
Northwest		8.5600		11.2829		0.6300		0.7000		0.7700		29.5167		(81)
Horizontal		0.7200		26.0000		0.6300		0.7000		1.0000		7.4300		(82)
Solar gains	36.9467	75.5136	135.6826	220.6409	293.8329	311.9161	292.3352	234.8611	164.7662	92.2858	46.5700	30.1060		(83)
Total gains	262.7876	300.3579	352.8381	425.2384	485.3950	491.1231	463.6427	409.0617	345.5265	285.7076	254.5634	249.3019		(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	17.7219	17.7835	17.8444	18.1359	18.1916	18.4550	18.4550	18.5046	18.3526	18.1916	18.0794	17.9636			
alpha	2.1815	2.1856	2.1896	2.2091	2.2128	2.2303	2.2303	2.2336	2.2235	2.2128	2.2053	2.1976			
util living area	0.9480	0.9294	0.8892	0.8049	0.6807	0.5370	0.4243	0.4826	0.6930	0.8640	0.9311	0.9531			(86)
MIT	18.0788	18.3753	18.9368	19.6930	20.3195	20.7239	20.8836	20.8419	20.4806	19.6587	18.7535	18.0369			(87)
Th 2	19.9517	19.9549	19.9581	19.9731	19.9759	19.9890	19.9890	19.9915	19.9840	19.9759	19.9702	19.9643			(88)
util rest of house	0.9416	0.9207	0.8752	0.7800	0.6394	0.4747	0.3415	0.3977	0.6367	0.8407	0.9212	0.9473			(89)
MIT 2	17.2790	17.5732	18.1256	18.8642	19.4476	19.8093	19.9318	19.9088	19.6162	18.8503	17.9611	17.2460			(90)
Living area fraction															(91)
MIT	17.7174	18.0129	18.5702	19.3185	19.9255	20.3106	20.4535	20.4202	20.0900	19.2934	18.3954	17.6795			(92)
Temperature adjustment															(93)
adjusted MIT	17.7174	18.0129	18.5702	19.3185	19.9255	20.3106	20.4535	20.4202	20.0900	19.2934	18.3954	17.6795			(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9233	0.8999	0.8524	0.7618	0.6372	0.4954	0.3808	0.4354	0.6431	0.8221	0.9016	0.9302	(94)
Useful gains	242.6398	270.2863	300.7492	323.9643	309.2701	243.3164	176.5690	178.1200	222.2161	234.8884	229.5073	231.8907	(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													
	702.2876	683.9660	627.4346	532.8693	419.4180	287.0259	193.6857	201.5232	302.7507	443.2763	579.5257	696.0422	(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													
	341.9780	277.9927	243.0540	150.4116	81.9500	0.0000	0.0000	0.0000	0.0000	155.0406	252.0133	345.3287	(98)
Space heating													1847.7687 (98)
Space heating per m2													(98) / (4) = 40.9705 (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	472.4654	371.9409	380.9690	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7795	0.8298	0.7947	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	368.2804	308.6520	302.7454	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	623.4311	590.7533	529.3429	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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

Energy Calculations Ltd
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CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	183.7085	209.8833	168.5886	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												562.1804 (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	45.9271	52.4708	42.1471	0.0000	0.0000	0.0000	0.0000 (107)	
Space cooling												140.5451 (107)
Space cooling per m2												3.1163 (108)
Energy for space heating												40.9705 (99)
Energy for space cooling												3.1163 (108)
Total												44.0868 (109)
Dwelling Fabric Energy Efficiency (DFEE)												44.1 (109)

FULL SAP CALCULATION PRINTOUT

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CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As 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	45.1000 (1b)	x 2.3500 (2b)	= 105.9850 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	45.1000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 105.9850 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	0 * 40 =	0.0000 (6a)
Number of open flues	0	+	0	0 * 20 =	0.0000 (6b)
Number of intermittent fans				2 * 10 =	20.0000 (7a)
Number of passive vents				0 * 10 =	0.0000 (7b)
Number of flueless gas fires				0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					Air changes per hour
Pressure test				20.0000 / (5) =	0.1887 (8)
Measured/design AP50					Yes
Infiltration rate					5.0000
Number of sides sheltered					0.4387 (18)
					3 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.7750 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3400 (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	0.4335	0.4250	0.4165	0.3740	0.3655	0.3230	0.3230	0.3145	0.3400	0.3655	0.3825	0.3995 (22b)
	0.5940	0.5903	0.5867	0.5699	0.5668	0.5522	0.5522	0.5495	0.5578	0.5668	0.5732	0.5798 (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)			8.5600	1.3258	11.3485		(27)
TER Room Window (Uw = 1.70)			0.7200	1.5918	1.1461		(27a)
Main Walls	10.2900	8.5600	1.7300	0.1800	0.3114		(29a)
Wall to Hall	25.8500	1.8900	23.9600	0.1800	4.3128		(29a)
External Roof 1	45.1000	0.7200	44.3800	0.1300	5.7694		(30)
Total net area of external elements Aum(A, m ²)			81.2400				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		24.7782		(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)							4.1602 (36)
Total fabric heat loss						(33) + (36) =	28.9384 (37)
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)							
(38)m	Jan 20.7738	Feb 20.6462	Mar 20.5211	Apr 19.9336	May 19.8236	Jun 19.3119	Jul 19.3119
Heat transfer coeff	49.7121	49.5845	49.4594	48.8719	48.7620	48.2503	48.2503
Average = Sum(39)m / 12 =							
	48.1555	48.4474	48.7620	48.9844	49.2168	49.2168	49.2168 (39)
					48.8714		(39)
HLP	Jan 1.1023	Feb 1.0994	Mar 1.0967	Apr 1.0836	May 1.0812	Jun 1.0699	Jul 1.0699
HLP (average)							
Days in month	31	28	31	30	31	30	31
							1.0678
							1.0742
							1.0812
							1.0861
							1.0913 (40)
							1.0836 (40)
							31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.5475 (42)
Average daily hot water use (litres/day)												70.9533 (43)
Daily hot water use	Jan 78.0486	Feb 75.2105	Mar 72.3723	Apr 69.5342	May 66.6961	Jun 63.8580	Jul 63.8580	Aug 66.6961	Sep 69.5342	Oct 72.3723	Nov 75.2105	Dec 78.0486 (44)
Energy conte	115.7438	101.2303	104.4606	91.0713	87.3851	75.4067	69.8754	80.1830	81.1406	94.5616	103.2214	112.0917 (45)
Energy content (annual)												Total = Sum(45)m = 1116.3714 (45)
Distribution loss (46)m = 0.15 x (45)m												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

Energy Calculations Ltd
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CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Heat gains from water heating, kWh/month	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
	24.5956	21.5114	22.1979	19.3526	18.5693	16.0239	14.8485	17.0389	17.2424	20.0943	21.9345	23.8195 (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	77.3753	77.3753	77.3753	77.3753	77.3753	77.3753	77.3753	77.3753	77.3753	77.3753	77.3753	77.3753	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	12.0311	10.6859	8.6904	6.5792	4.9180	4.1520	4.4864	5.8316	7.8271	9.9383	11.5995	12.3655	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	134.5387	135.9347	132.4166	124.9270	115.4727	106.5870	100.6508	99.2547	102.7728	110.2624	119.7167	128.6024	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	30.7375	30.7375	30.7375	30.7375	30.7375	30.7375	30.7375	30.7375	30.7375	30.7375	30.7375	30.7375	(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)	-61.9003	-61.9003	-61.9003	-61.9003	-61.9003	-61.9003	-61.9003	-61.9003	-61.9003	-61.9003	-61.9003	-61.9003	(71)
Water heating gains (Table 5)	33.0586	32.0111	29.8359	26.8787	24.9588	22.2554	19.9577	22.9017	23.9478	27.0085	30.4646	32.0154	(72)
Total internal gains	225.8409	224.8443	217.1555	204.5975	191.5621	179.2070	171.3074	174.2006	180.7603	193.4219	207.9934	219.1960	(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			
Northwest				8.5600	11.2829	0.6300	0.7000	0.7700	29.5167			
Horizontal				0.7200	26.0000	0.6300	0.7000	1.0000	7.4300 (81)			
Solar gains	36.9467	75.5136	135.6826	220.6409	293.8329	311.9161	292.3352	234.8611	164.7662	92.2858	46.5700	30.1060 (83)
Total gains	262.7876	300.3579	352.8381	425.2384	485.3950	491.1231	463.6427	409.0617	345.5265	285.7076	254.5634	249.3019 (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	63.0016	63.1638	63.3235	64.0847	64.2292	64.9104	64.9104	65.0381	64.6463	64.2292	63.9376	63.6356	
alpha	5.2001	5.2109	5.2216	5.2723	5.2819	5.3274	5.3274	5.3359	5.3098	5.2819	5.2625	5.2424	
util living area	0.9983	0.9962	0.9873	0.9435	0.8109	0.6080	0.4540	0.5319	0.8273	0.9783	0.9965	0.9987	(86)
MIT	19.8071	19.9510	20.2245	20.5992	20.8737	20.9784	20.9962	20.9917	20.8977	20.5200	20.0999	19.7836	(87)
Th 2	19.9990	20.0013	20.0036	20.0142	20.0162	20.0255	20.0255	20.0273	20.0219	20.0162	20.0122	20.0080	(88)
util rest of house	0.9977	0.9949	0.9828	0.9239	0.7569	0.5241	0.3555	0.4244	0.7543	0.9675	0.9950	0.9983	(89)
MIT 2	18.9103	19.0556	19.3283	19.6974	19.9358	20.0163	20.0246	20.0250	19.9665	19.6309	19.2132	18.8941	(90)
Living area fraction												0.5481	(91)
MIT	19.4019	19.5464	19.8195	20.1917	20.4499	20.5436	20.5571	20.5549	20.4769	20.1182	19.6992	19.3817	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.4019	19.5464	19.8195	20.1917	20.4499	20.5436	20.5571	20.5549	20.4769	20.1182	19.6992	19.3817	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9972	0.9941	0.9818	0.9279	0.7821	0.5696	0.4097	0.4836	0.7909	0.9689	0.9944	0.9979	(94)
Ext temp.	262.0590	298.5813	346.4171	394.5668	379.6127	279.7564	189.9348	197.8043	273.2928	276.8186	253.1426	248.7749	(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	750.7460	726.2327	658.7766	551.8463	426.6618	286.7828	190.9333	200.0793	308.9446	464.1279	617.1650	747.1951	(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	363.5831	287.3818	232.3954	113.2412	35.0046	0.0000	0.0000	0.0000	0.0000	139.3581	262.0961	370.8246	(98)
Space heating per m2												1803.8849	(98)
												39.9974	(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	453.5528	357.0522	365.9821	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9422	0.9718	0.9523	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	427.3572	346.9745	348.5351	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	623.4311	590.7533	529.3429	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	141.1732	181.3714	134.5210	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												457.0656	(104)
Cooled fraction												1.0000	(105)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	35.2933	45.3429	33.6302	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling											114.2664 (107)
Space cooling per m2											2.5336 (108)
Energy for space heating											39.9974 (99)
Energy for space cooling											2.5336 (108)
Total											42.5311 (109)
Target Fabric Energy Efficiency (TFEE)											48.9 (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	45.1000 (1b)	x 2.3500 (2b)	= 105.9850 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	45.1000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 105.9850 (5)

2. Ventilation rate

	main		secondary		other		total	m3 per hour				
	heating		heating									
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000 (6a)				
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000 (6b)				
Number of intermittent fans							0 * 10 =	0.0000 (7a)				
Number of passive vents							0 * 10 =	0.0000 (7b)				
Number of flueless gas fires							0 * 40 =	0.0000 (7c)				
							Air changes per hour					
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =						0.0000 / (5) =	0.0000 (8)				
Pressure test								Yes				
Measured/design AP50								6.6900				
Infiltration rate								0.3345 (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) =	0.2592 (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	0.2787	0.2657	0.2657	0.2463	0.2528	0.2204	0.2204	0.2139	0.2204	0.2463	0.2398	0.2592 (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	0.3962	0.3832	0.3832	0.3638	0.3703	0.3379	0.3379	0.3314	0.3379	0.3638	0.3573	0.3767 (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	10.2900	8.5600	1.7300	0.1800	0.3114	0.0000	0.0000 (29a)
Wall to Hall	25.8500	1.8900	23.9600	0.2600	6.2296	18.0000	431.2800 (29a)
External Roof 1	45.1000	0.7200	44.3800	0.0800	3.5504	9.0000	399.4200 (30)
Total net area of external elements Aum(A, m ²)			81.2400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	25.0404		(33)
Party Wall 1			34.6600	0.0000	0.0000	20.0000	693.2000 (32)
Party Floor 1			45.1000			30.0000	1353.0000 (32d)
Internal Wall 1			51.3800			9.0000	462.4200 (32c)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	3339.3200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							74.0426 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.1394 (36)
Total fabric heat loss						(33) + (36) =	30.1798 (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	13.8564	13.4031	13.4031	12.7231	12.9497	11.8164	11.8164	11.5897	11.8164	12.7231	12.4964	13.1764 (38)
Heat transfer coeff	44.0363	43.5829	43.5829	42.9029	43.1296	41.9962	41.9962	41.7695	41.9962	42.9029	42.6762	43.3562 (39)
Average = Sum(39)m / 12 =												42.8273 (39)
HLP	Jan 0.9764	Feb 0.9664	Mar 0.9664	Apr 0.9513	May 0.9563	Jun 0.9312	Jul 0.9312	Aug 0.9262	Sep 0.9312	Oct 0.9513	Nov 0.9463	Dec 0.9613 (40)
HLP (average)												0.9496 (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												1.5475 (42)
Average daily hot water use (litres/day)												70.9533 (43)
Daily hot water use	Jan 78.0486	Feb 75.2105	Mar 72.3723	Apr 69.5342	May 66.6961	Jun 63.8580	Jul 63.8580	Aug 66.6961	Sep 69.5342	Oct 72.3723	Nov 75.2105	Dec 78.0486 (44)

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 content (annual)	115.7438	101.2303	104.4606	91.0713	87.3851	75.4067	69.8754	80.1830	81.1406	94.5616	103.2214	112.0917 (45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1116.3714 (45)
Water storage loss:												
Total storage loss:	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Total heat required for water heating calculated for each month	98.3823	86.0458	88.7915	77.4106	74.2773	64.0957	59.3941	68.1555	68.9695	80.3774	87.7382	95.2780 (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	98.3823	86.0458	88.7915	77.4106	74.2773	64.0957	59.3941	68.1555	68.9695	80.3774	87.7382	95.2780 (64)
RHI water heating demand	24.5956	21.5114	22.1979	19.3526	18.5693	16.0239	14.8485	17.0389	17.2424	20.0943	21.9345	23.8195 (65)
Heat gains from water heating, kWh/month												
	24.5956	21.5114	22.1979	19.3526	18.5693	16.0239	14.8485	17.0389	17.2424	20.0943	21.9345	23.8195 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	92.8504	92.8504	92.8504	92.8504	92.8504	92.8504	92.8504	92.8504	92.8504	92.8504	92.8504	92.8504 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	30.0778	26.7148	21.7259	16.4479	12.2950	10.3800	11.2159	14.5789	19.5677	24.8458	28.9987	30.9137 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	200.8040	202.8877	197.6368	186.4582	172.3473	159.0851	150.2251	148.1414	153.3923	164.5708	178.6817	191.9440 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	45.8325	45.8325	45.8325	45.8325	45.8325	45.8325	45.8325	45.8325	45.8325	45.8325	45.8325	45.8325 (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)	-61.9003	-61.9003	-61.9003	-61.9003	-61.9003	-61.9003	-61.9003	-61.9003	-61.9003	-61.9003	-61.9003	-61.9003 (71)
Water heating gains (Table 5)	33.0586	32.0111	29.8359	26.8787	24.9588	22.2554	19.9577	22.9017	23.9478	27.0085	30.4646	32.0154 (72)
Total internal gains	340.7229	338.3962	325.9812	306.5675	286.3838	268.5032	258.1814	262.4046	273.6904	293.2077	314.9277	331.6558 (73)

6. Solar gains

[Jan]												Gains
					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d	W
Northwest					8.5600	13.7804	0.6300		0.7000		0.7700	36.0502
Horizontal					0.7200	32.0000	0.6300		0.7000		1.0000	9.1446 (81)
Solar gains	45.1948	81.0500	144.9239	238.8497	308.8054	346.0270	321.4116	265.6364	187.5638	106.4601	56.1950	36.9852 (83)
Total gains	385.9177	419.4462	470.9052	545.4172	595.1892	614.5302	579.5930	528.0411	461.2542	399.6678	371.1226	368.6410 (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	21.0642	21.2833	21.2833	21.6207	21.5070	22.0874	22.0874	22.2073	22.0874	21.6207	21.7355	21.3946
alpha	2.4043	2.4189	2.4189	2.4414	2.4338	2.4725	2.4725	2.4805	2.4725	2.4414	2.4490	2.4263
util living area	0.8766	0.8480	0.7837	0.6599	0.5080	0.3371	0.2338	0.2613	0.4829	0.7163	0.8351	0.8846 (86)
MIT	19.1708	19.4203	19.8643	20.4056	20.7603	20.9422	20.9841	20.9791	20.8493	20.3801	19.7456	19.1515 (87)
Th 2	20.1030	20.1115	20.1115	20.1241	20.1199	20.1411	20.1411	20.1453	20.1411	20.1241	20.1284	20.1157 (88)
util rest of house	0.8640	0.8329	0.7625	0.6289	0.4654	0.2862	0.1749	0.1983	0.4270	0.6816	0.8164	0.8727 (89)
MIT 2	17.6804	18.0386	18.6619	19.4082	19.8629	20.0924	20.1323	20.1332	19.9980	19.3935	18.5181	17.6614 (90)
Living area fraction	18.4973	18.7959	19.3209	19.9549	20.3548	20.5582	20.5992	20.5969	20.4646	19.9343	19.1909	18.4782 (91)
MIT	18.4973	18.7959	19.3209	19.9549	20.3548	20.5582	20.5992	20.5969	20.4646	19.9343	19.1909	18.4782 (92)
Temperature adjustment												0.0000
adjusted MIT	18.4973	18.7959	19.3209	19.9549	20.3548	20.5582	20.5992	20.5969	20.4646	19.9343	19.1909	18.4782 (93)

8. Space heating requirement

Utilisation	0.8369	0.8067	0.7414	0.6225	0.4771	0.3112	0.2065	0.2319	0.4487	0.6734	0.7931	0.8461 (94)
Useful gains	322.9692	338.3826	349.1335	339.5385	283.9621	191.2658	119.7139	122.4723	206.9741	269.1344	294.3449	311.9011 (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	589.9679	570.7583	519.5492	431.3828	321.5223	199.8243	121.7534	125.1780	229.4934	361.8546	477.5872	580.0276 (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	198.6471	156.1564	126.7893	66.1279	27.9448	0.0000	0.0000	0.0000	0.0000	68.9838	131.9344	199.4861 (98)
Space heating												976.0698 (98)
RHI space heating demand												976 (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	45.1000 (1b)	x 2.3500 (2b)	= 105.9850 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	45.1000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 105.9850 (5)

2. Ventilation rate

	main		secondary		other		total	m3 per hour				
	heating		heating									
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)			
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)			
Number of intermittent fans							0 * 10 =	0.0000	(7a)			
Number of passive vents							0 * 10 =	0.0000	(7b)			
Number of flueless gas fires							0 * 40 =	0.0000	(7c)			
Air changes per hour												
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =						0.0000 / (5) =	0.0000	(8)			
Pressure test								Yes				
Measured/design AP50								6.6900				
Infiltration rate								0.3345	(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) =	0.2592	(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	0.3305	0.3240	0.3176	0.2852	0.2787	0.2463	0.2463	0.2398	0.2592	0.2787	0.2916	0.3046 (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	0.4480	0.4415	0.4351	0.4027	0.3962	0.3638	0.3638	0.3573	0.3767	0.3962	0.4091	0.4221 (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	10.2900	8.5600	1.7300	0.1800	0.3114	0.0000	0.0000 (29a)
Wall to Hall	25.8500	1.8900	23.9600	0.2600	6.2296	18.0000	431.2800 (29a)
External Roof 1	45.1000	0.7200	44.3800	0.0800	3.5504	9.0000	399.4200 (30)
Total net area of external elements Aum(A, m ²)			81.2400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	25.0404		(33)
Party Wall 1			34.6600	0.0000	0.0000	20.0000	693.2000 (32)
Party Floor 1			45.1000			30.0000	1353.0000 (32d)
Internal Wall 1			51.3800			9.0000	462.4200 (32c)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	3339.3200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							74.0426 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.1394 (36)
Total fabric heat loss						(33) + (36) =	30.1798 (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	15.6698	15.4431	15.2165	14.0831	13.8564	12.7231	12.7231	12.4964	13.1764	13.8564	14.3098	14.7631 (38)
Heat transfer coeff	45.8496	45.6230	45.3963	44.2629	44.0363	42.9029	42.9029	42.6762	43.3562	44.0363	44.4896	44.9429 (39)
Average = Sum(39)m / 12 =												44.2063 (39)
HLP	Jan 1.0166	Feb 1.0116	Mar 1.0066	Apr 0.9814	May 0.9764	Jun 0.9513	Jul 0.9513	Aug 0.9463	Sep 0.9613	Oct 0.9764	Nov 0.9865	Dec 0.9965 (40)
HLP (average)												0.9802 (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												1.5475 (42)
Average daily hot water use (litres/day)												70.9533 (43)
Daily hot water use	Jan 78.0486	Feb 75.2105	Mar 72.3723	Apr 69.5342	May 66.6961	Jun 63.8580	Jul 63.8580	Aug 66.6961	Sep 69.5342	Oct 72.3723	Nov 75.2105	Dec 78.0486 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

Energy Calculations Ltd
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CALCULATION OF ENERGY RATINGS 09 Jan 2014

Energy conte	115.7438	101.2303	104.4606	91.0713	87.3851	75.4067	69.8754	80.1830	81.1406	94.5616	103.2214	112.0917 (45)
Energy content (annual)										Total = Sum (45)m =		1116.3714 (45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Total heat required for water heating calculated for each month												
Solar input	98.3823	86.0458	88.7915	77.4106	74.2773	64.0957	59.3941	68.1555	68.9695	80.3774	87.7382	95.2780 (62)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum (63)m =				0.0000 (63)
Output from w/h	98.3823	86.0458	88.7915	77.4106	74.2773	64.0957	59.3941	68.1555	68.9695	80.3774	87.7382	95.2780 (64)
								Total per year (kWh/year) = Sum (64)m =				948.9157 (64)
Heat gains from water heating, kWh/month	24.5956	21.5114	22.1979	19.3526	18.5693	16.0239	14.8485	17.0389	17.2424	20.0943	21.9345	23.8195 (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	92.8504	92.8504	92.8504	92.8504	92.8504	92.8504	92.8504	92.8504	92.8504	92.8504	92.8504	92.8504 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	30.0778	26.7148	21.7259	16.4479	12.2950	10.3800	11.2159	14.5789	19.5677	24.8458	28.9987	30.9137 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	200.8040	202.8877	197.6368	186.4582	172.3473	159.0851	150.2251	148.1414	153.3923	164.5708	178.6817	191.9440 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	45.8325	45.8325	45.8325	45.8325	45.8325	45.8325	45.8325	45.8325	45.8325	45.8325	45.8325	45.8325 (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)	-61.9003	-61.9003	-61.9003	-61.9003	-61.9003	-61.9003	-61.9003	-61.9003	-61.9003	-61.9003	-61.9003	-61.9003 (71)
Water heating gains (Table 5)	33.0586	32.0111	29.8359	26.8787	24.9588	22.2554	19.9577	22.9017	23.9478	27.0085	30.4646	32.0154 (72)
Total internal gains	340.7229	338.3962	325.9812	306.5675	286.3838	268.5032	258.1814	262.4046	273.6904	293.2077	314.9277	331.6558 (73)

6. Solar gains

[Jan]												Gains	
	Area				Solar flux		g		FF		Access		W
	m2				Table 6a		or Table 6b		or Table 6c		factor		
					W/m2						Table 6d		
Northwest	8.5600				11.2829		0.6300		0.7000		0.7700		29.5167
Horizontal	0.7200				26.0000		0.6300		0.7000		1.0000		7.4300 (81)
Solar gains	36.9467	75.5136	135.6826	220.6409	293.8329	311.9161	292.3352	234.8611	164.7662	92.2858	46.5700	30.1060	(83)
Total gains	377.6696	413.9098	461.6638	527.2084	580.2167	580.4192	550.5166	497.2657	438.4567	385.4935	361.4977	361.7617	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	20.2311	20.3316	20.4331	20.9563	21.0642	21.6207	21.6207	21.7355	21.3946	21.0642	20.8496	20.6393
alpha	2.3487	2.3554	2.3622	2.3971	2.4043	2.4414	2.4414	2.4490	2.4263	2.4043	2.3900	2.3760
util living area	0.8937	0.8676	0.8145	0.7112	0.5765	0.4297	0.3260	0.3692	0.5649	0.7643	0.8626	0.9011 (86)
MIT	18.8735	19.1315	19.5923	20.1898	20.6206	20.8713	20.9523	20.9349	20.7380	20.1744	19.4572	18.8503 (87)
Th 2	20.0695	20.0737	20.0779	20.0988	20.1030	20.1241	20.1241	20.1284	20.1157	20.1030	20.0946	20.0862 (88)
util rest of house	0.8828	0.8543	0.7960	0.6836	0.5378	0.3799	0.2660	0.3064	0.5126	0.7346	0.8468	0.8909 (89)
MIT 2	17.2353	17.6050	18.2594	19.0994	19.6737	20.0006	20.0887	20.0775	19.8470	19.1016	18.0898	17.2122 (90)
Living area fraction									fLA = Living area / (4) =			0.5481 (91)
MIT	18.1333	18.4417	18.9900	19.6971	20.1927	20.4778	20.5621	20.5474	20.3354	19.6896	18.8393	18.1101 (92)
Temperature adjustment												0.0000
adjusted MIT	18.1333	18.4417	18.9900	19.6971	20.1927	20.4778	20.5621	20.5474	20.3354	19.6896	18.8393	18.1101 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.8547	0.8262	0.7709	0.6703	0.5418	0.4004	0.2964	0.3371	0.5262	0.7194	0.8207	0.8636 (94)
Ext temp.	322.7858	341.9679	355.8757	353.3719	314.3783	232.4210	163.1964	167.6500	230.7201	277.3299	296.6931	312.4267 (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	634.2498	617.8130	566.9995	477.9093	373.9861	252.1755	169.9841	176.9975	270.3435	400.2710	522.2777	625.1590 (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	231.7293	185.3679	157.0761	89.6670	44.3482	0.0000	0.0000	0.0000	0.0000	91.4682	162.4209	232.6728 (98)
Space heating per m2												1194.7503 (98)
										(98) / (4) =		26.4911 (99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

Energy Calculations Ltd
SAP ♦ CODE ♦ SBEM ♦ DESIGN

CALCULATION OF ENERGY RATINGS 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													1194.7503 (211)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	231.7293	185.3679	157.0761	89.6670	44.3482	0.0000	0.0000	0.0000	0.0000	91.4682	162.4209	232.6728	(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)	231.7293	185.3679	157.0761	89.6670	44.3482	0.0000	0.0000	0.0000	0.0000	91.4682	162.4209	232.6728	(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	98.3823	86.0458	88.7915	77.4106	74.2773	64.0957	59.3941	68.1555	68.9695	80.3774	87.7382	95.2780	(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	98.3823	86.0458	88.7915	77.4106	74.2773	64.0957	59.3941	68.1555	68.9695	80.3774	87.7382	95.2780	(219)
Water heating fuel used												948.9157	(219)
Annual totals kWh/year													
Space heating fuel - main system												1194.7503	(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)													84.0461 (230a)
Total electricity for the above, kWh/year													84.0461 (231)
Electricity for lighting (calculated in Appendix L)													212.4730 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
Total delivered energy for all uses													2440.1851 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1194.7503	13.1900	157.5876	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	948.9157	13.1900	125.1620	(247)
Mechanical ventilation fans	84.0461	13.1900	11.0857	(249)
Pumps and fans for heating	0.0000	0.0000	0.0000	(249)
Energy for lighting	212.4730	13.1900	28.0252	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit	0.0000	13.1900	0.0000	(252)
Total energy cost			321.8604	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	1.5003 (257)
SAP value		79.0701
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	1194.7503	0.5190	620.0754	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	948.9157	0.5190	492.4873	(264)
Space and water heating			1112.5627	(265)
Pumps and fans	84.0461	0.5190	43.6199	(267)
Energy for lighting	212.4730	0.5190	110.2735	(268)
Energy saving/generation technologies				
PV Unit	-811.8000	0.5190	-421.3242	(269)
Total kg/year			845.1319	(272)
CO2 emissions per m2			18.7400	(273)
EI value			87.4309	
EI rating			87 (274)	
EI band			B	

Calculation of stars for heating and DHW

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

Energy Calculations Ltd
SAP ♦ CODE ♦ SBEM ♦ DESIGN

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

FULL SAP CALCULATION PRINTOUT

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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	45.1000 (1b)	x 2.3500 (2b)	= 105.9850 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	45.1000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 105.9850 (5)

2. Ventilation rate

	main		secondary		other		total		m3 per hour			
	heating		heating									
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000 (6a)				
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000 (6b)				
Number of intermittent fans							0 * 10 =	0.0000 (7a)				
Number of passive vents							0 * 10 =	0.0000 (7b)				
Number of flueless gas fires							0 * 40 =	0.0000 (7c)				
Air changes per hour												
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =						0.0000 / (5) =	0.0000 (8)				
Pressure test							Yes					
Measured/design AP50							6.6900					
Infiltration rate							0.3345	(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) =	0.2592 (21)				
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind factor	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)
Adj infilt rate	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)
	0.2787	0.2657	0.2657	0.2463	0.2528	0.2204	0.2204	0.2139	0.2204	0.2463	0.2398	0.2592 (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	0.3962	0.3832	0.3832	0.3638	0.3703	0.3379	0.3379	0.3314	0.3379	0.3638	0.3573	0.3767 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Door to Hall			1.8900	1.4000	2.6460			(26)
Windows (Uw = 1.40)			8.5600	1.3258	11.3485			(27)
Roof lights (Uw = 1.40)			0.7200	1.3258	0.9545			(27a)
Main Walls	10.2900	8.5600	1.7300	0.1800	0.3114	0.0000	0.0000	(29a)
Wall to Hall	25.8500	1.8900	23.9600	0.2600	6.2296	18.0000	431.2800	(29a)
External Roof 1	45.1000	0.7200	44.3800	0.0800	3.5504	9.0000	399.4200	(30)
Total net area of external elements Aum(A, m2)			81.2400					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	25.0404			(33)
Party Wall 1			34.6600	0.0000	0.0000	20.0000	693.2000	(32)
Party Floor 1			45.1000			30.0000	1353.0000	(32d)
Internal Wall 1			51.3800			9.0000	462.4200	(32c)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	3339.3200	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							74.0426	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.1394	(36)
Total fabric heat loss						(33) + (36) =	30.1798	(37)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.5475 (42)
Average daily hot water use (litres/day)												70.9533 (43)
Daily hot water use	Jan 78.0486	Feb 75.2105	Mar 72.3723	Apr 69.5342	May 66.6961	Jun 63.8580	Jul 63.8580	Aug 66.6961	Sep 69.5342	Oct 72.3723	Nov 75.2105	Dec 78.0486 (44)

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SAP ♦ CODE ♦ SBEM ♦ DESIGN

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Energy conte	115.7438	101.2303	104.4606	91.0713	87.3851	75.4067	69.8754	80.1830	81.1406	94.5616	103.2214	112.0917 (45)
Energy content (annual)										Total = Sum (45)m =		1116.3714 (45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Total heat required for water heating calculated for each month												
Solar input	98.3823	86.0458	88.7915	77.4106	74.2773	64.0957	59.3941	68.1555	68.9695	80.3774	87.7382	95.2780 (62)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	98.3823	86.0458	88.7915	77.4106	74.2773	64.0957	59.3941	68.1555	68.9695	80.3774	87.7382	95.2780 (64)
Heat gains from water heating, kWh/month	24.5956	21.5114	22.1979	19.3526	18.5693	16.0239	14.8485	17.0389	17.2424	20.0943	21.9345	23.8195 (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	92.8504	92.8504	92.8504	92.8504	92.8504	92.8504	92.8504	92.8504	92.8504	92.8504	92.8504	92.8504 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	30.0778	26.7148	21.7259	16.4479	12.2950	10.3800	11.2159	14.5789	19.5677	24.8458	28.9987	30.9137 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	200.8040	202.8877	197.6368	186.4582	172.3473	159.0851	150.2251	148.1414	153.3923	164.5708	178.6817	191.9440 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	45.8325	45.8325	45.8325	45.8325	45.8325	45.8325	45.8325	45.8325	45.8325	45.8325	45.8325	45.8325 (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)	-61.9003	-61.9003	-61.9003	-61.9003	-61.9003	-61.9003	-61.9003	-61.9003	-61.9003	-61.9003	-61.9003	-61.9003 (71)
Water heating gains (Table 5)	33.0586	32.0111	29.8359	26.8787	24.9588	22.2554	19.9577	22.9017	23.9478	27.0085	30.4646	32.0154 (72)
Total internal gains	340.7229	338.3962	325.9812	306.5675	286.3838	268.5032	258.1814	262.4046	273.6904	293.2077	314.9277	331.6558 (73)

6. Solar gains

[Jan]												Area m2	Solar flux Table 6a W/m2		Specific data or Table 6b		Specific data or Table 6c		Access factor Table 6d		Gains W	
Northwest												8.5600	13.7804		0.6300		0.7000		0.7700		36.0502 (81)	
Horizontal												0.7200	32.0000		0.6300		0.7000		1.0000		9.1446 (82)	
Solar gains	45.1948	81.0500	144.9239	238.8497	308.8054	346.0270	321.4116	265.6364	187.5638	106.4601	56.1950									36.9852 (83)		
Total gains	385.9177	419.4462	470.9052	545.4172	595.1892	614.5302	579.5930	528.0411	461.2542	399.6678	371.1226									368.6410 (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	21.0642	21.2833	21.2833	21.6207	21.5070	22.0874	22.0874	22.2073	22.0874	21.6207	21.7355	21.3946
alpha	2.4043	2.4189	2.4189	2.4414	2.4338	2.4725	2.4725	2.4805	2.4725	2.4414	2.4490	2.4263
util living area	0.8766	0.8480	0.7837	0.6599	0.5080	0.3371	0.2338	0.2613	0.4829	0.7163	0.8351	0.8846 (86)
MIT	19.1708	19.4203	19.8643	20.4056	20.7603	20.9422	20.9841	20.9791	20.8493	20.3801	19.7456	19.1515 (87)
Th 2	20.1030	20.1115	20.1115	20.1241	20.1199	20.1411	20.1411	20.1453	20.1411	20.1241	20.1284	20.1157 (88)
util rest of house	0.8640	0.8329	0.7625	0.6289	0.4654	0.2862	0.1749	0.1983	0.4270	0.6816	0.8164	0.8727 (89)
MIT 2	17.6804	18.0386	18.6619	19.4082	19.8629	20.0924	20.1323	20.1332	19.9980	19.3935	18.5181	17.6614 (90)
Living area fraction	18.4973	18.7959	19.3209	19.9549	20.3548	20.5582	20.5992	20.5969	20.4646	19.9343	19.1909	0.5481 (91)
MIT	18.4973	18.7959	19.3209	19.9549	20.3548	20.5582	20.5992	20.5969	20.4646	19.9343	19.1909	18.4782 (92)
Temperature adjustment												0.0000
adjusted MIT	18.4973	18.7959	19.3209	19.9549	20.3548	20.5582	20.5992	20.5969	20.4646	19.9343	19.1909	18.4782 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.8369	0.8067	0.7414	0.6225	0.4771	0.3112	0.2065	0.2319	0.4487	0.6734	0.7931	0.8461 (94)
Ext temp.	322.9692	338.3826	349.1335	339.5385	283.9621	191.2658	119.7139	122.4723	206.9741	269.1344	294.3449	311.9011 (95)
Heat loss rate W	5.1000	5.7000	7.4000	9.9000	12.9000	15.8000	17.7000	17.6000	15.0000	11.5000	8.0000	5.1000 (96)
Month fracti	589.9679	570.7583	519.5492	431.3828	321.5223	199.8243	121.7534	125.1780	229.4934	361.8546	477.5872	580.0276 (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	198.6471	156.1564	126.7893	66.1279	27.9448	0.0000	0.0000	0.0000	0.0000	68.9838	131.9344	199.4861 (98)
Space heating per m2												976.0698 (98)
										(98) / (4) =		21.6423 (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													976.0698 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	198.6471	156.1564	126.7893	66.1279	27.9448	0.0000	0.0000	0.0000	0.0000	68.9838	131.9344	199.4861	(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)	198.6471	156.1564	126.7893	66.1279	27.9448	0.0000	0.0000	0.0000	0.0000	68.9838	131.9344	199.4861	(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	98.3823	86.0458	88.7915	77.4106	74.2773	64.0957	59.3941	68.1555	68.9695	80.3774	87.7382	95.2780	(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	98.3823	86.0458	88.7915	77.4106	74.2773	64.0957	59.3941	68.1555	68.9695	80.3774	87.7382	95.2780	(219)
Water heating fuel used													(219)
Annual totals kWh/year													
Space heating fuel - main system													976.0698 (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)													84.0461 (230a)
Total electricity for the above, kWh/year													84.0461 (231)
Electricity for lighting (calculated in Appendix L)													212.4730 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
Total delivered energy for all uses													2221.5046 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	976.0698	19.1200	186.6245 (240)	
Space heating - secondary	0.0000	0.0000	0.0000 (242)	
Water heating (other fuel)	948.9157	19.1200	181.4327 (247)	
Mechanical ventilation fans	84.0461	19.1200	16.0696 (249)	
Pumps and fans for heating	0.0000	0.0000	0.0000 (249)	
Energy for lighting	212.4730	19.1200	40.6248 (250)	
Additional standing charges			0.0000 (251)	
Energy saving/generation technologies				
PV Unit	0.0000	19.1200	0.0000 (252)	
Total energy cost			424.7517 (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	976.0698	0.5190	506.5802 (261)	
Space heating - secondary	0.0000	0.0000	0.0000 (263)	
Water heating (other fuel)	948.9157	0.5190	492.4873 (264)	
Space and water heating			999.0675 (265)	
Pumps and fans	84.0461	0.5190	43.6199 (267)	
Energy for lighting	212.4730	0.5190	110.2735 (268)	
Energy saving/generation technologies				
PV Unit	-811.8000	0.5190	-421.3242 (269)	
Total kg/year			731.6367 (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	976.0698	3.0700	2996.5342 (261)	
Space heating - secondary	0.0000	0.0000	0.0000 (263)	
Water heating (other fuel)	948.9157	3.0700	2913.1712 (264)	
Space and water heating			5909.7054 (265)	
Pumps and fans	84.0461	3.0700	258.0215 (267)	
Energy for lighting	212.4730	3.0700	652.2921 (268)	
Energy saving/generation technologies				
PV Unit	-811.8000	3.0700	-2492.2260 (269)	
Primary energy kWh/year			4327.7930 (272)	
Primary energy kWh/m2/year			95.9599 (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 87

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

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

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

Total Savings	£0	0.00 kg/m²
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Potential energy efficiency rating: C 79
Potential environmental impact rating: B 87

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 £425	Potential £425	Saving £0
Electricity			
Space heating	£203	£203	£0
Water heating	£181	£181	£0
Lighting	£41	£41	£0
Total cost of fuels	£425	£425	£0
Total cost of uses	£425	£425	£0
Delivered energy	49 kWh/m²	49 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	96 kWh/m²	96 kWh/m²	0 kWh/m²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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

No improvements selected / applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

Energy Calculations Ltd
SAP ♦ CODE ♦ SBEM ♦ DESIGN

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

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

No improvements selected / applicable

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

Overheating Calculation Input Data

Dwelling type	MidTerrace Flat
Number of storeys	1
Cross ventilation possible	Yes
SAP Region	Thames Valley
Front of dwelling faces	South East
Overshading	Average or unknown
Thermal mass parameter	74.0 (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	209.85 (P1)
Transmission heat loss coefficient	30.18 (37)
Summer heat loss coefficient	240.03 (P2)

Overhangs	Ratio	Z_overhangs	Overhang type
Orientation			
North West	0.000	1.000	None
Solar shading			
Orientation	Z blinds	Solar access	Z overhangs Z summer
North West	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
North West	8.5600	98.8453	0.6300 0.7000
Horizontal	0.7200	203.0000	0.6300 0.7000
total:			360.2518

Solar gains	Jun	Jul	Aug	(P3)
Internal gains	388	360	297	
Total summer gains	269	258	262	(P5)
	657	618	559	
Summer gain/loss ratio	2.74	2.58	2.33	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 74.0)	1.48	1.48	1.48	
Threshold temperature	20.22	21.96	21.61	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	
Assessment of likelihood of high internal temperature:	Slight			

U-VALUE CALCULATOR REPORT

Energy Calculations Ltd
SAP • CODE • SBEM • DESIGN

Property Reference	015385	Issued on Date	08/11/2021
Assessment Reference	003	Prop Type Ref	
Project	Flat 18, Wesley Gate, 1-2 Queens Road, READING, RG1 4FR		
Calculation Type	New Build (As Built)		

SAP Rating	79 C	DER	21.58	TER	29.88
Environmental	87 B	% DER<TER	27.79		
CO ₂ Emissions (t/year)	0.73	DFEE	44.09	TFEE	48.91
General Requirements Compliance	Pass	% DFEE<TFEE	9.86		

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

Building Elements

Roof 000003 - Flat roof inverted

Roof Type: Flat Roof inverted (with corrections)

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

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

Unheated space: None

Total thickness: 296 mm

U-value: 0.08 W/m² K

Kappa: n/a

U-VALUE CALCULATOR REPORT

Energy Calculations Ltd
SAP • CODE • SBEM • DESIGN

Property Reference	015385	Issued on Date	08/11/2021
Assessment Reference	003	Prop Type Ref	
Project	Flat 18, Wesley Gate, 1-2 Queens Road, READING, RG1 4FR		
Calculation Type	New Build (As Built)		

SAP Rating	79 C	DER	21.58	TER	29.88
Environmental	87 B	% DER<TER	27.79		
CO ₂ Emissions (t/year)	0.73	DFEE	44.09	TFEE	48.91
General Requirements Compliance	Pass	% DFEE<TFEE	9.86		

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	015385	Issued on Date	08/11/2021
Assessment Reference	003	Prop Type Ref	
Project	Flat 18, Wesley Gate, 1-2 Queens Road, READING, RG1 4FR		
Calculation Type	New Build (As Built)		

SAP Rating	79 C	DER	21.58	TER	29.88
Environmental	87 B	% DER<TER	27.79		
CO ₂ Emissions (t/year)	0.73	DFEE	44.09	TFEE	48.91
General Requirements Compliance	Pass	% DFEE<TFEE	9.86		

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

Wall 000002 - Timber framed insulation between studs

Wall Type: Standard Wall

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

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

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

BASIC COMPLIANCE REPORT

Calculation Type: New Build (As Built)

Energy Calculations Ltd
SAP • CODE • SBEM • DESIGN

Property Reference	015385	Issued on Date	08/11/2021
Assessment Reference	003	Prop Type Ref	
Property	Flat 18, Wesley Gate, 1-2 Queens Road, READING, RG1 4FR		
SAP Rating	79 C	DER	21.58
Environmental	87 B	TER	29.88
CO ₂ Emissions (t/year)	0.73	% DER<TER	27.79
General Requirements Compliance	Pass	DFEE	44.09
		TFEE	48.91
		% DFEE<TFEE	9.86
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)	29.88	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	21.58	kgCO ₂ /m ²	Pass
	-8.30 (-27.8%)	kgCO ₂ /m ²	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	48.91	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DFEE)	44.09	kWh/m ² /yr	
	-4.8 (-9.8%)	kWh/m ² /yr	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.25 (max. 0.30)	0.26 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Roof	0.08 (max. 0.20)	0.08 (max. 0.35)	Pass
Openings	1.40 (max. 2.00)	1.40 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	6.69 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

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

5 Cylinder insulation

BASIC COMPLIANCE REPORT

Calculation Type: New Build (As Built)

Energy Calculations Ltd
SAP • CODE • SBEM • DESIGN

Hot water storage

No cylinder

6 Controls

Space heating controls

Programmer and appliance thermostats

Pass

Hot water controls

No cylinder

7 Low energy lights

Percentage of fixed lights with low-energy fittings

100

%

Minimum

75

%

Pass

8 Mechanical ventilation

Continuous supply and extract system

Specific fan power

0.52

Maximum

1.5

Pass

MVHR efficiency

90

%

Minimum

70

%

Pass

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Thames Valley)

Slight

Pass

Based on:

Overshading

Average

Windows facing North West

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

Filled Cavity with Edge Sealing

0.00

W/m²K

Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals

6.69 (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

811.80

kWh/Year

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

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

Energy Calculations Ltd
SAP • CODE • SBEM • DESIGN

Property Reference	015385	Issued on Date	08/11/2021
Assessment Reference	003	Prop Type Ref	
Property	Flat 18, Wesley Gate, 1-2 Queens Road, READING, RG1 4FR		
SAP Rating	79 C	DER	21.58
Environmental	87 B	TER	29.88
CO ₂ Emissions (t/year)	0.73	% DER<TER	27.79
General Requirements Compliance	Pass	DFEE	44.09
		TFEE	48.91
		% DFEE<TFEE	9.86
Assessor Details	Mr. Matthew Carter, Energy Calculations Limited, Tel: 01754 761035, mcarter@energycalculations.co.uk		Assessor ID
			7869-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Built)

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

6.0 Measurements			
	Ground Floor:	Heat Loss Perimeter 15.38 m	Internal Floor Area 45.10 m ²
			Average Storey Height 2.35 m

7.0 Living Area	24.72	m ²
8.0 Thermal Mass Parameter	Precise calculation	
Thermal Mass	74.04	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	10.29	1.73
Wall to Hall	Timber Frame	Timber framed wall (two layers of plasterboard)	0.26	18.00	25.85	23.96

9.1 Party Walls					
Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Area (m ²)
Party Wall 1	Filled Cavity with Edge Sealing	Double plasterboard on both sides, twin timber f rame with/without sheathing board	0.00	20.00	34.66

9.2 Internal Walls					
Description	Construction		Kappa (kJ/m ² K)	Area (m ²)	
Internal Wall 1	Plasterboard on timber frame		9.00	51.38	

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	45.10	44.38

11.1 Party Floors

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

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Description	Construction	Kappa (kJ/m²K)	Area (m²)
Party Floor 1	Timber I-joists, carpeted	30.00	45.10

12.0 Opening Types

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

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
Door to Hall	Door to Corridor	[2] Wall to Hall	South East							1.89	
Windows	Window	[1] Main Walls	North West	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)	15.38	0.070	No
Table K1 - Default	E14 Flat roof	15.38	0.080	No
Table K1 - Approved	E16 Corner (normal)	2.36	0.090	No
Table K1 - Approved	E18 Party wall between dwellings	7.08	0.060	No
Table K1 - Default	R1 Head of roof window	0.70	0.080	No
Table K1 - Default	R2 Sill of roof window	0.70	0.060	No
Table K1 - Default	R3 Jamb of roof window	1.00	0.080	No

Y-value	0.063	W/m²K
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18.0 Pressure Testing

Designed AP ₅₀	Yes	
Property Tested ?	6.70	m³/(h.m²) @ 50 Pa
As Built AP ₅₀	Yes	
	6.69	m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	6.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	Yes
Mechanical Ventilation data Type	Database
Type	Balanced mechanical ventilation with heat recovery

SUMMARY FOR INPUT DATA

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Calculation Type: New Build (As Built)

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

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

25.0 Main Heating 2

None

Community Heating	None
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28.0 Water Heating

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

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

29.0 Hot Water Cylinder	None	
32.0 Photovoltaic Unit	More Dwellings, One Block	
Apportioned	811.80	kWh/Year

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

None