

Energy Calculations Ltd

SAP ♦ CODE ♦ SBEM ♦ DESIGN

01754-761035



SAP Report Submission for Building Regulations Compliance

Client:

Project: Flat 9, 18, Parkside Road
READING, RG30 2DB

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

Report Issue Date: 01/03/2021

EXCELLENCE
IN ENERGY
ASSESSMENT

PREDICTED ENERGY ASSESSMENT

Energy Calculations Ltd
SAP • CODE • SBEM • DESIGN

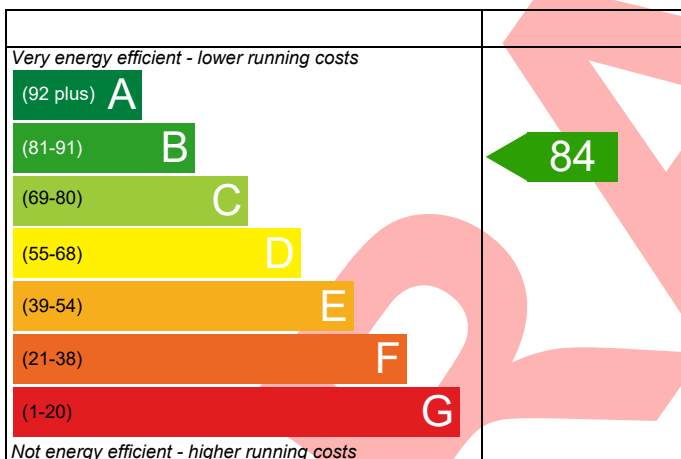
Flat 9, 18, Parkside Road,
READING,
RG30 2DB

Dwelling type: Flat, Semi-Detached
Date of assessment: 01/03/2021
Produced by: Energy Calculations Limited
Total floor area: 63.8 m²

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

The energy performance has been assessed using the Government approved SAP2012 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO₂) emissions.

Energy Efficiency Rating

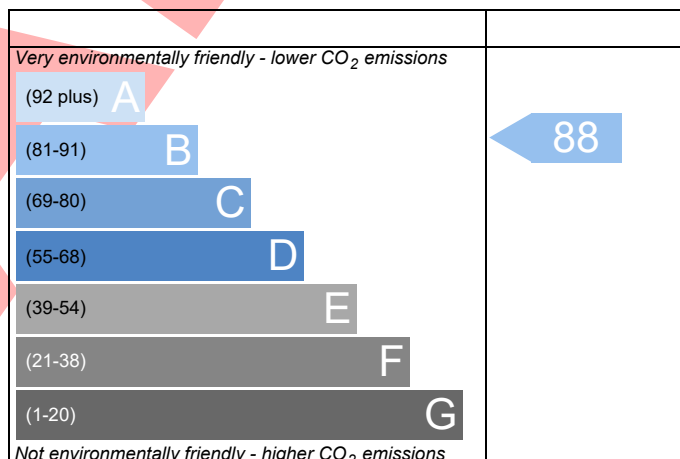


England

EU Directive
2002/91/EC

The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

Environmental Impact (CO₂) Rating



England

EU Directive
2002/91/EC

The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO₂) emissions. The higher the rating the less impact it has on the environment.

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

THERMAL BRIDGING

Energy Calculations Ltd
SAP • CODE • SBEM • DESIGN

Calculation Type: New Build (As Designed)

Property Reference	015730	Issued on Date	01/03/2021
Assessment Reference	003	Prop Type Ref	
Property	Flat 9, 18, Parkside Road, READING, RG30 2DB		
SAP Rating	84 B	DER	17.28
Environmental	88 B	TER	28.45
CO ₂ Emissions (t/year)	0.94	% DER<TER	39.26
General Requirements Compliance	Pass	DFEE	50.50
		TFEE	52.76
		% DFEE<TFEE	4.28
Assessor Details	Mr. Matthew Carter, Energy Calculations Limited, Tel: 01754 761035, mcarter@energycalculations.co.uk		Assessor ID
			7869-0001
Client			

	Junction detail	Source Type	Psi (W/mK)	Length (m)	Result	Reference
External wall	E2 Other lintels (including other steel lintels)	Table K1 - Approved	0.300	7.09	2.13	
External wall	E3 Sill	Table K1 - Approved	0.040	7.09	0.28	
External wall	E4 Jamb	Table K1 - Approved	0.050	37.44	1.87	
External wall	E7 Party floor between dwellings (in blocks of flats)	Table K1 - Approved	0.070	32.11	2.25	
External wall	E14 Flat roof	Table K1 - Default	0.080	32.11	2.57	
External wall	E16 Corner (normal)	Table K1 - Approved	0.090	9.60	0.86	
External wall	E17 Corner (inverted – internal area greater than external area)	Table K1 - Approved	-0.090	4.80	-0.43	
External wall	E18 Party wall between dwellings	Table K1 - Approved	0.060	4.80	0.29	
Party wall	P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	Table K1 - Default	0.000	3.63	0.00	

Total: **9.82** W/mK:
Y-Value: **0.070** W/m²K:

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Energy Calculations Ltd
SAP • CODE • SBEM • DESIGN

Property Reference	015730			Issued on Date	01/03/2021
Assessment Reference	003	Prop Type Ref			
Property	Flat 9, 18, Parkside Road, READING, RG30 2DB				
SAP Rating	84 B	DER	17.28	TER	28.45
Environmental	88 B	% DER<TER	39.26		
CO ₂ Emissions (t/year)	0.94	DFEE	50.50	TFEE	52.76
General Requirements Compliance	Pass	% DFEE<TFEE	4.28		
Assessor Details	Mr. Matthew Carter, Energy Calculations Limited, Tel: 01754 761035, mcarter@energycalculations.co.uk			Assessor ID	7869-0001
Client					

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Energy Calculations Ltd
SAP ♦ CODE ♦ SBEM ♦ DESIGN

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

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

DWELLING AS DESIGNED

Top-floor flat, total floor area 64 m²

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

1a TER and DER

Fuel for main heating:Electricity

Fuel factor:1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER) 28.45 kgCO₂/m²

Dwelling Carbon Dioxide Emission Rate (DER) 17.28 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)52.8 kWh/m²/yr

Dwelling Fabric Energy Efficiency (DFEE)50.5 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.22 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	(no floor)		
Roof	0.14 (max. 0.20)	0.14 (max. 0.35)	OK
Openings	1.40 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals:	5.00 (design value)	
Maximum	10.0	OK

4 Heating efficiency

Main heating system: Heat pump with radiators or underfloor - Electric
Panasonic WH-MDC05F3E5

Secondary heating system: None

5 Cylinder insulation

Hot water storage	Measured cylinder loss: 1.86 kWh/day	
Permitted by DBSCG 2.30	OK	
Primary pipework insulated:	Yes	OK

6 Controls

Space heating controls:	Time and temperature zone control	OK
-------------------------	-----------------------------------	----

Hot water controls:

Cylinderstat	OK
Independent timer for DHW	OK

7 Low energy lights

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

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Thames Valley): Slight OK

Based on:

Overshading:	Average
Windows facing North:	5.28 m ² , No overhang
Windows facing East:	3.56 m ² , No overhang
Windows facing South:	5.92 m ² , No overhang
Air change rate:	6.00 ach
Blinds/curtains:	None

10 Key features

Party wall U-value	0.00 W/m ² K
Photovoltaic array	300.00 kWh/Year

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Energy Calculations Ltd
SAP ♦ CODE ♦ SBEM ♦ DESIGN

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	63.8000 (1b)	x 2.4000 (2b)	= 153.1200 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	63.8000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 153.1200 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					2 * 10 = 20.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					Air changes per hour 20.0000 / (5) = 0.1306 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3806 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3521 (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												
	0.4489	0.4401	0.4313	0.3873	0.3785	0.3345	0.3345	0.3257	0.3521	0.3785	0.3961	0.4137 (22b)
Effective ac	0.6008	0.5968	0.5930	0.5750	0.5716	0.5559	0.5559	0.5530	0.5620	0.5716	0.5784	0.5856 (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
Windows (Uw = 1.40)			14.7600	1.3258	19.5682		(27)
Door to Stairs			1.8900	1.4000	2.6460		(26)
Main Wall	55.6800	14.7600	40.9200	0.2200	9.0024	60.0000	2455.2000 (29a)
Wall to stairs	21.3800	1.8900	19.4900	0.1864	3.6325	190.0000	3703.1000 (29a)
Flat roof	63.8000		63.8000	0.1400	8.9320	9.0000	574.2000 (30)
Total net area of external elements Aum, m ²			140.8600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	43.7811		(33)
Party Wall 1			8.7100	0.0000	0.0000	180.0000	1567.8000 (32)
Party Floor 1			63.8000			40.0000	2552.0000 (32d)
Internal Wall 1			71.3200			100.0000	7132.0000 (32c)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 17984.3000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							281.8856 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.8191 (36)
Total fabric heat loss							(33) + (36) = 53.6002 (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	30.3557	30.1580	29.9642	29.0541	28.8838	28.0911	28.0911	27.9443	28.3965	28.8838	29.2283	29.5884 (38)
Heat transfer coeff												
	83.9559	83.7582	83.5644	82.6543	82.4840	81.6913	81.6913	81.5445	81.9966	82.4840	82.8285	83.1886 (39)
Average = Sum(39)m / 12 =												82.6535 (39)
HLP	1.3159	1.3128	1.3098	1.2955	1.2929	1.2804	1.2804	1.2781	1.2852	1.2929	1.2983	1.3039 (40)
HLP (average)												1.2955 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.0868 (42)
Average daily hot water use (litres/day)												83.7612 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	92.1373	88.7869	85.4364	82.0860	78.7355	75.3851	75.3851	78.7355	82.0860	85.4364	88.7869	92.1373 (44)
Energy conte	136.6370	119.5036	123.3170	107.5107	103.1591	89.0185	82.4887	94.6570	95.7875	111.6311	121.8541	132.3256 (45)
Energy content (annual)										Total = Sum(45)m =		1317.8899 (45)
Distribution loss (46)m = 0.15 x (45)m												
	20.4955	17.9255	18.4975	16.1266	15.4739	13.3528	12.3733	14.1985	14.3681	16.7447	18.2781	19.8488 (46)
Water storage loss:												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Energy Calculations Ltd
SAP • CODE • SBEM • DESIGN

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Store volume													210.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.8600 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													1.0044 (55)
Total storage loss													
31.1364	28.1232	31.1364	30.1320	31.1364	30.1320	31.1364	31.1364	30.1320	31.1364	30.1320	31.1364	30.1320	(56)
If cylinder contains dedicated solar storage													
31.1364	28.1232	31.1364	30.1320	31.1364	30.1320	31.1364	31.1364	30.1320	31.1364	30.1320	31.1364	30.1320	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month													
191.0358	168.6380	177.7158	160.1547	157.5579	141.6625	136.8875	149.0558	148.4315	166.0299	174.4981	186.7244	186.7244	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Solar input (sum of months) = Sum(63)m =													
Output from w/h													
191.0358	168.6380	177.7158	160.1547	157.5579	141.6625	136.8875	149.0558	148.4315	166.0299	174.4981	186.7244	186.7244	(64)
Heat gains from water heating, kWh/month													
88.9508	79.0425	84.5219	77.8625	77.8194	71.7138	70.9465	74.9925	73.9645	80.6364	82.6317	87.5173	87.5173	(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	104.3394	104.3394	104.3394	104.3394	104.3394	104.3394	104.3394	104.3394	104.3394	104.3394	104.3394	104.3394	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
16.2628	14.4445	11.7470	8.8933	6.6478	5.6124	6.0644	7.8827	10.5801	13.4339	15.6793	16.7148	16.7148	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
182.4190	184.3119	179.5418	169.3867	156.5677	144.5197	136.4709	134.5780	139.3481	149.5032	162.3221	174.3702	174.3702	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
33.4339	33.4339	33.4339	33.4339	33.4339	33.4339	33.4339	33.4339	33.4339	33.4339	33.4339	33.4339	33.4339	(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)													
-83.4715	-83.4715	-83.4715	-83.4715	-83.4715	-83.4715	-83.4715	-83.4715	-83.4715	-83.4715	-83.4715	-83.4715	-83.4715	(71)
Water heating gains (Table 5)													
119.5576	117.6227	113.6048	108.1424	104.5960	99.6026	95.3582	100.7964	102.7285	108.3822	114.7662	117.6308	117.6308	(72)
Total internal gains													
372.5411	370.6809	359.1954	340.7241	322.1134	304.0365	292.1953	297.5588	306.9586	325.6211	347.0695	363.0175	363.0175	(73)

6. Solar gains

[Jan]													
	Area	Solar flux	Specific data	g	FF	Access	Gains						
	m2	Table 6a	or Table 6b	W/m2	or Table 6c	factor	W						
						Table 6d							
North	5.2800	10.6334	0.6300	0.7000	0.7700	17.1584	(74)						
East	3.5600	19.6403	0.6300	0.7000	0.7700	21.3683	(76)						
South	5.9200	46.7521	0.6300	0.7000	0.7700	84.5852	(78)						
Solar gains	123.1119	213.1202	301.0204	389.3379	451.4350	455.0299	435.8347	388.3859	331.3909	238.0495	148.0731	104.9657	(83)
Total gains	495.6530	583.8011	660.2158	730.0620	773.5484	759.0663	728.0300	685.9448	638.3495	563.6706	495.1426	467.9833	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
tau	59.5031	59.6436	59.7819	60.4402	60.5649	61.1526	61.1526	61.2627	60.9249	60.5649	60.3131	60.0519	
alpha	4.9669	4.9762	4.9855	5.0293	5.0377	5.0768	5.0768	5.0842	5.0617	5.0377	5.0209	5.0035	
util living area													
0.9963	0.9911	0.9774	0.9348	0.8309	0.6527	0.4867	0.5350	0.7809	0.9551	0.9917	0.9972	0.9972	(86)
Tweekday	18.5895	18.7870	19.0742	19.4202	19.6587	19.7625	19.7764	19.7772	19.7284	19.4271	18.9512	18.5627	
Tweekend	20.3916	20.4787	20.6070	20.7640	20.8864	20.9481	20.9622	20.9603	20.9227	20.7628	20.5472	20.3764	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
MIT	20.0610	20.1936	20.3935	20.6315	20.8247	20.9203	20.9416	20.9388	20.8792	20.6340	20.2930	20.0375	(87)
Th 2	19.8284	19.8308	19.8332	19.8443	19.8464	19.8562	19.8562	19.8580	19.8524	19.8464	19.8422	19.8378	(88)
util rest of house													
0.9949	0.9878	0.9686	0.9095	0.7706	0.5516	0.3640	0.4084	0.6893	0.9322	0.9880	0.9961	0.9961	(89)
Tweekday	18.5895	18.7870	19.0742	19.4202	19.6587	19.7625	19.7764	19.7772	19.7284	19.4271	18.9512	18.5627	
Tweekend	18.5895	18.7870	19.0742	19.4202	19.6587	19.7625	19.7764	19.7772	19.7284	19.4271	18.9512	18.5627	
MIT 2	18.5895	18.7870	19.0742	19.4202	19.6587	19.7625	19.7764	19.7772	19.7284	19.4271	18.9512	18.5627	(90)
Living area fraction									fLA = Living area / (4) =				
MIT	19.2768	19.4440	19.6904	19.9860	20.2033	20.3033	20.3207	20.3198	20.2659	19.9908	19.5779	19.2516	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.2768	19.4440	19.6904	19.9860	20.2033	20.3033	20.3207	20.3198	20.2659	19.9908	19.5779	19.2516	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9940	0.9864	0.9673	0.9131	0.7910	0.5928	0.4146	0.4608	0.7251	0.9357	0.9869	0.9954	(94)
Useful gains	492.6942	575.8826	638.6473	666.6121	611.8858	449.9906	301.8365	316.0841	462.8936	527.4003	488.6552	465.8473	(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													
1257.3913	1218.1813	1102.2494	916.3026	701.3872	465.9092	303.9468	319.6348	505.5845	774.5910	1033.5296	1252.1192	1252.1192	(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													

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Energy Calculations Ltd
SAP ♦ CODE ♦ SBEM ♦ DESIGN

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Space heating	568.9347	431.6247	344.9199	179.7772	66.5890	0.0000	0.0000	0.0000	0.0000	183.9099	392.3095	584.9864 (98)
Space heating per m2												2753.0513 (98)
										(98) / (4) =		43.1513 (99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												280.4475 (206)
Efficiency of secondary/supplementary heating system, %												100.0000 (208)
Space heating requirement												981.6635 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	568.9347	431.6247	344.9199	179.7772	66.5890	0.0000	0.0000	0.0000	0.0000	183.9099	392.3095	584.9864 (98)
Space heating efficiency (main heating system 1)	280.4475	280.4475	280.4475	280.4475	280.4475	0.0000	0.0000	0.0000	0.0000	280.4475	280.4475	280.4475 (210)
Space heating fuel (main heating system)	202.8667	153.9057	122.9891	64.1037	23.7438	0.0000	0.0000	0.0000	0.0000	65.5773	139.8869	208.5903 (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	191.0358	168.6380	177.7158	160.1547	157.5579	141.6625	136.8875	149.0558	148.4315	166.0299	174.4981	186.7244 (64)
Efficiency of water heater	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400 (216)
Fuel for water heating, kWh/month	112.7454	99.5267	104.8842	94.5200	92.9874	83.6063	80.7882	87.9697	87.6012	97.9874	102.9852	110.2009 (219)
Water heating fuel used												1155.8026 (219)
Annual totals kWh/year												
Space heating fuel - main system												981.6635 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
Total electricity for the above, kWh/year												0.0000 (231)
Electricity for lighting (calculated in Appendix L)												287.2058 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
Total delivered energy for all uses												2424.6719 (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	981.6635	0.5190	509.4834 (261)
Space heating - secondary	0.0000	0.5190	0.0000 (263)
Water heating (other fuel)	1155.8026	0.5190	599.8615 (264)
Space and water heating			1109.3449 (265)
Pumps and fans	0.0000	0.0000	0.0000 (267)
Energy for lighting	287.2058	0.5190	149.0598 (268)
Energy saving/generation technologies			
PV Unit	-300.0000	0.5190	-155.7000 (269)
Total CO2, kg/year			1102.7047 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			17.2800 (273)

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

DER		17.2800 ZC1
Total Floor Area	TFA	63.8000
Assumed number of occupants	N	2.0868
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190
CO2 emissions from appliances, equation (L14)		16.9432 ZC2
CO2 emissions from cooking, equation (L16)		2.6502 ZC3
Total CO2 emissions		36.8734 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		36.8734 ZC8

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Energy Calculations Ltd
SAP ♦ CODE ♦ SBEM ♦ DESIGN

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	63.8000 (1b)	x 2.4000 (2b)	= 153.1200 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	63.8000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 153.1200 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					2 * 10 = 20.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					20.0000 / (5) = 0.1306 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3806 (18)
Number of sides sheltered					1 (19)
Shelter factor					(20) = 1 - [0.075 x (19)] = 0.9250 (20)
Infiltration rate adjusted to include shelter factor					(21) = (18) x (20) = 0.3521 (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	0.4489	0.4401	0.4313	0.3873	0.3785	0.3345	0.3345	0.3257	0.3521	0.3785	0.3961	0.4137 (22b)
	0.6008	0.5968	0.5930	0.5750	0.5716	0.5559	0.5559	0.5530	0.5620	0.5716	0.5784	0.5856 (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)			14.0600	1.3258	18.6402		(27)
Main Wall	55.6800	14.0600	41.6200	0.1800	7.4916		(29a)
Wall to stairs	21.3800	1.8900	19.4900	0.1800	3.5082		(29a)
Flat roof	63.8000		63.8000	0.1300	8.2940		(30)
Total net area of external elements Aum(A, m ²)			140.8600				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 39.8240		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.1175 (36)
Total fabric heat loss							(33) + (36) = 47.9415 (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	30.3557	30.1580	29.9642	29.0541	28.8838	28.0911	28.0911	27.9443	28.3965	28.8838	29.2283	29.5884 (38)
Heat transfer coeff	78.2972	78.0995	77.9057	76.9956	76.8253	76.0326	76.0326	75.8858	76.3379	76.8253	77.1698	77.5299 (39)
Average = Sum(39)m / 12 =												76.9947 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2272	1.2241	1.2211	1.2068	1.2042	1.1917	1.1917	1.1894	1.1965	1.2042	1.2096	1.2152 (40)
HLP (average)												1.2068 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.0868 (42)
Average daily hot water use (litres/day)												83.7612 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	92.1373	88.7869	85.4364	82.0860	78.7355	75.3851	75.3851	78.7355	82.0860	85.4364	88.7869	92.1373 (44)
Energy conte	136.6370	119.5036	123.3170	107.5107	103.1591	89.0185	82.4887	94.6570	95.7875	111.6311	121.8541	132.3256 (45)
Energy content (annual)										Total = Sum(45)m =		1317.8899 (45)
Distribution loss (46)m = 0.15 x (45)m	20.4955	17.9255	18.4975	16.1266	15.4739	13.3528	12.3733	14.1985	14.3681	16.7447	18.2781	19.8488 (46)
Water storage loss:												
Store volume												210.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.7016 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.9188 (55)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Energy Calculations Ltd
SAP • CODE • SBEM • DESIGN

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Total storage loss	28.4842	25.7277	28.4842	27.5653	28.4842	27.5653	28.4842	28.4842	27.5653	28.4842	27.5653	28.4842 (56)
If cylinder contains dedicated solar storage	28.4842	25.7277	28.4842	27.5653	28.4842	27.5653	28.4842	28.4842	27.5653	28.4842	27.5653	28.4842 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	188.3836	166.2424	175.0636	157.5881	154.9057	139.0958	134.2353	146.4036	145.8648	163.3777	171.9314	184.0722 (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	188.3836	166.2424	175.0636	157.5881	154.9057	139.0958	134.2353	146.4036	145.8648	163.3777	171.9314	184.0722 (64)
Heat gains from water heating, kWh/month	86.8291	77.1260	82.4002	75.8092	75.6977	69.6605	68.8248	72.8707	71.9112	78.5146	80.5784	85.3955 (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	104.3394	104.3394	104.3394	104.3394	104.3394	104.3394	104.3394	104.3394	104.3394	104.3394	104.3394	104.3394 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	16.2675	14.4487	11.7504	8.8958	6.6497	5.6140	6.0661	7.8850	10.5832	13.4378	15.6839	16.7196 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	182.4190	184.3119	179.5418	169.3867	156.5677	144.5197	136.4709	134.5780	139.3481	149.5032	162.3221	174.3702 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.4339	33.4339	33.4339	33.4339	33.4339	33.4339	33.4339	33.4339	33.4339	33.4339	33.4339	33.4339 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-83.4715	-83.4715	-83.4715	-83.4715	-83.4715	-83.4715	-83.4715	-83.4715	-83.4715	-83.4715	-83.4715	-83.4715 (71)
Water heating gains (Table 5)	116.7057	114.7709	110.7529	105.2906	101.7442	96.7507	92.5064	97.9445	99.8767	105.5304	111.9144	114.7790 (72)
Total internal gains	372.6940	370.8333	359.3469	340.8749	322.2635	304.1863	292.3453	297.7093	307.1098	325.7732	347.2222	363.1706 (73)

6. Solar gains

[Jan]			Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
North			5.0300	10.6334		0.6300		0.7000		0.7700		16.3460 (74)
East			3.3900	19.6403		0.6300		0.7000		0.7700		20.3479 (76)
South			5.6400	46.7521		0.6300		0.7000		0.7700		80.5845 (78)
Solar gains	117.2784	203.0195	286.7487	370.8729	430.0211	433.4442	415.1601	369.9645	315.6771	226.7658	141.0565	99.9924 (83)
Total gains	489.9724	573.8528	646.0957	711.7478	752.2846	737.6305	707.5053	667.6738	622.7869	552.5390	488.2787	463.1630 (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	56.5864	56.7296	56.8708	57.5430	57.6705	58.2718	58.2718	58.3845	58.0387	57.6705	57.4131	57.1464
alpha	4.7724	4.7820	4.7914	4.8362	4.8447	4.8848	4.8848	4.8923	4.8692	4.8447	4.8275	4.8098
util living area	0.9942	0.9871	0.9694	0.9190	0.8069	0.6275	0.4663	0.5121	0.7536	0.9416	0.9877	0.9955 (86)
MIT	19.8090	19.9964	20.2685	20.5956	20.8433	20.9653	20.9933	20.9896	20.9162	20.5937	20.1402	19.7759 (87)
Th 2	19.8983	19.9007	19.9032	19.9145	19.9167	19.9266	19.9266	19.9285	19.9228	19.9167	19.9124	19.9079 (88)
util rest of house	0.9923	0.9829	0.9593	0.8924	0.7491	0.5354	0.3560	0.3983	0.6678	0.9165	0.9829	0.9941 (89)
MIT 2	18.3354	18.6084	18.9998	19.4603	19.7721	19.9051	19.9243	19.9245	19.8617	19.4697	18.8272	18.2940 (90)
Living area fraction	19.0237	19.2567	19.5924	19.9906	20.2725	20.4003	20.4236	20.4220	20.3542	19.9947	19.4405	18.9862 (92)
Temperature adjustment	19.0237	19.2567	19.5924	19.9906	20.2725	20.4003	20.4236	20.4220	20.3542	19.9947	19.4405	18.9862 (93)
adjusted MIT	19.0237	19.2567	19.5924	19.9906	20.2725	20.4003	20.4236	20.4220	20.3542	19.9947	19.4405	18.9862 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9902	0.9797	0.9557	0.8946	0.7695	0.5774	0.4077	0.4517	0.7045	0.9187	0.9802	0.9923 (94)
Useful gains	485.1911	562.2266	617.4964	636.7089	578.9040	425.9044	288.4849	301.5773	438.7609	507.6045	478.6214	459.6138 (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	1152.8242	1121.2536	1019.9741	853.9244	658.5820	441.0113	290.7196	305.2117	477.4349	721.7530	952.3130	1146.3728 (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	496.7190	375.6661	299.4434	156.3952	59.2805	0.0000	0.0000	0.0000	0.0000	159.3264	341.0580	510.9487 (98)
Space heating	2398.8373 (98)											
Space heating per m2	(98) / (4) = 37.5993 (99)											

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Energy Calculations Ltd
SAP ♦ CODE ♦ SBEM ♦ DESIGN

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													2565.6014 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	496.7190	375.6661	299.4434	156.3952	59.2805	0.0000	0.0000	0.0000	0.0000	159.3264	341.0580	510.9487	(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)	531.2503	401.7820	320.2603	167.2676	63.4016	0.0000	0.0000	0.0000	0.0000	170.4026	364.7679	546.4692	(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	188.3836	166.2424	175.0636	157.5881	154.9057	139.0958	134.2353	146.4036	145.8648	163.3777	171.9314	184.0722	(64)
Efficiency of water heater (217)m	87.2820	86.9245	86.2341	84.7936	82.4996	79.8000	79.8000	79.8000	79.8000	84.7470	86.6079	87.3964	(216)
Fuel for water heating, kWh/month	215.8334	191.2493	203.0097	185.8490	187.7653	174.3055	168.2147	183.4631	182.7880	192.7828	198.5170	210.6176	(219)
Water heating fuel used												2294.3955	(219)
Annual totals kWh/year													
Space heating fuel - main system												2565.6014	(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)												287.2895	(232)
Total delivered energy for all uses												5222.2864	(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	2565.6014	0.2160	554.1699 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2294.3955	0.2160	495.5894 (264)
Space and water heating			1049.7593 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	287.2895	0.5190	149.1033 (268)
Total CO2, kg/m2/year			1237.7876 (272)
Emissions per m2 for space and water heating			16.4539 (272a)
Fuel factor (electricity)			1.5500
Emissions per m2 for lighting			2.3370 (272b)
Emissions per m2 for pumps and fans			0.6101 (272c)
Target Carbon Dioxide Emission Rate (TER) = (16.4539 * 1.55) + 2.3370 + 0.6101, rounded to 2 d.p.			28.4500 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Energy Calculations Ltd
SAP ♦ CODE ♦ SBEM ♦ DESIGN

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	63.8000 (1b)	x 2.4000 (2b)	= 153.1200 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	63.8000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 153.1200 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					2 * 10 = 20.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				Air changes per hour
Pressure test					20.0000 / (5) = 0.1306 (8)
Measured/design AP50					Yes
Infiltration rate					5.0000
Number of sides sheltered					0.3806 (18)
					1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3521 (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												
	0.4489	0.4401	0.4313	0.3873	0.3785	0.3345	0.3345	0.3257	0.3521	0.3785	0.3961	0.4137 (22b)
Effective ac	0.6008	0.5968	0.5930	0.5750	0.5716	0.5559	0.5559	0.5530	0.5620	0.5716	0.5784	0.5856 (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
Windows (Uw = 1.40)			14.7600	1.3258	19.5682		(27)
Door to Stairs			1.8900	1.4000	2.6460		(26)
Main Wall	55.6800	14.7600	40.9200	0.2200	9.0024	60.0000	2455.2000 (29a)
Wall to stairs	21.3800	1.8900	19.4900	0.1864	3.6325	190.0000	3703.1000 (29a)
Flat roof	63.8000		63.8000	0.1400	8.9320	9.0000	574.2000 (30)
Total net area of external elements Aum, m ²			140.8600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	43.7811		(33)
Party Wall 1			8.7100	0.0000	0.0000	180.0000	1567.8000 (32)
Party Floor 1			63.8000			40.0000	2552.0000 (32d)
Internal Wall 1			71.3200			100.0000	7132.0000 (32c)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	17984.3000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							281.8856 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.8191 (36)
Total fabric heat loss						(33) + (36) =	53.6002 (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	30.3557	30.1580	29.9642	29.0541	28.8838	28.0911	28.0911	27.9443	28.3965	28.8838	29.2283	29.5884 (38)
Heat transfer coeff												
	83.9559	83.7582	83.5644	82.6543	82.4840	81.6913	81.6913	81.5445	81.9966	82.4840	82.8285	83.1886 (39)
Average = Sum(39)m / 12 =												82.6535 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.3159	1.3128	1.3098	1.2955	1.2929	1.2804	1.2804	1.2781	1.2852	1.2929	1.2983	1.3039 (40)
HLP (average)												1.2955 (40)
Days in month												
	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.0868 (42)
Average daily hot water use (litres/day)												83.7612 (43)
Daily hot water use												
	92.1373	88.7869	85.4364	82.0860	78.7355	75.3851	75.3851	78.7355	82.0860	85.4364	88.7869	92.1373 (44)
Energy conte	136.6370	119.5036	123.3170	107.5107	103.1591	89.0185	82.4887	94.6570	95.7875	111.6311	121.8541	132.3256 (45)
Energy content (annual)										Total = Sum(45)m =		1317.8899 (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:												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Energy Calculations Ltd
SAP ♦ CODE ♦ SBEM ♦ DESIGN

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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	29.0354	25.3945	26.2049	22.8460	21.9213	18.9164	17.5288	20.1146	20.3548	23.7216	25.8940	28.1192 (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	104.3394	104.3394	104.3394	104.3394	104.3394	104.3394	104.3394	104.3394	104.3394	104.3394	104.3394	104.3394	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	16.2628	14.4445	11.7470	8.8933	6.6478	5.6124	6.0644	7.8827	10.5801	13.4339	15.6793	16.7148	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	182.4190	184.3119	179.5418	169.3867	156.5677	144.5197	136.4709	134.5780	139.3481	149.5032	162.3221	174.3702	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.4339	33.4339	33.4339	33.4339	33.4339	33.4339	33.4339	33.4339	33.4339	33.4339	33.4339	33.4339	(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)	-83.4715	-83.4715	-83.4715	-83.4715	-83.4715	-83.4715	-83.4715	-83.4715	-83.4715	-83.4715	-83.4715	-83.4715	(71)
Water heating gains (Table 5)	39.0260	37.7895	35.2216	31.7306	29.4641	26.2728	23.5603	27.0358	28.2706	31.8839	35.9639	37.7946	(72)
Total internal gains	292.0096	290.8476	280.8122	264.3124	246.9815	230.7067	220.3974	223.7982	232.5007	249.1228	268.2672	283.1814	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	5.2800	10.6334	0.6300	0.7000	0.7700	17.1584 (74)
East	3.5600	19.6403	0.6300	0.7000	0.7700	21.3683 (76)
South	5.9200	46.7521	0.6300	0.7000	0.7700	84.5852 (78)

Solar gains	123.1119	213.1202	301.0204	389.3379	451.4350	455.0299	435.8347	388.3859	331.3909	238.0495	148.0731	104.9657	(83)
Total gains	415.1215	503.9679	581.8326	653.6502	698.4165	685.7366	656.2320	612.1842	563.8916	487.1722	416.3403	388.1471	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.5031	59.6436	59.7819	60.4402	60.5649	61.1526	61.1526	61.2627	60.9249	60.5649	60.3131	60.0519	
alpha	4.9669	4.9762	4.9855	5.0293	5.0377	5.0768	5.0768	5.0842	5.0617	5.0377	5.0209	5.0035	
util living area	0.9983	0.9953	0.9864	0.9558	0.8709	0.7058	0.5358	0.5920	0.8364	0.9742	0.9961	0.9988	(86)
MIT	19.7146	19.8972	20.1692	20.5099	20.7925	20.9492	20.9897	20.9834	20.8769	20.4994	20.0386	19.6831	(87)
Th 2	19.8284	19.8308	19.8332	19.8443	19.8464	19.8562	19.8562	19.8580	19.8524	19.8464	19.8422	19.8378	(88)
util rest of house	0.9977	0.9935	0.9809	0.9370	0.8178	0.6031	0.4029	0.4557	0.7527	0.9595	0.9943	0.9983	(89)
MIT 2	18.6707	18.8543	19.1252	19.4629	19.7148	19.8355	19.8541	19.8541	19.7906	19.4608	19.0050	18.6467	(90)
Living area fraction									fLA = Living area / (4) =			0.4671	(91)
MIT	19.1583	19.3415	19.6128	19.9519	20.2182	20.3557	20.3845	20.3816	20.2980	19.9459	19.4878	19.1308	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1583	19.3415	19.6128	19.9519	20.2182	20.3557	20.3845	20.3816	20.2980	19.9459	19.4878	19.1308	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9972	0.9925	0.9796	0.9391	0.8369	0.6504	0.4656	0.5202	0.7888	0.9611	0.9936	0.9980	(94)
Useful gains	413.9475	500.1789	569.9386	613.8181	584.4788	445.9871	305.5431	318.4794	444.7953	468.2222	413.6580	387.3543	(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	1247.4396	1209.5905	1095.7629	913.4878	702.6142	470.1894	309.1620	324.6757	508.2158	770.8851	1026.0608	1242.0731	(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	620.1182	476.7246	391.2133	215.7622	87.8928	0.0000	0.0000	0.0000	0.0000	225.1812	440.9300	635.9108	(98)
Space heating												3093.7331	(98)
Space heating per m2												(98) / (4) =	48.4911 (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	767.8982	604.5156	619.7382	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8864	0.9398	0.9197	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	680.6890	568.0994	569.9495	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	879.2012	843.1695	792.9060	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 Designed)

Energy Calculations Ltd
SAP ♦ CODE ♦ SBEM ♦ DESIGN

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	142.9288	204.6521	165.8796	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												513.4605 (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	35.7322	51.1630	41.4699	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												128.3651 (107)
Space cooling per m2												2.0120 (108)
Energy for space heating												48.4911 (99)
Energy for space cooling												2.0120 (108)
Total												50.5031 (109)
Dwelling Fabric Energy Efficiency (DFEE)												50.5 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Energy Calculations Ltd
SAP ♦ CODE ♦ SBEM ♦ DESIGN

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	63.8000 (1b)	x 2.4000 (2b)	= 153.1200 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	63.8000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 153.1200 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					2 * 10 = 20.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					Air changes per hour 20.0000 / (5) = 0.1306 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3806 (18)
Number of sides sheltered					1 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.9250 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3521 (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	0.4489	0.4401	0.4313	0.3873	0.3785	0.3345	0.3345	0.3257	0.3521	0.3785	0.3961	0.4137 (22b)
Effective ac	0.6008	0.5968	0.5930	0.5750	0.5716	0.5559	0.5559	0.5530	0.5620	0.5716	0.5784	0.5856 (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)			14.0600	1.3258	18.6402		(27)
Main Wall	55.6800	14.0600	41.6200	0.1800	7.4916		(29a)
Wall to stairs	21.3800	1.8900	19.4900	0.1800	3.5082		(29a)
Flat roof	63.8000		63.8000	0.1300	8.2940		(30)
Total net area of external elements Aum(A, m ²)			140.8600				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		39.8240		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.1175 (36)
Total fabric heat loss						(33) + (36) =	47.9415 (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	30.3557	30.1580	29.9642	29.0541	28.8838	28.0911	28.0911	27.9443	28.3965	28.8838	29.2283	29.5884 (38)
Heat transfer coeff	78.2972	78.0995	77.9057	76.9956	76.8253	76.0326	76.0326	75.8858	76.3379	76.8253	77.1698	77.5299 (39)
Average = Sum(39)m / 12 =												76.9947 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2272	1.2241	1.2211	1.2068	1.2042	1.1917	1.1917	1.1894	1.1965	1.2042	1.2096	1.2152 (40)
HLP (average)												1.2068 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.0868 (42)
Average daily hot water use (litres/day)												83.7612 (43)
Daily hot water use	92.1373	88.7869	85.4364	82.0860	78.7355	75.3851	75.3851	78.7355	82.0860	85.4364	88.7869	92.1373 (44)
Energy conte	136.6370	119.5036	123.3170	107.5107	103.1591	89.0185	82.4887	94.6570	95.7875	111.6311	121.8541	132.3256 (45)
Energy content (annual)										Total = Sum(45)m =		1317.8899 (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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Energy Calculations Ltd
SAP ♦ CODE ♦ SBEM ♦ DESIGN

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	(59)
Heat gains from water heating, kWh/month	29.0354	25.3945	26.2049	22.8460	21.9213	18.9164	17.5288	20.1146	20.3548	23.7216	25.8940	(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	104.3394	104.3394	104.3394	104.3394	104.3394	104.3394	104.3394	104.3394	104.3394	104.3394	104.3394	104.3394	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	16.2675	14.4487	11.7504	8.8958	6.6497	5.6140	6.0661	7.8850	10.5832	13.4378	15.6839	16.7196	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	182.4190	184.3119	179.5418	169.3867	156.5677	144.5197	136.4709	134.5780	139.3481	149.5032	162.3221	174.3702	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.4339	33.4339	33.4339	33.4339	33.4339	33.4339	33.4339	33.4339	33.4339	33.4339	33.4339	33.4339	(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)	-83.4715	-83.4715	-83.4715	-83.4715	-83.4715	-83.4715	-83.4715	-83.4715	-83.4715	-83.4715	-83.4715	-83.4715	(71)
Water heating gains (Table 5)	39.0260	37.7895	35.2216	31.7306	29.4641	26.2728	23.5603	27.0358	28.2706	31.8839	35.9639	37.7946	(72)
Total internal gains	292.0143	290.8518	280.8156	264.3149	246.9834	230.7084	220.3991	223.8005	232.5038	249.1267	268.2717	283.1862	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	5.0300	10.6334	0.6300	0.7000	0.7700	16.3460	(74)
East	3.3900	19.6403	0.6300	0.7000	0.7700	20.3479	(76)
South	5.6400	46.7521	0.6300	0.7000	0.7700	80.5845	(78)

Solar gains	117.2784	203.0195	286.7487	370.8729	430.0211	433.4442	415.1601	369.9645	315.6771	226.7658	141.0565	99.9924	(83)
Total gains	409.2927	493.8713	567.5643	635.1879	677.0045	664.1526	635.5592	593.7651	548.1808	475.8925	409.3282	383.1786	(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	56.5864	56.7296	56.8708	57.5430	57.6705	58.2718	58.2718	58.3845	58.0387	57.6705	57.4131	57.1464	
alpha	4.7724	4.7820	4.7914	4.8362	4.8447	4.8848	4.8848	4.8923	4.8692	4.8447	4.8275	4.8098	
util living area	0.9973	0.9930	0.9813	0.9441	0.8504	0.6816	0.5153	0.5691	0.8126	0.9655	0.9941	0.9980	(86)
MIT	19.6945	19.8860	20.1677	20.5163	20.7978	20.9505	20.9897	20.9837	20.8814	20.5051	20.0305	19.6615	(87)
Th 2	19.8983	19.9007	19.9032	19.9145	19.9167	19.9266	19.9266	19.9285	19.9228	19.9167	19.9124	19.9079	(88)
util rest of house	0.9964	0.9906	0.9747	0.9239	0.7987	0.5873	0.3953	0.4459	0.7328	0.9489	0.9917	0.9974	(89)
MIT 2	18.7174	18.9098	19.1896	19.5339	19.7847	19.9048	19.9241	19.9241	19.8603	19.5316	19.0636	18.6922	(90)
Living area fraction													(91)
MIT	19.1738	19.3657	19.6465	19.9928	20.2579	20.3932	20.4218	20.4190	20.3373	19.9863	19.5152	19.1449	(92)
Temperature adjustment													(93)
adjusted MIT	19.1738	19.3657	19.6465	19.9928	20.2579	20.3932	20.4218	20.4190	20.3373	19.9863	19.5152	19.1449	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9956	0.9891	0.9728	0.9256	0.8165	0.6302	0.4517	0.5039	0.7664	0.9502	0.9905	0.9967	(94)
Useful gains	407.4826	488.5117	552.1004	587.9147	552.8025	418.5626	287.1011	299.1708	420.1334	452.1952	405.4363	381.9245	(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	1164.5740	1129.7673	1024.1865	854.0967	657.4622	440.4742	290.5845	304.9832	476.1389	721.1051	958.0814	1158.6792	(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	563.2760	430.9237	351.2321	191.6511	77.8668	0.0000	0.0000	0.0000	0.0000	200.0689	397.9045	577.9055	(98)
Space heating												2790.8286	(98)
Space heating per m2												43.7434	(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	714.7062	562.6411	576.7319	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8947	0.9438	0.9258	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	639.4666	531.0329	533.9367	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	853.9753	819.0088	771.3802	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	154.4462	214.2541	176.6579	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												545.3583	(104)
Cooled fraction												1.0000	(105)

fC = cooled area / (4) =

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Energy Calculations Ltd
SAP ♦ CODE ♦ SBEM ♦ DESIGN

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	38.6116	53.5635	44.1645	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												136.3396 (107)
Space cooling per m2												2.1370 (108)
Energy for space heating												43.7434 (99)
Energy for space cooling												2.1370 (108)
Total												45.8804 (109)
Target Fabric Energy Efficiency (TFEE)												52.8 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Energy Calculations Ltd
SAP ♦ CODE ♦ SBEM ♦ DESIGN

CALCULATION OF HEAT DEMAND 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	63.8000 (1b)	x 2.4000 (2b)	= 153.1200 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	63.8000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 153.1200 (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) = 0.1306 (8)
Measured/design AP50					Yes
Infiltration rate					5.0000
Number of sides sheltered					0.3806 (18)
					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3521 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.4000	4.1000	4.1000	3.9000	3.9000	3.4000	3.4000	3.3000	3.4000	3.8000	3.7000	4.0000 (22)
Wind factor	1.1000	1.0250	1.0250	0.9750	0.9750	0.8500	0.8500	0.8250	0.8500	0.9500	0.9250	1.0000 (22a)
Adj infilt rate	0.3873	0.3609	0.3609	0.3433	0.3433	0.2993	0.2993	0.2905	0.2993	0.3345	0.3257	0.3521 (22b)
Effective ac	0.5750	0.5651	0.5651	0.5589	0.5589	0.5448	0.5448	0.5422	0.5448	0.5559	0.5530	0.5620 (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
Windows (Uw = 1.40)			14.7600	1.3258	19.5682		(27)
Door to Stairs			1.8900	1.4000	2.6460		(26)
Main Wall	55.6800	14.7600	40.9200	0.2200	9.0024	60.0000	2455.2000 (29a)
Wall to stairs	21.3800	1.8900	19.4900	0.1864	3.6325	190.0000	3703.1000 (29a)
Flat roof	63.8000		63.8000	0.1400	8.9320	9.0000	574.2000 (30)
Total net area of external elements Aum, m ²			140.8600				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	43.7811			(33)
Party Wall 1			8.7100	0.0000	0.0000	180.0000	1567.8000 (32)
Party Floor 1			63.8000			40.0000	2552.0000 (32d)
Internal Wall 1			71.3200			100.0000	7132.0000 (32c)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 17984.3000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							281.8856 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.8191 (36)
Total fabric heat loss							(33) + (36) = 53.6002 (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	29.0541	28.5550	28.5550	28.2418	28.2418	27.5274	27.5274	27.3963	27.5274	28.0911	27.9443	28.3965 (38)
Heat transfer coeff	82.6543	82.1552	82.1552	81.8420	81.8420	81.1276	81.1276	80.9965	81.1276	81.6913	81.5445	81.9966 (39)
Average = Sum(39)m / 12 =												81.6884 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2955	1.2877	1.2877	1.2828	1.2828	1.2716	1.2716	1.2695	1.2716	1.2804	1.2781	1.2852 (40)
HLP (average)												1.2804 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.0868 (42)
Average daily hot water use (litres/day)	83.7612 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	92.1373	88.7869	85.4364	82.0860	78.7355	75.3851	75.3851	78.7355	82.0860	85.4364	88.7869	92.1373 (44)
Energy conte	136.6370	119.5036	123.3170	107.5107	103.1591	89.0185	82.4887	94.6570	95.7875	111.6311	121.8541	132.3256 (45)
Energy content (annual)										Total = Sum(45)m =		1317.8899 (45)
Distribution loss (46)m = 0.15 x (45)m												
	20.4955	17.9255	18.4975	16.1266	15.4739	13.3528	12.3733	14.1985	14.3681	16.7447	18.2781	19.8488 (46)
Water storage loss:												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Energy Calculations Ltd
SAP • CODE • SBEM • DESIGN

CALCULATION OF HEAT DEMAND 09 Jan 2014

Store volume													210.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.8600 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													1.0044 (55)
Total storage loss													
	31.1364	28.1232	31.1364	30.1320	31.1364	30.1320	31.1364	31.1364	30.1320	31.1364	30.1320	31.1364	(56)
If cylinder contains dedicated solar storage													
	31.1364	28.1232	31.1364	30.1320	31.1364	30.1320	31.1364	31.1364	30.1320	31.1364	30.1320	31.1364	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month													
	191.0358	168.6380	177.7158	160.1547	157.5579	141.6625	136.8875	149.0558	148.4315	166.0299	174.4981	186.7244	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	191.0358	168.6380	177.7158	160.1547	157.5579	141.6625	136.8875	149.0558	148.4315	166.0299	174.4981	186.7244	(64)
								Total per year (kWh/year) = Sum(64)m =				1958.3919	(64)
RHI water heating demand												1958	(64)
Heat gains from water heating, kWh/month													
	88.9508	79.0425	84.5219	77.8625	77.8194	71.7138	70.9465	74.9925	73.9645	80.6364	82.6317	87.5173	(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	125.2073	125.2073	125.2073	125.2073	125.2073	125.2073	125.2073	125.2073	125.2073	125.2073	125.2073	125.2073 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	40.6570	36.1111	29.3676	22.2331	16.6195	14.0309	15.1609	19.7067	26.4503	33.5847	39.1983	41.7869 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	272.2671	275.0924	267.9728	252.8160	233.6832	215.7011	203.6879	200.8627	207.9823	223.1391	242.2719	260.2540 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	49.6075	49.6075	49.6075	49.6075	49.6075	49.6075	49.6075	49.6075	49.6075	49.6075	49.6075	49.6075 (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)												
	-83.4715	-83.4715	-83.4715	-83.4715	-83.4715	-83.4715	-83.4715	-83.4715	-83.4715	-83.4715	-83.4715	-83.4715 (71)
Water heating gains (Table 5)												
	119.5576	117.6227	113.6048	108.1424	104.5960	99.6026	95.3582	100.7964	102.7285	108.3822	114.7662	117.6308 (72)
Total internal gains												
	523.8249	520.1695	502.2884	474.5347	446.2420	420.6778	405.5503	412.7090	428.5044	456.4493	487.5797	511.0150 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d			Gains W
North				5.2800	12.7500	0.6300	0.7000			0.7700			20.5738 (74)
East				3.5600	23.7835	0.6300	0.7000			0.7700			25.8760 (76)
South				5.9200	54.0600	0.6300	0.7000			0.7700			97.8069 (78)

Solar gains	144.2568	218.4758	307.6119	406.8050	462.2524	494.0428	468.0606	423.2629	361.9525	262.2283	170.9574	123.6914 (83)	
Total gains	668.0817	738.6453	809.9003	881.3398	908.4944	914.7206	873.6109	835.9719	790.4568	718.6776	658.5370	634.7063 (84)	

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	60.4402	60.8074	60.8074	61.0400	61.0400	61.5775	61.5775	61.6772	61.5775	61.1526	61.2627	60.9249
alpha	5.0293	5.0538	5.0538	5.0693	5.0693	5.1052	5.1052	5.1118	5.1052	5.0768	5.0842	5.0617
util living area												
	0.9842	0.9722	0.9385	0.8547	0.6956	0.4730	0.3151	0.3478	0.6118	0.8696	0.9664	0.9871 (86)
Tweekday	18.9313	19.0998	19.3583	19.6072	19.7412	19.7831	19.7852	19.7868	19.7750	19.6304	19.2681	18.9083
Tweekend	20.5389	20.6133	20.7336	20.8565	20.9353	20.9622	20.9653	20.9651	20.9533	20.8644	20.6861	20.5255
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	0	0	0	0	0	0	0	0	0	0	0	0
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0
MIT	20.2884	20.4018	20.5889	20.7760	20.9002	20.9419	20.9464	20.9462	20.9270	20.7907	20.5099	20.2676 (87)
Th 2	19.8443	19.8505	19.8505	19.8543	19.8543	19.8632	19.8632	19.8648	19.8632	19.8562	19.8580	19.8524 (88)
util rest of house												
	0.9786	0.9626	0.9176	0.8098	0.6179	0.3765	0.2101	0.2387	0.5107	0.8185	0.9529	0.9825 (89)
Tweekday	18.9313	19.0998	19.3583	19.6072	19.7412	19.7831	19.7852	19.7868	19.7750	19.6304	19.2681	18.9083
Tweekend	18.9313	19.0998	19.3583	19.6072	19.7412	19.7831	19.7852	19.7868	19.7750	19.6304	19.2681	18.9083
MIT 2	18.9313	19.0998	19.3583	19.6072	19.7412	19.7831	19.7852	19.7868	19.7750	19.6304	19.2681	18.9083 (90)
Living area fraction									fLA = Living area / (4) =			0.4671 (91)
MIT	19.5652	19.7079	19.9331	20.1531	20.2826	20.3244	20.3276	20.3283	20.3131	20.1723	19.8481	19.5432 (92)
Temperature adjustment												0.0000
adjusted MIT	19.5652	19.7079	19.9331	20.1531	20.2826	20.3244	20.3276	20.3283	20.3131	20.1723	19.8481	19.5432 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9769	0.9612	0.9193	0.8226	0.6483	0.4161	0.2531	0.2834	0.5520	0.8342	0.9527	0.9809 (94)
Useful gains	652.6702	709.9979	744.5450	724.9611	588.9600	380.6402	221.1341	236.9142	436.3195	599.5521	627.4005	622.5784 (95)
Ext temp.	4.9000	5.5000	7.3000	9.7000	12.7000	15.6000	17.6000	17.4000	14.8000	11.4000	7.8000	4.9000 (96)
Heat loss rate W												
	1212.1397	1167.2559	1037.8722	855.5057	620.5729	383.2780	221.2833	237.1857	447.2664	716.6246	982.4579	1200.6939 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Energy Calculations Ltd
SAP ♦ CODE ♦ SBEM ♦ DESIGN

CALCULATION OF HEAT DEMAND 09 Jan 2014

Space heating kWh	416.2453	307.2773	218.2355	93.9921	23.5200	0.0000	0.0000	0.0000	0.0000	87.1019	255.6414	430.1179 (98)
Space heating												1832.1314 (98)
RHI space heating demand												1832 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Energy Calculations Ltd
SAP ♦ CODE ♦ SBEM ♦ DESIGN

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	63.8000 (1b)	x 2.4000 (2b)	= 153.1200 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	63.8000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 153.1200 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					2 * 10 = 20.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					Air changes per hour 20.0000 / (5) = 0.1306 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3806 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3521 (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												
	0.4489	0.4401	0.4313	0.3873	0.3785	0.3345	0.3345	0.3257	0.3521	0.3785	0.3961	0.4137 (22b)
Effective ac	0.6008	0.5968	0.5930	0.5750	0.5716	0.5559	0.5559	0.5530	0.5620	0.5716	0.5784	0.5856 (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
Windows (Uw = 1.40)			14.7600	1.3258	19.5682		(27)
Door to Stairs			1.8900	1.4000	2.6460		(26)
Main Wall	55.6800	14.7600	40.9200	0.2200	9.0024	60.0000	2455.2000 (29a)
Wall to stairs	21.3800	1.8900	19.4900	0.1864	3.6325	190.0000	3703.1000 (29a)
Flat roof	63.8000		63.8000	0.1400	8.9320	9.0000	574.2000 (30)
Total net area of external elements Aum, m ²			140.8600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	43.7811		(33)
Party Wall 1			8.7100	0.0000	0.0000	180.0000	1567.8000 (32)
Party Floor 1			63.8000			40.0000	2552.0000 (32d)
Internal Wall 1			71.3200			100.0000	7132.0000 (32c)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	17984.3000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							281.8856 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.8191 (36)
Total fabric heat loss						(33) + (36) =	53.6002 (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	30.3557	30.1580	29.9642	29.0541	28.8838	28.0911	28.0911	27.9443	28.3965	28.8838	29.2283	29.5884 (38)
Heat transfer coeff												
	83.9559	83.7582	83.5644	82.6543	82.4840	81.6913	81.6913	81.5445	81.9966	82.4840	82.8285	83.1886 (39)
Average = Sum(39)m / 12 =												82.6535 (39)
HLP	1.3159	1.3128	1.3098	1.2955	1.2929	1.2804	1.2804	1.2781	1.2852	1.2929	1.2983	1.3039 (40)
HLP (average)												1.2955 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.0868 (42)
Average daily hot water use (litres/day)												83.7612 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	92.1373	88.7869	85.4364	82.0860	78.7355	75.3851	75.3851	78.7355	82.0860	85.4364	88.7869	92.1373 (44)
Energy conte	136.6370	119.5036	123.3170	107.5107	103.1591	89.0185	82.4887	94.6570	95.7875	111.6311	121.8541	132.3256 (45)
Energy content (annual)										Total = Sum(45)m =		1317.8899 (45)
Distribution loss (46)m = 0.15 x (45)m												
	20.4955	17.9255	18.4975	16.1266	15.4739	13.3528	12.3733	14.1985	14.3681	16.7447	18.2781	19.8488 (46)
Water storage loss:												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Energy Calculations Ltd
SAP • CODE • SBEM • DESIGN

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Store volume													210.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.8600 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													1.0044 (55)
Total storage loss													
31.1364	28.1232	31.1364	30.1320	31.1364	30.1320	31.1364	31.1364	30.1320	31.1364	30.1320	31.1364	31.1364	(56)
If cylinder contains dedicated solar storage													
31.1364	28.1232	31.1364	30.1320	31.1364	30.1320	31.1364	31.1364	30.1320	31.1364	30.1320	31.1364	31.1364	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month													
191.0358	168.6380	177.7158	160.1547	157.5579	141.6625	136.8875	149.0558	148.4315	166.0299	174.4981	186.7244	186.7244	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Solar input (sum of months) = Sum(63)m =													
Output from w/h													
191.0358	168.6380	177.7158	160.1547	157.5579	141.6625	136.8875	149.0558	148.4315	166.0299	174.4981	186.7244	186.7244	(64)
Heat gains from water heating, kWh/month													
88.9508	79.0425	84.5219	77.8625	77.8194	71.7138	70.9465	74.9925	73.9645	80.6364	82.6317	87.5173	87.5173	(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	125.2073	125.2073	125.2073	125.2073	125.2073	125.2073	125.2073	125.2073	125.2073	125.2073	125.2073	125.2073	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
40.6570	36.1111	29.3676	22.2331	16.6195	14.0309	15.1609	19.7067	26.4503	33.5847	39.1983	41.7869	41.7869	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
272.2671	275.0924	267.9728	252.8160	233.6832	215.7011	203.6879	200.8627	207.9823	223.1391	242.2719	260.2540	260.2540	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
49.6075	49.6075	49.6075	49.6075	49.6075	49.6075	49.6075	49.6075	49.6075	49.6075	49.6075	49.6075	49.6075	(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)													
-83.4715	-83.4715	-83.4715	-83.4715	-83.4715	-83.4715	-83.4715	-83.4715	-83.4715	-83.4715	-83.4715	-83.4715	-83.4715	(71)
Water heating gains (Table 5)													
119.5576	117.6227	113.6048	108.1424	104.5960	99.6026	95.3582	100.7964	102.7285	108.3822	114.7662	117.6308	117.6308	(72)
Total internal gains													
523.8249	520.1695	502.2884	474.5347	446.2420	420.6778	405.5503	412.7090	428.5044	456.4493	487.5797	511.0150	511.0150	(73)

6. Solar gains

[Jan]												
				Area	Solar flux		g		FF		Access	Gains
				m2	Table 6a	Table 6b	Specific data	Specific data	Specific data	factor	W	
					W/m2		or Table 6b	or Table 6c	or Table 6c	Table 6d		
North				5.2800	10.6334		0.6300		0.7000	0.7700	17.1584 (74)	
East				3.5600	19.6403		0.6300		0.7000	0.7700	21.3683 (76)	
South				5.9200	46.7521		0.6300		0.7000	0.7700	84.5852 (78)	
Solar gains	123.1119	213.1202	301.0204	389.3379	451.4350	455.0299	435.8347	388.3859	331.3909	238.0495	148.0731	104.9657 (83)
Total gains	646.9368	733.2897	803.3088	863.8726	897.6770	875.7077	841.3850	801.0949	759.8952	694.4988	635.6528	615.9807 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
tau	59.5031	59.6436	59.7819	60.4402	60.5649	61.1526	61.1526	61.2627	60.9249	60.5649	60.3131	60.0519	
alpha	4.9669	4.9762	4.9855	5.0293	5.0377	5.0768	5.0768	5.0842	5.0617	5.0377	5.0209	5.0035	
util living area													
0.9883	0.9774	0.9525	0.8888	0.7627	0.5787	0.4239	0.4629	0.6932	0.9088	0.9767	0.9907	0.9907	(86)
Tweekday	18.7948	18.9793	19.2355	19.5244	19.6993	19.7693	19.7771	19.7785	19.7495	19.5410	19.1314	18.7661	
Tweekend	20.4834	20.5659	20.6828	20.8180	20.9129	20.9552	20.9637	20.9628	20.9406	20.8216	20.6293	20.4671	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
MIT	20.2027	20.3285	20.5104	20.7159	20.8656	20.9313	20.9440	20.9426	20.9073	20.7247	20.4212	20.1776	(87)
Th 2	19.8284	19.8308	19.8332	19.8443	19.8464	19.8562	19.8562	19.8580	19.8524	19.8464	19.8422	19.8378	(88)
util rest of house													
0.9842	0.9697	0.9364	0.8527	0.6956	0.4835	0.3155	0.3509	0.5984	0.8709	0.9673	0.9874	0.9874	(89)
Tweekday	18.7948	18.9793	19.2355	19.5244	19.6993	19.7693	19.7771	19.7785	19.7495	19.5410	19.1314	18.7661	
Tweekend	18.7948	18.9793	19.2355	19.5244	19.6993	19.7693	19.7771	19.7785	19.7495	19.5410	19.1314	18.7661	
MIT 2	18.7948	18.9793	19.2355	19.5244	19.6993	19.7693	19.7771	19.7785	19.7495	19.5410	19.1314	18.7661	(90)
Living area fraction													
fLA = Living area / (4) =													
MIT	19.4524	19.6094	19.8310	20.0809	20.2441	20.3121	20.3221	20.3222	20.2903	20.0939	19.7338	19.4254	(92)
Temperature adjustment													
adjusted MIT	19.4524	19.6094	19.8310	20.0809	20.2441	20.3121	20.3221	20.3222	20.2903	20.0939	19.7338	19.4254	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9826	0.9679	0.9364	0.8610	0.7201	0.5224	0.3601	0.3970	0.6365	0.8802	0.9662	0.9859	(94)
Useful gains	635.6787	709.7855	752.1962	743.7543	646.4617	457.5041	302.9570	318.0246	483.6495	611.2726	614.1608	607.2789	(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													
1272.1371	1232.0370	1113.9950	924.1518	704.7491	466.6248	304.0662	319.8355	507.5833	783.0927	1046.4423	1266.5802	1266.5802	(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													

Regs Region: England

Elmhurst Energy Systems
SAP2012 Calculator (Design
System) version 4.14r16

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Energy Calculations Ltd
SAP ♦ CODE ♦ SBEM ♦ DESIGN

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Space heating	473.5251	350.9529	269.1783	129.8862	43.3659	0.0000	0.0000	0.0000	0.0000	127.8342	311.2427	490.5201 (98)
Space heating per m2												2196.5054 (98)
											(98) / (4) =	34.4280 (99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												280.4475 (206)
Efficiency of secondary/supplementary heating system, %												100.0000 (208)
Space heating requirement												783.2143 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	473.5251	350.9529	269.1783	129.8862	43.3659	0.0000	0.0000	0.0000	0.0000	127.8342	311.2427	490.5201 (98)
Space heating efficiency (main heating system 1)	280.4475	280.4475	280.4475	280.4475	280.4475	0.0000	0.0000	0.0000	0.0000	280.4475	280.4475	280.4475 (210)
Space heating fuel (main heating system)	168.8462	125.1403	95.9817	46.3139	15.4631	0.0000	0.0000	0.0000	0.0000	45.5822	110.9807	174.9062 (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	191.0358	168.6380	177.7158	160.1547	157.5579	141.6625	136.8875	149.0558	148.4315	166.0299	174.4981	186.7244 (64)
Efficiency of water heater (217)m	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400 (216)
Fuel for water heating, kWh/month	112.7454	99.5267	104.8842	94.5200	92.9874	83.6063	80.7882	87.9697	87.6012	97.9874	102.9852	110.2009 (219)
Water heating fuel used												1155.8026 (219)
Annual totals kWh/year												
Space heating fuel - main system												783.2143 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
Total electricity for the above, kWh/year												0.0000 (231)
Electricity for lighting (calculated in Appendix L)												287.2058 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
Total delivered energy for all uses												2226.2227 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	783.2143	13.1900	103.3060 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1155.8026	13.1900	152.4504 (247)
Pumps and fans for heating	0.0000	0.0000	0.0000 (249)
Energy for lighting	287.2058	13.1900	37.8824 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit	0.0000	13.1900	0.0000 (252)
Total energy cost			293.6388 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.1335 (257)
SAP value		84.1872
SAP rating (Section 12)		84 (258)
SAP band		B

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	783.2143	0.5190	406.4882 (261)
Space heating - secondary	0.0000	0.5190	0.0000 (263)
Water heating (other fuel)	1155.8026	0.5190	599.8615 (264)
Space and water heating			1006.3498 (265)
Pumps and fans	0.0000	0.0000	0.0000 (267)
Energy for lighting	287.2058	0.5190	149.0598 (268)
Energy saving/generation technologies			
PV Unit	-300.0000	0.5190	-155.7000 (269)
Total kg/year			999.7096 (272)
CO2 emissions per m2			15.6700 (273)
EI value			87.6874
EI rating			88 (274)
EI band			B

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Energy Calculations Ltd
SAP ♦ CODE ♦ SBEM ♦ DESIGN

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Calculation of stars for heating and DHW

Main heating energy efficiency	$13.19 \times (1 + 0.29 \times 0.25) / 2.8045 = 5.044$, stars = 4
Main heating environmental impact	$0.519 \times (1 + 0.29 \times 0.25) / 2.8045 = 0.1985$, stars = 5
Water heating energy efficiency	$13.19 / 1.6944 = 7.784$, stars = 2
Water heating environmental impact	$0.519 / 1.6944 = 0.3063$, stars = 4

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Energy Calculations Ltd
SAP ♦ CODE ♦ SBEM ♦ DESIGN

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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	63.8000 (1b)	x 2.4000 (2b)	= 153.1200 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	63.8000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 153.1200 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					2 * 10 = 20.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					Air changes per hour 20.0000 / (5) = 0.1306 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3806 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3521 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.4000	4.1000	4.1000	3.9000	3.9000	3.4000	3.4000	3.3000	3.4000	3.8000	3.7000	4.0000 (22)
Wind factor	1.1000	1.0250	1.0250	0.9750	0.9750	0.8500	0.8500	0.8250	0.8500	0.9500	0.9250	1.0000 (22a)
Adj infilt rate	0.3873	0.3609	0.3609	0.3433	0.3433	0.2993	0.2993	0.2905	0.2993	0.3345	0.3257	0.3521 (22b)
Effective ac	0.5750	0.5651	0.5651	0.5589	0.5589	0.5448	0.5448	0.5422	0.5448	0.5559	0.5530	0.5620 (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
Windows (Uw = 1.40)			14.7600	1.3258	19.5682		(27)
Door to Stairs			1.8900	1.4000	2.6460		(26)
Main Wall	55.6800	14.7600	40.9200	0.2200	9.0024	60.0000	2455.2000 (29a)
Wall to stairs	21.3800	1.8900	19.4900	0.1864	3.6325	190.0000	3703.1000 (29a)
Flat roof	63.8000		63.8000	0.1400	8.9320	9.0000	574.2000 (30)
Total net area of external elements Aum, m ²			140.8600				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	43.7811			(33)
Party Wall 1			8.7100	0.0000	0.0000	180.0000	1567.8000 (32)
Party Floor 1			63.8000			40.0000	2552.0000 (32d)
Internal Wall 1			71.3200			100.0000	7132.0000 (32c)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	17984.3000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							281.8856 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.8191 (36)
Total fabric heat loss						(33) + (36) =	53.6002 (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	29.0541	28.5550	28.5550	28.2418	28.2418	27.5274	27.5274	27.3963	27.5274	28.0911	27.9443	28.3965 (38)
Heat transfer coeff	82.6543	82.1552	82.1552	81.8420	81.8420	81.1276	81.1276	80.9965	81.1276	81.6913	81.5445	81.9966 (39)
Average = Sum(39)m / 12 =												81.6884 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2955	1.2877	1.2877	1.2828	1.2828	1.2716	1.2716	1.2695	1.2716	1.2804	1.2781	1.2852 (40)
HLP (average)												1.2804 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.0868 (42)
Average daily hot water use (litres/day)												83.7612 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	92.1373	88.7869	85.4364	82.0860	78.7355	75.3851	75.3851	78.7355	82.0860	85.4364	88.7869	92.1373 (44)
Energy content (annual)	136.6370	119.5036	123.3170	107.5107	103.1591	89.0185	82.4887	94.6570	95.7875	111.6311	121.8541	132.3256 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		1317.8899 (45)
Water storage loss:	20.4955	17.9255	18.4975	16.1266	15.4739	13.3528	12.3733	14.1985	14.3681	16.7447	18.2781	19.8488 (46)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Energy Calculations Ltd
SAP • CODE • SBEM • DESIGN

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

Store volume													210.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.8600 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													1.0044 (55)
Total storage loss													
31.1364	28.1232	31.1364	30.1320	31.1364	30.1320	31.1364	31.1364	30.1320	31.1364	30.1320	31.1364	31.1364	(56)
If cylinder contains dedicated solar storage													
31.1364	28.1232	31.1364	30.1320	31.1364	30.1320	31.1364	31.1364	30.1320	31.1364	30.1320	31.1364	31.1364	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month													
191.0358	168.6380	177.7158	160.1547	157.5579	141.6625	136.8875	149.0558	148.4315	166.0299	174.4981	186.7244	186.7244	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Solar input (sum of months) = Sum(63)m =													
Output from w/h													
191.0358	168.6380	177.7158	160.1547	157.5579	141.6625	136.8875	149.0558	148.4315	166.0299	174.4981	186.7244	186.7244	(64)
Heat gains from water heating, kWh/month													
88.9508	79.0425	84.5219	77.8625	77.8194	71.7138	70.9465	74.9925	73.9645	80.6364	82.6317	87.5173	87.5173	(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	125.2073	125.2073	125.2073	125.2073	125.2073	125.2073	125.2073	125.2073	125.2073	125.2073	125.2073	125.2073	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
40.6570	36.1111	29.3676	22.2331	16.6195	14.0309	15.1609	19.7067	26.4503	33.5847	39.1983	41.7869	41.7869	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
272.2671	275.0924	267.9728	252.8160	233.6832	215.7011	203.6879	200.8627	207.9823	223.1391	242.2719	260.2540	260.2540	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
49.6075	49.6075	49.6075	49.6075	49.6075	49.6075	49.6075	49.6075	49.6075	49.6075	49.6075	49.6075	49.6075	(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)													
-83.4715	-83.4715	-83.4715	-83.4715	-83.4715	-83.4715	-83.4715	-83.4715	-83.4715	-83.4715	-83.4715	-83.4715	-83.4715	(71)
Water heating gains (Table 5)													
119.5576	117.6227	113.6048	108.1424	104.5960	99.6026	95.3582	100.7964	102.7285	108.3822	114.7662	117.6308	117.6308	(72)
Total internal gains													
523.8249	520.1695	502.2884	474.5347	446.2420	420.6778	405.5503	412.7090	428.5044	456.4493	487.5797	511.0150	511.0150	(73)

6. Solar gains

[Jan]				Area	Solar flux	g	FF	Access			Gains	
				m2	Table 6a	Specific data	Specific data	factor			W	
					W/m2	or Table 6b	or Table 6c	Table 6d				
North				5.2800	12.7500	0.6300	0.7000	0.7700			20.5738 (74)	
East				3.5600	23.7835	0.6300	0.7000	0.7700			25.8760 (76)	
South				5.9200	54.0600	0.6300	0.7000	0.7700			97.8069 (78)	

Solar gains	144.2568	218.4758	307.6119	406.8050	462.2524	494.0428	468.0606	423.2629	361.9525	262.2283	170.9574	123.6914 (83)
Total gains	668.0817	738.6453	809.9003	881.3398	908.4944	914.7206	873.6109	835.9719	790.4568	718.6776	658.5370	634.7063 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
tau	60.4402	60.8074	60.8074	61.0400	61.0400	61.5775	61.5775	61.6772	61.5775	61.1526	61.2627	60.9249	
alpha	5.0293	5.0538	5.0538	5.0693	5.0693	5.1052	5.1052	5.1118	5.1052	5.0768	5.0842	5.0617	
util living area													
0.9842	0.9722	0.9385	0.8547	0.6956	0.4730	0.3151	0.3478	0.6118	0.8696	0.9664	0.9871	0.9871	(86)
Tweekday	18.9313	19.0998	19.3583	19.6072	19.7412	19.7831	19.7852	19.7868	19.7750	19.6304	19.2681	18.9083	
Tweekend	20.5389	20.6133	20.7336	20.8565	20.9353	20.9622	20.9653	20.9651	20.9533	20.8644	20.6861	20.5255	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
MIT	20.2884	20.4018	20.5889	20.7760	20.9002	20.9419	20.9464	20.9462	20.9270	20.7907	20.5099	20.2676	(87)
Th 2	19.8443	19.8505	19.8505	19.8543	19.8543	19.8632	19.8632	19.8648	19.8632	19.8562	19.8580	19.8524	(88)
util rest of house													
0.9786	0.9626	0.9176	0.8098	0.6179	0.3765	0.2101	0.2387	0.5107	0.8185	0.9529	0.9825	0.9825	(89)
Tweekday	18.9313	19.0998	19.3583	19.6072	19.7412	19.7831	19.7852	19.7868	19.7750	19.6304	19.2681	18.9083	
Tweekend	18.9313	19.0998	19.3583	19.6072	19.7412	19.7831	19.7852	19.7868	19.7750	19.6304	19.2681	18.9083	
MIT 2	18.9313	19.0998	19.3583	19.6072	19.7412	19.7831	19.7852	19.7868	19.7750	19.6304	19.2681	18.9083	(90)
Living area fraction													
fLA = Living area / (4) =													
19.5652	19.7079	19.9331	20.1531	20.2826	20.3244	20.3276	20.3283	20.3131	20.1723	19.8481	19.5432	19.5432	(92)
Temperature adjustment													
adjusted MIT	19.5652	19.7079	19.9331	20.1531	20.2826	20.3244	20.3276	20.3283	20.3131	20.1723	19.8481	19.5432	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9769	0.9612	0.9193	0.8226	0.6483	0.4161	0.2531	0.2834	0.5520	0.8342	0.9527	0.9809	(94)
Useful gains	652.6702	709.9979	744.5450	724.9611	588.9600	380.6402	221.1341	236.9142	436.3195	599.5521	627.4005	622.5784	(95)
Ext temp.	4.9000	5.5000	7.3000	9.7000	12.7000	15.6000	17.6000	17.4000	14.8000	11.4000	7.8000	4.9000	(96)
Heat loss rate W													
1212.1397	1167.2559	1037.8722	855.5057	620.5729	383.2780	221.2833	237.1857	447.2664	716.6246	982.4579	1200.6939	1200.6939	(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													

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Energy Calculations Ltd
SAP ♦ CODE ♦ SBEM ♦ DESIGN

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

Space heating	416.2453	307.2773	218.2355	93.9921	23.5200	0.0000	0.0000	0.0000	0.0000	87.1019	255.6414	430.1179 (98)
Space heating per m2												1832.1314 (98)
											(98) / (4) =	28.7168 (99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												277.9626 (206)
Efficiency of secondary/supplementary heating system, %												100.0000 (208)
Space heating requirement												659.1287 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	416.2453	307.2773	218.2355	93.9921	23.5200	0.0000	0.0000	0.0000	0.0000	87.1019	255.6414	430.1179 (98)
Space heating efficiency (main heating system 1)	277.9626	277.9626	277.9626	277.9626	277.9626	0.0000	0.0000	0.0000	0.0000	277.9626	277.9626	277.9626 (210)
Space heating fuel (main heating system)	149.7487	110.5463	78.5125	33.8147	8.4616	0.0000	0.0000	0.0000	0.0000	31.3358	91.9697	154.7395 (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	191.0358	168.6380	177.7158	160.1547	157.5579	141.6625	136.8875	149.0558	148.4315	166.0299	174.4981	186.7244 (64)
Efficiency of water heater	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400	169.4400 (216)
Fuel for water heating, kWh/month	112.7454	99.5267	104.8842	94.5200	92.9874	83.6063	80.7882	87.9697	87.6012	97.9874	102.9852	110.2009 (219)
Water heating fuel used												1155.8026 (219)
Annual totals kWh/year												
Space heating fuel - main system												659.1287 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
Total electricity for the above, kWh/year												0.0000 (231)
Electricity for lighting (calculated in Appendix L)												287.2058 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
Total delivered energy for all uses												2102.1371 (238)

10a. Fuel costs - using BEDF prices (472)

	Fuel	Fuel price	Fuel cost
	kWh/year	p/kWh	£/year
Space heating - main system 1	659.1287	18.9000	124.5753 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1155.8026	18.9000	218.4467 (247)
Pumps and fans for heating	0.0000	0.0000	0.0000 (249)
Energy for lighting	287.2058	18.9000	54.2819 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit	0.0000	18.9000	0.0000 (252)
Total energy cost			397.3039 (255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy	Emission factor	Emissions
	kWh/year	kg CO2/kWh	kg CO2/year
Space heating - main system 1	659.1287	0.5190	342.0878 (261)
Space heating - secondary	0.0000	0.5190	0.0000 (263)
Water heating (other fuel)	1155.8026	0.5190	599.8615 (264)
Space and water heating			941.9493 (265)
Pumps and fans	0.0000	0.0000	0.0000 (267)
Energy for lighting	287.2058	0.5190	149.0598 (268)
Energy saving/generation technologies			
PV Unit	-300.0000	0.5190	-155.7000 (269)
Total kg/year			935.3091 (272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy	Primary energy factor	Primary energy
	kWh/year	kg CO2/kWh	kWh/year
Space heating - main system 1	659.1287	3.0700	2023.5251 (261)
Space heating - secondary	0.0000	3.0700	0.0000 (263)
Water heating (other fuel)	1155.8026	3.0700	3548.3139 (264)
Space and water heating			5571.8390 (265)
Pumps and fans	0.0000	0.0000	0.0000 (267)
Energy for lighting	287.2058	3.0700	881.7219 (268)
Energy saving/generation technologies			

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Energy Calculations Ltd
SAP ♦ CODE ♦ SBEM ♦ DESIGN

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

PV Unit	-300.0000	3.0700	-921.0000 (269)
Primary energy kWh/year			5532.5609 (272)
Primary energy kWh/m ² /year			86.7173 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating:	B 84
Current environmental impact rating:	B 88

(For testing purposes):

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

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

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
(none)			
Total Savings	£0		0.00 kg/m ²
Potential energy efficiency rating:		B 84	
Potential environmental impact rating:			B 88

Fuel prices for cost data on this page from database revision number 472 TEST (30 Jan 2021)
Recommendation texts revision number 4.9c (22 Feb 2014)

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

	Current	Potential	Saving
Electricity	£397	£397	£0
Space heating	£125	£125	£0
Water heating	£218	£218	£0
Lighting	£54	£54	£0
Total cost of fuels	£397	£397	£0
Total cost of uses	£397	£397	£0
Delivered energy	33 kWh/m ²	33 kWh/m ²	0 kWh/m ²
Carbon dioxide emissions	0.9 tonnes	0.9 tonnes	0.0 tonnes
CO2 emissions per m ²	15 kg/m ²	15 kg/m ²	0 kg/m ²
Primary energy	87 kWh/m ²	87 kWh/m ²	0 kWh/m ²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Energy Calculations Ltd
SAP ♦ CODE ♦ SBEM ♦ DESIGN

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

No improvements selected / applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Energy Calculations Ltd
SAP ♦ CODE ♦ SBEM ♦ DESIGN

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

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

No improvements selected / applicable

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

Overheating Calculation Input Data

Dwelling type	SemiDetached Flat
Number of storeys	1
Cross ventilation possible	Yes
SAP Region	Thames Valley
Front of dwelling faces	West
Overshading	Average or unknown
Thermal mass parameter	281.9 (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	303.18 (P1)
Transmission heat loss coefficient	53.60 (37)
Summer heat loss coefficient	356.78 (P2)

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

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

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	5.2800	81.1852	0.6300	0.7000	0.9000	153.1208
East	3.5600	117.5071	0.6300	0.7000	0.9000	149.4299
South	5.9200	112.2060	0.6300	0.7000	0.9000	237.2801
total:						539.8309

	Jun	Jul	Aug	
Solar gains	570	540	490	(P3)
Internal gains	421	406	413	
Total summer gains	991	945	903	(P5)

	2.78	2.65	2.53	
Summer gain/loss ratio				(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 281.9)	0.03	0.03	0.03	
Threshold temperature	18.80	20.58	20.36	(P7)
Likelihood of high internal temperature	Not significant	Slight	Not significant	

Assessment of likelihood of high internal temperature: Slight

BASIC COMPLIANCE REPORT

Energy Calculations Ltd
SAP • CODE • SBEM • DESIGN

Calculation Type: New Build (As Designed)

Property Reference	015730	Issued on Date	01/03/2021
Assessment Reference	003	Prop Type Ref	
Property	Flat 9, 18, Parkside Road, READING, RG30 2DB		
SAP Rating	84 B	DER	17.28
Environmental	88 B	TER	28.45
CO ₂ Emissions (t/year)	0.94	% DER<TER	39.26
General Requirements Compliance	Pass	DFEE	50.50
		TFEE	52.76
		% DFEE<TFEE	4.28
Assessor Details	Mr. Matthew Carter, Energy Calculations Limited, Tel: 01754 761035, mcarter@energycalculations.co.uk		Assessor ID
			7869-0001
Client			

SUMMARY FOR INPUT DATA FOR New Build (As Designed)

Criterion 1 – Achieving the TER and TFE rate

1a TER and DER

Fuel for main heating	Electricity		
Fuel factor	1.55 (electricity)		
Target Carbon Dioxide Emission Rate (TER)	28.45	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	17.28	kgCO ₂ /m ²	Pass
	-11.17 (-39.3%)	kgCO ₂ /m ²	

1b TFE and DFEE

Target Fabric Energy Efficiency (TFEE)	52.76	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DFEE)	50.50	kWh/m ² /yr	
	-2.3 (-4.4%)	kWh/m ² /yr	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.22 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Roof	0.14 (max. 0.20)	0.14 (max. 0.35)	Pass
Openings	1.40 (max. 2.00)	1.40 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Heat pump with radiators or underfloor - Electric Panasonic WH-MDC05F3E5	
Secondary heating system	None	

5 Cylinder insulation

BASIC COMPLIANCE REPORT

Energy Calculations Ltd
SAP • CODE • SBEM • DESIGN

Calculation Type: New Build (As Designed)

Hot water storage	Measured cylinder loss: 1.86 kWh/day Permitted by DBSCG 2.30	Pass
Primary pipework insulated	Yes	Pass

6 Controls

Space heating controls	Time and temperature zone control	Pass
Hot water controls	Cylinderstat	Pass
	Independent timer for DHW	Pass

7 Low energy lights

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

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Thames Valley)	Slight	Pass
Based on:		
Overshading	Average	
Windows facing North	5.28 m ² , No overhang	
Windows facing East	3.56 m ² , No overhang	
Windows facing South	5.92 m ² , No overhang	
Air change rate	6.00 ach	
Blinds/curtains	None	

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Solid Wall	0.00	W/m ² K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	Pass

10 Key features

Party wall U-value	0.00	W/m ² K
Photovoltaic array	300.00	kWh/Year

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

SUMMARY FOR INPUT DATA

Energy Calculations Ltd
SAP • CODE • SBEM • DESIGN

Calculation Type: New Build (As Designed)

Property Reference	015730	Issued on Date	01/03/2021
Assessment Reference	003	Prop Type Ref	
Property	Flat 9, 18, Parkside Road, READING, RG30 2DB		
SAP Rating	84 B	DER	17.28
Environmental	88 B	TER	28.45
CO ₂ Emissions (t/year)	0.94	% DER<TER	39.26
General Requirements Compliance	Pass	DFEE	50.50
		TFEE	52.76
		% DFEE<TFEE	4.28
Assessor Details	Mr. Matthew Carter, Energy Calculations Limited, Tel: 01754 761035, mcarter@energycalculations.co.uk		Assessor ID
			7869-0001
Client			

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

Orientation	West					
Property Tenure	Unknown					
Transaction Type	New dwelling					
Terrain Type	Urban					
1.0 Property Type	Flat, Semi-Detached					
2.0 Number of Storeys	1					
3.0 Date Built	2020					
4.0 Sheltered Sides	1					
5.0 Sunlight/Shade	Average or unknown					
6.0 Measurements						
Ground Floor:		Heat Loss Perimeter		Internal Floor Area		Average Storey Height
		32.11 m		63.80 m²		2.40 m
7.0 Living Area	29.80			m²		
8.0 Thermal Mass Parameter	Precise calculation					
Thermal Mass	281.89			kJ/m²K		
9.0 External Walls						
Description	Type	Construction		U-Value (W/m²K)	Kappa (kJ/m²K)	Gross Area (m²)
						Nett Area (m²)
Main Wall	Cavity Wall	Cavity wall : plasterboard on dabs, AAC block, filled cavity, any outside structure		0.22	60.00	55.68
Wall to stairs	Cavity Wall	Cavity wall : dense plaster, dense block, filled cavity, any outside structure		0.22	190.00	21.38
9.1 Party Walls						
Description	Type	Construction		U-Value (W/m²K)	Kappa (kJ/m²K)	Area (m²)
Party Wall 1	Solid Wall	Dense plaster both sides, dense blocks, cavity or cavity fill		0.00	180.00	8.71
9.2 Internal Walls						
Description	Construction				Kappa (kJ/m²K)	Area (m²)
Internal Wall 1	Dense block, dense plaster				100.00	71.32
10.0 External Roofs						
Description	Type	Construction		U-Value (W/m²K)	Kappa (kJ/m²K)	Gross Area (m²)
						Nett Area (m²)
Flat roof	External Flat Roof	Plasterboard, insulated flat roof		0.14	9.00	63.80
11.1 Party Floors						

SUMMARY FOR INPUT DATA

Energy Calculations Ltd
SAP • CODE • SBEM • DESIGN

Calculation Type: New Build (As Designed)

Description	Construction	Kappa (kJ/m²K)	Area (m²)
Party Floor 1	Precast concrete planks floor, screed, carpeted	40.00	63.80

12.0 Opening Types

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

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
Door	Door to Corridor	[2] Wall to stairs	North							1.89	
Windows	Window	[1] Main Wall	East	None	0.00					3.56	
Windows	Window	[1] Main Wall	South	None	0.00					5.92	
Windows	Window	[1] Main Wall	North	None	0.00					5.28	

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)	7.09	0.300	No
Table K1 - Approved	E3 Sill	7.09	0.040	No
Table K1 - Approved	E4 Jamb	37.44	0.050	No
Table K1 - Approved	E7 Party floor between dwellings (in blocks of flats)	32.11	0.070	No
Table K1 - Default	E14 Flat roof	32.11	0.080	No
Table K1 - Approved	E16 Corner (normal)	9.60	0.090	No
Table K1 - Approved	E17 Corner (inverted – internal area greater than external area)	4.80	-0.090	No
Table K1 - Approved	E18 Party wall between dwellings	4.80	0.060	No
Table K1 - Default	P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	3.63	0.000	No

Y-value	0.070	W/m²K
---------	-------	-------

18.0 Pressure Testing

Yes

Designed AP ₅₀	5.00	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP ₅₀		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

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

Mechanical Ventilation

Mechanical Ventilation System Present	No
---------------------------------------	----

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0

SUMMARY FOR INPUT DATA

Energy Calculations Ltd
SAP ♦ CODE ♦ SBEM ♦ DESIGN

Calculation Type: New Build (As Designed)

Number of open flues	0	0	0
Number of intermittent fans			2
Number of passive vents			0
Number of flueless gas fires			0

21.0 Fixed Cooling System

22.0 Lighting

Internal

Total number of light fittings	9	
Total number of L.E.L. fittings	9	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	Yes
Light and motion sensor	Yes

23.0 Electricity Tariff

24.0 Main Heating 1

	Database	
Percentage of Heat	100	%
Database Ref. No.	102968	
Fuel Type	Electricity	
Main Heating	PET	
SAP Code	224	
In Winter	0.0	
In Summer	0.0	
Controls	CHD Time and temperature zone control	
PCDF Controls	0	
Sap Code	2207	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Underfloor	
Underfloor Heating	Yes - Pipes in thin screed	
Flow Temperature	≤ 35°C	

25.0 Main Heating 2

Community Heating

28.0 Water Heating

	HWP From main heating 1
Water Heating	Main Heating 1
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	901
Immersion Only Heating Hot Water	Yes

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

29.0 Hot Water Cylinder

Hot Water Cylinder		
Cylinder Stat	Yes	
Cylinder In Heated Space	Yes	
Independent Time Control	Yes	
Insulation Type	Measured Loss	
Cylinder Volume	210.00	L
Loss	1.86	kWh/day
Pipes insulation	Fully insulated primary pipework	

31.0 Thermal Store

None

32.0 Photovoltaic Unit

More Dwellings, One Block	
Apportioned	300.00 kWh/Year

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

None

BLOCK COMPLIANCE

Energy Calculations Ltd
SAP • CODE • SBEM • DESIGN

Calculation Type: New Build (As Designed)

Block Reference	000516	Issued on Date	01/03/2021
Block Name	Parkside Road		
Assessor Details	Mr. Matthew Carter, Energy Calculations Limited, Tel: 01754 761035, mcarter@energycalculations.co.uk		Assessor ID 7869-0001
Client			

Block Compliance Report - DER

Block Reference: 000516		Block Name: Parkside Road			
Property-Assessment Reference	Multiplier	Floor Area (m ²)	DER (kgCO ₂ /m ²)	TER (kgCO ₂ /m ²)	% DER/TER
015722-003	1	73.4	16.43	27.83	40.96 %
015723-003	1	53	21.18	34.27	38.19 %
015724-003	1	50	19.12	28.78	33.57 %
015725-003	1	62.62	17.20	27.70	37.90 %
015726-003	1	45.84	19.12	29.28	34.69 %
015727-003	1	50.5	18.06	27.97	35.44 %
015728-003	1	44.2	21.03	31.09	32.37 %
015729-003	1	78.1	14.72	23.84	38.25 %
015730-003	1	63.8	17.28	28.45	39.26 %
015731-003	1	60.7	17.13	27.10	36.79 %
015732-003	1	43.25	21.26	29.47	27.86 %
015733-003	1	78.25	15.78	27.04	41.63 %
Totals:	12	703.66	218.31	342.81	
Average DER = 17.80 kgCO ₂ /m ²		% DER/TER	PASS		
Average TER = 28.24 kgCO ₂ /m ²		36.97 %			

Block Compliance Report - DFEE

Block Reference: 000516		Block Name: Parkside Road			
Property-Assessment Reference	Multiplier	Floor Area (m ²)	DFEE (kWh/m ² /yr)	TFEE (kWh/m ² /yr)	% DFEE/TFEE
015722-003	1	73.4	51.81	54.01	4.08 %
015723-003	1	53	67.01	66.99	-0.03 %
015724-003	1	50	45.25	46.33	2.34 %
015725-003	1	62.62	49.26	49.72	0.92 %
015726-003	1	45.84	46.34	45.82	-1.15 %
015727-003	1	50.5	45.03	44.75	-0.61 %
015728-003	1	44.2	47.58	50.81	6.35 %
015729-003	1	78.1	41.12	42.82	3.99 %
015730-003	1	63.8	50.50	52.76	4.28 %
015731-003	1	60.7	45.65	47.49	3.89 %
015732-003	1	43.25	42.47	43.04	1.31 %
015733-003	1	78.25	50.76	53.42	4.97 %
Totals:	12	703.66	582.78	597.97	
Average DFEE = 48.63 kWh/m ² /yr		% DFEE/TFEE	PASS		
Average TFEE = 50.00 kWh/m ² /yr		2.74 %			