

elmhurst
energy



SAP Report Submission for Building Regulations Compliance

Client: K & J Contracts

Project: Plot 1

Contact: Tobias Whiting
Abacus Energy (UK) Ltd



Report Issue Date: 07/04/2022

EXCELLENCE
IN ENERGY
ASSESSMENT

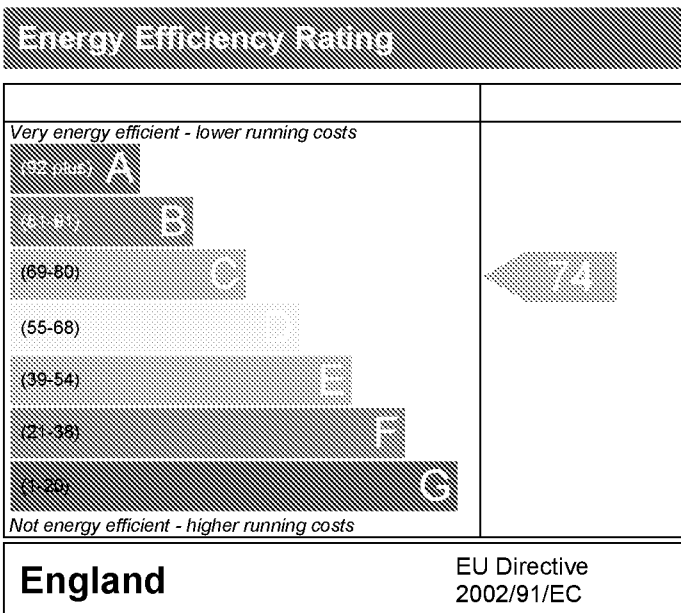
PREDICTED ENERGY ASSESSMENT

Design SAP
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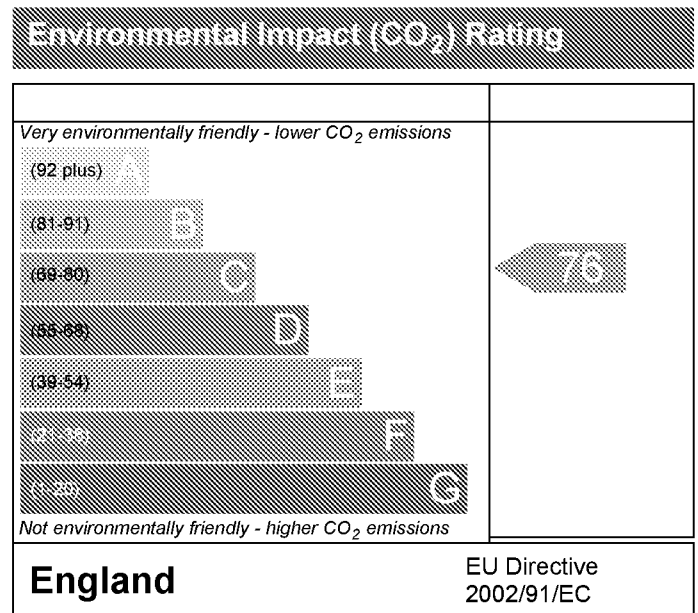
Dwelling type: Bungalow, Detached
Date of assessment: 07/04/2022
Produced by: Abacus Energy (UK) Ltd
Total floor area: 119.17 m²
DRRN: 5202-2742-3091

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.



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.



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 been produced by an accredited Elmhurst member whose work is subject to quality assurance audits. The data used to produce the report has been verified by the Elmhurst members' portal.

BUILDING REGULATION COMPLIANCE

Calculation Type: New Build (As Designed)

Design SAP
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Property Reference	SAP 0873 Plot 1		Issued on Date	07/04/2022	
Assessment Reference	Rev A	Prop Type Ref			
Property					
SAP Rating	74 C	DER	25.68	TER	28.91
Environmental	76 C	% DER<TER	11.17		
CO ₂ Emissions (t/year)	2.65	DFEE	65.63	TFEE	70.71
General Requirements Compliance	Pass	% DFEE<TFEE	7.18		
Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 01329 313079, tobiaswhiting26@gmail.com			Assessor ID	E477-0001
Client	K & J Contracts, K&JC				

SUMMARY FOR INPUT DATA FOR New Build (As Designed)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Electricity		
Fuel factor	1.55 (electricity)		
Target Carbon Dioxide Emission Rate (TER)	28.91	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	25.68	kgCO ₂ /m ²	Pass
	-3.23 (-11.2%)	kgCO ₂ /m ²	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	70.71	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DFEE)	65.63	kWh/m ² /yr	
	-5.1 (-7.2%)	kWh/m ² /yr	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.26 (max. 0.30)	0.45 (max. 0.70)	Pass
Floor	0.12 (max. 0.25)	0.12 (max. 0.70)	Pass
Roof	0.14 (max. 0.20)	0.19 (max. 0.35)	Pass
Openings	1.43 (max. 2.00)	1.80 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

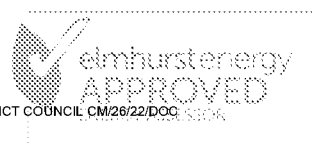
Air permeability at 50 pascals	5.00 (design value)	m ³ /(h.m ²) @ 50 Pa	
Maximum	10.0	m ³ /(h.m ²) @ 50 Pa	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Heat pump with radiators or underfloor - Electric Air-to-water heat pump	
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BUILDING REGULATION COMPLIANCE

Calculation Type: New Build (As Designed)

Design SAP
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Secondary heating system

None

5 Cylinder insulation

Hot water storage

Measured cylinder loss: 1.73 kWh/day
Permitted by DB5CG 2.33

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 (South East England)

Slight

Pass

Based on:

Overshading

Average

Windows facing North

0.66 m², No overhang

Windows facing East

10.54 m², No overhang

Windows facing South

3.29 m², No overhang

Windows facing West

17.25 m², No overhang

Air change rate

6.00 ach

Blinds/curtains

None

Criterion 4 – Building performance consistent with DER and DFEE rate

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals

5.00 (design value)

m³/(h.m²) @ 50 Pa

Maximum

10.0

m³/(h.m²) @ 50 Pa

Pass

10 Key features

Roof U-value

0.10

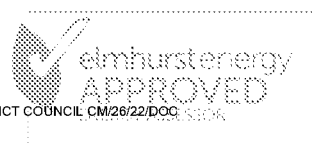
W/m²K

Floor U-value

0.12

W/m²K

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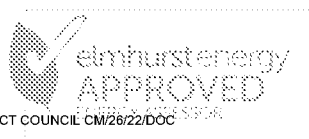


RECOMMENDATIONS

Design SAP
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	Typical cost	Typical savings per year	Energy efficiency	Environmental Impact	Result
Low energy lights			0	0	Already installed
Solar water heating	£4,000 - £6,000	£102	C 76	C 79	Recommended
Photovoltaic	£3,500 - £5,500	£375	B 84	B 86	Recommended
Wind turbine			0	0	Not applicable
Totals	£7,500 - £11,500	£477	B 84	B 86	

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THERMAL BRIDGING

Calculation Type: New Build (As Designed)

Design SAP
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Property Reference	SAP 0873 Plot 1	Issued on Date	07/04/2022
Assessment Reference	Rev A	Prop Type Ref	
Property			

SAP Rating	74 C	DER	25.68	TSL	28.91
Environmental	76 C	2 DER-TED	11.17		
CO ₂ Emissions (t/year)	2.65	DERE	65.63	TTEE	70.71
General Requirements Compliance	Pass	2 DER-TTEE	7.18		

Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 01329 313079, tobiaswhiting26@gmail.com	Assessment ID	E477-0001
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Client	K & J Contracts, K&JC
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	Junction detail	Source Type	Psi (W/mK)	Length (m)	Result	Reference
External wall	E2 Other lintels (including other steel lintels)	Table K1 - Approved	0.300	17.47	5.24	
External wall	E3 Sill	Table K1 - Approved	0.040	3.00	0.12	
External wall	E4 Jamb	Table K1 - Approved	0.050	43.12	2.16	
External wall	E5 Ground floor (normal)	Table K1 - Approved	0.160	50.82	8.13	
External wall	E10 Eaves (insulation at ceiling level)	Table K1 - Approved	0.060	26.82	1.61	
External wall	E11 Eaves (insulation at rafter level)	Table K1 - Approved	0.040	13.58	0.54	
External wall	E12 Gable (insulation at ceiling level)	Table K1 - Approved	0.240	6.07	1.46	
External wall	E13 Gable (insulation at rafter level)	Table K1 - Approved	0.040	5.14	0.21	
External wall	E16 Corner (normal)	Table K1 - Approved	0.090	23.80	2.14	
External wall	E17 Corner (inverted – internal area greater than external area)	Table K1 - Approved	-0.090	14.28	-1.29	
External roof	R1 Head of roof window	Table K1 - Default	0.080	2.46	0.20	
External roof	R2 Sill of roof window	Table K1 - Default	0.060	2.46	0.15	
External roof	R3 Jamb of roof window	Table K1 - Default	0.080	8.51	0.68	
External roof	R4 Ridge (vaulted ceiling)	Table K1 - Default	0.080	11.49	0.92	
External roof	R5 Ridge (inverted)	Table K1 - Default	0.040	8.15	0.33	
External roof	R6 Flat ceiling	Table K1 - Default	0.060	2.10	0.13	

Total: 22.72 W/mK:
Y-Value: 0.054 W/m²K:

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Design SAP
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Property Reference	SAP 0873 Plot 1		Issued on Date	07/04/2022	
Assessment Reference	Rev A	Prop Type Ref			
Property					
SAP Rating	74 C	DEI	25.68	TSE	28.91
Environmental	76 C	% DER-TED	11.17		
CO ₂ Emissions (t/year)	2.65	DREE	65.63	TTEE	70.71
General Requirements Compliance	Pass	% DPEE-CTEE	7.18		
Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 01329 313079, tobiaswhiting26@gmail.com			Assessor ID	E477-0001
Client	K & J Contracts, K&JC				

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

DWELLING AS DESIGNED

Detached Bungalow, total floor area 119 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) 28.91 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 25.68 kgCO₂/m² OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 70.7 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE) 65.6 kWh/m²/yr OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.26 (max. 0.30)	0.45 (max. 0.70)	OK
Floor	0.12 (max. 0.25)	0.12 (max. 0.70)	OK
Roof	0.14 (max. 0.20)	0.19 (max. 0.35)	OK
Openings	1.43 (max. 2.00)	1.80 (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
Air-to-water heat pump

Secondary heating system: None

5 Cylinder insulation

Hot water storage	Measured cylinder loss: 1.73 kWh/day	
Permitted by DBSCG 2.33	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 (South East England): Slight OK

Based on:

Overshading:	Average
Windows facing North:	0.66 m ² , No overhang
Windows facing East:	10.54 m ² , No overhang
Windows facing South:	3.29 m ² , No overhang
Windows facing West:	17.25 m ² , No overhang
Air change rate:	6.00 ach
Blinds/curtains:	None

10 Key features

Roof U-value	0.10 W/m ² K
Floor U-value	0.12 W/m ² K

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Design SAP
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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	119.1700 (1b)	x 2.6100 (2b)	= 311.0337 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	119.1700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 311.0337 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)
Number of intermittent fans				4 * 10 =	40.0000 (7a)
Number of passive vents				0 * 10 =	0.0000 (7b)
Number of flueless gas fires				0 * 40 =	0.0000 (7c)
Air changes per hour					
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				40.0000 / (5) =	0.1286 (8)
Pressure test				Yes	
Measured/design AP50				5.0000	
Infiltration rate				0.3786	(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) =		0.3502 (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	0.4465	0.4378	0.4290	0.3852	0.3765	0.3327	0.3327	0.3239	0.3502	0.3765	0.3940	0.4115 (22b)
	0.5997	0.5958	0.5920	0.5742	0.5709	0.5553	0.5553	0.5525	0.5613	0.5709	0.5776	0.5847 (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
Front Door			2.2100	1.6000	3.5360		(26)
Personnel Door			1.6600	1.8000	2.9880		(26)
Windows (Uw = 1.40)			31.7400	1.3258	42.0795		(27)
Roof Windows (Uw = 1.40)			3.6300	1.3258	4.8125		(27a)
Ground Floor			119.1700	0.1200	14.3004		(28a)
Brick	82.5500	30.3800	52.1700	0.2100	10.9557		(29a)
Stone Clad	30.2400	3.5700	26.6700	0.2100	5.6007		(29a)
Wall to Garage	14.4500	1.6600	12.7900	0.4500	5.7555		(29a)
Wall to voids	31.4700		31.4700	0.2979	9.3740		(29a)
Pitched Roof	82.4400		82.4400	0.1000	8.2440		(30)
Skeillins	44.1000	3.6300	40.4700	0.1900	7.6893		(30)
Skeillin at Roof	16.2700		16.2700	0.1900	3.0913		(30)
Total net area of external elements Aum(A, m ²)			420.6900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	118.4270		(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 100.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 22.7162 (36)
Total fabric heat loss (33) + (36) = 141.1432 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 61.5526	Feb 61.1553	Mar 60.7659	Apr 58.9366	May 58.5944	Jun 57.0011	Jul 57.0011	Aug 56.7061	Sep 57.6148	Oct 58.5944	Nov 59.2867	Dec 60.0106 (38)
Heat transfer coeff	202.6958	202.2985	201.9091	200.0798	199.7375	198.1443	198.1443	197.8493	198.7580	199.7375	200.4299	201.1537 (39)
Average = Sum(39)m / 12 =												200.0782 (39)
HLP	Jan 1.7009	Feb 1.6976	Mar 1.6943	Apr 1.6789	May 1.6761	Jun 1.6627	Jul 1.6627	Aug 1.6602	Sep 1.6679	Oct 1.6761	Nov 1.6819	Dec 1.6880 (40)
HLP (average)												1.6789 (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												2.8600 (42)
Average daily hot water use (litres/day)												102.1262 (43)
Daily hot water use	Jan 112.3388	Feb 108.2538	Mar 104.1687	Apr 100.0837	May 95.9986	Jun 91.9136	Jul 91.9136	Aug 95.9986	Sep 100.0837	Oct 104.1687	Nov 108.2538	Dec 112.3388 (44)
Energy conte	166.5952	145.7052	150.3547	131.0829	125.7772	108.5361	100.5747	115.4109	116.7893	136.1067	148.5711	161.3386 (45)
Energy content (annual)										Total = Sum(45)m =		1606.8425 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	24.9893	21.8558	22.5532	19.6624	18.8666	16.2804	15.0862	17.3116	17.5184	20.4160	22.2857	24.2008 (46)
Water storage loss:												
Store volume												215.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.7300 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.9342 (55)
Total storage loss												
28.9602 26.1576 28.9602 28.0260 28.9602 28.0260 28.9602 28.9602 28.0260 28.9602 28.0260 28.9602 28.9602 (56)												
If cylinder contains dedicated solar storage												
28.9602 26.1576 28.9602 28.0260 28.9602 28.0260 28.9602 28.9602 28.0260 28.9602 28.0260 28.9602 28.9602 (57)												
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624 (59)
Total heat required for water heating calculated for each month												
218.8178 192.8740 202.5773 181.6209 177.9998 159.0741 152.7973 167.6335 167.3273 188.3293 199.1091 213.5612 (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	218.8178	192.8740	202.5773	181.6209	177.9998	159.0741	152.7973	167.6335	167.3273	188.3293	199.1091	213.5612 (64)
Total per year (kWh/year) = Sum(64)m =												2221.7215 (64)
Heat gains from water heating, kWh/month												
97.1710 86.1820 91.7710 84.0155 83.5990 76.5187 75.2192 80.1522 79.2628 87.0335 89.8303 95.4231 (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	143.0025	143.0025	143.0025	143.0025	143.0025	143.0025	143.0025	143.0025	143.0025	143.0025	143.0025	143.0025 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
25.3303 22.4981 18.2967 13.8518 10.3544 8.7416 9.4456 12.2778 16.4792 20.9241 24.4215 26.0343 (67)												
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
284.1287 287.0771 279.6473 263.8301 243.8638 225.0983 212.5618 209.6134 217.0432 232.8604 252.8267 271.5922 (68)												
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
37.3002 37.3002 37.3002 37.3002 37.3002 37.3002 37.3002 37.3002 37.3002 37.3002 37.3002 37.3002 (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)												
-114.4020 -114.4020 -114.4020 -114.4020 -114.4020 -114.4020 -114.4020 -114.4020 -114.4020 -114.4020 -114.4020 -114.4020 (71)												
Water heating gains (Table 5)												
130.6062 128.2471 123.3482 116.6881 112.3642 106.2759 101.1010 107.7315 110.0873 116.9806 124.7643 128.2569 (72)												
Total internal gains	508.9659	506.7230	490.1929	463.2708	435.4832	409.0166	392.0092	398.5234	412.5104	439.6658	470.9132	494.7841 (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					0.6600	10.6334		0.6300	0.7000	0.7700		2.1448 (74)
East					10.5400	19.6403		0.6300	0.6300	0.7700		63.2645 (76)
South					3.2900	46.7521		0.6300	0.7000	0.7700		47.0076 (78)
West					17.2500	19.6403		0.6300	0.7000	0.7700		103.5400 (80)
East					1.5600	26.6725		0.6300	0.7000	1.0000		16.5147 (82)
West					2.0700	26.6725		0.6300	0.7000	1.0000		21.9137 (82)
Solar gains	254.3853	485.3852	777.8296	1114.1510	1356.1048	1386.1049	1320.3600	1138.9059	896.8563	569.4890	314.7745	210.8557 (83)
Total gains	763.3512	992.1082	1268.0225	1577.4218	1791.5880	1795.1215	1712.3691	1537.4293	1309.3667	1009.1548	785.6877	705.6398 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	16.3313	16.3633	16.3949	16.5448	16.5731	16.7064	16.7064	16.7313	16.6548	16.5731	16.5159	16.4565
alpha	2.0888	2.0909	2.0930	2.1030	2.1049	2.1138	2.1138	2.1154	2.1103	2.1049	2.1011	2.0971
util living area	0.9651	0.9406	0.8936	0.8075	0.6901	0.5560	0.4408	0.4930	0.6941	0.8741	0.9487	0.9701 (86)
MIT	18.3720	18.6763	19.1751	19.7832	20.2826	20.6160	20.7621	20.7285	20.4326	19.7367	18.9358	18.3189 (87)
Th 2	19.5402	19.5426	19.5449	19.5560	19.5580	19.5677	19.5677	19.5695	19.5640	19.5580	19.5538	19.5495 (88)
util rest of house	0.9588	0.9301	0.8746	0.7727	0.6321	0.4661	0.3190	0.3693	0.6132	0.8428	0.9379	0.9647 (89)
MIT 2	16.1136	16.5500	17.2586	18.1069	18.7678	19.1784	19.3256	19.3031	18.9865	18.0726	16.9355	16.0415 (90)
Living area fraction												0.2429 (91)
MIT	16.6623	17.0666	17.7242	18.5141	19.1358	19.5277	19.6746	19.6494	19.3378	18.4768	17.4214	16.5947 (92)
Temperature adjustment												0.0000
adjusted MIT	16.6623	17.0666	17.7242	18.5141	19.1358	19.5277	19.6746	19.6494	19.3378	18.4768	17.4214	16.5947 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9404	0.9050	0.8434	0.7421	0.6126	0.4633	0.3289	0.3770	0.5982	0.8118	0.9146	0.9482 (94)
Useful gains	717.8653	897.8296	1069.3920	1170.5663	1097.4696	831.7452	563.2037	579.5553	783.2050	819.2050	718.6188	669.0554 (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	2505.7791	2461.2814	2266.2629	1923.5956	1485.2075	976.3871	609.2121	642.8871	1041.0617	1573.3012	2068.7189	2493.2484 (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	1330.2079	1050.6396	890.4720	542.1811	288.4771	0.0000	0.0000	0.0000	0.0000	561.0475	972.0720	1357.1996 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Space heating 6992.2967 (98)
Space heating per m2 (98) / (4) = 58.6750 (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 %) 170.0000 (206)
Efficiency of secondary/supplementary heating system, % 0.0000 (208)
Space heating requirement 4113.1157 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	1330.2079	1050.6396	890.4720	542.1811	288.4771	0.0000	0.0000	0.0000	0.0000	561.0475	972.0720	1357.1996
Space heating efficiency (main heating system 1)	170.0000	170.0000	170.0000	170.0000	170.0000	0.0000	0.0000	0.0000	0.0000	170.0000	170.0000	170.0000
Space heating fuel (main heating system)	782.4752	618.0233	523.8071	318.9300	169.6924	0.0000	0.0000	0.0000	0.0000	330.0280	571.8071	798.3527
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
Water heating requirement	218.8178	192.8740	202.5773	181.6209	177.9998	159.0741	152.7973	167.6335	167.3273	188.3293	199.1091	213.5612
Efficiency of water heater (217)m	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000
Fuel for water heating, kWh/month	128.7164	113.4553	119.1631	106.8358	104.7057	93.5730	89.8808	98.6080	98.4278	110.7819	117.1230	125.6242
Water heating fuel used												1306.8950
Annual totals kWh/year												
Space heating fuel - main system												4113.1157
Space heating fuel - secondary												0.0000
Electricity for pumps and fans:												
central heating pump												30.0000
Total electricity for the above, kWh/year												30.0000
Electricity for lighting (calculated in Appendix L)												447.3406
Total delivered energy for all uses												5897.3514

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	4113.1157	0.5190	2134.7071
Space heating - secondary	0.0000	0.0000	0.0000
Water heating (other fuel)	1306.8950	0.5190	678.2785
Space and water heating			2812.9856
Pumps and fans	30.0000	0.5190	15.5700
Energy for lighting	447.3406	0.5190	232.1698
Total CO2, kg/year			3060.7254
Dwelling Carbon Dioxide Emission Rate (DER)			25.6800

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

	DER	TFA	N	EF
Total Floor Area		119.1700		
Assumed number of occupants			2.8600	
CO2 emission factor in Table 12 for electricity displaced from grid				0.5190
CO2 emissions from appliances, equation (L14)				14.1284
CO2 emissions from cooking, equation (L16)				1.5746
Total CO2 emissions				41.3830
Residual CO2 emissions offset from biofuel CHP				0.0000
Additional allowable electricity generation, kWh/m²/year				0.0000
Resulting CO2 emissions offset from additional allowable electricity generation				0.0000
Net CO2 emissions				41.3830

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	119.1700 (1b)	x 2.6100 (2b)	= 311.0337 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	119.1700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 311.0337 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)
Number of intermittent fans				4 * 10 =	40.0000 (7a)
Number of passive vents				0 * 10 =	0.0000 (7b)
Number of flueless gas fires				0 * 40 =	0.0000 (7c)
Air changes per hour					
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				40.0000 / (5) =	0.1286 (8)
Pressure test				Yes	
Measured/design AP50				5.0000	
Infiltration rate				0.3786	(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) =		0.3502 (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	0.4465	0.4378	0.4290	0.3852	0.3765	0.3327	0.3327	0.3239	0.3502	0.3765	0.3940	0.4115 (22b)
	0.5997	0.5958	0.5920	0.5742	0.5709	0.5553	0.5553	0.5525	0.5613	0.5709	0.5776	0.5847 (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			3.8700	1.0000	3.8700		(26)
TER Opening Type (Uw = 1.40)			23.2800	1.3258	30.8636		(27)
TER Room Window (Uw = 1.70)			2.6600	1.5918	4.2341		(27a)
Ground Floor			119.1700	0.1300	15.4921		(28a)
Brick	82.5500	22.8700	59.6800	0.1800	10.7424		(29a)
Stone Clad	30.2400	2.6200	27.6200	0.1800	4.9716		(29a)
Wall to Garage	14.4500	1.6600	12.7900	0.1800	2.3022		(29a)
Wall to voids	31.4700		31.4700	0.1800	5.6646		(29a)
Pitched Roof	82.4400		82.4400	0.1300	10.7172		(30)
Skeillins	44.1000	2.6600	41.4400	0.1300	5.3872		(30)
Skeillins at Roof	16.2700		16.2700	0.1300	2.1151		(30)
Total net area of external elements Aum, m ²			420.6900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	96.3601		(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 17.4917 (36)
Total fabric heat loss (33) + (36) = 113.8518 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	61.5526	61.1553	60.7659	58.9366	58.5944	57.0011	57.0011	56.7061	57.6148	58.5944	59.2867	60.0106 (38)
Average = Sum(39)m / 12 =	175.4045	175.0071	174.6177	172.7884	172.4462	170.8529	170.8529	170.5579	171.4666	172.4462	173.1385	173.8624 (39)
												172.7868 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.4719	1.4686	1.4653	1.4499	1.4471	1.4337	1.4337	1.4312	1.4388	1.4471	1.4529	1.4589 (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												2.8600 (42)
Average daily hot water use (litres/day)												102.1262 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	112.3388	108.2538	104.1687	100.0837	95.9986	91.9136	91.9136	95.9986	100.0837	104.1687	108.2538	112.3388 (44)
Energy content (annual)	166.5952	145.7052	150.3547	131.0829	125.7772	108.5361	100.5747	115.4109	116.7893	136.1067	148.5711	161.3386 (45)
Distribution loss (46)m = 0.15 x (45)m												1606.8425 (45)

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24.9893	21.8558	22.5532	19.6624	18.8666	16.2804	15.0862	17.3116	17.5184	20.4160	22.2857	24.2008 (46)
Water storage loss:											215.0000 (47)
Store volume											1.7258 (48)
a) If manufacturer declared loss factor is known (kWh/day):											0.5400 (49)
Temperature factor from Table 2b											0.9319 (55)
Enter (49) or (54) in (55)											
Total storage loss											
28.8896	26.0938	28.8896	27.9576	28.8896	27.9576	28.8896	28.8896	27.9576	28.8896	27.9576	28.8896 (56)
If cylinder contains dedicated solar storage											
28.8896	26.0938	28.8896	27.9576	28.8896	27.9576	28.8896	28.8896	27.9576	28.8896	27.9576	28.8896 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month											
218.7471	192.8102	202.5067	181.5525	177.9291	159.0058	152.7266	167.5629	167.2589	188.2586	199.0407	213.4905 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Solar input (sum of months) = Sum(63)m =											0.0000 (63)
Output from w/h											
218.7471	192.8102	202.5067	181.5525	177.9291	159.0058	152.7266	167.5629	167.2589	188.2586	199.0407	213.4905 (64)
Heat gains from water heating, kWh/month											
97.1145	86.1310	91.7145	83.9608	83.5425	76.4640	75.1626	80.0957	79.2081	86.9770	89.7756	95.3666 (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	143.0025	143.0025	143.0025	143.0025	143.0025	143.0025	143.0025	143.0025	143.0025	143.0025	143.0025	143.0025 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	25.3320	22.4997	18.2979	13.8527	10.3551	8.7422	9.4462	12.2786	16.4803	20.9255	24.4232	26.0360 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	284.1287	287.0771	279.6473	263.8301	243.8638	225.0983	212.5618	209.6134	217.0432	232.8604	252.8267	271.5922 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	37.3002	37.3002	37.3002	37.3002	37.3002	37.3002	37.3002	37.3002	37.3002	37.3002	37.3002	37.3002 (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)												
	-114.4020	-114.4020	-114.4020	-114.4020	-114.4020	-114.4020	-114.4020	-114.4020	-114.4020	-114.4020	-114.4020	-114.4020 (71)
Water heating gains (Table 5)												
	130.5302	128.1711	123.2722	116.6122	112.2883	106.2000	101.0251	107.6555	110.0113	116.9046	124.6883	128.1810 (72)
Total internal gains												
	508.8916	506.6485	490.1181	463.1958	435.4079	408.9412	391.9339	398.4483	412.4356	439.5912	470.8389	494.7099 (73)

6. Solar gains

[Jan]					Area m ²	Solar flux Table 6a W/m ²	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d			Gains W
North					0.4800	10.6334	0.6300	0.7000			0.7700			1.5599 (74)
East					7.7400	19.6403	0.6300	0.7000			0.7700			46.4580 (76)
South					2.4200	46.7521	0.6300	0.7000			0.7700			34.5771 (78)
West					12.6400	19.6403	0.6300	0.7000			0.7700			75.8693 (80)
East					1.1400	26.6725	0.6300	0.7000			1.0000			12.0684 (82)
West					1.5200	26.6725	0.6300	0.7000			1.0000			16.0912 (82)
Solar gains	186.6238	356.0608	570.5231	817.1273	994.5200	1016.4987	968.2936	835.2598	657.7985	417.7381	230.9211	154.6933 (83)		
Total gains	695.5154	862.7093	1060.6412	1280.3231	1429.9279	1425.4399	1360.2275	1233.7081	1070.2340	857.3293	701.7600	649.4032 (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	47.1806	47.2878	47.3932	47.8950	47.9900	48.4375	48.4375	48.5213	48.2642	47.9900	47.7981	47.5991
alpha	4.1454	4.1525	4.1595	4.1930	4.1993	4.2292	4.2292	4.2348	4.2176	4.1993	4.1865	4.1733
util living area												
	0.9980	0.9949	0.9842	0.9462	0.8510	0.6895	0.5316	0.5984	0.8466	0.9760	0.9959	0.9985 (86)
MIT												
	19.3361	19.5406	19.8910	20.3429	20.7107	20.9171	20.9785	20.9653	20.7925	20.2847	19.7245	19.3045 (87)
Th 2												
	19.7087	19.7112	19.7136	19.7253	19.7274	19.7376	19.7376	19.7395	19.7337	19.7274	19.7230	19.7184 (88)
util rest of house												
	0.9973	0.9931	0.9783	0.9252	0.7944	0.5827	0.3894	0.4521	0.7648	0.9629	0.9941	0.9980 (89)
MIT 2												
	17.5181	17.8180	18.3276	18.9745	19.4554	19.6859	19.7306	19.7265	19.5720	18.9079	18.0954	17.4783 (90)
Living area fraction												
	17.9597	18.2364	18.7074	19.3069	19.7604	19.9850	20.0338	20.0274	19.8685	19.2423	18.4912	17.9219 (92)
Temperature adjustment												
	17.9597	18.2364	18.7074	19.3069	19.7604	19.9850	20.0338	20.0274	19.8685	19.2423	18.4912	17.9219 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9958	0.9898	0.9717	0.9163	0.7961	0.6055	0.4242	0.4877	0.7752	0.9559	0.9914	0.9968 (94)
Useful gains	692.5822	853.9354	1030.6002	1173.2192	1138.3009	863.0556	577.0268	601.6382	829.6531	819.4783	695.7560	647.3297 (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												
	2395.9750	2333.9726	2131.6329	1798.1977	1389.9771	920.0384	586.6668	618.6870	989.1037	1490.3399	1972.2509	2385.7289 (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												
	1267.3243	994.5850	819.1684	449.9845	187.2471	0.0000	0.0000	0.0000	0.0000	499.1210	919.0763	1293.3690 (98)
Space heating												
												6429.8755 (98)

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Space heating per m²

(98) / (4) = 53.9555 (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 %)													93.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													6876.8722 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1267.3243	994.5850	819.1684	449.9845	187.2471	0.0000	0.0000	0.0000	0.0000	499.1210	919.0763	1293.3690	(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)	1355.4270	1063.7273	876.1159	481.2668	200.2643	0.0000	0.0000	0.0000	0.0000	533.8192	982.9693	1383.2823	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	218.7471	192.8102	202.5067	181.5525	177.9291	159.0058	152.7266	167.5629	167.2589	188.2586	199.0407	213.4905	(64)
Efficiency of water heater	88.7484	88.5715	88.1570	87.1410	84.9501	79.8000	79.8000	79.8000	79.8000	87.2943	88.3902	79.8000	(216)
Fuel for water heating, kWh/month	246.4802	217.6887	229.7113	208.3434	209.4515	199.2553	191.3868	209.9785	209.5976	215.6597	225.1841	240.3825	(219)
Water heating fuel used												2603.1196	(219)
Annual totals kWh/year													
Space heating fuel - main system												6876.8722	(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)												447.3709	(232)
Total delivered energy for all uses												10002.3628	(238)

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

	Energy kWh/year	Emission factor kg CO ₂ /kWh	Emissions kg CO ₂ /year
Space heating - main system 1	6876.8722	0.2160	1485.4044 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2603.1196	0.2160	562.2738 (264)
Space and water heating			2047.6782 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	447.3709	0.5190	232.1855 (268)
Total CO ₂ , kg/m ² /year			2318.7887 (272)
Emissions per m ² for space and water heating			17.1828 (272a)
Fuel factor (electricity)			1.5500
Emissions per m ² for lighting			1.9484 (272b)
Emissions per m ² for pumps and fans			0.3266 (272c)
Target Carbon Dioxide Emission Rate (TER) = (17.1828 * 1.55) + 1.9484 + 0.3266, rounded to 2 d.p.			28.9100 (273)

FULL SAP CALCULATION PRINTOUT

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CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	119.1700 (1b)	x 2.6100 (2b)	= 311.0337 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	119.1700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 311.0337 (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					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
					Air changes per hour
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				40.0000 / (5) = 0.1286 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3786 (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) =				0.3502 (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	0.4465	0.4378	0.4290	0.3852	0.3765	0.3327	0.3327	0.3239	0.3502	0.3765	0.3940	0.4115 (22b)
	0.5997	0.5958	0.5920	0.5742	0.5709	0.5553	0.5553	0.5525	0.5613	0.5709	0.5776	0.5847 (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
Front Door			2.2100	1.6000	3.5360		(26)
Personnel Door			1.6600	1.8000	2.9880		(26)
Windows (Uw = 1.40)			31.7400	1.3258	42.0795		(27)
Roof Windows (Uw = 1.40)			3.6300	1.3258	4.8125		(27a)
Ground Floor			119.1700	0.1200	14.3004		(28a)
Brick	82.5500	30.3800	52.1700	0.2100	10.9557		(29a)
Stone Clad	30.2400	3.5700	26.6700	0.2100	5.6007		(29a)
Wall to Garage	14.4500	1.6600	12.7900	0.4500	5.7555		(29a)
Wall to voids	31.4700		31.4700	0.2979	9.3740		(29a)
Pitched Roof	82.4400		82.4400	0.1000	8.2440		(30)
Skeillins	44.1000	3.6300	40.4700	0.1900	7.6893		(30)
Skeillin at Roof	16.2700		16.2700	0.1900	3.0913		(30)
Total net area of external elements Aum(A, m ²)			420.6900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	118.4270		(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 100.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 22.7162 (36)
Total fabric heat loss (33) + (36) = 141.1432 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 61.5526	Feb 61.1553	Mar 60.7659	Apr 58.9366	May 58.5944	Jun 57.0011	Jul 57.0011	Aug 56.7061	Sep 57.6148	Oct 58.5944	Nov 59.2867	Dec 60.0106 (38)
Heat transfer coeff	202.6958	202.2985	201.9091	200.0798	199.7375	198.1443	198.1443	197.8493	198.7580	199.7375	200.4299	201.1537 (39)
Average = Sum(39)m / 12 =												200.0782 (39)
HLP	Jan 1.7009	Feb 1.6976	Mar 1.6943	Apr 1.6789	May 1.6761	Jun 1.6627	Jul 1.6627	Aug 1.6602	Sep 1.6679	Oct 1.6761	Nov 1.6819	Dec 1.6880 (40)
HLP (average)												1.6789 (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												2.8600 (42)
Average daily hot water use (litres/day)												102.1262 (43)
Daily hot water use	Jan 112.3388	Feb 108.2538	Mar 104.1687	Apr 100.0837	May 95.9986	Jun 91.9136	Jul 91.9136	Aug 95.9986	Sep 100.0837	Oct 104.1687	Nov 108.2538	Dec 112.3388 (44)
Energy conte	166.5952	145.7052	150.3547	131.0829	125.7772	108.5361	100.5747	115.4109	116.7893	136.1067	148.5711	161.3386 (45)
Energy content (annual)										Total = Sum(45)m =		1606.8425 (45)

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Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	35.4015	30.9624	31.9504	27.8551	26.7276	23.0639	21.3721	24.5248	24.8177	28.9227	31.5714	34.2844 (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	143.0025	143.0025	143.0025	143.0025	143.0025	143.0025	143.0025	143.0025	143.0025	143.0025	143.0025	143.0025	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.3303	22.4981	19.2967	13.8518	10.3544	8.7416	9.4456	12.2778	16.4792	20.9241	24.4215	26.0343	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	284.1287	287.0771	279.6473	263.8301	243.8638	225.0983	212.5618	209.6134	217.0432	232.8604	252.8267	271.5922	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.3002	37.3002	37.3002	37.3002	37.3002	37.3002	37.3002	37.3002	37.3002	37.3002	37.3002	37.3002	(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)	-114.4020	-114.4020	-114.4020	-114.4020	-114.4020	-114.4020	-114.4020	-114.4020	-114.4020	-114.4020	-114.4020	-114.4020	(71)
Water heating gains (Table 5)	47.5826	46.0749	42.9441	38.6877	35.9243	32.0332	28.7260	32.9635	34.4691	38.8745	43.8491	46.0812	(72)
Total internal gains	422.9423	421.5509	406.7888	382.2703	356.0432	331.7739	316.6341	320.7554	333.8922	358.5598	386.9980	409.6084	(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				0.6600	10.6334		0.6300		0.7000		0.7700		2.1448 (74)
East				10.5400	19.6403		0.6300		0.7000		0.7700		63.2645 (76)
South				3.2900	46.7521		0.6300		0.7000		0.7700		47.0076 (78)
West				17.2500	19.6403		0.6300		0.7000		0.7700		103.5400 (80)
East				1.5600	26.6725		0.6300		0.7000		1.0000		16.5147 (82)
West				2.0700	26.6725		0.6300		0.7000		1.0000		21.9137 (82)
Solar gains	254.3853	485.3852	777.8296	1114.1510	1356.1048	1386.1049	1320.3600	1138.9059	896.8563	569.4890	314.7745	210.8557	(83)
Total gains	677.3276	906.9361	1184.6184	1496.4214	1712.1480	1717.8788	1636.9941	1459.6613	1230.7485	928.0487	701.7725	620.4641	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	16.3313	16.3633	16.3949	16.5448	16.5731	16.7064	16.7064	16.7313	16.6548	16.5731	16.5159	16.4565	
alpha	2.0888	2.0909	2.0930	2.1030	2.1049	2.1138	2.1138	2.1154	2.1103	2.1049	2.1011	2.0971	
util living area	0.9720	0.9492	0.9046	0.8209	0.7051	0.5718	0.4561	0.5113	0.7144	0.8895	0.9581	0.9765	(86)
MIT	17.5675	17.9806	18.6589	19.4891	20.1754	20.6361	20.8406	20.7914	20.3744	19.4127	18.3244	17.4953	(87)
Th 2	19.5402	19.5426	19.5449	19.5560	19.5580	19.5677	19.5677	19.5695	19.5640	19.5580	19.5538	19.5495	(88)
util rest of house	0.9669	0.9400	0.8871	0.7876	0.6480	0.4814	0.3316	0.3854	0.6352	0.8610	0.9490	0.9722	(89)
MIT 2	16.4758	16.8842	17.5483	18.3479	18.9747	19.3674	19.5102	19.4873	19.1772	18.3024	17.2371	16.4101	(90)
Living area fraction									fLA = Living area / (4) =			0.2429	(91)
MIT	16.7410	17.1506	17.8181	18.6251	19.2664	19.6756	19.8334	19.8041	19.4680	18.5721	17.5013	16.6737	(92)
Temperature adjustment												0.0000	
adjusted MIT	16.7410	17.1506	17.8181	18.6251	19.2664	19.6756	19.8334	19.8041	19.4680	18.5721	17.5013	16.6737	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9522	0.9189	0.8599	0.7614	0.6348	0.4890	0.3567	0.4082	0.6289	0.8353	0.9303	0.9593	(94)
Useful gains	644.9652	833.3584	1018.6421	1139.4317	1086.8283	839.9625	583.9422	595.8946	774.0621	775.1778	652.8437	595.1952	(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	2521.7367	2478.2753	2285.2264	1945.7996	1511.2865	1005.7064	640.6823	673.4970	1066.9417	1592.3357	2084.7218	2509.1359	(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	1396.3180	1105.3842	942.3387	580.5849	315.7969	0.0000	0.0000	0.0000	0.0000	607.9654	1030.9522	1423.9719	(98)
Space heating												7403.3121	(98)
Space heating per m2										(98) / (4) =		62.1240	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

Ext. temp.	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	

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Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1862.5565	1466.2679	1503.6544	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7148	0.7738	0.7348	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1331.3614	1134.6284	1104.8757	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	2075.6720	1981.0960	1783.2187	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	535.9037	629.7719	504.6871	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												1670.3627 (104)
Cooled fraction									fC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	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	133.9759	157.4430	126.1718	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												417.5907 (107)
Space cooling per m2												3.5042 (108)
Energy for space heating												62.1240 (99)
Energy for space cooling												3.5042 (108)
Total												65.6281 (109)
Dwelling Fabric Energy Efficiency (DFEE)												65.6 (109)

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CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	119.1700 (1b)	x 2.6100 (2b)	= 311.0337 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	119.1700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 311.0337 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)
Number of intermittent fans				4 * 10 =	40.0000 (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					40.0000 / (5) =
Measured/design AP50					Yes
Infiltration rate					5.0000
Number of sides sheltered					0.3786 (18)
Shelter factor					1 (19)
Infiltration rate adjusted to include shelter factor					(20) = 1 - [0.075 x (19)] =
					(21) = (18) x (20) =

	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	0.4465	0.4378	0.4290	0.3852	0.3765	0.3327	0.3327	0.3239	0.3502	0.3765	0.3940	0.4115 (22b)
	0.5997	0.5958	0.5920	0.5742	0.5709	0.5553	0.5553	0.5525	0.5613	0.5709	0.5776	0.5847 (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			3.8700	1.0000	3.8700		(26)
TER Opening Type (Uw = 1.40)			23.2800	1.3258	30.8636		(27)
TER Room Window (Uw = 1.70)			2.6600	1.5918	4.2341		(27a)
Ground Floor			119.1700	0.1300	15.4921		(28a)
Brick	82.5500	22.8700	59.6800	0.1800	10.7424		(29a)
Stone Clad	30.2400	2.6200	27.6200	0.1800	4.9716		(29a)
Wall to Garage	14.4500	1.6600	12.7900	0.1800	2.3022		(29a)
Wall to voids	31.4700		31.4700	0.1800	5.6646		(29a)
Pitched Roof	82.4400		82.4400	0.1300	10.7172		(30)
Skeillins	44.1000	2.6600	41.4400	0.1300	5.3872		(30)
Skeillins at Roof	16.2700		16.2700	0.1300	2.1151		(30)
Total net area of external elements Aum(A, m ²)			420.6900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	96.3601		(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss

250.0000 (35)
17.4917 (36)
(33) + (36) = 113.8518 (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	61.5526	61.1553	60.7659	58.9366	58.5944	57.0011	57.0011	56.7061	57.6148	58.5944	59.2867	60.0106 (38)
Heat transfer coeff	175.4045	175.0071	174.6177	172.7884	172.4462	170.8529	170.8529	170.5579	171.4666	172.4462	173.1385	173.8624 (39)
Average = Sum(39)m / 12 =												172.7868 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.4719	1.4686	1.4653	1.4499	1.4471	1.4337	1.4337	1.4312	1.4388	1.4471	1.4529	1.4589 (40)
HLP (average)												1.4499 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy
Average daily hot water use (litres/day)

2.8600 (42)
102.1262 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	112.3388	108.2538	104.1687	100.0837	95.9986	91.9136	91.9136	95.9986	100.0837	104.1687	108.2538	112.3388 (44)
Energy conte	166.5952	145.7052	150.3547	131.0829	125.7772	108.5361	100.5747	115.4109	116.7893	136.1067	148.5711	161.3386 (45)
Energy content (annual)												Total = Sum(45)m = 1606.8425 (45)
Distribution loss (46)m = 0.15 x (45)m												

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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (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	(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	(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	(59)
Heat gains from water heating, kWh/month	35.4015	30.9624	31.9504	27.8551	26.7276	23.0639	21.3721	24.5248	24.8177	28.9227	31.5714	34.2844 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	143.0025	143.0025	143.0025	143.0025	143.0025	143.0025	143.0025	143.0025	143.0025	143.0025	143.0025	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.3320	22.4997	18.2979	13.8527	10.3551	8.7422	9.4462	12.2786	16.4803	20.9255	24.4232	26.0360 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	284.1287	287.0771	279.6473	263.8301	243.8638	225.0983	212.5618	209.6134	217.0432	232.8604	252.8267	271.5922 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.3002	37.3002	37.3002	37.3002	37.3002	37.3002	37.3002	37.3002	37.3002	37.3002	37.3002	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-114.4020	-114.4020	-114.4020	-114.4020	-114.4020	-114.4020	-114.4020	-114.4020	-114.4020	-114.4020	-114.4020	(71)
Water heating gains (Table 5)	47.5826	46.0749	42.9441	38.6877	35.9243	32.0332	28.7260	32.9635	34.4691	38.8745	43.8491	46.0812 (72)
Total internal gains	422.9441	421.5524	406.7900	382.2713	356.0439	331.7745	316.6348	320.7562	333.8933	358.5612	386.9997	409.6102 (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	0.4800				10.6334		0.6300		0.7000		0.7700		1.5599 (74)	
East	7.7400				19.6403		0.6300		0.7000		0.7700		46.4580 (76)	
South	2.4200				46.7521		0.6300		0.7000		0.7700		34.5771 (78)	
West	12.6400				19.6403		0.6300		0.7000		0.7700		75.8693 (80)	
East	1.1400				26.6725		0.6300		0.7000		1.0000		12.0684 (82)	
West	1.5200				26.6725		0.6300		0.7000		1.0000		16.0912 (82)	
Solar gains	186.6238	356.0608	570.5231	817.1273	994.5200	1016.4987	968.2936	835.2598	657.7985	417.7381	230.9211	154.6933	(83)	
Total gains	609.5679	777.6131	977.3131	1199.3986	1350.5639	1348.2732	1284.9284	1156.0161	991.6918	776.2992	617.9208	564.3035	(84)	

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	47.1806	47.2878	47.3932	47.4986	47.6040	47.7094	47.8148	47.9202	48.0256	48.1310	48.2364	48.3418
alpha	4.1454	4.1525	4.1595	4.1665	4.1735	4.1805	4.1875	4.1945	4.2015	4.2085	4.2155	4.2225
util living area	0.9988	0.9965	0.9882	0.9561	0.8701	0.7161	0.5583	0.6300	0.8723	0.9829	0.9975	0.9992 (86)
MIT	19.2726	19.4785	19.8328	20.2946	20.6796	20.9041	20.9742	20.9578	20.7619	20.2296	19.6629	19.2414 (87)
Th 2	19.7087	19.7112	19.7136	19.7253	19.7274	19.7376	19.7376	19.7395	19.7337	19.7274	19.7230	19.7184 (88)
util rest of house	0.9984	0.9953	0.9836	0.9382	0.8175	0.6097	0.4111	0.4799	0.7976	0.9733	0.9964	0.9988 (89)
MIT 2	18.1497	18.3569	18.7105	19.1684	19.5179	19.6958	19.7317	19.7284	19.6026	19.1155	18.5505	18.1259 (90)
Living area fraction	18.4225	18.6294	18.9831	19.4420	19.8001	19.9893	20.0336	20.0271	19.8842	19.3862	18.8208	18.3969 (92)
Temperature adjustment												0.0000
adjusted MIT	18.4225	18.6294	18.9831	19.4420	19.8001	19.9893	20.0336	20.0271	19.8842	19.3862	18.8208	18.3969 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	608.1925	772.7407	957.8335	1119.2026	1108.8433	853.4192	574.8673	597.4592	801.6713	752.7396	614.9550	563.3822 (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	2477.1438	2402.7379	2179.7708	1821.5291	1396.8368	920.7810	586.6354	618.6254	991.8050	1515.1458	2029.3153	2468.3100 (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	1390.4998	1095.3581	909.1214	505.6751	214.2672	0.0000	0.0000	0.0000	0.0000	567.2302	1018.3395	1417.2663 (98)
Space heating												7117.7576 (98)
Space heating per m2												59.7278 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b												
Ext. temp.	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000

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FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	1606.0176	1264.3118	1296.2400	0.0000	0.0000	0.0000	0.0000 (100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.8210	0.8872	0.8485	0.0000	0.0000	0.0000	0.0000 (101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1318.4975	1121.6361	1099.8431	0.0000	0.0000	0.0000	0.0000 (102)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1656.0990	1581.3490	1438.1180	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	243.0730	342.0264	251.6766	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction									FC = cooled area / (4) =			836.7760 (104)
Intermittency factor (Table 10b)												1.0000 (105)
Space cooling kWh	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	0.0000	0.0000	0.0000	0.0000	0.0000	60.7683	85.5066	62.9191	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling per m2												209.1940 (107)
Energy for space heating												1.7554 (108)
Energy for space cooling												59.7278 (99)
Total												1.7554 (108)
Target Fabric Energy Efficiency (TFEE)												61.4832 (109)
												70.7 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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CALCULATION OF HEAT DEMAND 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	119.1700 (1b)	x 2.6100 (2b)	= 311.0337 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	119.1700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 311.0337 (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					4 * 10 = 40.0000 (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) =				40.0000 / (5) = 0.1286 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3786 (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) =				0.3502 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.8000	4.5000	4.4000	3.9000	3.9000	3.6000	3.7000	3.5000	3.7000	4.0000	4.1000	4.4000 (22)
Wind factor	1.2000	1.1250	1.1000	0.9750	0.9750	0.9000	0.9250	0.8750	0.9250	1.0000	1.0250	1.1000 (22a)
Adj infilt rate	0.4202	0.3940	0.3852	0.3415	0.3415	0.3152	0.3239	0.3064	0.3239	0.3502	0.3590	0.3852 (22b)
Effective ac	0.5883	0.5776	0.5742	0.5583	0.5583	0.5497	0.5525	0.5470	0.5525	0.5613	0.5644	0.5742 (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
Front Door			2.2100	1.6000	3.5360		(26)
Personnel Door			1.6600	1.8000	2.9880		(26)
Windows (Uw = 1.40)			31.7400	1.3258	42.0795		(27)
Roof Windows (Uw = 1.40)			3.6300	1.3258	4.8125		(27a)
Ground Floor			119.1700	0.1200	14.3004		(28a)
Brick	82.5500	30.3800	52.1700	0.2100	10.9557		(29a)
Stone Clad	30.2400	3.5700	26.6700	0.2100	5.6007		(29a)
Wall to Garage	14.4500	1.6600	12.7900	0.4500	5.7555		(29a)
Wall to voids	31.4700		31.4700	0.2979	9.3740		(29a)
Pitched Roof	82.4400		82.4400	0.1000	8.2440		(30)
Skeillins	44.1000	3.6300	40.4700	0.1900	7.6893		(30)
Skeillin at Roof	16.2700		16.2700	0.1900	3.0913		(30)
Total net area of external elements Aum(A, m ²)			420.6900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	118.4270		(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 100.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 22.7162 (36)
Total fabric heat loss (33) + (36) = 141.1432 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 60.3843	Feb 59.2867	Mar 58.9366	Apr 57.3040	May 57.3040	Jun 56.4189	Jul 56.7061	Aug 56.1396	Sep 56.7061	Oct 57.6148	Nov 57.9335	Dec 58.9366 (38)
Heat transfer coeff	201.5275	200.4299	200.0798	198.4472	198.4472	197.5621	197.8493	197.2828	197.8493	198.7580	199.0766	200.0798 (39)
Average = Sum(39)m / 12 =												198.9491 (39)
HLP	Jan 1.6911	Feb 1.6819	Mar 1.6789	Apr 1.6652	May 1.6652	Jun 1.6578	Jul 1.6602	Aug 1.6555	Sep 1.6602	Oct 1.6679	Nov 1.6705	Dec 1.6789 (40)
HLP (average)												1.6695 (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												2.8600 (42)
Average daily hot water use (litres/day)												102.1262 (43)
Daily hot water use	Jan 112.3388	Feb 108.2538	Mar 104.1687	Apr 100.0837	May 95.9986	Jun 91.9136	Jul 91.9136	Aug 95.9986	Sep 100.0837	Oct 104.1687	Nov 108.2538	Dec 112.3388 (44)
Energy conte	166.5952	145.7052	150.3547	131.0829	125.7772	108.5361	100.5747	115.4109	116.7893	136.1067	148.5711	161.3386 (45)
Energy content (annual)										Total = Sum(45)m =		1606.8425 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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CALCULATION OF HEAT DEMAND 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	24.9893	21.8558	22.5532	19.6624	18.8666	16.2804	15.0862	17.3116	17.5184	20.4160	22.2857	24.2008 (46)
Water storage loss:												
Store volume												215.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.7300 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.9342 (55)
Total storage loss												
28.9602 26.1576 28.9602 28.0260 28.9602 28.0260 28.9602 28.9602 28.0260 28.9602 28.0260 28.9602 (56)												
If cylinder contains dedicated solar storage												
28.9602 26.1576 28.9602 28.0260 28.9602 28.0260 28.9602 28.9602 28.0260 28.9602 28.0260 28.9602 (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												
218.8178 192.8740 202.5773 181.6209 177.9998 159.0741 152.7973 167.6335 167.3273 188.3293 199.1091 213.5612 (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	218.8178	192.8740	202.5773	181.6209	177.9998	159.0741	152.7973	167.6335	167.3273	188.3293	199.1091	213.5612 (64)
RHI water heating demand												2221.7215 (64)
Heat gains from water heating, kWh/month	97.1710	86.1820	91.7710	84.0155	83.5990	76.5187	75.2192	80.1522	79.2628	87.0335	89.8303	95.4231 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	171.6030	171.6030	171.6030	171.6030	171.6030	171.6030	171.6030	171.6030	171.6030	171.6030	171.6030	171.6030 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	63.3257	56.2453	45.7418	34.6295	25.8859	21.8540	23.6140	30.6944	41.1979	52.3102	61.0538	65.0857 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	424.0727	428.4732	417.3840	393.7763	363.9759	335.9676	317.2564	312.8559	323.9451	347.5528	377.3532	405.3615 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.0203	55.0203	55.0203	55.0203	55.0203	55.0203	55.0203	55.0203	55.0203	55.0203	55.0203	55.0203 (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)	-114.4020	-114.4020	-114.4020	-114.4020	-114.4020	-114.4020	-114.4020	-114.4020	-114.4020	-114.4020	-114.4020	-114.4020 (71)
Water heating gains (Table 5)	130.6062	128.2471	123.3482	116.6881	112.3642	106.2759	101.1010	107.7315	110.0873	116.9806	124.7643	128.2569 (72)
Total internal gains	733.2259	728.1869	701.6952	660.3153	617.4474	579.3189	557.1928	566.5031	590.4517	632.0649	678.3926	713.9254 (73)

6. Solar gains

[Jan]												
Area												
Solar flux												
Specific data												
Specific data												
Access factor												
Gains												
North	0.6600	12.7054	0.6300	0.7000	0.7700	2.5627 (74)						
East	10.5400	23.7288	0.6300	0.7000	0.7700	76.4343 (76)						
South	3.2900	53.5774	0.6300	0.7000	0.7700	53.8702 (78)						
West	17.2500	23.7288	0.6300	0.7000	0.7700	125.0941 (80)						
East	1.5600	32.5812	0.6300	0.7000	1.0000	20.1731 (82)						
West	2.0700	32.5812	0.6300	0.7000	1.0000	26.7682 (82)						
Solar gains	304.9026	517.6387	825.9651	1244.0563	1453.0946	1586.2661	1494.0050	1303.0113	1018.7724	649.4500	381.0799	244.3286 (83)
Total gains	1038.1285	1245.8256	1527.6603	1904.3715	2070.5419	2165.5850	2051.1978	1869.5144	1609.2241	1281.5149	1059.4726	958.2540 (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	16.4259	16.5159	16.5448	16.6809	16.6809	16.7556	16.7313	16.7794	16.7313	16.6548	16.6282	16.5448
alpha	2.0951	2.1011	2.1030	2.1121	2.1121	2.1170	2.1154	2.1186	2.1154	2.1103	2.1085	2.1030
util living area	0.9349	0.9077	0.8485	0.7377	0.6028	0.4421	0.3221	0.3398	0.5717	0.7918	0.9030	0.9419 (86)
MIT	18.7387	18.9782	19.4623	20.0368	20.4741	20.7317	20.8247	20.8213	20.6187	20.0788	19.3386	18.7270 (87)
Th 2	19.5472	19.5538	19.5560	19.5658	19.5658	19.5712	19.5695	19.5729	19.5695	19.5640	19.5620	19.5560 (88)
util rest of house	0.9235	0.8921	0.8230	0.6947	0.5355	0.3485	0.2032	0.2119	0.4746	0.7429	0.8830	0.9315 (89)
MIT 2	16.6409	16.9821	17.6613	18.4438	19.0015	19.2908	19.3683	19.3715	19.1904	18.5309	17.5086	16.6301 (90)
Living area fraction												
MIT	17.1505	17.4670	18.0988	18.8308	19.3592	19.6408	19.7221	19.7237	19.5374	18.9069	17.9531	17.1395 (92)
Temperature adjustment												0.0000
adjusted MIT	17.1505	17.4670	18.0988	18.8308	19.3592	19.6408	19.7221	19.7237	19.5374	18.9069	17.9531	17.1395 (93)

8. Space heating requirement

Utilisation	0.8974	0.8621	0.7906	0.6691	0.5248	0.3534	0.2166	0.2262	0.4722	0.7154	0.8528	0.9068 (94)
Useful gains	931.5801	1073.9682	1207.7717	1274.2092	1086.5191	765.2694	444.2383	422.9525	759.8658	916.7982	903.5426	868.9585 (95)
Ext temp.	5.0000	5.4000	7.1000	9.5000	12.6000	15.4000	17.4000	17.5000	15.0000	11.7000	8.1000	5.2000 (96)
Heat loss rate W	2448.6661	2418.5950	2200.6440	1851.6640	1341.3491	837.8293	459.4314	438.6903	897.7124	1432.4381	1961.5273	2388.8601 (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												

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CALCULATION OF HEAT DEMAND 09 Jan 2014

	1128.7120	903.5893	738.6970	415.7674	189.5935	0.0000	0.0000	0.0000	0.0000	383.6361	761.7489	1130.8068 (98)
Space heating												5652.5510 (98)
RHI space heating demand												5653 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Design SAP
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CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	119.1700 (1b)	x 2.6100 (2b)	= 311.0337 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	119.1700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 311.0337 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)
Number of intermittent fans				4 * 10 =	40.0000 (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				40.0000 / (5) =	0.1286 (8)
Measured/design AP50				Yes	5.0000
Infiltration rate					0.3786 (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) =	0.3502 (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	0.4465	0.4378	0.4290	0.3852	0.3765	0.3327	0.3327	0.3239	0.3502	0.3765	0.3940	0.4115 (22b)
	0.5997	0.5958	0.5920	0.5742	0.5709	0.5553	0.5553	0.5525	0.5613	0.5709	0.5776	0.5847 (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
Front Door			2.2100	1.6000	3.5360		(26)
Personnel Door			1.6600	1.8000	2.9880		(26)
Windows (Uw = 1.40)			31.7400	1.3258	42.0795		(27)
Roof Windows (Uw = 1.40)			3.6300	1.3258	4.8125		(27a)
Ground Floor			119.1700	0.1200	14.3004		(28a)
Brick	82.5500	30.3800	52.1700	0.2100	10.9557		(29a)
Stone Clad	30.2400	3.5700	26.6700	0.2100	5.6007		(29a)
Wall to Garage	14.4500	1.6600	12.7900	0.4500	5.7555		(29a)
Wall to voids	31.4700		31.4700	0.2979	9.3740		(29a)
Pitched Roof	82.4400		82.4400	0.1000	8.2440		(30)
Skeillins	44.1000	3.6300	40.4700	0.1900	7.6893		(30)
Skeillin at Roof	16.2700		16.2700	0.1900	3.0913		(30)
Total net area of external elements Aum(A, m ²)			420.6900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	118.4270		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							100.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							22.7162 (36)
Total fabric heat loss						(33) + (36) =	141.1432 (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	61.5526	61.1553	60.7659	58.9366	58.5944	57.0011	57.0011	56.7061	57.6148	58.5944	59.2867	60.0106 (38)
Heat transfer coeff	202.6958	202.2985	201.9091	200.0798	199.7375	198.1443	198.1443	197.8493	198.7580	199.7375	200.4299	201.1537 (39)
Average = Sum(39)m / 12 =												200.0782 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.7009	1.6976	1.6943	1.6789	1.6761	1.6627	1.6627	1.6602	1.6679	1.6761	1.6819	1.6880 (40)
HLP (average)												1.6789 (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												2.8600 (42)
Average daily hot water use (litres/day)												102.1262 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	112.3388	108.2538	104.1687	100.0837	95.9986	91.9136	91.9136	95.9986	100.0837	104.1687	108.2538	112.3388 (44)
Energy conte	166.5952	145.7052	150.3547	131.0829	125.7772	108.5361	100.5747	115.4109	116.7893	136.1067	148.5711	161.3386 (45)
Energy content (annual)										Total = Sum(45)m =		1606.8425 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Design SAP
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CALCULATION OF ENERGY RATINGS 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	24.9893	21.8558	22.5532	19.6624	18.8666	16.2804	15.0862	17.3116	17.5184	20.4160	22.2857	24.2008 (46)
Water storage loss:												
Store volume												215.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.7300 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.9342 (55)
Total storage loss												
28.9602 26.1576 28.9602 28.0260 28.9602 28.0260 28.9602 28.9602 28.0260 28.9602 28.0260 28.9602 28.9602 (56)												
If cylinder contains dedicated solar storage												
28.9602 26.1576 28.9602 28.0260 28.9602 28.0260 28.9602 28.9602 28.0260 28.9602 28.0260 28.9602 28.9602 (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												
218.8178 192.8740 202.5773 181.6209 177.9998 159.0741 152.7973 167.6335 167.3273 188.3293 199.1091 213.5612 (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	218.8178	192.8740	202.5773	181.6209	177.9998	159.0741	152.7973	167.6335	167.3273	188.3293	199.1091	213.5612 (64)
Total per year (kWh/year) = Sum(64)m =												2221.7215 (64)
Heat gains from water heating, kWh/month												
97.1710 86.1820 91.7710 84.0155 83.5990 76.5187 75.2192 80.1522 79.2628 87.0335 89.8303 95.4231 (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	171.6030	171.6030	171.6030	171.6030	171.6030	171.6030	171.6030	171.6030	171.6030	171.6030	171.6030	171.6030	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
63.3257 56.2453 45.7418 34.6295 25.8859 21.8540 23.6140 30.6944 41.1979 52.3102 61.0538 65.0857 (67)													
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
424.0727 428.4732 417.3840 393.7763 363.9759 335.9676 317.2564 312.8559 323.9451 347.5528 377.3532 405.3615 (68)													
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
55.0203 55.0203 55.0203 55.0203 55.0203 55.0203 55.0203 55.0203 55.0203 55.0203 55.0203 55.0203 (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)													
-114.4020 -114.4020 -114.4020 -114.4020 -114.4020 -114.4020 -114.4020 -114.4020 -114.4020 -114.4020 -114.4020 -114.4020 (71)													
Water heating gains (Table 5)													
130.6062 128.2471 123.3482 116.6881 112.3642 106.2759 101.1010 107.7315 110.0873 116.9806 124.7643 128.2569 (72)													
Total internal gains	733.2259	728.1869	701.6952	660.3153	617.4474	579.3189	557.1928	566.5031	590.4517	632.0649	678.3926	713.9254 (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					0.6600	10.6334		0.6300	0.7000	0.7700		2.1448 (74)
East					10.5400	19.6403		0.6300	0.6300	0.7700		63.2645 (76)
South					3.2900	46.7521		0.6300	0.7000	0.7700		47.0076 (78)
West					17.2500	19.6403		0.6300	0.7000	0.7700		103.5400 (80)
East					1.5600	26.6725		0.6300	0.7000	1.0000		16.5147 (82)
West					2.0700	26.6725		0.6300	0.7000	1.0000		21.9137 (82)
Solar gains	254.3853	485.3852	777.8296	1114.1510	1356.1048	1386.1049	1320.3600	1138.9059	896.8563	569.4890	314.7745	210.8557 (83)
Total gains	987.6112	1213.5721	1479.5249	1774.4663	1973.5522	1965.4238	1877.5528	1705.4090	1487.3080	1201.5539	993.1671	924.7811 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
tau	16.3313	16.3633	16.3949	16.5448	16.5731	16.7064	16.7064	16.7313	16.6548	16.5731	16.5159	16.4565	
alpha	2.0888	2.0909	2.0930	2.1030	2.1049	2.1138	2.1138	2.1154	2.1103	2.1049	2.1011	2.0971	
util living area	0.9447	0.9164	0.8651	0.7754	0.6572	0.5234	0.4102	0.4569	0.6506	0.8370	0.9232	0.9512 (86)	
MIT	18.5573	18.8455	19.3139	19.8802	20.3402	20.6453	20.7769	20.7489	20.4887	19.8543	19.0986	18.5038 (87)	
Th 2	19.5402	19.5426	19.5449	19.5560	19.5580	19.5677	19.5677	19.5695	19.5640	19.5580	19.5538	19.5495 (88)	
util rest of house	0.9352	0.9025	0.8425	0.7375	0.5978	0.4352	0.2942	0.3384	0.5676	0.7998	0.9079	0.9427 (89)	
MIT 2	16.3772	16.7874	17.4479	18.2312	18.8332	19.2044	19.3342	19.3161	19.0438	18.2256	17.1634	16.3053 (90)	
Living area fraction												0.2429 (91)	
MIT	16.9068	17.2874	17.9012	18.6318	19.1993	19.5545	19.6846	19.6642	19.3948	18.6213	17.6335	16.8394 (92)	
Temperature adjustment												0.0000	
adjusted MIT	16.9068	17.2874	17.9012	18.6318	19.1993	19.5545	19.6846	19.6642	19.3948	18.6213	17.6335	16.8394 (93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
0.9111 0.8733 0.8099 0.7086 0.5810 0.4343 0.3044 0.3470 0.5563 0.7690 0.8798 0.9202 (94)													
Useful gains	899.7666	1059.8021	1198.3058	1257.4112	1146.6771	853.6809	571.5511	591.7507	827.3380	924.0065	873.8010	850.9954 (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	2555.3543	2505.9459	2302.0091	1947.1385	1497.8976	981.7007	611.2044	645.8158	1052.3835	1602.1471	2111.2343	2542.4540 (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	1231.7572	971.8086	821.1552	496.6037	261.3080	0.0000	0.0000	0.0000	0.0000	504.5366	890.9520	1258.4452 (98)	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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elmhurst energy

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Space heating
Space heating per m2

6436.5666 (98)
(98) / (4) = 54.0116 (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 %)													170.0000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3786.2157 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1231.7572	971.8086	821.1552	496.6037	261.3080	0.0000	0.0000	0.0000	0.0000	504.5366	890.9520	1258.4452	(98)
Space heating efficiency (main heating system 1)	170.0000	170.0000	170.0000	170.0000	170.0000	0.0000	0.0000	0.0000	0.0000	170.0000	170.0000	170.0000	(210)
Space heating fuel (main heating system)	724.5631	571.6521	483.0325	292.1198	153.7106	0.0000	0.0000	0.0000	0.0000	296.7862	524.0894	740.2619	(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	218.8178	192.8740	202.5773	181.6209	177.9998	159.0741	152.7973	167.6335	167.3273	188.3293	199.1091	213.5612	(64)
Efficiency of water heater (217)m	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	(216)
Fuel for water heating, kWh/month	128.7164	113.4553	119.1631	106.8358	104.7057	93.5730	89.8808	98.6080	98.4278	110.7819	117.1230	125.6242	(219)
Water heating fuel used												1306.8950	(219)
Annual totals kWh/year													
Space heating fuel - main system												3786.2157	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
Total electricity for the above, kWh/year												30.0000	(231)
Electricity for lighting (calculated in Appendix L)												447.3406	(232)
Total delivered energy for all uses												5570.4513	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3786.2157	13.1900	499.4018 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1306.8950	13.1900	172.3795 (247)
Pumps and fans for heating	30.0000	13.1900	3.9570 (249)
Energy for lighting	447.3406	13.1900	59.0042 (250)
Additional standing charges			0.0000 (251)
Total energy cost			734.7425 (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] =	1.8797 (257)
SAP value		73.7781
SAP rating (Section 12)		74 (258)
SAP band		C

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	3786.2157	0.5190	1965.0459 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1306.8950	0.5190	678.2785 (264)
Space and water heating			2643.3244 (265)
Pumps and fans	30.0000	0.5190	15.5700 (267)
Energy for lighting	447.3406	0.5190	232.1698 (268)
Total kg/year			2891.0642 (272)
CO2 emissions per m2			24.2600 (273)
EI value			76.4024
EI rating			76 (274)
EI band			C

Calculation of stars for heating and DHW

Main heating energy efficiency	13.19 x (1 + 0.29 x 0.25) / 1.7000 = 8.321, stars = 2
Main heating environmental impact	0.519 x (1 + 0.29 x 0.25) / 1.7000 = 0.3274, stars = 4
Water heating energy efficiency	13.19 / 1.7000 = 7.759, stars = 2

Regs Region: England
Elmhurst Energy Systems
SAP2012 Calculator (Design
System) version 4.14r19

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

Water heating environmental impact

$0.519 / 1.7000 = 0.3053$, stars = 4

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Design SAP
elmhurst energy

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	119.1700 (1b)	x 2.6100 (2b)	= 311.0337 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	119.1700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	311.0337 (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				4 * 10 =	40.0000 (7a)
Number of passive vents				0 * 10 =	0.0000 (7b)
Number of flueless gas fires				0 * 40 =	0.0000 (7c)
Air changes per hour					
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				40.0000 / (5) =	0.1286 (8)
Pressure test				Yes	
Measured/design AP50				5.0000	
Infiltration rate				0.3786 (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) =		0.3502 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.8000	4.5000	4.4000	3.9000	3.9000	3.6000	3.7000	3.5000	3.7000	4.0000	4.1000	4.4000 (22)
Wind factor	1.2000	1.1250	1.1000	0.9750	0.9750	0.9000	0.9250	0.8750	0.9250	1.0000	1.0250	1.1000 (22a)
Adj infilt rate	0.4202	0.3940	0.3852	0.3415	0.3415	0.3152	0.3239	0.3064	0.3239	0.3502	0.3590	0.3852 (22b)
Effective ac	0.5883	0.5776	0.5742	0.5583	0.5583	0.5497	0.5525	0.5470	0.5525	0.5613	0.5644	0.5742 (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
Front Door			2.2100	1.6000	3.5360		(26)
Personnel Door			1.6600	1.8000	2.9880		(26)
Windows (Uw = 1.40)			31.7400	1.3258	42.0795		(27)
Roof Windows (Uw = 1.40)			3.6300	1.3258	4.8125		(27a)
Ground Floor			119.1700	0.1200	14.3004		(28a)
Brick	82.5500	30.3800	52.1700	0.2100	10.9557		(29a)
Stone Clad	30.2400	3.5700	26.6700	0.2100	5.6007		(29a)
Wall to Garage	14.4500	1.6600	12.7900	0.4500	5.7555		(29a)
Wall to voids	31.4700		31.4700	0.2979	9.3740		(29a)
Pitched Roof	82.4400		82.4400	0.1000	8.2440		(30)
Skeillins	44.1000	3.6300	40.4700	0.1900	7.6893		(30)
Skeillin at Roof	16.2700		16.2700	0.1900	3.0913		(30)
Total net area of external elements Aum(A, m ²)			420.6900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	118.4270		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							100.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							22.7162 (36)
Total fabric heat loss						(33) + (36) =	141.1432 (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	60.3843	59.2867	58.9366	57.3040	57.3040	56.4189	56.7061	56.1396	56.7061	57.6148	57.9335	58.9366 (38)
Heat transfer coeff	201.5275	200.4299	200.0798	198.4472	198.4472	197.5621	197.8493	197.2828	197.8493	198.7580	199.0766	200.0798 (39)
Average = Sum(39)m / 12 =												198.9491 (39)
HLP	1.6911	1.6819	1.6789	1.6652	1.6652	1.6578	1.6602	1.6555	1.6602	1.6679	1.6705	1.6789 (40)
HLP (average)												1.6695 (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												2.8600 (42)
Average daily hot water use (litres/day)												102.1262 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.3388	108.2538	104.1687	100.0837	95.9986	91.9136	91.9136	95.9986	100.0837	104.1687	108.2538	112.3388 (44)
Energy conte	166.5952	145.7052	150.3547	131.0829	125.7772	108.5361	100.5747	115.4109	116.7893	136.1067	148.5711	161.3386 (45)
Energy content (annual)										Total = Sum(45)m =		1606.8425 (45)

Regs Region: England

Elmhurst Energy Systems

SAP2012 Calculator (Design

System) version 4.14r19

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Design SAP
elmhurst energy

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

Distribution loss (46)m = 0.15 x (45)m	24.9893	21.8558	22.5532	19.6624	18.8666	16.2804	15.0862	17.3116	17.5184	20.4160	22.2857	24.2008 (46)
Water storage loss:												
Store volume												215.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.7300 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.9342 (55)
Total storage loss												
28.9602 26.1576 28.9602 28.0260 28.9602 28.0260 28.9602 28.9602 28.0260 28.9602 28.0260 28.9602 28.9602 (56)												
If cylinder contains dedicated solar storage												
28.9602 26.1576 28.9602 28.0260 28.9602 28.0260 28.9602 28.9602 28.0260 28.9602 28.0260 28.9602 28.9602 (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												
218.8178 192.8740 202.5773 181.6209 177.9998 159.0741 152.7973 167.6335 167.3273 188.3293 199.1091 213.5612 (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	218.8178	192.8740	202.5773	181.6209	177.9998	159.0741	152.7973	167.6335	167.3273	188.3293	199.1091	213.5612 (64)
Total per year (kWh/year) = Sum(64)m =												2221.7215 (64)
Heat gains from water heating, kWh/month												
97.1710 86.1820 91.7710 84.0155 83.5990 76.5187 75.2192 80.1522 79.2628 87.0335 89.8303 95.4231 (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	171.6030	171.6030	171.6030	171.6030	171.6030	171.6030	171.6030	171.6030	171.6030	171.6030	171.6030	171.6030	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
63.3257 56.2453 45.7418 34.6295 25.8859 21.8540 23.6140 30.6944 41.1979 52.3102 61.0538 65.0857 (67)													
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
424.0727 428.4732 417.3840 393.7763 363.9759 335.9676 317.2564 312.8559 323.9451 347.5528 377.3532 405.3615 (68)													
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
55.0203 55.0203 55.0203 55.0203 55.0203 55.0203 55.0203 55.0203 55.0203 55.0203 55.0203 55.0203 (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)													
-114.4020 -114.4020 -114.4020 -114.4020 -114.4020 -114.4020 -114.4020 -114.4020 -114.4020 -114.4020 -114.4020 -114.4020 (71)													
Water heating gains (Table 5)													
130.6062 128.2471 123.3482 116.6881 112.3642 106.2759 101.1010 107.7315 110.0873 116.9806 124.7643 128.2569 (72)													
Total internal gains	733.2259	728.1869	701.6952	660.3153	617.4474	579.3189	557.1928	566.5031	590.4517	632.0649	678.3926	713.9254 (73)	

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	PF Specific data or Table 6c	Access factor Table 6d	Gains W
North	0.6600	12.7054	0.6300	0.7000	0.7700	2.5627 (74)
East	10.5400	23.7288	0.6300	0.7000	0.7700	76.4343 (76)
South	3.2900	53.5774	0.6300	0.7000	0.7700	53.8702 (78)
West	17.2500	23.7288	0.6300	0.7000	0.7700	125.0941 (80)
East	1.5600	32.5812	0.6300	0.7000	1.0000	20.1731 (82)
West	2.0700	32.5812	0.6300	0.7000	1.0000	26.7682 (82)

Solar gains	304.9026	517.6387	825.9651	1244.0563	1453.0946	1586.2661	1494.0050	1303.0113	1018.7724	649.4500	381.0799	244.3286 (83)
Total gains	1038.1285	1245.8256	1527.6603	1904.3715	2070.5419	2165.5850	2051.1978	1869.5144	1609.2241	1281.5149	1059.4726	958.2540 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
tau	16.4259	16.5159	16.5448	16.6809	16.6809	16.7556	16.7313	16.7794	16.7313	16.6548	16.6282	16.5448	
alpha	2.0951	2.1011	2.1030	2.1121	2.1121	2.1170	2.1154	2.1186	2.1154	2.1103	2.1085	2.1030	
util living area	0.9349	0.9077	0.8485	0.7377	0.6028	0.4421	0.3221	0.3398	0.5717	0.7918	0.9030	0.9419 (86)	
MIT	18.7387	18.9782	19.4623	20.0368	20.4741	20.7317	20.8247	20.8213	20.6187	20.0788	19.3386	18.7270 (87)	
Th 2	19.5472	19.5538	19.5560	19.5658	19.5658	19.5712	19.5695	19.5729	19.5695	19.5640	19.5620	19.5560 (88)	
util rest of house	0.9235	0.8921	0.8230	0.6947	0.5355	0.3485	0.2032	0.2119	0.4746	0.7429	0.8830	0.9315 (89)	
MIT 2	16.6409	16.9821	17.6613	18.4438	19.0015	19.2908	19.3683	19.3715	19.1904	18.5309	17.5086	16.6301 (90)	
Living area fraction												0.2429 (91)	
MIT	17.1505	17.4670	18.0988	18.8308	19.3592	19.6408	19.7221	19.7237	19.5374	18.9069	17.9531	17.1395 (92)	
Temperature adjustment												0.0000	
adjusted MIT	17.1505	17.4670	18.0988	18.8308	19.3592	19.6408	19.7221	19.7237	19.5374	18.9069	17.9531	17.1395 (93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
0.8974 0.8621 0.7906 0.6691 0.5248 0.3534 0.2166 0.2262 0.4722 0.7154 0.8528 0.9068 (94)													
Useful gains	931.5801	1073.9682	1207.7717	1274.2092	1086.5191	765.2694	444.2383	422.9525	759.8658	916.7982	903.5426	868.9585 (95)	
Ext temp.	5.0000	5.4000	7.1000	9.5000	12.6000	15.4000	17.4000	17.5000	15.0000	11.7000	8.1000	5.2000 (96)	
Heat loss rate W	2448.6661	2418.5950	2200.6440	1851.6640	1341.3491	837.8293	459.4314	438.6903	897.7124	1432.4381	1961.5273	2388.8601 (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	1128.7120	903.5893	738.6970	415.7674	189.5935	0.0000	0.0000	0.0000	0.0000	383.6361	761.7489	1130.8068 (98)	

Regs Region: England
Elmhurst Energy Systems
SAP2012 Calculator (Design
System) version 4.14r19

FULL SAP CALCULATION PRINTOUT

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

Space heating
Space heating per m2

5652.5510 (98)
(98) / (4) = 47.4327 (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 %)																170.0000 (206)
Efficiency of secondary/supplementary heating system, %																0.0000 (208)
Space heating requirement																3325.0300 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec				
Space heating requirement	1128.7120	903.5893	738.6970	415.7674	189.5935	0.0000	0.0000	0.0000	0.0000	383.6361	761.7489	1130.8068	(98)			
Space heating efficiency (main heating system 1)	170.0000	170.0000	170.0000	170.0000	170.0000	0.0000	0.0000	0.0000	0.0000	170.0000	170.0000	170.0000	(210)			
Space heating fuel (main heating system)	663.9483	531.5231	434.5276	244.5691	111.5256	0.0000	0.0000	0.0000	0.0000	225.6683	448.0876	665.1805	(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	218.8178	192.8740	202.5773	181.6209	177.9998	159.0741	152.7973	167.6335	167.3273	188.3293	199.1091	213.5612	(64)			
Efficiency of water heater (217)m	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	(216)			
Fuel for water heating, kWh/month	128.7164	113.4553	119.1631	106.8358	104.7057	93.5730	89.8808	98.6080	98.4278	110.7819	117.1230	125.6242	(219)			
Water heating fuel used												1306.8950	(219)			
Annual totals kWh/year																
Space heating fuel - main system												3325.0300	(211)			
Space heating fuel - secondary												0.0000	(215)			
Electricity for pumps and fans:																
central heating pump												30.0000	(230c)			
Total electricity for the above, kWh/year												30.0000	(231)			
Electricity for lighting (calculated in Appendix L)												447.3406	(232)			
Total delivered energy for all uses												5109.2657	(238)			

10a. Fuel costs - using BEDF prices (493)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3325.0300	19.4400	646.3858 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1306.8950	19.4400	254.0604 (247)
Pumps and fans for heating	30.0000	19.4400	5.8320 (249)
Energy for lighting	447.3406	19.4400	86.9630 (250)
Additional standing charges			0.0000 (251)
Total energy cost			993.2412 (255)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	3325.0300	0.5190	1725.6906 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1306.8950	0.5190	678.2785 (264)
Space and water heating			2403.9691 (265)
Pumps and fans	30.0000	0.5190	15.5700 (267)
Energy for lighting	447.3406	0.5190	232.1698 (268)
Total kg/year			2651.7089 (272)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	3325.0300	3.0700	10207.8422 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1306.8950	3.0700	4012.1677 (264)
Space and water heating			14220.0099 (265)
Pumps and fans	30.0000	3.0700	92.1000 (267)
Energy for lighting	447.3406	3.0700	1373.3358 (268)
Primary energy kWh/year			15685.4456 (272)
Primary energy kWh/m2/year			131.6224 (273)

SAP 2012 EPC IMPROVEMENTS

Regs Region: England
Elmhurst Energy Systems
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FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Current energy efficiency rating: C 74
Current environmental impact rating: C 76

(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	Recommended
O	Not considered
P	Not considered
R	Not considered
S	Not considered
T	Not considered
U Solar photovoltaic panels	Recommended
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
N Solar water heating	+ 2.4	-£ 102	-272 kg (10.3%)
U Solar photovoltaic panels	+ 8.1	-£ 375	-1000 kg (42.0%)

	Typical annual savings	Energy efficiency	Environmental impact
Recommended measures			
Solar water heating	£102	2.28 kg/m²	C 76 C 79
Solar photovoltaic panels	£375	8.39 kg/m²	B 84 B 86
Total Savings	£477	10.68 kg/m²	

Potential energy efficiency rating: B 84
Potential environmental impact rating: B 86

Fuel prices for cost data on this page from database revision number 493 TEST (31 Mar 2022)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, South East England):

	Current £993	Potential £891	Saving £102
Electricity			
Space heating	£652	£653	-£0
Water heating	£254	£152	£102
Lighting	£87	£87	£0
Generated (PV)	-£0	-£375	£375
Total cost of fuels	£993	£516	£477
Total cost of uses	£993	£517	£477
Delivered energy	43 kWh/m²	22 kWh/m²	21 kWh/m²
Carbon dioxide emissions	2.7 tonnes	1.4 tonnes	1.3 tonnes
CO2 emissions per m²	22 kg/m²	12 kg/m²	11 kg/m²
Primary energy	132 kWh/m²	68 kWh/m²	63 kWh/m²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	119.1700 (1b)	x 2.6100 (2b)	= 311.0337 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	119.1700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	311.0337 (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					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
					Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.1286 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3786 (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) =	0.3502 (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	0.4465	0.4378	0.4290	0.3852	0.3765	0.3327	0.3327	0.3239	0.3502	0.3765	0.3940	0.4115 (22b)
	0.5997	0.5958	0.5920	0.5742	0.5709	0.5553	0.5553	0.5525	0.5613	0.5709	0.5776	0.5847 (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
Front Door			2.2100	1.6000	3.5360		(26)
Personnel Door			1.6600	1.8000	2.9880		(26)
Windows (Uw = 1.40)			31.7400	1.3258	42.0795		(27)
Roof Windows (Uw = 1.40)			3.6300	1.3258	4.8125		(27a)
Ground Floor			119.1700	0.1200	14.3004		(28a)
Brick	82.5500	30.3800	52.1700	0.2100	10.9557		(29a)
Stone Clad	30.2400	3.5700	26.6700	0.2100	5.6007		(29a)
Wall to Garage	14.4500	1.6600	12.7900	0.4500	5.7555		(29a)
Wall to voids	31.4700		31.4700	0.2979	9.3740		(29a)
Pitched Roof	82.4400		82.4400	0.1000	8.2440		(30)
Skeillins	44.1000	3.6300	40.4700	0.1900	7.6893		(30)
Skeillin at Roof	16.2700		16.2700	0.1900	3.0913		(30)
Total net area of external elements Aum(A, m ²)			420.6900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	118.4270		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							100.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							22.7162 (36)
Total fabric heat loss						(33) + (36) =	141.1432 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 61.5526	Feb 61.1553	Mar 60.7659	Apr 58.9366	May 58.5944	Jun 57.0011	Jul 57.0011	Aug 56.7061	Sep 57.6148	Oct 58.5944	Nov 59.2867	Dec 60.0106 (38)
Heat transfer coeff	202.6958	202.2985	201.9091	200.0798	199.7375	198.1443	198.1443	197.8493	198.7580	199.7375	200.4299	201.1537 (39)
Average = Sum(39)m / 12 =												200.0782 (39)
HLP	Jan 1.7009	Feb 1.6976	Mar 1.6943	Apr 1.6789	May 1.6761	Jun 1.6627	Jul 1.6627	Aug 1.6602	Sep 1.6679	Oct 1.6761	Nov 1.6819	Dec 1.6880 (40)
HLP (average)												1.6789 (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												2.8600 (42)
Average daily hot water use (litres/day)												102.1262 (43)
Daily hot water use	Jan 112.3388	Feb 108.2538	Mar 104.1687	Apr 100.0837	May 95.9986	Jun 91.9136	Jul 91.9136	Aug 95.9986	Sep 100.0837	Oct 104.1687	Nov 108.2538	Dec 112.3388 (44)
Energy conte	166.5952	145.7052	150.3547	131.0829	125.7772	108.5361	100.5747	115.4109	116.7893	136.1067	148.5711	161.3386 (45)
Energy content (annual)										Total = Sum(45)m =		1606.8425 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Design SAP
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CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	24.9893	21.8558	22.5532	19.6624	18.8666	16.2804	15.0862	17.3116	17.5184	20.4160	22.2857	24.2008 (46)
Water storage loss:												
Store volume												215.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.7300 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.9342 (55)
Total storage loss												
28.9602 26.1576 28.9602 28.0260 28.9602 28.0260 28.9602 28.9602 28.0260 28.9602 28.0260 28.9602 (56)												
If cylinder contains dedicated solar storage												
28.9602 26.1576 28.9602 28.0260 28.9602 28.0260 28.9602 28.0260 28.9602 28.0260 28.9602 (57)												
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month												
218.8178 192.8740 201.1816 174.8673 165.2054 146.4674 139.7703 155.5371 161.9244 186.9335 199.1091 213.5612 (62)												
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.7000 (H2)
Collector heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0050 (H3a)
Collector effective heat loss coefficient												1.8063 (H3b)
Collector performance ratio												2.5804 (H4)
Annual solar radiation per m2												1079.5246 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												1813.6014 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.1287 (H8)
Utilisation factor												0.5877 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												102.1262 (H14)
Volume ratio Veff/V												0.7344 (H15)
Solar storage volume factor												0.9383 (H16)
Solar input												-879.3262 (H17)
Solar input	-25.4987	-42.5500	-72.4675	-97.1208	-119.9845	-117.9639	-116.4050	-101.7036	-79.6543	-54.3945	-30.2451	-21.3381 (63)
Solar input (sum of months) = Sum(63)m =												-879.3262 (63)
Output from w/h												
193.3191 150.3240 128.7141 77.7465 45.2209 28.5035 23.3654 53.8335 82.2701 132.5390 168.8639 192.2231 (64)												
Total per year (kWh/year) = Sum(64)m =												1276.9230 (64)
Heat gains from water heating, kWh/month												
97.1710 86.1820 90.6544 78.6126 73.3635 66.4333 64.7976 70.4751 74.9405 85.9169 89.8303 95.4231 (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)												
(66)m 171.6030 171.6030 171.6030 171.6030 171.6030 171.6030 171.6030 171.6030 171.6030 171.6030 171.6030 171.6030 (66)												
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
63.3257 56.2453 45.7418 34.6295 25.8859 21.8540 23.6140 30.6944 41.1979 52.3102 61.0538 65.0857 (67)												
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
424.0727 428.4732 417.3840 393.7763 363.9759 335.9676 317.2564 312.8559 323.9451 347.5528 377.3532 405.3615 (68)												
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
55.0203 55.0203 55.0203 55.0203 55.0203 55.0203 55.0203 55.0203 55.0203 55.0203 55.0203 55.0203 (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)												
-114.4020 -114.4020 -114.4020 -114.4020 -114.4020 -114.4020 -114.4020 -114.4020 -114.4020 -114.4020 -114.4020 -114.4020 (71)												
Water heating gains (Table 5)												
130.6062 128.2471 121.8474 109.1841 98.6069 92.2685 87.0936 94.7245 104.0841 115.4798 124.7643 128.2569 (72)												
Total internal gains												
733.2259 728.1869 700.1944 652.8113 603.6900 565.3114 543.1853 553.4961 584.4485 630.5641 678.3926 713.9254 (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	0.6600	10.6334	0.6300	0.7000	0.7700	2.1448 (74)
East	10.5400	19.6403	0.6300	0.7000	0.7700	63.2645 (76)
South	3.2900	46.7521	0.6300	0.7000	0.7700	47.0076 (78)
West	17.2500	19.6403	0.6300	0.7000	0.7700	103.5400 (80)
East	1.5600	26.6725	0.6300	0.7000	1.0000	16.5147 (82)
West	2.0700	26.6725	0.6300	0.7000	1.0000	21.9137 (82)

Solar gains	254.3853	485.3852	777.8296	1114.1510	1356.1048	1386.1049	1320.3600	1138.9059	896.8563	569.4890	314.7745	210.8557 (83)
Total gains	987.6112	1213.5721	1478.0241	1766.9623	1959.7948	1951.4163	1863.5453	1692.4020	1481.3048	1200.0531	993.1671	924.7811 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec												
tau 16.3313 16.3633 16.3949 16.5448 16.5731 16.7064 16.7064 16.7313 16.6548 16.5731 16.5159 16.4565												
alpha 2.0888 2.0909 2.0930 2.1030 2.1049 2.1138 2.1138 2.1154 2.1103 2.1049 2.1011 2.0971												
util living area												
0.9447 0.9164 0.8653 0.7766 0.6596 0.5260 0.4127 0.4595 0.6520 0.8373 0.9232 0.9512 (86)												
MIT 18.5573 18.8455 19.3130 19.8767 20.3361 20.6431 20.7757 20.7474 20.4870 19.8534 19.0986 18.5038 (87)												
Th 2 19.5402 19.5426 19.5449 19.5560 19.5580 19.5677 19.5677 19.5695 19.5640 19.5580 19.5538 19.5495 (88)												
util rest of house												
0.9352 0.9025 0.8427 0.7388 0.6003 0.4376 0.2961 0.3406 0.5690 0.8001 0.9079 0.9427 (89)												
MIT 2 16.3772 16.7874 17.4466 18.2268 18.8286 19.2025 19.3335 19.3152 19.0420 18.2245 17.1634 16.3053 (90)												
Living area fraction												FLA = Living area / (4) = 0.2429 (91)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

MIT	16.9068	17.2874	17.9000	18.6276	19.1948	19.5524	19.6839	19.6632	19.3931	18.6202	17.6335	16.8394 (92)
Temperature adjustment												0.0000
adjusted MIT	16.9068	17.2874	17.9000	18.6276	19.1948	19.5524	19.6839	19.6632	19.3931	18.6202	17.6335	16.8394 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9111	0.8733	0.8102	0.7099	0.5833	0.4366	0.3064	0.3491	0.5576	0.7693	0.8798	0.9202 (94)
Useful gains	899.7666	1059.8021	1197.4357	1254.2820	1143.1824	852.0143	570.9096	590.9004	825.9779	923.2420	873.8010	850.9954 (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	2555.3543	2505.9459	2301.7680	1946.2947	1497.0026	981.2994	611.0517	645.6125	1052.0378	1601.9374	2111.2343	2542.4540 (97)
Month fractl	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	1231.7572	971.8086	821.6232	498.2492	263.2422	0.0000	0.0000	0.0000	0.0000	504.9494	890.9520	1258.4452 (98)
Space heating												6441.0271 (98)
Space heating per m2											(98) / (4) =	54.0491 (99)

8c. Space cooling requirement

Not applicable

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

[illegible]

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price £/kWh	Fuel cost £/year
Space heating - main system 1	3788.8394	13.1900	499.7479 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	751.1312	13.1900	99.0742 (247)
Pumps and fans for heating	30.0000	13.1900	3.9570 (249)
Pump for solar water heating	50.0000	13.1900	6.5950 (249)
Energy for lighting	447.3406	13.1900	59.0042 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit	-1727.2394	13.1900	-227.8229 (252)
Total energy cost			440.5555 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	1.1271	(257)
SAP value		84.2772	
SAP rating (Section 12)		B4	(258)
SAP band		B	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Design SAP
elmhurst energy

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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	3788.8394	0.5190	1966.4077	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	751.1312	0.5190	389.8371	(264)
Space and water heating			2356.2447	(265)
Pumps and fans	80.0000	0.5190	41.5200	(267)
Energy for lighting	447.3406	0.5190	232.1698	(268)
Energy saving/generation technologies				
FV Unit	-1727.2394	0.5190	-896.4372	(269)
Total kg/year			1733.4973	(272)
CO2 emissions per m2			14.5500	(273)
EI value			85.8507	
EI rating			86	(274)
EI band			B	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	119.1700 (1b)	x 2.6100 (2b)	= 311.0337 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	119.1700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	311.0337 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)
Number of intermittent fans				4 * 10 =	40.0000 (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					40.0000 / (5) =
Measured/design AP50					Yes
Infiltration rate					5.0000
Number of sides sheltered					0.3786 (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) =				0.3502 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.8000	4.5000	4.4000	3.9000	3.9000	3.6000	3.7000	3.5000	3.7000	4.0000	4.1000	4.4000 (22)
Wind factor	1.2000	1.1250	1.1000	0.9750	0.9750	0.9000	0.9250	0.8750	0.9250	1.0000	1.0250	1.1000 (22a)
Adj infilt rate	0.4202	0.3940	0.3852	0.3415	0.3415	0.3152	0.3239	0.3064	0.3239	0.3502	0.3590	0.3852 (22b)
Effective ac	0.5883	0.5776	0.5742	0.5583	0.5583	0.5497	0.5525	0.5470	0.5525	0.5613	0.5644	0.5742 (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
Front Door			2.2100	1.6000	3.5360		(26)
Personnel Door			1.6600	1.8000	2.9880		(26)
Windows (Uw = 1.40)			31.7400	1.3258	42.0795		(27)
Roof Windows (Uw = 1.40)			3.6300	1.3258	4.8125		(27a)
Ground Floor			119.1700	0.1200	14.3004		(28a)
Brick	82.5500	30.3800	52.1700	0.2100	10.9557		(29a)
Stone Clad	30.2400	3.5700	26.6700	0.2100	5.6007		(29a)
Wall to Garage	14.4500	1.6600	12.7900	0.4500	5.7555		(29a)
Wall to voids	31.4700		31.4700	0.2979	9.3740		(29a)
Pitched Roof	82.4400		82.4400	0.1000	8.2440		(30)
Skeillins	44.1000	3.6300	40.4700	0.1900	7.6893		(30)
Skeillin at Roof	16.2700		16.2700	0.1900	3.0913		(30)
Total net area of external elements Aum(A, m ²)			420.6900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	118.4270		(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 100.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 22.7162 (36)
Total fabric heat loss (33) + (36) = 141.1432 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 60.3843	Feb 59.2867	Mar 58.9366	Apr 57.3040	May 57.3040	Jun 56.4189	Jul 56.7061	Aug 56.1396	Sep 56.7061	Oct 57.6148	Nov 57.9335	Dec 58.9366 (38)
Heat transfer coeff	201.5275	200.4299	200.0798	198.4472	198.4472	197.5621	197.8493	197.2828	197.8493	198.7580	199.0766	200.0798 (39)
Average = Sum(39)m / 12 =												198.9491 (39)
HLP	Jan 1.6911	Feb 1.6819	Mar 1.6789	Apr 1.6652	May 1.6652	Jun 1.6578	Jul 1.6602	Aug 1.6555	Sep 1.6602	Oct 1.6679	Nov 1.6705	Dec 1.6789 (40)
HLP (average)												1.6695 (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												2.8600 (42)
Average daily hot water use (litres/day)												102.1262 (43)
Daily hot water use	Jan 112.3388	Feb 108.2538	Mar 104.1687	Apr 100.0837	May 95.9986	Jun 91.9136	Jul 91.9136	Aug 95.9986	Sep 100.0837	Oct 104.1687	Nov 108.2538	Dec 112.3388 (44)
Energy conte	166.5952	145.7052	150.3547	131.0829	125.7772	108.5361	100.5747	115.4109	116.7893	136.1067	148.5711	161.3386 (45)
Energy content (annual)										Total = Sum(45)m =		1606.8425 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Distribution loss (46)m = 0.15 x (45)m	24.9893	21.8558	22.5532	19.6624	18.8666	16.2804	15.0862	17.3116	17.5184	20.4160	22.2857	24.2008 (46)
Water storage loss:												
Store volume												215.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.7300 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.9342 (55)
Total storage loss												
28.9602 26.1576 28.9602 28.0260 28.9602 28.0260 28.9602 28.9602 28.0260 28.9602 28.0260 28.9602 (56)												
If cylinder contains dedicated solar storage												
28.9602 26.1576 28.9602 28.0260 28.9602 28.0260 28.9602 28.0260 28.9602 28.0260 28.9602 (57)												
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month												
218.8178 192.8740 201.1816 174.8673 165.2054 146.4674 139.7703 155.5371 161.9244 186.9335 199.1091 213.5612 (62)												
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.7000 (H2)
Collector heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0050 (H3a)
Collector effective heat loss coefficient												1.8063 (H3b)
Collector performance ratio												2.5804 (H4)
Annual solar radiation per m2												1204.7564 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												2023.9908 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.2596 (H8)
Utilisation factor												0.5479 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												102.1262 (H14)
Volume ratio Veff/V												0.7344 (H15)
Solar storage volume factor												0.9383 (H16)
Solar input												-914.9166 (H17)
Solar input	-28.2126	-41.9083	-71.1796	-100.5512	-119.4367	-125.5143	-122.4179	-107.9808	-83.7717	-57.3162	-33.8036	-22.8237 (63)
Solar input (sum of months) = Sum(63)m =												-914.9166 (63)
Output from w/h												
190.6052 150.9657 130.0020 74.3161 45.7687 20.9531 17.3524 47.5562 78.1528 129.6173 165.3055 190.7375 (64)												
Total per year (kWh/year) = Sum(64)m =												1241.3325 (64)
Heat gains from water heating, kWh/month												
97.1710 86.1820 90.6544 78.6126 73.3635 66.4333 64.7976 70.4751 74.9405 85.9169 89.8303 95.4231 (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)												
(66)m 171.6030 171.6030 171.6030 171.6030 171.6030 171.6030 171.6030 171.6030 171.6030 171.6030 171.6030 171.6030 (66)												
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
63.3257 56.2453 45.7418 34.6295 25.8859 21.8540 23.6140 30.6944 41.1979 52.3102 61.0538 65.0857 (67)												
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
424.0727 428.4732 417.3840 393.7763 363.9759 335.9676 317.2564 312.8559 323.9451 347.5528 377.3532 405.3615 (68)												
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
55.0203 55.0203 55.0203 55.0203 55.0203 55.0203 55.0203 55.0203 55.0203 55.0203 55.0203 55.0203 (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)												
-114.4020 -114.4020 -114.4020 -114.4020 -114.4020 -114.4020 -114.4020 -114.4020 -114.4020 -114.4020 -114.4020 -114.4020 (71)												
Water heating gains (Table 5)												
130.6062 128.2471 121.8474 109.1841 98.6069 92.2685 87.0936 94.7245 104.0841 115.4798 124.7643 128.2569 (72)												
Total internal gains												
733.2259 728.1869 700.1944 652.8113 603.6900 565.3114 543.1853 553.4961 584.4485 630.5641 678.3926 713.9254 (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		0.6600	12.7054	0.6300	0.7000	0.7700	2.5627 (74)
East		10.5400	23.7288	0.6300	0.7000	0.7700	76.4343 (76)
South		3.2900	53.5774	0.6300	0.7000	0.7700	53.8702 (78)
West		17.2500	23.7288	0.6300	0.7000	0.7700	125.0941 (80)
East		1.5600	32.5812	0.6300	0.7000	1.0000	20.1731 (82)
West		2.0700	32.5812	0.6300	0.7000	1.0000	26.7682 (82)

Solar gains	304.9026	517.6387	825.9651	1244.0563	1453.0946	1586.2661	1494.0050	1303.0113	1018.7724	649.4500	381.0799	244.3286 (83)
Total gains	1038.1285	1245.8256	1526.1595	1896.8675	2056.7846	2151.5775	2037.1903	1856.5074	1603.2209	1280.0141	1059.4726	958.2540 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec												
tau 16.4259 16.5159 16.5448 16.6809 16.6809 16.7556 16.7313 16.7794 16.7313 16.6548 16.6282 16.5448												
alpha 2.0951 2.1011 2.1030 2.1121 2.1121 2.1170 2.1154 2.1186 2.1154 2.1103 2.1085 2.1030												
util living area	0.9349	0.9077	0.8488	0.7389	0.6052	0.4443	0.3240	0.3418	0.5730	0.7921	0.9030	0.9419 (86)
MIT 18.7387 18.9782 19.4614 20.0337 20.4709 20.7303 20.8242 20.8207 20.6175 20.0781 19.3386 18.7270 (87)												
Th 2 19.5472 19.5538 19.5560 19.5658 19.5658 19.5712 19.5695 19.5729 19.5695 19.5640 19.5620 19.5560 (88)												
util rest of house												
0.9235 0.8921 0.8232 0.6960 0.5379 0.3504 0.2045 0.2133 0.4759 0.7433 0.8830 0.9315 (89)												
MIT 2 16.6409 16.9821 17.6601 18.4400 18.9981 19.2898 19.3681 19.3712 19.1893 18.5300 17.5086 16.6301 (90)												
Living area fraction												FLA = Living area / (4) = 0.2429 (91)

Regs Region: England

Elmhurst Energy Systems

SAP2012 Calculator (Design

System) version 4.14r19

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

MIT	17.1505	17.4670	18.0977	18.8272	19.3559	19.6397	19.7218	19.7233	19.5363	18.9061	17.9531	17.1395 (92)
Temperature adjustment												0.0000
adjusted MIT	17.1505	17.4670	18.0977	18.8272	19.3559	19.6397	19.7218	19.7233	19.5363	18.9061	17.9531	17.1395 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8974	0.8621	0.7908	0.6703	0.5270	0.3552	0.2179	0.2277	0.4734	0.7157	0.8528	0.9068 (94)
Useful gains	931.5601	1073.9682	1206.9531	1271.5021	1083.8354	764.3138	443.9883	422.6901	758.9783	916.1594	903.5426	868.9585 (95)
Ext temp.	5.0000	5.4000	7.1000	9.5000	12.6000	15.4000	17.4000	17.5000	15.0000	11.7000	8.1000	5.2000 (96)
Heat loss rate W	2448.6661	2418.5950	2200.4188	1850.9477	1340.6811	837.6050	459.3699	438.6252	897.4947	1432.2657	1961.5273	2388.8601 (97)
Month fractl	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	1128.7120	903.5893	739.1385	417.2008	191.0933	0.0000	0.0000	0.0000	0.0000	383.9831	761.7489	1130.8068 (98)
Space heating												5656.2727 (98)
Space heating per m2											(98) / (4) =	47.4639 (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 %)	170.0000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	3327.2192	(211)

[illegible][illegible]

Electricity for pumps and fans:		
central heating pump		30.0000 (230c)
pump for solar water heating		50.0000 (230g)
Total electricity for the above, kWh/year		80.0000 (231)
Electricity for lighting (calculated in Appendix L)		447.3406 (232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV Unit 0 (0.80 * 2.50 * 1205 * 0.80) =	-1927.6103	-1927.6103 (233)
Total delivered energy for all uses		2657.1452 (238)

10a. Fuel costs - using BEDF prices (493)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3327.2192	19.4400	646.8114 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	730.1956	19.4400	141.9500 (247)
Pumps and fans for heating	30.0000	19.4400	5.8320 (249)
Pump for solar water heating	50.0000	19.4400	9.7200 (249)
Energy for lighting	447.3406	19.4400	86.9630 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit	-1927.6103	19.4400	-374.7274 (252)
Total energy cost			516.5490 (255)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	3327.2192	0.5190	1726.8268 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	730.1956	0.5190	378.9715 (264)
Space and water heating			2105.7983 (265)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Design SAP
elmhurst energy

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

Pumps and fans	80.0000	0.5190	41.5200 (267)
Energy for lighting	447.3406	0.5190	232.1698 (268)
Energy saving/generation technologies			
PV Unit	-1927.6103	0.5190	-1000.4297 (269)
Total kg/year			1379.0584 (272)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	3327.2192	3.0700	10214.5630 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	730.1956	3.0700	2241.7005 (264)
Space and water heating			12456.2636 (265)
Pumps and fans	80.0000	3.0700	245.6000 (267)
Energy for lighting	447.3406	3.0700	1373.3358 (268)
Energy saving/generation technologies			
PV Unit	-1927.6103	3.0700	-5917.7636 (269)
Primary energy kWh/year			8157.4358 (272)
Primary energy kWh/m2/year			68.4521 (273)

U-VALUE CALCULATOR REPORT

Design SAP
elmhurst energy

Property Reference	SAP 0873 Plot 1	Issued on Date	07/04/2022
Assessment Reference	Rev A	Prop Type Ref	
Project			
Calculation Type	New Build (As Designed)		

SAP Rating	74 C	DER	25.68	TER	28.91
Environmental	76 C	% DER < TER	11.17		
CO ₂ Emissions (t/year)	2.65	DERF	65.63	TERF	70.71
General Requirements Compliance	Pass	% DERF < TERF	7.18		

Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 01329 313079, tobiaswhiting26@gmail.com	Assessor ID	E477-0001
Client	K & J Contracts, K&JC		

Building Elements

Roof 000002 - Mineral Wool between and above

Roof Type: Pitched Roof, insulated flat ceiling

Layer	Description	Thickness (mm)	Conductivity (W/m ² K)	Resistance (m ² K/W)	Fraction (%)	Density (kg/m ³)	Heat Cap. (J/kgK)
Ext surface				0.0400			
Layer 1	Mineral wool batt						
	Main construction	350	0.0380	9.2105	100.00		
	Corrections - Air Gap: Level 1, Fasteners: None or plastic						
Layer 2	Mineral wool batt						
	Main construction	100	0.0380	2.6316	87.50		
	Main construction	100	0.1300	0.7692	12.50		
	Corrections - Air Gap: Level 1, Fasteners: None or plastic						
Layer 3	Plasterboard, standard						
	Main construction	12.5	0.2100	0.0595	100.00	700	1000
Int surface				0.1000			

Total resistance: Upper limit = 11.772 m² K/W Lower limit = 11.430 m² K/W Average = 11.601 m² K/W
Total correction = 0.0096 m² K/W U-value (unrounded) = 0.1 W/m² K

Unheated space: None

Total thickness: 463 mm

U-value: 0.10 W/m² K

Kappa: 9.10 kJ/m² K

U-VALUE CALCULATOR REPORT

Design SAP
elmhurst energy

Property Reference	SAP 0873 Plot 1	Issued on Date	07/04/2022
Assessment Reference	Rev A	Prop Type Ref	
Project			
Calculation Type	New Build (As Designed)		
SAP Rating	74 C	DER	25.68
Environmental	76 C	% DER < TER	11.17
CO ₂ Emissions (t/year)	2.65	DREE	65.63
General Requirements Compliance	Pass	% DPER < TPER	7.18
Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 01329 313079, tobiaswhiting26@gmail.com		Assessor ID
			E477-0001
Client	K & J Contracts, K&JC		

Building Elements

Roof 000003 - Insulation between and below

Roof Type: Pitched Roof, insulated sloping ceiling

Layer	Description	Thickness (mm)	Conductivity (W/m ² K)	Resistance (m ² K/W)	Fraction (%)	Density (kg/m ³)	Heat Cap. (J/kgK)
Ext surface				0.0400			
Layer 1	Tiles						
	Main construction	30	1.5000	0.0200	100.00		
Layer 2	airspace/timber battens						
	Main construction	25	0.2500	0.1000	91.59		
	Main construction	25	0.1563	0.1600	8.41		
	Corrections - Cavity Unventilated, Emissivity: Normal						
Layer 3	Breather membrane						
	Main construction	1	0.0000	0.0000	100.00		
Layer 4	Standard cavity						
	Main construction	50	0.2948	0.1696	87.50		
	Main construction	50	0.1300	0.3846	12.50		
	Corrections - Cavity Unventilated, Emissivity: Low Emissivity (BR443)						
Layer 5	Ecotherm						
	Main construction	120	0.0220	5.4545	87.50		
	Main construction	120	0.1300	0.9231	12.50		
	Corrections - Air Gap: Level 1, Fasteners: None or plastic						
Layer 6	Ecotherm						
	Main construction	20	0.0220	0.9091	100.00		
	Corrections - Air Gap: Level 1, Fasteners: None or plastic						
Layer 7	Plasterboard, standard						
	Main construction	12.5	0.2100	0.0595	100.00	700	1000
Int surface				0.1000			

Total resistance: Upper limit = 5.547 m² K/W Lower limit = 4.795 m² K/W Average = 5.171 m² K/W
Total correction = 0.0046 m² K/W U-value (unrounded) = 0.19 W/m² K

Unheated space: None

Total thickness: 259 mm

U-value: 0.19 W/m² K

Kappa: 9.10 kJ/m² K

U-VALUE CALCULATOR REPORT

Design SAP
elmhurst energy

Property Reference	SAP 0873 Plot 1	Issued on Date	07/04/2022
Assessment Reference	Rev A	Prop Type Ref	
Project			
Calculation Type	New Build (As Designed)		

SAP Rating	74 C	DER	25.68	TBR	28.91
Environmental	76 C	% DER < TBR	11.17		
CO ₂ Emissions (t/year)	2.65	DREE	65.63	TREE	70.71
General Requirements Compliance	Pass	% DER < TREE	7.18		

Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 01329 313079, tobiaswhiting26@gmail.com	Assessor ID	E477-0001
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Client	K & J Contracts, K&JC
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Building Elements

Roof 000004 - Insulation between and below

Roof Type: Pitched Roof, insulated sloping ceiling

Layer	Description	Thickness (mm)	Conductivity (W/m ² K)	Resistance (m ² K/W)	Fraction (%)	Density (kg/m ³)	Heat Cap. (J/kgK)
Ext surface				0.0400			
Layer 1	Tiling						
	Main construction	30	1.5000	0.0200	100.00		
Layer 2	airspace/timber battens						
	Main construction	25	0.2500	0.1000	91.59		
	Main construction	25	0.1563	0.1600	8.41		
	Corrections - Cavity Unventilated, Emissivity: Normal						
Layer 3	Breather membrane						
	Main construction	1	0.0000	0.0000	100.00		
Layer 4	Standard cavity						
	Main construction	50	0.2948	0.1696	87.50		
	Main construction	50	0.1300	0.3846	12.50		
	Corrections - Cavity Unventilated, Emissivity: Low Emissivity (BR443)						
Layer 5	Ecotherm						
	Main construction	120	0.0220	5.4545	87.50		
	Main construction	120	0.1300	0.9231	12.50		
	Corrections - Air Gap: Level 1, Fasteners: None or plastic						
Layer 6	Ecotherm						
	Main construction	20	0.0220	0.9091	100.00		
	Corrections - Air Gap: Level 1, Fasteners: None or plastic						
Layer 7	Plasterboard, standard						
	Main construction	12.5	0.2100	0.0595	100.00	700	1000
Int surface				0.1000			

Total resistance:	Upper limit = 5.547 m ² K/W	Lower limit = 4.795 m ² K/W	Average = 5.171 m ² K/W
	Total correction = 0.0046 m ² K/W	U-value (unrounded) = 0.19 W/m ² K	

Unheated space: None

Total thickness: 259 mm

U-value: 0.19 W/m² K

Kappa: 9.10 kJ/m² K

U-VALUE CALCULATOR REPORT

Design SAP
elmhurst energy

Property Reference	SAP 0873 Plot 1	Issued on Date	07/04/2022
Assessment Reference	Rev A	Prop Type Ref	
Project			
Calculation Type	New Build (As Designed)		
SAP Rating	74 C	DER	25.68
Environmental	76 C	% DER < TER	11.17
CO ₂ Emissions (t/year)	2.65	DREE	65.63
General Requirements Compliance	Pass	% DPER < TPER	7.18
Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 01329 313079, tobiaswhiting26@gmail.com		Assessor ID
			E477-0001
Client	K & J Contracts, K&JC		

Building Elements

Wall Brick Timber Frame

Wall Type: Standard Wall

Layer	Description	Thickness (mm)	Conductivity (W/m ² K)	Resistance (m ² K/W)	Fraction (%)
Ext surface				0.0400	
Layer 1	Brick, outer leaf				
	Main construction	102	0.7700	0.1325	82.81
	Main construction	102	0.9407	0.1084	17.19
Layer 2	Standard cavity				
	Main construction	50	0.2778	0.1800	100.00
	Corrections - Cavity Unventilated, Emissivity: Normal				
Layer 3	Protect TF200 Thermo				
	Main construction	0.5	0.0007	0.6700	100.00
Layer 4	Fermacell Gypsum Fibre Board				
	Main construction	12	0.3200	0.0375	100.00
Layer 5	Ecotherm				
	Main construction	120	0.0220	5.4545	83.85
	Main construction	120	0.1300	0.9231	16.15
	Corrections - Air Gap: Level 1, Fasteners: None or plastic				
Layer 6	Standard cavity				
	Main construction	20	0.1143	0.1750	83.85
	Main construction	20	0.1300	0.1538	16.15
	Corrections - Cavity Unventilated, Emissivity: Normal				
Layer 7	Plasterboard, standard				
	Main construction	12.5	0.2100	0.0595	100.00
Int surface				0.1300	

Total resistance: Upper limit = 5.235 m² K/W Lower limit = 4.459 m² K/W Average = 4.847 m² K/W
Total correction = 0.0039 m² K/W U-value (unrounded) = 0.21 W/m² K

Unheated space: None

Total thickness: 317 mm

U-value: 0.21 W/m² K

Kappa: n/a

U-VALUE CALCULATOR REPORT

Design SAP
elmhurst energy

Property Reference	SAP 0873 Plot 1	Issued on Date	07/04/2022
Assessment Reference	Rev A	Prop Type Ref	
Project			
Calculation Type	New Build (As Designed)		
SAP Rating	74 C	DER	25.68
Environmental	76 C	% DER < TER	11.17
CO ₂ Emissions (t/year)	2.65	DREE	65.63
General Requirements Compliance	Pass	% DPER < TPER	7.18
Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 01329 313079, tobiaswhiting26@gmail.com		Assessor ID
			E477-0001
Client	K & J Contracts, K&JC		

Building Elements

Wall 000001

Wall Type: Standard Wall

Layer	Description	Thickness (mm)	Conductivity (W/m ² K)	Resistance (m ² K/W)	Fraction (%)
Ext surface				0.0400	
Layer 1	Artificial stone				
	Main construction	20	1.3000	0.0154	100.00
Layer 2	Blockwork, dense				
	Main construction	100	1.5900	0.0629	93.18
	Main construction	100	0.8800	0.1136	6.82
Layer 3	Standard cavity				
	Main construction	50	0.2778	0.1800	100.00
	Corrections - Cavity Unventilated, Emissivity: Normal				
Layer 4	Protect TF200 Thermo				
	Main construction	0.5	0.0007	0.6700	100.00
Layer 5	Fermacell Gypsum Fibre Board				
	Main construction	12	0.3200	0.0375	100.00
Layer 6	Ecotherm				
	Main construction	120	0.0220	5.4545	83.85
	Main construction	120	0.1300	0.9231	16.15
	Corrections - Air Gap: Level 1, Fasteners: None or plastic				
Layer 7	Standard cavity				
	Main construction	20	0.1143	0.1750	83.85
	Main construction	20	0.1300	0.1538	16.15
	Corrections - Cavity Unventilated, Emissivity: Normal				
Layer 8	Plasterboard, standard				
	Main construction	12.5	0.2100	0.0595	100.00
Int surface				0.1300	

Total resistance: Upper limit = 5.174 m² K/W Lower limit = 4.411 m² K/W Average = 4.793 m² K/W
Total correction = 0.0040 m² K/W U-value (unrounded) = 0.21 W/m² K

Unheated space: None

Total thickness: 335 mm

U-value: 0.21 W/m² K

Kappa: n/a

U-VALUE CALCULATOR REPORT

Design SAP
elmhurst energy

Property Reference	SAP 0873 Plot 1	Issued on Date	07/04/2022
Assessment Reference	Rev A	Prop Type Ref	
Project			
Calculation Type	New Build (As Designed)		
SAP Rating	74 C	DER	25.68
Environmental	76 C	% DER < TER	11.17
CO ₂ Emissions (t/year)	2.65	DREE	65.63
General Requirements Compliance	Pass	% DPER < TPER	7.18
Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 01329 313079, tobiaswhiting26@gmail.com		Assessor ID
			E477-0001
Client	K & J Contracts, K&JC		

Building Elements

Wall Stud to Garage

Wall Type: Standard Wall

Layer	Description	Thickness (mm)	Conductivity (W/m ² K)	Resistance (m ² K/W)	Fraction (%)
Ext surface				0.0400	
Layer 1	Plasterboard, standard				
	Main construction	30	0.2100	0.1429	100.00
Layer 2	Earthwool Dritherm 32 Ultimate				
	Main construction	85	0.0320	2.6563	83.85
	Main construction	85	0.1300	0.6538	16.15
	Corrections - Air Gap: Level 1, Fasteners: None or plastic				
Layer 3	Plasterboard, standard				
	Main construction	15	0.2100	0.0714	100.00
Int surface				0.1300	

Total resistance: Upper limit = 2.318 m² K/W Lower limit = 2.162 m² K/W Average = 2.240 m² K/W
Total correction = 0.0063 m² K/W U-value (unrounded) = 0.45 W/m² K

Unheated space: None

Total thickness: 130 mm

U-value: 0.45 W/m² K

Kappa: n/a

U-VALUE CALCULATOR REPORT

Design SAP
elmhurst energy

Property Reference	SAP 0873 Plot 1	Issued on Date	07/04/2022
Assessment Reference	Rev A	Prop Type Ref	
Project			
Calculation Type	New Build (As Designed)		

SAP Rating	74 C	DER	25.68	TBR	28.91
Environmental	76 C	% DER < TBR	11.17		
CO ₂ Emissions (t/year)	2.65	DREE	65.63	TREE	70.71
General Requirements Compliance	Pass	% DPER < TREE	7.18		

Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 01329 313079, tobiaswhiting26@gmail.com	Assessor ID	E477-0001
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Client	K & J Contracts, K&JC
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Building Elements

Wall Timber Stud

Wall Type: Standard Wall

Layer	Description	Thickness (mm)	Conductivity (W/m ² K)	Resistance (m ² K/W)	Fraction (%)	Density (kg/m ³)	Heat Cap. (J/kgK)
Ext surface				0.0400			
Layer 1	Plasterboard, standard						
	Main construction	12.5	0.2100	0.0595	100.00		
Layer 2	Earthwool Dritherm 32 Ultimate						
	Main construction	125	0.0320	3.9063	83.85		
	Main construction	125	0.1300	0.9615	16.15		
	Corrections - Air Gap: Level 1, Fasteners: None or plastic						
Int surface				0.1300			

Total resistance: Upper limit = 2.956 m² K/W Lower limit = 2.843 m² K/W Average = 2.900 m² K/W
Total correction = 0.0081 m² K/W U-value (unrounded) = 0.35 W/m² K

Unheated space: None

Total thickness: 138 mm

U-value: 0.35 W/m² K

Kappa: 0.00 kJ/m² K

U-VALUE CALCULATOR REPORT

Design SAP
elmhurst energy

Property Reference	SAP 0873 Plot 1	Issued on Date	07/04/2022
Assessment Reference	Rev A	Prop Type Ref	
Project			
Calculation Type	New Build (As Designed)		

SAP Rating	74 C	DER	25.68	TBR	28.91
Environmental	76 C	% DER < TBR	11.17		
CO ₂ Emissions (t/year)	2.65	DREE	65.63	TREE	70.71
General Requirements Compliance	Pass	% DPER < TREE	7.18		

Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 01329 313079, tobiaswhiting26@gmail.com	Assessor ID	E477-0001
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Client	K & J Contracts, K&JC
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Building Elements

Floor 000005 - Block and Beam

Floor Type: Suspended Floor

Area = 119.17 m², Perimeter = 50.82 m, Wall thickness = 275.00 mm, Soil: Unknown

Depth of underfloor space below ground: 0.200 m Floor wind shielding: Average (suburban)

Floor height above ground: h = 0.200 m

U-value of walls above ground: U_w = 1.500 m

Ventilation openings per perimeter length: e = 0.0015 %

Mean wind speed: v = 5.000 m/s

Resistance on solum: R_g = 0.000 m²K/W

Layer	Description	Thickness (mm)	Conductivity (W/m ² K)	Resistance (m ² K/W)	Fraction (%)
Ext surface				0.1700	
Layer 1	Blockwork, dense				
	Main construction	100	1.5900	0.0629	84.09
	Main construction	100	2.3000	0.0435	15.91
Layer 2	Polythene, 1000 gauge				
	Main construction	1	0.0000	0.0000	100.00
Layer 3	Celotex XR4000				
	Main construction	150	0.0220	6.8182	100.00
	Corrections - Air Gap: Level 1, Fasteners: None or plastic				
Layer 4	Polythene, 500 gauge				
	Main construction	1	0.0000	0.0000	100.00
Layer 5	Screed				
	Main construction	75	1.1500	0.0652	100.00
Int surface				0.1700	

Total resistance: Upper limit = 7.283 m² K/W Lower limit = 7.282 m² K/W Average = 7.283 m² K/W

Total correction = 0.0088 m² K/W

U-value (unrounded) = 0.12 W/m² K

Unheated space: None

Total thickness: 327 mm

U-value: 0.12 W/m² K

Kappa: n/a

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

Design SAP
elmhurst energy

Property Reference	SAP 0873 Plot 1	Issued on Date	07/04/2022
Assessment Reference	Rev A	Prop Type Ref	
Property			
SAP Rating	74 C	DER	25.68
Environmental	76 C	% DER-TER	11.17
CO ₂ Emissions (t/year)	2.65	DERE	65.63
General Requirements Compliance	Pass	% DERE-TERE	7.18
Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 01329 313079, tobiaswhiting26@gmail.com		Assessor ID
Client	K & J Contracts, K&JC		

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

Orientation	East
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Suburban
1.0 Property Type	Bungalow, Detached
2.0 Number of Storeys	1
3.0 Date Built	2022
4.0 Sheltered Sides	1
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
	Ground Floor: 50.82 m	119.17 m ²	2.61 m

7.0 Living Area	28.95	m ²
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8.0 Thermal Mass Parameter	Simple calculation - Low	
Thermal Mass	100.00	kJ/m²K

9.0 External Walls		U-Value (W/m ² K)	Gross Area (m ²)	Nett Area (m ²)
Description	Type			
Brick	Timber Frame	0.21	82.55	52.17
Stone Clad	Timber Frame	0.21	30.24	26.67
Wall to Garage	Timber Frame	0.45	14.45	12.79
Wall to voids	Timber Frame	0.35	31.47	31.47

10.0 External Roofs		U-Value (W/m ² K)	Gross Area (m ²)	Nett Area (m ²)
Description	Type			
Pitched Roof	External Plane Roof	0.10	82.44	82.44
Skeillins	External Slope Roof	0.19	44.10	40.47
Skeilllin at Roof	External Slope Roof	0.19	16.27	16.27

11.0 Heat Loss Floors		U-Value (W/m ² K)	Area (m ²)
Description	Type		
Ground Floor	Ground Floor - Solid	0.12	119.17

12.0 Opening Types

Regs Region: England
Elmhurst Energy Systems
SAP2012 Calculator (Design System) version 4.14r19

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

Design SAP
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Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Front Door	Manufacturer	Solid Door							1.60
Personnel Door	Manufacturer	Solid Door							1.80
Windows	Manufacturer	Window	Double Low-E Soft 0.1			0.63		0.70	1.40
Roof Windows	Manufacturer	Roof Window	Double Low-E Soft 0.1			0.63		0.70	1.40

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
Front Door	Solid Door	[1] Brick	East							2.21	
Front Elevation	Window	[1] Brick	East	None	0.00					6.97	
Front Elevation	Window	[2] Stone Clad	East	None	0.00					3.57	
North	Solid Door	[3] Wall to Garage	North							1.66	
North Elevation	Window	[1] Brick	North	None	0.00					0.66	
West Elevation	Window	[1] Brick	West	None	0.00					17.25	
South Elevation	Window	[1] Brick	South	None	0.00					3.29	
East Roof Window	Roof Window	[2] Skeillins	East	None						1.56	
West Roof Windows	Roof Window	[2] Skeillins	West	None						2.07	

14.0 Conservatory

None

15.0 Draught Proofing

100

%

16.0 Draught Lobby

No

17.0 Thermal Bridging

Calculate Bridges

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Table K1 - Approved	E2 Other lintels (including other steel lintels)	17.47	0.300	No
Table K1 - Approved	E3 Sill	3.00	0.040	No
Table K1 - Approved	E4 Jamb	43.12	0.050	No
Table K1 - Approved	E5 Ground floor (normal)	50.82	0.160	No
Table K1 - Approved	E10 Eaves (insulation at ceiling level)	26.82	0.060	No
Table K1 - Approved	E11 Eaves (insulation at rafter level)	13.58	0.040	No
Table K1 - Approved	E12 Gable (insulation at ceiling level)	6.07	0.240	No
Table K1 - Approved	E13 Gable (insulation at rafter level)	5.14	0.040	No
Table K1 - Approved	E16 Corner (normal)	23.80	0.090	No
Table K1 - Approved	E17 Corner (inverted -- internal area greater than external area)	14.28	-0.090	No
Table K1 - Default	R1 Head of roof window	2.46	0.080	No
Table K1 - Default	R2 Sill of roof window	2.46	0.060	No
Table K1 - Default	R3 Jamb of roof window	8.51	0.080	No
Table K1 - Default	R4 Ridge (vaulted ceiling)	11.49	0.080	No
Table K1 - Default	R5 Ridge (inverted)	8.15	0.040	No
Table K1 - Default	R6 Flat ceiling	2.10	0.060	No

Y-value 0.054 W/m²K

18.0 Pressure Testing

Yes

Designed AP₅₀ 5.00 m³/(h.m²) @ 50 Pa

Property Tested ?

As Built AP₅₀ m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather Windows fully open

Regs Region: England

Elmhurst Energy Systems

SAP2012 Calculator (Design

System) version 4.14r19

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

Design SAP
elmhurst energy

Cross ventilation possible	Yes
Night Ventilation	Yes
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
Number of open flues	0		0	0
Number of intermittent fans				4
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System

No

22.0 Lighting

Internal

Total number of light fittings	12	
Total number of L.E.L. fittings	12	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	Yes
Light and motion sensor	Yes

23.0 Electricity Tariff

Standard

24.0 Main Heating 1

Description	SAP table	
Percentage of Heat	PET	%
Main Heating	100	
SAP Code	PET	
Efficiency (SAP Table)	224	%
Controls	170.0	
PCDF Controls	CHD Time and temperature zone control	
Sap Code	0	
Is MHS Pumped	2207	
Heat Emitter	Pump in heated space	
Underfloor Heating	Underfloor	
Flow Temperature	Yes - Pipes in thin screed	
	Unknown	

25.0 Main Heating 2

None

Community Heating	None
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28.0 Water Heating

Water Heating	HWP From main heating 1
Flue Gas Heat Recovery System	Main Heating 1
Waste Water Heat Recovery Instantaneous System 1	No
Waste Water Heat Recovery Instantaneous System 2	No

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

Design SAP
elmhurst energy

Waste Water Heat Recovery Storage System	No
Solar Panel	No
Water use <= 125 litres/person/day	Yes
SAP Code	901
Immersion Heater	Single
Supplementary Immersion	Yes
Immersion Only Heating Hot Water	Yes

29.0 Hot Water Cylinder	Hot Water Cylinder
Cylinder Stat	Yes
Cylinder In Heated Space	Yes
Independent Time Control	Yes
Insulation Type	Measured Loss
Cylinder Volume	215.00 L
Loss	1.73 kWh/day
Pipes insulation	Fully insulated primary pipework

31.0 Thermal Store	None
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Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental impact
Solar water heating	£4,000 - £6,000	£102	C 76	
	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental impact
Solar photovoltaic panels, 2.5 kWp	£3,500 - £5,500	£375	B 84	