

elmhurst
energy



SAP Report Submission for Building Regulations Compliance

Client: K & J Contracts

Project: Plot 3

Contact: Tobias Whiting
Abacus Energy (UK) Ltd



Report Issue Date: 07/04/2022

EXCELLENCE
IN ENERGY
ASSESSMENT

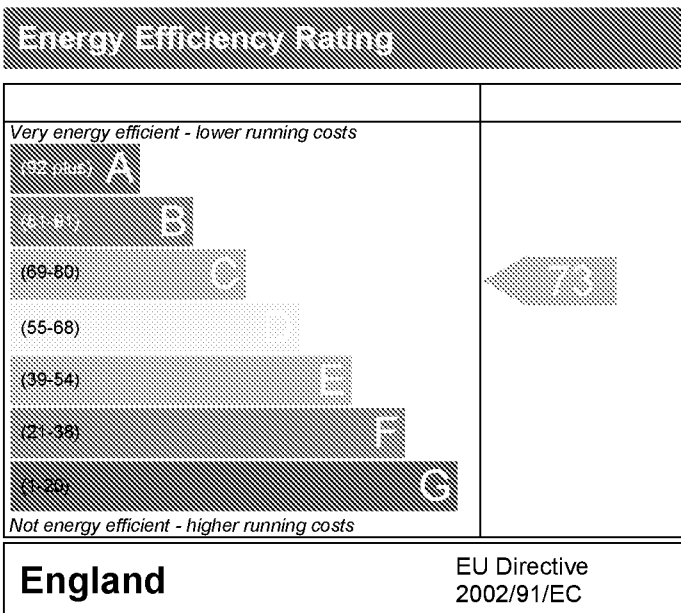
PREDICTED ENERGY ASSESSMENT

Design SAP
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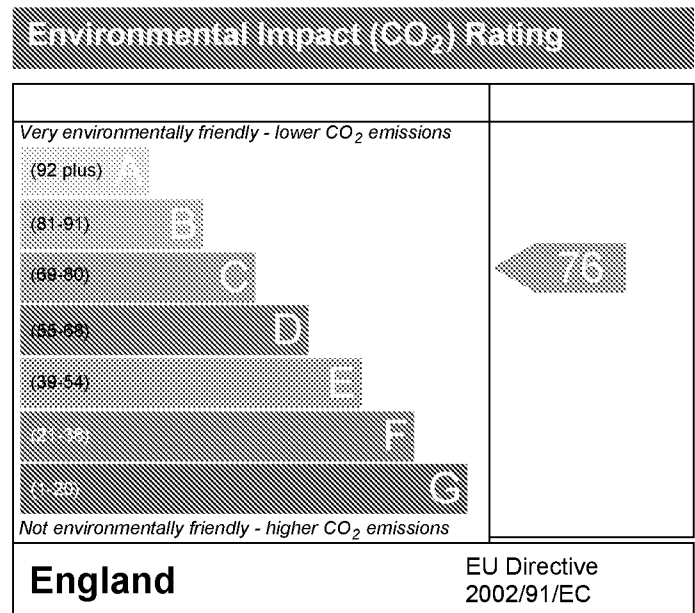
Dwelling type: Bungalow, Detached
Date of assessment: 07/04/2022
Produced by: Abacus Energy (UK) Ltd
Total floor area: 120.16 m²
DRRN: 9202-8448-3031

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.

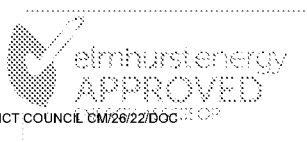


The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.



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 3		Issued on Date	07/04/2022	
Assessment Reference	Rev A	Prop Type Ref			
Property					
SAP Rating	73 C	DER	26.10	TER	29.26
Environmental	76 C	% DER-TER	10.79		
CO ₂ Emissions (t/year)	2.71	DFEE	66.26	TFEE	71.51
General Requirements Compliance	Pass	% DFEE-TFEE	7.34		
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)	29.26	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	26.10	kgCO ₂ /m ²	Pass
	-3.16 (-10.8%)	kgCO ₂ /m ²	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	71.51	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DFEE)	66.26	kWh/m ² /yr	
	-5.2 (-7.3%)	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

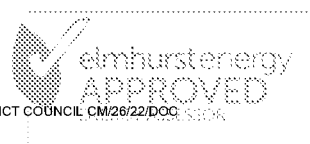
Air permeability at 50 pascals	5.00 (design value)	m ³ /(h.m ²) @ 50 Pa	
Maximum	10.0	m ³ /(h.m ²) @ 50 Pa	Pass

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)

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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

17.28 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

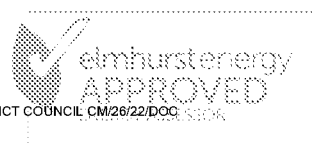
W/m²K

Floor U-value

0.12

W/m²K

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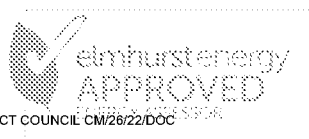


RECOMMENDATIONS

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 78	Recommended
Photovoltaic	£3,500 - £5,500	£375	B 84	B 85	Recommended
Wind turbine			0	0	Not applicable
Totals	£7,500 - £11,500	£477	B 84	B 85	

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THERMAL BRIDGING

Calculation Type: New Build (As Designed)

Design SAP
elmhurst energy

Property Reference	SAP 0873 Plot 3	Issued on Date	07/04/2022
Assessment Reference	Rev A	Prop Type Ref	
Property			

SAP Rating	73 C	DER	26.10	TSL	29.26
Environmental	76 C	2 DER-TED	10.79		
CO ₂ Emissions (t/year)	2.71	DERE	66.26	TTER	71.51
General Requirements Compliance	Pass	2 DER-TED	7.34		

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 3			Issued on Date	07/04/2022
Assessment Reference	Rev A	Prop Type Ref			
Property					
SAP Rating	73 C	DER	26.10	TSL	29.26
Environmental	76 C	% DER<TER	10.79		
CO ₂ Emissions (t/year)	2.71	DREE	66.26	TTEE	71.51
General Requirements Compliance	Pass	% DPEE<CTEE	7.34		
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 120 m²

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

1a TER and DER

Fuel for main heating: Electricity
Fuel factor: 1.55 (electricity)
Target Carbon Dioxide Emission Rate (TER) 29.26 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 26.10 kgCO₂/m² OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 71.5 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE) 66.3 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 m², No overhang
Windows facing East: 10.54 m², No overhang
Windows facing South: 3.29 m², No overhang
Windows facing West: 17.28 m², No overhang
Air change rate: 6.00 ach
Blinds/curtains: None

10 Key features

Roof U-value 0.10 W/m²K
Floor U-value 0.12 W/m²K

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	120.1600 (1b)	x 2.6100 (2b)	= 313.6176 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	120.1600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	313.6176 (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) =	0.1275 (8)
Pressure test				Yes	
Measured/design AP50				5.0000	
Infiltration rate				0.3775 (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) =		0.3492 (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	0.4453	0.4365	0.4278	0.3842	0.3754	0.3318	0.3318	0.3230	0.3492	0.3754	0.3929	0.4103 (22b)
	0.5991	0.5953	0.5915	0.5738	0.5705	0.5550	0.5550	0.5522	0.5610	0.5705	0.5772	0.5842 (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)			31.7700	1.3258	42.1193		(27)
Roof Windows (Uw = 1.40)			3.6300	1.3258	4.8125		(27a)
Ground Floor			120.1600	0.1200	14.4192		(28a)
Brick	75.1200	26.4400	48.6800	0.2100	10.2228		(29a)
Stone Clad	36.6500	7.5400	29.1100	0.2100	6.1131		(29a)
Wall to Garage	13.3800	1.6600	11.7200	0.4500	5.2740		(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)			419.5900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	117.8836		(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) =	140.5998 (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	62.0063	61.6079	61.2174	59.3833	59.0401	57.4426	57.4426	57.1468	58.0580	59.0401	59.7343	60.4601 (38)
Heat transfer coeff	202.6061	202.2077	201.8172	199.9831	199.6399	198.0424	198.0424	197.7466	198.6577	199.6399	200.3341	201.0599 (39)
Average = Sum(39)m / 12 =												199.9814 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.6861	1.6828	1.6796	1.6643	1.6615	1.6482	1.6482	1.6457	1.6533	1.6615	1.6672	1.6733 (40)
HLP (average)												1.6643 (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												2.8639 (42)
Average daily hot water use (litres/day)												102.2183 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	112.4402	108.3515	104.2627	100.1740	96.0852	91.9965	91.9965	96.0852	100.1740	104.2627	108.3515	112.4402 (44)
Energy conte	166.7455	145.8367	150.4904	131.2012	125.8907	108.6341	100.6654	115.5151	116.8947	136.2295	148.7051	161.4842 (45)
Energy content (annual)										Total = Sum(45)m =		1608.2927 (45)

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

Distribution loss (46)m = 0.15 x (45)m	25.0118	21.8755	22.5736	19.6802	18.8836	16.2951	15.0998	17.3273	17.5342	20.4344	22.3058	24.2226 (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 28.0260 (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 28.0260 (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	22.5120 (59)
Total heat required for water heating calculated for each month												
218.9681 193.0055 202.7130 181.7392 178.1133 159.1721 152.8880 167.7377 167.4327 188.4521 199.2431 213.7068 (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	218.9681	193.0055	202.7130	181.7392	178.1133	159.1721	152.8880	167.7377	167.4327	188.4521	199.2431	213.7068 (64)
Total per year (kWh/year) = Sum(64)m =												2223.1717 (64)
Heat gains from water heating, kWh/month												
97.2210 86.2257 91.8161 84.0548 83.6367 76.5512 75.2493 80.1868 79.2979 87.0744 89.8749 95.4716 (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	143.1965	143.1965	143.1965	143.1965	143.1965	143.1965	143.1965	143.1965	143.1965	143.1965	143.1965	143.1965 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
25.4455 22.6005 18.3799 13.9148 10.4015 8.7814 9.4886 12.3336 16.5541 21.0193 24.5326 26.1527 (67)												
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
285.4213 288.3831 280.9195 265.0304 244.9733 226.1224 213.5288 210.5671 218.0307 233.9198 253.9769 272.8278 (68)												
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
37.3197 37.3197 37.3197 37.3197 37.3197 37.3197 37.3197 37.3197 37.3197 37.3197 37.3197 37.3197 (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)												
-114.5572 -114.5572 -114.5572 -114.5572 -114.5572 -114.5572 -114.5572 -114.5572 -114.5572 -114.5572 -114.5572 -114.5572 (71)												
Water heating gains (Table 5)												
130.6734 128.3121 123.4088 116.7428 112.4150 106.3212 101.1416 107.7780 110.1360 117.0355 124.8262 128.3220 (72)												
Total internal gains	510.4991	508.2547	491.6672	464.6469	436.7487	410.1839	393.1180	399.6377	413.6797	440.9335	472.2947	496.2615 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2		g	Specific data or Table 6b		Specific data or Table 6c	FF	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					17.2800	19.6403			0.6300			0.7000	0.7700		103.7201 (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	254.5654	485.7375	778.4097	1114.9971	1357.1417	1387.1663	1321.3705	1139.7739	897.5310	569.9070	314.9990	211.0038 (83)			
Total gains	765.0645	993.9921	1270.0770	1579.6440	1793.8904	1797.3502	1714.4885	1539.4116	1311.2107	1010.8404	787.2937	707.2652 (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	16.4742	16.5067	16.5386	16.6903	16.7190	16.8539	16.8539	16.8791	16.8017	16.7190	16.6611	16.6009
alpha	2.0983	2.1004	2.1026	2.1127	2.1146	2.1236	2.1236	2.1253	2.1201	2.1146	2.1107	2.1067
util living area	0.9655	0.9410	0.8942	0.8081	0.6905	0.5561	0.4407	0.4930	0.6945	0.8747	0.9492	0.9704 (86)
MIT	18.3857	18.6890	19.1860	19.7917	20.2886	20.6196	20.7643	20.7311	20.4373	19.7447	18.9471	18.3328 (87)
Th 2	19.5508	19.5532	19.5555	19.5665	19.5686	19.5782	19.5782	19.5800	19.5745	19.5686	19.5644	19.5601 (88)
util rest of house	0.9592	0.9306	0.8754	0.7735	0.6329	0.4668	0.3197	0.3701	0.6141	0.8437	0.9384	0.9651 (89)
MIT 2	16.1380	16.5733	17.2798	18.1254	18.7833	19.1914	19.3374	19.3150	19.0003	18.0899	16.9568	16.0661 (90)
Living area fraction												
MIT	16.9590	17.3461	17.9761	18.7341	19.3332	19.7131	19.8586	19.8322	19.5252	18.6943	17.6837	16.8940 (92)
Temperature adjustment												0.0000
adjusted MIT	16.9590	17.3461	17.9761	18.7341	19.3332	19.7131	19.8586	19.8322	19.5252	18.6943	17.6837	16.8940 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.9432 0.9089 0.8489 0.7495 0.6221 0.4761 0.3455 0.3940 0.6109 0.8192 0.9186 0.9507 (94)												
Useful gains	721.6263	903.4542	1078.1354	1183.9340	1116.0650	855.7562	592.3024	606.5609	801.0421	828.0874	723.2016	672.3820 (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	2564.7851	2516.6992	2316.0689	1966.6457	1523.8824	1012.6098	645.3397	678.7136	1077.7528	1615.9531	2120.2858	2552.2637 (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	1371.3101	1084.1007	921.0226	563.5524	303.4161	0.0000	0.0000	0.0000	0.0000	586.1721	1005.9006	1398.6320 (98)

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Space heating 7234.1067 (98)
Space heating per m2 (98) / (4) = 60.2040 (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 4255.3569 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	1371.3101	1084.1007	921.0226	563.5524	303.4161	0.0000	0.0000	0.0000	0.0000	586.1721	1005.9006	1398.6320
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)	806.6530	637.7063	541.7780	331.5014	178.4801	0.0000	0.0000	0.0000	0.0000	344.8071	591.7062	822.7247
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	218.9681	193.0055	202.7130	181.7392	178.1133	159.1721	152.8880	167.7377	167.4327	188.4521	199.2431	213.7068
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	128.8048	113.5327	119.2430	106.9054	104.7725	93.6306	89.9341	98.6692	98.4898	110.8542	117.2018	125.7099
Water heating fuel used												1307.7480
Annual totals kWh/year												
Space heating fuel - main system												4255.3569
Space heating fuel - secondary												0.0000
Electricity for pumps and fans:												30.0000
central heating pump												30.0000
Total electricity for the above, kWh/year												449.3758
Electricity for lighting (calculated in Appendix L)												3136.0475
Total delivered energy for all uses												6042.4807

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	4255.3569	0.5190	2208.5302
Space heating - secondary	0.0000	0.0000	0.0000
Water heating (other fuel)	1307.7480	0.5190	678.7212
Space and water heating			2887.2514
Pumps and fans	30.0000	0.5190	15.5700
Energy for lighting	449.3758	0.5190	233.2260
Total CO2, kg/year			3136.0475
Dwelling Carbon Dioxide Emission Rate (DER)			26.1000

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

	DER	TFA	N	EF
Total Floor Area		26.1000	ZC1	
Assumed number of occupants		120.1600		
CO2 emission factor in Table 12 for electricity displaced from grid		2.8639		
CO2 emissions from appliances, equation (L14)		0.5190		
CO2 emissions from cooking, equation (L16)		14.0758	ZC2	
Total CO2 emissions		1.5624	ZC3	
Residual CO2 emissions offset from biofuel CHP		41.7382	ZC4	
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC5	
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC6	
Net CO2 emissions		0.0000	ZC7	
		41.7382	ZC8	

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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	120.1600 (1b)	x 2.6100 (2b)	= 313.6176 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	120.1600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 313.6176 (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) =	0.1275 (8)
Pressure test				Yes	
Measured/design AP50				5.0000	
Infiltration rate				0.3775	(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) =		0.3492 (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	0.4453	0.4365	0.4278	0.3842	0.3754	0.3318	0.3318	0.3230	0.3492	0.3754	0.3929	0.4103 (22b)
	0.5991	0.5953	0.5915	0.5738	0.5705	0.5550	0.5550	0.5522	0.5610	0.5705	0.5772	0.5842 (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)			23.5000	1.3258	31.1553		(27)
TER Room Window (Uw = 1.70)			2.6800	1.5918	4.2659		(27a)
Ground Floor			120.1600	0.1300	15.6208		(28a)
Brick	75.1200	19.5600	55.5600	0.1800	10.0008		(29a)
Stone Clad	36.6500	6.1500	30.5000	0.1800	5.4900		(29a)
Wall to Garage	13.3800	1.6600	11.7200	0.1800	2.1096		(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	2.6800	41.4200	0.1300	5.3846		(30)
Skeillins at Roof	16.2700		16.2700	0.1300	2.1151		(30)
Total net area of external elements Aum (A, m ²)			419.5900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	96.3939		(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) = 113.8856 (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	62.0063	61.6079	61.2174	59.3833	59.0401	57.4426	57.4426	57.1468	58.0580	59.0401	59.7343	60.4601 (38)
Heat transfer coeff	175.8919	175.4936	175.1031	173.2689	172.9257	171.3283	171.3283	171.0324	171.9436	172.9257	173.6200	174.3457 (39)
Average = Sum(39)m / 12 =												173.2673 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.4638	1.4605	1.4572	1.4420	1.4391	1.4258	1.4258	1.4234	1.4310	1.4391	1.4449	1.4509 (40)
HLP (average)												1.4420 (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)

2.8639 (42)
102.2183 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	112.4402	108.3515	104.2627	100.1740	96.0852	91.9965	91.9965	96.0852	100.1740	104.2627	108.3515	112.4402 (44)
Energy conte	166.7455	145.8367	150.4904	131.2012	125.8907	108.6341	100.6654	115.5151	116.8947	136.2295	148.7051	161.4842 (45)
Energy content (annual)												
Distribution loss (46)m = 0.15 x (45)m												1608.2927 (45)

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25.0118	21.8755	22.5736	19.6802	18.8836	16.2951	15.0998	17.3273	17.5342	20.4344	22.3058	24.2226 (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)
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											
218.8975	192.9417	202.6424	181.6708	178.0426	159.1037	152.8174	167.6670	167.3643	188.3814	199.1748	213.6361 (62)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Solar input											0.0000 (63)
Output from w/h											
218.8975	192.9417	202.6424	181.6708	178.0426	159.1037	152.8174	167.6670	167.3643	188.3814	199.1748	213.6361 (64)
Heat gains from water heating, kWh/month											2222.3398 (64)
97.1645	86.1747	91.7596	84.0001	83.5802	76.4965	75.1928	80.1303	79.2432	87.0179	89.8202	95.4150 (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
143.1965	143.1965	143.1965	143.1965	143.1965	143.1965	143.1965	143.1965	143.1965	143.1965	143.1965	143.1965 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5											
25.4467	22.6016	18.3808	13.9155	10.4020	8.7818	9.4890	12.3342	16.5549	21.0203	24.5338	26.1540 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5											
285.4213	288.3831	280.9195	265.0304	244.9733	226.1224	213.5288	210.5671	218.0307	233.9198	253.9769	272.8278 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5											
37.3197	37.3197	37.3197	37.3197	37.3197	37.3197	37.3197	37.3197	37.3197	37.3197	37.3197	37.3197 (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)											
-114.5572	-114.5572	-114.5572	-114.5572	-114.5572	-114.5572	-114.5572	-114.5572	-114.5572	-114.5572	-114.5572	-114.5572 (71)
Water heating gains (Table 5)											
130.5974	128.2362	123.3328	116.6668	112.3390	106.2452	101.0656	107.7020	110.0600	116.9595	124.7502	128.2460 (72)
Total internal gains											
510.4244	508.1798	491.5921	464.5716	436.6732	410.1083	393.0425	399.5623	413.6045	440.8585	472.2199	496.1867 (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					0.4900	10.6334	0.6300	0.7000			0.7700	1.5924 (74)	
East					7.7900	19.6403	0.6300	0.7000			0.7700	46.7581 (76)	
South					2.4400	46.7521	0.6300	0.7000			0.7700	34.8628 (78)	
West					12.7800	19.6403	0.6300	0.7000			0.7700	76.7096 (80)	
East					1.1500	26.6725	0.6300	0.7000			1.0000	12.1743 (82)	
West					1.5300	26.6725	0.6300	0.7000			1.0000	16.1971 (82)	
Solar gains	188.2942	359.2515	575.6449	824.4772	1003.4776	1025.6596	977.0179	842.7774	663.7085	421.4840	232.9887	156.0775	(83)
Total gains	698.7186	867.4313	1067.2370	1289.0488	1440.1508	1435.7679	1370.0604	1242.3396	1077.3130	862.3425	705.2086	652.2642	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)											
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	47.4407	47.5484	47.6545	48.1589	48.2545	48.7044	48.7044	48.7887	48.5301	48.2545	47.8615
alpha	4.1627	4.1699	4.1770	4.2106	4.2170	4.2470	4.2470	4.2526	4.2353	4.2170	4.1908
util living area											
0.9981	0.9950	0.9843	0.9460	0.8501	0.6878	0.5298	0.5967	0.8459	0.9760	0.9960	0.9986 (86)
MIT											
19.3439	19.5483	19.8982	20.3491	20.7149	20.9189	20.9791	20.9661	20.7954	20.2896	19.7309	19.3123 (87)
Th 2	19.7147	19.7173	19.7197	19.7313	19.7335	19.7436	19.7436	19.7455	19.7397	19.7335	19.7245 (88)
util rest of house											
0.9974	0.9931	0.9784	0.9250	0.7935	0.5815	0.3886	0.4512	0.7642	0.9630	0.9942	0.9980 (89)
MIT 2											
17.5334	17.8332	18.3422	18.9874	19.4654	19.6930	19.7368	19.7328	19.5802	18.9190	18.1087	17.4936 (90)
Living area fraction											
18.1947	18.4597	18.9106	19.4848	19.9218	20.1408	20.1906	20.1833	20.0241	19.4196	18.7012	18.1579 (92)
Temperature adjustment											
adjusted MIT	18.1947	18.4597	18.9106	19.4848	19.9218	20.1408	20.1906	20.1833	20.0241	19.4196	18.7012
											18.1579 (93)

8. Space heating requirement

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9961	0.9905	0.9732	0.9199	0.8031	0.6175	0.4406	0.5047	0.7857	0.9586	0.9921
Useful gains	695.9954	859.1874	1038.6599	1185.8240	1156.5710	886.6509	603.6884	627.0642	846.4093	826.6756	699.6260
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000
Heat loss rate W											
2443.9638	2379.6379	2173.1298	1834.0190	1421.7682	949.2938	615.1651	647.0654	1018.6077	1525.1425	2014.2038	2433.4980 (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											
1300.4885	1021.7427	844.0456	466.7004	197.3067	0.0000	0.0000	0.0000	0.0000	519.6593	946.4960	1326.6657 (98)
Space heating											6623.1049 (98)

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Space heating per m²

(98) / (4) = 55.1190 (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													7083.5346 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1300.4885	1021.7427	844.0456	466.7004	197.3067	0.0000	0.0000	0.0000	0.0000	519.6593	946.4960	1326.6657	(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)	1390.8968	1092.7730	902.7226	499.1448	211.0232	0.0000	0.0000	0.0000	0.0000	555.7854	1012.2952	1418.8937	(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	218.8975	192.9417	202.6424	181.6708	178.0426	159.1037	152.8174	167.6670	167.3643	188.3814	199.1748	213.6361	(64)
Efficiency of water heater (217)m	88.7849	88.6127	88.2101	87.2230	85.0882	79.8000	79.8000	79.8000	79.8000	87.3826	88.4384	88.8477	(216)
Fuel for water heating, kWh/month	246.5481	217.7359	229.7269	208.2831	209.2447	199.3781	191.5005	210.1091	209.7297	215.5822	225.2129	240.4521	(219)
Water heating fuel used													(219)
Annual totals kWh/year													2603.5034
Space heating fuel - main system													7083.5346 (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)													449.3972 (232)
Total delivered energy for all uses													10211.4352 (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	7083.5346	0.2160	1530.0435 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2603.5034	0.2160	562.3567 (264)
Space and water heating			2092.4002 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	449.3972	0.5190	233.2372 (268)
Total CO ₂ , kg/m ² /year			2364.5624 (272)
Emissions per m ² for space and water heating			17.4135 (272a)
Fuel factor (electricity)			1.5500
Emissions per m ² for lighting			1.9411 (272b)
Emissions per m ² for pumps and fans			0.3239 (272c)
Target Carbon Dioxide Emission Rate (TER) = (17.4135 * 1.55) + 1.9411 + 0.3239, rounded to 2 d.p.			29.2600 (273)

FULL SAP CALCULATION PRINTOUT

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CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	120.1600 (1b)	x 2.6100 (2b)	= 313.6176 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	120.1600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 313.6176 (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) =	0.1275 (8)
Measured/design AP50				Yes	5.0000
Infiltration rate					0.3775 (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) =	0.3492 (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	0.4453	0.4365	0.4278	0.3842	0.3754	0.3318	0.3318	0.3230	0.3492	0.3754	0.3929	0.4103 (22b)
	0.5991	0.5953	0.5915	0.5738	0.5705	0.5550	0.5550	0.5522	0.5610	0.5705	0.5772	0.5842 (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)			31.7700	1.3258	42.1193		(27)
Roof Windows (Uw = 1.40)			3.6300	1.3258	4.8125		(27a)
Ground Floor			120.1600	0.1200	14.4192		(28a)
Brick	75.1200	26.4400	48.6800	0.2100	10.2228		(29a)
Stone Clad	36.6500	7.5400	29.1100	0.2100	6.1131		(29a)
Wall to Garage	13.3800	1.6600	11.7200	0.4500	5.2740		(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)			419.5900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	117.8836		(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) = 140.5998 (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	62.0063	61.6079	61.2174	59.3833	59.0401	57.4426	57.4426	57.1468	58.0580	59.0401	59.7343	60.4601 (38)
Average = Sum(39)m / 12 =	202.6061	202.2077	201.8172	199.9831	199.6399	198.0424	198.0424	197.7466	198.6577	199.6399	200.3341	201.0599 (39)
												199.9814 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.6861	1.6828	1.6796	1.6643	1.6615	1.6482	1.6482	1.6457	1.6533	1.6615	1.6672	1.6733 (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												2.8639 (42)
Average daily hot water use (litres/day)												102.2183 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	112.4402	108.3515	104.2627	100.1740	96.0852	91.9965	91.9965	96.0852	100.1740	104.2627	108.3515	112.4402 (44)
Energy content (annual)	166.7455	145.8367	150.4904	131.2012	125.8907	108.6341	100.6654	115.5151	116.8947	136.2295	148.7051	161.4842 (45)
										Total = Sum(45)m =		1608.2927 (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	35.4334	30.9903	31.9792	27.8803	26.7518	23.0847	21.3914	24.5470	24.8401	28.9488	31.5998	34.3154 (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	143.1965	143.1965	143.1965	143.1965	143.1965	143.1965	143.1965	143.1965	143.1965	143.1965	143.1965	143.1965	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.4455	22.6005	18.3799	13.9148	10.4015	8.7814	9.4886	12.3336	16.5541	21.0193	24.5326	26.1527	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	285.4213	288.3831	280.9195	265.0304	244.9733	226.1224	213.5288	210.5671	218.0307	233.9198	253.9769	272.8278	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.3197	37.3197	37.3197	37.3197	37.3197	37.3197	37.3197	37.3197	37.3197	37.3197	37.3197	37.3197	(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)	-114.5572	-114.5572	-114.5572	-114.5572	-114.5572	-114.5572	-114.5572	-114.5572	-114.5572	-114.5572	-114.5572	-114.5572	(71)
Water heating gains (Table 5)	47.6256	46.1165	42.9828	38.7226	35.9567	32.0621	28.7519	32.9932	34.5002	38.9096	43.8887	46.1228	(72)
Total internal gains	424.4514	423.0591	408.2412	383.6267	357.2904	332.9249	317.7283	321.8529	335.0439	359.8076	388.3571	411.0623	(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	17.2800	19.6403	0.6300	0.7000	0.7700	103.7201 (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	254.5654	485.7375	778.4097	1114.9971	1357.1417	1387.1663	1321.3705	1139.7739	897.5310	569.9070	314.9990	211.0038	(83)
Total gains	679.0167	908.7965	1186.6510	1498.6238	1714.4321	1720.0912	1639.0988	1461.6268	1232.5749	929.7146	703.3561	622.0661	(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	16.4742	16.5067	16.5386	16.6903	16.7190	16.8539	16.8539	16.8791	16.8017	16.7190	16.6611	16.6009	
alpha	2.0983	2.1004	2.1026	2.1127	2.1146	2.1236	2.1236	2.1253	2.1201	2.1146	2.1107	2.1067	
util living area	0.9723	0.9496	0.9051	0.8215	0.7056	0.5719	0.4560	0.5114	0.7148	0.8900	0.9585	0.9768	(86)
MIT	17.5853	17.9971	18.6730	19.4999	20.1828	20.6403	20.8429	20.7942	20.3800	19.4228	18.3390	17.5134	(87)
Th 2	19.5508	19.5532	19.5555	19.5665	19.5686	19.5782	19.5782	19.5800	19.5745	19.5686	19.5644	19.5601	(88)
util rest of house	0.9672	0.9406	0.8878	0.7884	0.6488	0.4821	0.3324	0.3863	0.6361	0.8618	0.9495	0.9725	(89)
MIT 2	16.4999	16.9071	17.5689	18.3656	18.9894	19.3797	19.5212	19.4984	19.1902	18.3192	17.2580	16.4345	(90)
Living area fraction									fLA = Living area / (4) =			0.3653	(91)
MIT	16.8963	17.3053	17.9722	18.7799	19.4253	19.8401	20.0040	19.9717	19.6248	18.7223	17.6528	16.8285	(92)
Temperature adjustment												0.0000	
adjusted MIT	16.8963	17.3053	17.9722	18.7799	19.4253	19.8401	20.0040	19.9717	19.6248	18.7223	17.6528	16.8285	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	647.5222	837.0195	1024.3658	1148.8371	1101.3109	860.4051	609.9840	619.5522	788.0117	781.0872	655.8153	597.4941	(94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	2552.0926	2508.4372	2315.2859	1975.8225	1542.2830	1037.7693	674.1344	706.2947	1097.5491	1621.5264	2114.0936	2539.0922	(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	1417.0004	1123.1927	960.4446	595.4295	328.0833	0.0000	0.0000	0.0000	0.0000	625.2868	1049.9604	1444.5490	(98)
Space heating												7543.9466	(98)
Space heating per m2												(98) / (4) =	62.7825 (99)

8c. Space cooling requirement

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

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Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1861.5986	1465.5138	1502.8739	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7165	0.7755	0.7365	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1333.8270	1136.4766	1106.8812	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	2078.6742	1983.9586	1785.9308	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	536.2900	630.5266	505.2128	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												1672.0295 (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	134.0725	157.6317	126.3032	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												418.0074 (107)
Space cooling per m2												3.4788 (108)
Energy for space heating												62.7825 (99)
Energy for space cooling												3.4788 (108)
Total												66.2613 (109)
Dwelling Fabric Energy Efficiency (DFEE)												66.3 (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	120.1600 (1b)	x 2.6100 (2b)	= 313.6176 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	120.1600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 313.6176 (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) =					40.0000 / (5) = 0.1275 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3775 (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) = 0.3492 (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	0.4453	0.4365	0.4278	0.3842	0.3754	0.3318	0.3318	0.3230	0.3492	0.3754	0.3929	0.4103 (22b)
	0.5991	0.5953	0.5915	0.5738	0.5705	0.5550	0.5550	0.5522	0.5610	0.5705	0.5772	0.5842 (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)			23.5000	1.3258	31.1553		(27)
TER Room Window (Uw = 1.70)			2.6800	1.5918	4.2659		(27a)
Ground Floor			120.1600	0.1300	15.6208		(28a)
Brick	75.1200	19.5600	55.5600	0.1800	10.0008		(29a)
Stone Clad	36.6500	6.1500	30.5000	0.1800	5.4900		(29a)
Wall to Garage	13.3800	1.6600	11.7200	0.1800	2.1096		(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	2.6800	41.4200	0.1300	5.3846		(30)
Skeillins at Roof	16.2700		16.2700	0.1300	2.1151		(30)
Total net area of external elements Aum(A, m ²)			419.5900				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 96.3939		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							17.4917 (36)
Total fabric heat loss							(33) + (36) = 113.8856 (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	62.0063	61.6079	61.2174	59.3833	59.0401	57.4426	57.4426	57.1468	58.0580	59.0401	59.7343	60.4601 (38)
Heat transfer coeff	175.8919	175.4936	175.1031	173.2689	172.9257	171.3283	171.3283	171.0324	171.9436	172.9257	173.6200	174.3457 (39)
Average = Sum(39)m / 12 =												173.2673 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.4638	1.4605	1.4572	1.4420	1.4391	1.4258	1.4258	1.4234	1.4310	1.4391	1.4449	1.4509 (40)
HLP (average)												1.4420 (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												2.8639 (42)
Average daily hot water use (litres/day)												102.2183 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	112.4402	108.3515	104.2627	100.1740	96.0852	91.9965	91.9965	96.0852	100.1740	104.2627	108.3515	112.4402 (44)
Energy conte	166.7455	145.8367	150.4904	131.2012	125.8907	108.6341	100.6654	115.5151	116.8947	136.2295	148.7051	161.4842 (45)
Energy content (annual)												
Distribution loss (46)m = 0.15 x (45)m												1608.2927 (45)

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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	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	35.4334	30.9903	31.9792	27.8803	26.7518	23.0847	21.3914	24.5470	24.8401	28.9488	31.5998	34.3154 (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	143.1965	143.1965	143.1965	143.1965	143.1965	143.1965	143.1965	143.1965	143.1965	143.1965	143.1965	143.1965	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.4467	22.6016	18.3808	13.9155	10.4020	8.7818	9.4890	12.3342	16.5549	21.0203	24.5338	26.1540	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	285.4213	288.3831	280.9195	265.0304	244.9733	226.1224	213.5288	210.5671	218.0307	233.9198	253.9769	272.8278	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.3197	37.3197	37.3197	37.3197	37.3197	37.3197	37.3197	37.3197	37.3197	37.3197	37.3197	37.3197	(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)	-114.5572	-114.5572	-114.5572	-114.5572	-114.5572	-114.5572	-114.5572	-114.5572	-114.5572	-114.5572	-114.5572	-114.5572	(71)
Water heating gains (Table 5)	47.6256	46.1165	42.9828	38.7226	35.9567	32.0621	28.7519	32.9932	34.5002	38.9096	43.8887	46.1228	(72)
Total internal gains	424.4526	423.0601	408.2421	383.6274	357.2909	332.9253	317.7287	321.8534	335.0447	359.8086	388.3583	411.0635	(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				0.4900	10.6334		0.6300		0.7000		0.7700		1.5924 (74)
East				7.7900	19.6403		0.6300		0.7000		0.7700		46.7581 (76)
South				2.4400	46.7521		0.6300		0.7000		0.7700		34.8628 (78)
West				12.7800	19.6403		0.6300		0.7000		0.7700		76.7096 (80)
East				1.1500	26.6725		0.6300		0.7000		1.0000		12.1743 (82)
West				1.5300	26.6725		0.6300		0.7000		1.0000		16.1971 (82)
Solar gains	188.2942	359.2515	575.6449	824.4772	1003.4776	1025.6596	977.0179	842.7774	663.7085	421.4840	232.9887	156.0775	(83)
Total gains	612.7468	782.3117	983.8870	1208.1046	1360.7685	1358.5848	1294.7466	1164.6308	998.7532	781.2926	621.3470	567.1410	(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	47.4407	47.5484	47.6545	48.1589	48.2545	48.7044	48.7044	48.7887	48.5301	48.2545	48.0615	47.8615	
alpha	4.1627	4.1699	4.1770	4.2106	4.2170	4.2470	4.2470	4.2526	4.2353	4.2170	4.2041	4.1908	
util living area	0.9988	0.9966	0.9882	0.9559	0.8693	0.7143	0.5563	0.6282	0.8716	0.9830	0.9975	0.9992	(86)
MIT	19.2808	19.4866	19.8404	20.3011	20.6842	20.9062	20.9750	20.9589	20.7651	20.2349	19.6697	19.2496	(87)
Th 2	19.7147	19.7173	19.7197	19.7313	19.7335	19.7436	19.7436	19.7455	19.7397	19.7335	19.7291	19.7245	(88)
util rest of house	0.9984	0.9953	0.9837	0.9380	0.8166	0.6082	0.4101	0.4788	0.7969	0.9733	0.9964	0.9989	(89)
MIT 2	18.1625	18.3697	18.7227	19.1795	19.5270	19.7027	19.7379	19.7347	19.6104	19.1254	18.5619	18.1387	(90)
Living area fraction	18.5710	18.7776	19.1310	19.5892	19.9497	20.1423	20.1897	20.1818	20.0322	19.5307	18.9665	18.5445	(92)
Temperature adjustment	18.5710	18.7776	19.1310	19.5892	19.9497	20.1423	20.1897	20.1818	20.0322	19.5307	18.9665	18.5445	(93)
adjusted MIT	18.5710	18.7776	19.1310	19.5892	19.9497	20.1423	20.1897	20.1818	20.0322	19.5307	18.9665	18.5445	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9979	0.9940	0.9809	0.9355	0.8269	0.6447	0.4642	0.5342	0.8174	0.9713	0.9955	0.9985	(94)
Useful gains	611.4385	777.6370	965.0693	1130.1932	1125.2331	875.8553	601.0655	622.1058	816.3887	758.8387	618.5307	566.2667	(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	2510.1461	2435.4357	2211.7201	1852.1042	1426.5849	949.5510	615.0246	646.8157	1020.0016	1544.3421	2060.2665	2500.8961	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	1412.6385	1114.0408	927.5082	519.7759	224.2058	0.0000	0.0000	0.0000	0.0000	584.4146	1038.0498	1439.3642	(98)
Space heating												7259.9977	(98)
Space heating per m2												60.4194	(99)

8c. Space cooling requirement

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

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	1610.4857	1267.8291	1299.8465	0.0000	0.0000	0.0000	0.0000 (100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.8234	0.8891	0.8507	0.0000	0.0000	0.0000	0.0000 (101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1326.0923	1127.2607	1105.7699	0.0000	0.0000	0.0000	0.0000 (102)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1668.3113	1592.9848	1448.3994	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	246.3977	346.4987	254.9164	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction									FC = cooled area / (4) =			847.8128 (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	61.5994	86.6247	63.7291	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling per m2												211.9532 (107)
Energy for space heating												1.7639 (108)
Energy for space cooling												60.4194 (99)
Total												1.7639 (108)
Target Fabric Energy Efficiency (TFEE)												62.1833 (109)
												71.5 (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	120.1600 (1b)	x 2.6100 (2b)	= 313.6176 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	120.1600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 313.6176 (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) = 0.1275 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3775 (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) =	0.3492 (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	0.4191	0.3929	0.3842	0.3405	0.3405	0.3143	0.3230	0.3056	0.3230	0.3492	0.3580	0.3842 (22b)
Effective ac	0.5878	0.5772	0.5738	0.5580	0.5580	0.5494	0.5522	0.5467	0.5522	0.5610	0.5641	0.5738 (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)			31.7700	1.3258	42.1193		(27)
Roof Windows (Uw = 1.40)			3.6300	1.3258	4.8125		(27a)
Ground Floor			120.1600	0.1200	14.4192		(28a)
Brick	75.1200	26.4400	48.6800	0.2100	10.2228		(29a)
Stone Clad	36.6500	7.5400	29.1100	0.2100	6.1131		(29a)
Wall to Garage	13.3800	1.6600	11.7200	0.4500	5.2740		(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)
Skeilllin at Roof	16.2700		16.2700	0.1900	3.0913		(30)
Total net area of external elements Aum(A, m ²)			419.5900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	117.8836		(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) = 140.5998 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 60.8348	Feb 59.7343	Mar 59.3833	Apr 57.7464	May 57.7464	Jun 56.8589	Jul 57.1468	Aug 56.5788	Sep 57.1468	Oct 58.0580	Nov 58.3775	Dec 59.3833 (38)
Heat transfer coeff	201.4346	200.3341	199.9831	198.3461	198.3461	197.4586	197.7466	197.1786	197.7466	198.6577	198.9772	199.9831 (39)
Average = Sum(39)m / 12 =												198.8494 (39)
HLP	Jan 1.6764	Feb 1.6672	Mar 1.6643	Apr 1.6507	May 1.6507	Jun 1.6433	Jul 1.6457	Aug 1.6410	Sep 1.6457	Oct 1.6533	Nov 1.6559	Dec 1.6643 (40)
HLP (average)												1.6549 (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												2.8639 (42)
Average daily hot water use (litres/day)												102.2183 (43)
Daily hot water use	Jan 112.4402	Feb 108.3515	Mar 104.2627	Apr 100.1740	May 96.0852	Jun 91.9965	Jul 91.9965	Aug 96.0852	Sep 100.1740	Oct 104.2627	Nov 108.3515	Dec 112.4402 (44)
Energy conte	166.7455	145.8367	150.4904	131.2012	125.8907	108.6341	100.6654	115.5151	116.8947	136.2295	148.7051	161.4842 (45)
Energy content (annual)										Total = Sum(45)m =		1608.2927 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Design SAP
elmhurst energy

CALCULATION OF HEAT DEMAND 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	25.0118	21.8755	22.5736	19.6802	18.8836	16.2951	15.0998	17.3273	17.5342	20.4344	22.3058	24.2226 (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												
218.9681 193.0055 202.7130 181.7392 178.1133 159.1721 152.8880 167.7377 167.4327 188.4521 199.2431 213.7068 (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	218.9681	193.0055	202.7130	181.7392	178.1133	159.1721	152.8880	167.7377	167.4327	188.4521	199.2431	213.7068 (64)
RHI water heating demand												2223.1717 (64)
Heat gains from water heating, kWh/month	97.2210	86.2257	91.8161	84.0548	83.6367	76.5512	75.2493	80.1868	79.2979	87.0744	89.8749	95.4716 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	171.8358	171.8358	171.8358	171.8358	171.8358	171.8358	171.8358	171.8358	171.8358	171.8358	171.8358	171.8358 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	63.6138	56.5012	45.9499	34.7870	26.0037	21.9534	23.7214	30.8340	41.3854	52.5482	61.3315	65.3818 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	426.0020	430.4225	419.2828	395.5678	365.6318	337.4961	318.6998	314.2792	325.4189	349.1340	379.0700	407.2056 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.0475	55.0475	55.0475	55.0475	55.0475	55.0475	55.0475	55.0475	55.0475	55.0475	55.0475	55.0475 (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)	-114.5572	-114.5572	-114.5572	-114.5572	-114.5572	-114.5572	-114.5572	-114.5572	-114.5572	-114.5572	-114.5572	-114.5572 (71)
Water heating gains (Table 5)	130.6734	128.3121	123.4088	116.7428	112.4150	106.3212	101.1416	107.7780	110.1360	117.0355	124.8262	128.3220 (72)
Total internal gains	735.6152	730.5620	703.9676	662.4237	619.3765	581.0968	558.8889	568.2174	592.2663	634.0438	680.5539	716.2356 (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	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				17.2800	23.7288	0.6300		0.7000		0.7700		125.3116 (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	305.1202	518.0169	826.5840	1245.0032	1454.2067	1587.4814	1495.1492	1304.0061	1019.5416	649.9295	381.3538	244.5016 (83)
Total gains	1040.7354	1248.5789	1530.5516	1907.4269	2073.5832	2168.5782	2054.0381	1872.2235	1611.8080	1283.9733	1061.9077	960.7372 (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	16.5700	16.6611	16.6903	16.8280	16.8280	16.9037	16.8791	16.9277	16.8791	16.8017	16.7747	16.6903
alpha	2.1047	2.1107	2.1127	2.1219	2.1219	2.1269	2.1253	2.1285	2.1253	2.1201	2.1183	2.1127
util living area	0.9353	0.9081	0.8491	0.7381	0.6029	0.4420	0.3219	0.3395	0.5717	0.7922	0.9034	0.9423 (86)
MIT	18.7518	18.9906	19.4728	20.0447	20.4792	20.7344	20.8262	20.8228	20.6224	20.0858	19.3490	18.7401 (87)
Th 2	19.5578	19.5644	19.5665	19.5764	19.5764	19.5817	19.5800	19.5834	19.5800	19.5745	19.5726	19.5665 (88)
util rest of house	0.9240	0.8927	0.8237	0.6954	0.5361	0.3490	0.2038	0.2126	0.4753	0.7437	0.8836	0.9320 (89)
MIT 2	16.6648	17.0053	17.6822	18.4617	19.0161	19.3031	19.3798	19.3829	19.2033	18.5473	17.5291	16.6540 (90)
Living area fraction									FLA = Living area / (4) =			0.3653 (91)
MIT	17.4271	17.7304	18.3362	19.0399	19.5505	19.8259	19.9081	19.9088	19.7216	19.1092	18.1938	17.4160 (92)
Temperature adjustment												0.0000
adjusted MIT	17.4271	17.7304	18.3362	19.0399	19.5505	19.8259	19.9081	19.9088	19.7216	19.1092	18.1938	17.4160 (93)

8. Space heating requirement

Utilisation	0.9014	0.8669	0.7969	0.6770	0.5348	0.3660	0.2324	0.2433	0.4860	0.7246	0.8584	0.9106 (94)
Useful gains	938.1326	1082.4051	1219.6204	1291.2336	1108.8584	793.7512	477.3912	455.5774	783.2772	930.3379	911.5597	874.8851 (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	2503.2493	2470.2053	2247.0573	1892.1957	1378.6008	873.9303	495.9674	474.9698	933.6822	1471.9032	2008.4400	2442.9870 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh												

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Space heating	1164.4468	932.6018	764.4131	432.6927	200.6883	0.0000	0.0000	0.0000	0.0000	402.9246	789.7538	1166.6678 (98)
RHI space heating demand												5854.1889 (98)
												5854 (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	120.1600 (1b)	x 2.6100 (2b)	= 313.6176 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	120.1600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 313.6176 (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					0.3775 (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	0.4453	0.4365	0.4278	0.3842	0.3754	0.3318	0.3318	0.3230	0.3492	0.3754	0.3929	0.4103 (22b)
	0.5991	0.5953	0.5915	0.5738	0.5705	0.5550	0.5550	0.5522	0.5610	0.5705	0.5772	0.5842 (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)			31.7700	1.3258	42.1193		(27)
Roof Windows (Uw = 1.40)			3.6300	1.3258	4.8125		(27a)
Ground Floor			120.1600	0.1200	14.4192		(28a)
Brick	75.1200	26.4400	48.6800	0.2100	10.2228		(29a)
Stone Clad	36.6500	7.5400	29.1100	0.2100	6.1131		(29a)
Wall to Garage	13.3800	1.6600	11.7200	0.4500	5.2740		(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)
Skeilllin at Roof	16.2700		16.2700	0.1900	3.0913		(30)
Total net area of external elements Aum(A, m ²)			419.5900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	117.8836		(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) = 140.5998 (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	62.0063	61.6079	61.2174	59.3833	59.0401	57.4426	57.4426	57.1468	58.0580	59.0401	59.7343	60.4601 (38)
Average = Sum(39)m / 12 =	202.6061	202.2077	201.8172	199.9831	199.6399	198.0424	198.0424	197.7466	198.6577	199.6399	200.3341	201.0599 (39)
												199.9814 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.6861	1.6828	1.6796	1.6643	1.6615	1.6482	1.6482	1.6457	1.6533	1.6615	1.6672	1.6733 (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												2.8639 (42)
Average daily hot water use (litres/day)												102.2183 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	112.4402	108.3515	104.2627	100.1740	96.0852	91.9965	91.9965	96.0852	100.1740	104.2627	108.3515	112.4402 (44)
Energy content (annual)	166.7455	145.8367	150.4904	131.2012	125.8907	108.6341	100.6654	115.5151	116.8947	136.2295	148.7051	161.4842 (45)
										Total = Sum(45)m =		1608.2927 (45)

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Distribution loss (46)m = 0.15 x (45)m	25.0118	21.8755	22.5736	19.6802	18.8836	16.2951	15.0998	17.3273	17.5342	20.4344	22.3058	24.2226 (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												
218.9681 193.0055 202.7130 181.7392 178.1133 159.1721 152.8880 167.7377 167.4327 188.4521 199.2431 213.7068 (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	218.9681	193.0055	202.7130	181.7392	178.1133	159.1721	152.8880	167.7377	167.4327	188.4521	199.2431	213.7068 (64)
Total per year (kWh/year) = Sum(64)m =												2223.1717 (64)
Heat gains from water heating, kWh/month	97.2210	86.2257	91.8161	84.0548	83.6367	76.5512	75.2493	80.1868	79.2979	87.0744	89.8749	95.4716 (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	171.8358	171.8358	171.8358	171.8358	171.8358	171.8358	171.8358	171.8358	171.8358	171.8358	171.8358	171.8358	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
63.6138 56.5012 45.9499 34.7870 26.0037 21.9534 23.7214 30.8340 41.3854 52.5482 61.3315 65.3818 (67)													
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
426.0020 430.4225 419.2828 395.5678 365.6318 337.4961 318.6998 314.2792 325.4189 349.1340 379.0700 407.2056 (68)													
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
55.0475 55.0475 55.0475 55.0475 55.0475 55.0475 55.0475 55.0475 55.0475 55.0475 55.0475 55.0475 (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)													
-114.5572 -114.5572 -114.5572 -114.5572 -114.5572 -114.5572 -114.5572 -114.5572 -114.5572 -114.5572 -114.5572 -114.5572 (71)													
Water heating gains (Table 5)													
130.6734 128.3121 123.4088 116.7428 112.4150 106.3212 101.1416 107.7780 110.1360 117.0355 124.8262 128.3220 (72)													
Total internal gains	735.6152	730.5620	703.9676	662.4237	619.3765	581.0968	558.8889	568.2174	592.2663	634.0438	680.5539	716.2356 (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					17.2800	19.6403	0.6300		0.7000		0.7700		103.7201 (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	254.5654	485.7375	778.4097	1114.9971	1357.1417	1387.1663	1321.3705	1139.7739	897.5310	569.9070	314.9990	211.0038	(83)	
Total gains	990.1806	1216.2994	1482.3774	1777.4208	1976.5182	1968.2632	1880.2594	1707.9913	1489.7973	1203.9507	995.5529	927.2393	(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	16.4742	16.5067	16.5386	16.6903	16.7190	16.8539	16.8539	16.8791	16.8017	16.7190	16.6611	16.6009	
alpha	2.0983	2.1004	2.1026	2.1127	2.1146	2.1236	2.1236	2.1253	2.1201	2.1146	2.1107	2.1067	
util living area	0.9451	0.9169	0.8656	0.7759	0.6575	0.5234	0.4100	0.4567	0.6508	0.8375	0.9236	0.9515 (86)	
MIT	18.5711	18.8583	19.3250	19.8888	20.3461	20.6489	20.7790	20.7513	20.4933	19.8623	19.1099	18.5177 (87)	
Th 2	19.5508	19.5532	19.5555	19.5665	19.5686	19.5782	19.5782	19.5800	19.5745	19.5686	19.5644	19.5601 (88)	
util rest of house	0.9357	0.9030	0.8432	0.7382	0.5984	0.4358	0.2948	0.3391	0.5683	0.8005	0.9084	0.9432 (89)	
MIT 2	16.4019	16.8110	17.4694	18.2498	18.8488	19.2174	19.3459	19.3280	19.0575	18.2431	17.1850	16.3302 (90)	
Living area fraction													
MIT	17.1942	17.5588	18.1472	18.8485	19.3957	19.7403	19.8694	19.8479	19.5820	18.8346	17.8881	17.1292 (92)	
Temperature adjustment												0.0000	
adjusted MIT	17.1942	17.5588	18.1472	18.8485	19.3957	19.7403	19.8694	19.8479	19.5820	18.8346	17.8881	17.1292 (93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
0.9147 0.8779 0.8158 0.7161 0.5904 0.4466 0.3200 0.3631 0.5688 0.7769 0.8846 0.9236 (94)													
Useful gains	905.6992	1067.7588	1209.3683	1272.8287	1166.9807	879.0937	601.7094	620.1273	847.3626	935.3985	880.6825	856.3730 (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	2612.4465	2559.7079	2350.5969	1989.5282	1536.3696	1017.9884	647.4713	681.8067	1089.0362	1643.9499	2161.2285	2599.5488 (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	1269.8200	1002.5898	849.0741	516.0237	274.8254	0.0000	0.0000	0.0000	0.0000	527.1623	921.9931	1296.9228 (98)	

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Space heating 6658.4111 (98)
Space heating per m2 (98) / (4) = 55.4129 (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 3916.7124 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	1269.8200	1002.5898	849.0741	516.0237	274.8254	0.0000	0.0000	0.0000	0.0000	527.1623	921.9931	1296.9228 (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)	746.9529	589.7587	499.4553	303.5433	161.6620	0.0000	0.0000	0.0000	0.0000	310.0954	542.3489	762.8958 (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	218.9681	193.0055	202.7130	181.7392	178.1133	159.1721	152.8880	167.7377	167.4327	188.4521	199.2431	213.7068 (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	128.8048	113.5327	119.2430	106.9054	104.7725	93.6306	89.9341	98.6692	98.4898	110.8542	117.2018	125.7099 (219)
Water heating fuel used												1307.7480 (219)
Annual totals kWh/year												
Space heating fuel - main system												3916.7124 (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)												449.3758 (232)
Total delivered energy for all uses												5703.8362 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3916.7124	13.1900	516.6144 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1307.7480	13.1900	172.4920 (247)
Pumps and fans for heating	30.0000	13.1900	3.9570 (249)
Energy for lighting	449.3758	13.1900	59.2727 (250)
Additional standing charges			0.0000 (251)
Total energy cost			752.3360 (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] = 1.9132 (257)
 SAP value 73.3111
 SAP rating (Section 12) 73 (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	3916.7124	0.5190	2032.7737 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1307.7480	0.5190	678.7212 (264)
Space and water heating			2711.4950 (265)
Pumps and fans	30.0000	0.5190	15.5700 (267)
Energy for lighting	449.3758	0.5190	233.2260 (268)
Total kg/year			2960.2910 (272)
CO2 emissions per m2			24.6400 (273)
EI value			75.9821
EI rating			76 (274)
EI band			C

Calculation of stars for heating and DHW

Main heating energy efficiency $13.19 \times (1 + 0.29 \times 0.25) / 1.7000 = 8.321$, stars = 2
 Main heating environmental impact $0.519 \times (1 + 0.29 \times 0.25) / 1.7000 = 0.3274$, 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

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Water heating environmental impact

$0.519 / 1.7000 = 0.3053$, stars = 4

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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	120.1600 (1b)	x 2.6100 (2b)	= 313.6176 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	120.1600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 313.6176 (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) = 0.1275 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3775 (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) = 0.3492 (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	0.4191	0.3929	0.3842	0.3405	0.3405	0.3143	0.3230	0.3056	0.3230	0.3492	0.3580	0.3842 (22b)
Effective ac	0.5878	0.5772	0.5738	0.5580	0.5580	0.5494	0.5522	0.5467	0.5522	0.5610	0.5641	0.5738 (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)			31.7700	1.3258	42.1193		(27)
Roof Windows (Uw = 1.40)			3.6300	1.3258	4.8125		(27a)
Ground Floor			120.1600	0.1200	14.4192		(28a)
Brick	75.1200	26.4400	48.6800	0.2100	10.2228		(29a)
Stone Clad	36.6500	7.5400	29.1100	0.2100	6.1131		(29a)
Wall to Garage	13.3800	1.6600	11.7200	0.4500	5.2740		(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)			419.5900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	117.8836		(33)

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

Total fabric heat loss (33) + (36) = 140.5998 (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	60.8348	59.7343	59.3833	57.7464	57.7464	56.8589	57.1468	56.5788	57.1468	58.0580	58.3775	59.3833 (38)
Heat transfer coeff	201.4346	200.3341	199.9831	198.3461	198.3461	197.4586	197.7466	197.1786	197.7466	198.6577	198.9772	199.9831 (39)
Average = Sum(39)m / 12 =												198.8494 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.6764	1.6672	1.6643	1.6507	1.6507	1.6433	1.6457	1.6410	1.6457	1.6533	1.6559	1.6643 (40)
HLP (average)												1.6549 (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												2.8639 (42)
Average daily hot water use (litres/day)												102.2183 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	112.4402	108.3515	104.2627	100.1740	96.0852	91.9965	91.9965	96.0852	100.1740	104.2627	108.3515	112.4402 (44)
Energy conte	166.7455	145.8367	150.4904	131.2012	125.8907	108.6341	100.6654	115.5151	116.8947	136.2295	148.7051	161.4842 (45)
Energy content (annual)										Total = Sum(45)m =		1608.2927 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Distribution loss (46)m = 0.15 x (45)m	25.0118	21.8755	22.5736	19.6802	18.8836	16.2951	15.0998	17.3273	17.5342	20.4344	22.3058	24.2226 (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												
218.9681 193.0055 202.7130 181.7392 178.1133 159.1721 152.8880 167.7377 167.4327 188.4521 199.2431 213.7068 (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	218.9681	193.0055	202.7130	181.7392	178.1133	159.1721	152.8880	167.7377	167.4327	188.4521	199.2431	213.7068 (64)
Heat gains from water heating, kWh/month	97.2210	86.2257	91.8161	84.0548	83.6367	76.5512	75.2493	80.1868	79.2979	87.0744	89.8749	95.4716 (65)
Total per year (kWh/year) = Sum(64)m =												2223.1717 (64)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	171.8358	171.8358	171.8358	171.8358	171.8358	171.8358	171.8358	171.8358	171.8358	171.8358	171.8358	171.8358	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
63.6138 56.5012 45.9499 34.7870 26.0037 21.9534 23.7214 30.8340 41.3854 52.5482 61.3315 65.3818 (67)													
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
426.0020 430.4225 419.2828 395.5678 365.6318 337.4961 318.6998 314.2792 325.4189 349.1340 379.0700 407.2056 (68)													
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
55.0475 55.0475 55.0475 55.0475 55.0475 55.0475 55.0475 55.0475 55.0475 55.0475 55.0475 55.0475 (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)													
-114.5572 -114.5572 -114.5572 -114.5572 -114.5572 -114.5572 -114.5572 -114.5572 -114.5572 -114.5572 -114.5572 -114.5572 (71)													
Water heating gains (Table 5)													
130.6734 128.3121 123.4088 116.7428 112.4150 106.3212 101.1416 107.7780 110.1360 117.0355 124.8262 128.3220 (72)													
Total internal gains	735.6152	730.5620	703.9676	662.4237	619.3765	581.0968	558.8889	568.2174	592.2663	634.0438	680.5539	716.2356 (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	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					17.2800	23.7288		0.6300		0.7000	0.7700	125.3116 (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	305.1202	518.0169	826.5840	1245.0032	1454.2067	1587.4814	1495.1492	1304.0061	1019.5416	649.9295	381.3538	244.5016 (83)
Total gains	1040.7354	1248.5789	1530.5516	1907.4269	2073.5832	2168.5782	2054.0381	1872.2235	1611.8080	1283.9733	1061.9077	960.7372 (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	16.5700	16.6611	16.6903	16.8280	16.8280	16.9037	16.8791	16.9277	16.8791	16.8017	16.7747	16.6903	
alpha	2.1047	2.1107	2.1127	2.1219	2.1219	2.1269	2.1253	2.1285	2.1253	2.1201	2.1183	2.1127	
util living area	0.9353	0.9081	0.8491	0.7381	0.6029	0.4420	0.3219	0.3395	0.5717	0.7922	0.9034	0.9423 (86)	
MIT	18.7518	18.9906	19.4728	20.0447	20.4792	20.7344	20.8262	20.8228	20.6224	20.0858	19.3490	18.7401 (87)	
Th 2	19.5578	19.5644	19.5665	19.5764	19.5764	19.5817	19.5800	19.5834	19.5800	19.5745	19.5726	19.5665 (88)	
util rest of house	0.9240	0.8927	0.8237	0.6954	0.5361	0.3490	0.2038	0.2126	0.4753	0.7437	0.8836	0.9320 (89)	
MIT 2	16.6648	17.0053	17.6822	18.4617	19.0161	19.3031	19.3798	19.3829	19.2033	18.5473	17.5291	16.6540 (90)	
Living area fraction									fLA = Living area / (4) =			0.3653 (91)	
MIT	17.4271	17.7304	18.3362	19.0399	19.5505	19.8259	19.9081	19.9088	19.7216	19.1092	18.1938	17.4160 (92)	
Temperature adjustment												0.0000	
adjusted MIT	17.4271	17.7304	18.3362	19.0399	19.5505	19.8259	19.9081	19.9088	19.7216	19.1092	18.1938	17.4160 (93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
0.9014 0.8669 0.7969 0.6770 0.5348 0.3660 0.2324 0.2433 0.4860 0.7246 0.8584 0.9106 (94)													
Useful gains	938.1326	1082.4051	1219.6204	1291.2336	1108.8584	793.7512	477.3912	455.5774	783.2772	930.3379	911.5597	874.8851 (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	2503.2493	2470.2053	2247.0573	1892.1957	1378.6008	873.9303	495.9674	474.9698	933.6822	1471.9032	2008.4400	2442.9870 (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	1164.4468	932.6018	764.4131	432.6927	200.6883	0.0000	0.0000	0.0000	0.0000	402.9246	789.7538	1166.6678 (98)	

FULL SAP CALCULATION PRINTOUT

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

Space heating 5854.1889 (98)
Space heating per m2 (98) / (4) = 48.7199 (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 3443.6405 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	1164.4468	932.6018	764.4131	432.6927	200.6883	0.0000	0.0000	0.0000	0.0000	402.9246	789.7538	1166.6678 (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)	684.9687	548.5893	449.6547	254.5251	118.0520	0.0000	0.0000	0.0000	0.0000	237.0145	464.5611	686.2752 (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	218.9681	193.0055	202.7130	181.7392	178.1133	159.1721	152.8880	167.7377	167.4327	188.4521	199.2431	213.7068 (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	128.8048	113.5327	119.2430	106.9054	104.7725	93.6306	89.9341	98.6692	98.4898	110.8542	117.2018	125.7099 (219)
Water heating fuel used												1307.7480 (219)
Annual totals kWh/year												
Space heating fuel - main system												3443.6405 (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)												449.3758 (232)
Total delivered energy for all uses												5230.7644 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3443.6405	19.4400	669.4437 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1307.7480	19.4400	254.2262 (247)
Pumps and fans for heating	30.0000	19.4400	5.8320 (249)
Energy for lighting	449.3758	19.4400	87.3587 (250)
Additional standing charges			0.0000 (251)
Total energy cost			1016.8606 (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	3443.6405	0.5190	1787.2494 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1307.7480	0.5190	678.7212 (264)
Space and water heating			2465.9707 (265)
Pumps and fans	30.0000	0.5190	15.5700 (267)
Energy for lighting	449.3758	0.5190	233.2260 (268)
Total kg/year			2714.7667 (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	3443.6405	3.0700	10571.9764 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1307.7480	3.0700	4014.7865 (264)
Space and water heating			14586.7629 (265)
Pumps and fans	30.0000	3.0700	92.1000 (267)
Energy for lighting	449.3758	3.0700	1379.5837 (268)
Primary energy kWh/year			16058.4466 (272)
Primary energy kWh/m2/year			133.6422 (273)

SAP 2012 EPC IMPROVEMENTS

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

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 73
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 (10.0%)
U Solar photovoltaic panels	+ 8.1	-£ 375	-1000 kg (41.0%)

	Typical annual savings	Energy efficiency	Environmental impact
Recommended measures			
Solar water heating	£102	2.27 kg/m²	C 76 C 78
Solar photovoltaic panels	£375	8.33 kg/m²	B 84 B 85
Total Savings	£477	10.59 kg/m²	

Potential energy efficiency rating: B 84
Potential environmental impact rating: B 85

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	Potential	Saving
Electricity	£1017	£915	£102
Space heating	£675	£676	-£0
Water heating	£254	£152	£102
Lighting	£87	£87	£0
Generated (PV)	-£0	-£375	£375
Total cost of fuels	£1017	£540	£477
Total cost of uses	£1016	£540	£477
Delivered energy	44 kWh/m²	23 kWh/m²	20 kWh/m²
Carbon dioxide emissions	2.7 tonnes	1.4 tonnes	1.3 tonnes
CO2 emissions per m²	23 kg/m²	12 kg/m²	11 kg/m²
Primary energy	134 kWh/m²	71 kWh/m²	63 kWh/m²

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

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	120.1600 (1b)	x 2.6100 (2b)	= 313.6176 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	120.1600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 313.6176 (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					0.3775 (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	0.4453	0.4365	0.4278	0.3842	0.3754	0.3318	0.3318	0.3230	0.3492	0.3754	0.3929	0.4103 (22b)
	0.5991	0.5953	0.5915	0.5738	0.5705	0.5550	0.5550	0.5522	0.5610	0.5705	0.5772	0.5842 (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)			31.7700	1.3258	42.1193		(27)
Roof Windows (Uw = 1.40)			3.6300	1.3258	4.8125		(27a)
Ground Floor			120.1600	0.1200	14.4192		(28a)
Brick	75.1200	26.4400	48.6800	0.2100	10.2228		(29a)
Stone Clad	36.6500	7.5400	29.1100	0.2100	6.1131		(29a)
Wall to Garage	13.3800	1.6600	11.7200	0.4500	5.2740		(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)			419.5900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	117.8836		(33)

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

100.0000 (35)
22.7162 (36)
(33) + (36) = 140.5998 (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	62.0063	61.6079	61.2174	59.3833	59.0401	57.4426	57.4426	57.1468	58.0580	59.0401	59.7343	60.4601 (38)
Heat transfer coeff	202.6061	202.2077	201.8172	199.9831	199.6399	198.0424	198.0424	197.7466	198.6577	199.6399	200.3341	201.0599 (39)
Average = Sum(39)m / 12 =												199.9814 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.6861	1.6828	1.6796	1.6643	1.6615	1.6482	1.6482	1.6457	1.6533	1.6615	1.6672	1.6733 (40)
HLP (average)												1.6643 (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												2.8639 (42)
Average daily hot water use (litres/day)												102.2183 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	112.4402	108.3515	104.2627	100.1740	96.0852	91.9965	91.9965	96.0852	100.1740	104.2627	108.3515	112.4402 (44)
Energy conte	166.7455	145.8367	150.4904	131.2012	125.8907	108.6341	100.6654	115.5151	116.8947	136.2295	148.7051	161.4842 (45)
Energy content (annual)										Total = Sum(45)m =		1608.2927 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	25.0118	21.8755	22.5736	19.6802	18.8836	16.2951	15.0998	17.3273	17.5342	20.4344	22.3058	24.2226 (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												
218.9681 193.0055 201.3173 174.9856 165.3190 146.5654 139.8611 155.6412 162.0298 187.0563 199.2431 213.7068 (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												1.1277 (H8)
Utilisation factor												0.5880 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												102.2183 (H14)
Volume ratio Veff/V												0.7337 (H15)
Solar storage volume factor												0.9381 (H16)
Solar input												-879.6500 (H17)
Solar input	-25.5081	-42.5657	-72.4942	-97.1566	-120.0287	-118.0074	-116.4479	-101.7411	-79.6837	-54.4146	-30.2563	-21.3459 (63)
Solar input (sum of months) = Sum(63)m =												-879.6500 (63)
Output from w/h												
193.4600 150.4398 128.8231 77.8290 45.2902 28.5580 23.4132 53.9001 82.3461 132.6418 168.9869 192.3608 (64)												
Total per year (kWh/year) = Sum(64)m =												1278.0492 (64)
Heat gains from water heating, kWh/month												
97.2210 86.2257 90.6996 78.6519 73.4013 66.4659 64.8278 70.5097 74.9756 85.9578 89.8749 95.4716 (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 171.8358 171.8358 171.8358 171.8358 171.8358 171.8358 171.8358 171.8358 171.8358 171.8358 171.8358 (66)												
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
63.6138 56.5012 45.9499 34.7870 26.0037 21.9534 23.7214 30.8340 41.3854 52.5482 61.3315 65.3818 (67)												
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
426.0020 430.4225 419.2828 395.5678 365.6318 337.4961 318.6998 314.2792 325.4189 349.1340 379.0700 407.2056 (68)												
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
55.0475 55.0475 55.0475 55.0475 55.0475 55.0475 55.0475 55.0475 55.0475 55.0475 55.0475 55.0475 (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)												
-114.5572 -114.5572 -114.5572 -114.5572 -114.5572 -114.5572 -114.5572 -114.5572 -114.5572 -114.5572 -114.5572 -114.5572 (71)												
Water heating gains (Table 5)												
130.6734 128.3121 121.9080 109.2388 98.6576 92.3137 87.1341 94.7711 104.1328 115.5347 124.8262 128.3220 (72)												
Total internal gains												
735.6152 730.5620 702.4668 654.9197 605.6192 567.0893 544.8815 555.2104 586.2631 632.5430 680.5539 716.2356 (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	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					17.2800	19.6403	0.6300		0.7000		0.7700		103.7201 (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	254.5654	485.7375	778.4097	1114.9971	1357.1417	1387.1663	1321.3705	1139.7739	897.5310	569.9070	314.9990	211.0038	(83)	
Total gains	990.1806	1216.2994	1480.8766	1769.9168	1962.7609	1954.2557	1866.2520	1694.9844	1483.7941	1202.4499	995.5529	927.2393	(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 16.4742 16.5067 16.5386 16.6903 16.7190 16.8539 16.8539 16.8791 16.8017 16.7190 16.6611 16.6009												
alpha 2.0983 2.1004 2.1026 2.1127 2.1146 2.1236 2.1236 2.1253 2.1201 2.1146 2.1107 2.1067												
util living area												
0.9451 0.9169 0.8658 0.7771 0.6599 0.5260 0.4125 0.4594 0.6522 0.8378 0.9236 0.9515 (86)												
MIT 18.5711 18.8583 19.3240 19.8853 20.3421 20.6466 20.7778 20.7499 20.4916 19.8615 19.1099 18.5177 (87)												
Th 2 19.5508 19.5532 19.5555 19.5665 19.5686 19.5782 19.5782 19.5800 19.5745 19.5686 19.5644 19.5601 (88)												
util rest of house												
0.9357 0.9030 0.8434 0.7395 0.6009 0.4382 0.2968 0.3413 0.5697 0.8009 0.9084 0.9432 (89)												
MIT 2 16.4019 16.8110 17.4681 18.2454 18.8442 19.2154 19.3453 19.3271 19.0558 18.2420 17.1850 16.3302 (90)												
Living area fraction												0.3653 (91)
FLA = Living area / (4) =												

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

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MIT	17.1942	17.5588	18.1460	18.8444	19.3913	19.7382	19.8685	19.8468	19.5802	18.8336	17.8881	17.1292 (92)
Temperature adjustment												0.0000
adjusted MIT	17.1942	17.5588	18.1460	18.8444	19.3913	19.7382	19.8685	19.8468	19.5802	18.8336	17.8881	17.1292 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9147	0.8779	0.8161	0.7173	0.5927	0.4489	0.3220	0.3653	0.5701	0.7773	0.8846	0.9236 (94)	
Useful gains	905.6992	1067.7588	1208.4855	1269.6366	1163.3766	877.3257	600.9882	619.1835	845.9387	934.6180	880.6825	856.3730 (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	2612.4465	2559.7079	2350.3648	1988.7106	1535.4916	1017.5832	647.3083	681.5924	1088.6924	1643.7470	2161.2285	2599.5488 (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	1269.8200	1002.5898	849.5582	517.7333	276.8535	0.0000	0.0000	0.0000	0.0000	527.5920	921.9931	1296.9228 (98)	
Space heating												6663.0626 (98)	
Space heating per m2												(98) / (4) = 55.4516 (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													3919.4486 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1269.8200	1002.5898	849.5582	517.7333	276.8535	0.0000	0.0000	0.0000	0.0000	527.5920	921.9931	1296.9228 (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)	746.9529	589.7587	499.7401	304.5490	162.8550	0.0000	0.0000	0.0000	0.0000	310.3482	542.3489	762.8958 (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	193.4600	150.4398	128.8231	77.8290	45.2902	28.5580	23.4132	53.9001	82.3461	132.6418	168.9869	192.3608 (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	113.8000	88.4940	75.7783	45.7818	26.6413	16.7988	13.7725	31.7060	48.4389	78.0246	99.4040	113.1534 (219)	
Water heating fuel used												751.7937 (219)	
Annual totals kWh/year													
Space heating fuel - main system													3919.4486 (211)
Space heating fuel - secondary													0.0000 (215)
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)													449.3758 (232)
Energy saving/generation technologies (Appendices M,N and Q)													
PV Unit 0 (0.80 * 2.50 * 1080 * 0.80) =									-1727.2394				-1727.2394 (233)
Total delivered energy for all uses													3473.3787 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost f/year	
Space heating - main system 1	3919.4486	13.1900	516.9753 (240)	
Space heating - secondary	0.0000	0.0000	0.0000 (242)	
Water heating (other fuel)	751.7937	13.1900	99.1616 (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	449.3758	13.1900	59.2727 (250)	
Additional standing charges			0.0000 (251)	
Energy saving/generation technologies				
PV Unit	-1727.2394	13.1900	-227.8229 (252)	
Total energy cost			458.1386 (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] =	1.1650 (257)
SAP value			83.7477
SAP rating (Section 12)			84 (258)
SAP band			B

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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	3919.4486	0.5190	2034.1938	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	751.7937	0.5190	390.1809	(264)
Space and water heating			2424.3747	(265)
Pumps and fans	80.0000	0.5190	41.5200	(267)
Energy for lighting	449.3758	0.5190	233.2260	(268)
Energy saving/generation technologies				
FV Unit	-1727.2394	0.5190	-896.4372	(269)
Total kg/year			1802.6835	(272)
CO2 emissions per m2			15.0000	(273)
EI value			85.3742	
EI rating			85	(274)
EI band			B	

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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	120.1600 (1b)	x 2.6100 (2b)	= 313.6176 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	120.1600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 313.6176 (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) =	0.1275 (8)
Pressure test				Yes	
Measured/design AP50				5.0000	
Infiltration rate				0.3775 (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) =		0.3492 (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												
Effective ac	0.4191	0.3929	0.3842	0.3405	0.3405	0.3143	0.3230	0.3056	0.3230	0.3492	0.3580	0.3842 (22b)
	0.5878	0.5772	0.5738	0.5580	0.5580	0.5494	0.5522	0.5467	0.5522	0.5610	0.5641	0.5738 (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)			31.7700	1.3258	42.1193		(27)
Roof Windows (Uw = 1.40)			3.6300	1.3258	4.8125		(27a)
Ground Floor			120.1600	0.1200	14.4192		(28a)
Brick	75.1200	26.4400	48.6800	0.2100	10.2228		(29a)
Stone Clad	36.6500	7.5400	29.1100	0.2100	6.1131		(29a)
Wall to Garage	13.3800	1.6600	11.7200	0.4500	5.2740		(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)			419.5900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	117.8836		(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) = 140.5998 (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	60.8348	59.7343	59.3833	57.7464	57.7464	56.8589	57.1468	56.5788	57.1468	58.0580	58.3775	59.3833 (38)
Average = Sum(39)m / 12 =	201.4346	200.3341	199.9831	198.3461	198.3461	197.4586	197.7466	197.1786	197.7466	198.6577	198.9772	199.9831 (39)
												198.8494 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.6764	1.6672	1.6643	1.6507	1.6507	1.6433	1.6457	1.6410	1.6457	1.6533	1.6559	1.6643 (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												2.8639 (42)
Average daily hot water use (litres/day)												102.2183 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	112.4402	108.3515	104.2627	100.1740	96.0852	91.9965	91.9965	96.0852	100.1740	104.2627	108.3515	112.4402 (44)
Energy content (annual)	166.7455	145.8367	150.4904	131.2012	125.8907	108.6341	100.6654	115.5151	116.8947	136.2295	148.7051	161.4842 (45)
										Total = Sum(45)m =		1608.2927 (45)

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Distribution loss (46)m = 0.15 x (45)m	25.0118	21.8755	22.5736	19.6802	18.8836	16.2951	15.0998	17.3273	17.5342	20.4344	22.3058	24.2226 (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	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												
218.9681 193.0055 201.3173 174.9856 165.3190 146.5654 139.8611 155.6412 162.0298 187.0563 199.2431 213.7068 (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												1.2585 (H8)
Utilisation factor												0.5482 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												102.2183 (H14)
Volume ratio Veff/V												0.7337 (H15)
Solar storage volume factor												0.9381 (H16)
Solar input												-915.2812 (H17)
Solar input	-28.2239	-41.9250	-71.2080	-100.5913	-119.4843	-125.5643	-122.4667	-108.0239	-83.8050	-57.3390	-33.8171	-22.8328 (63)
Solar input (sum of months) = Sum(63)m =												-915.2812 (63)
Output from w/h												
190.7443 151.0805 130.1093 74.3943 45.8346 21.0010 17.3944 47.6174 78.2248 129.7173 165.4261 190.8740 (64)												
Total per year (kWh/year) = Sum(64)m =												1242.4181 (64)
Heat gains from water heating, kWh/month												
97.2210 86.2257 90.6996 78.6519 73.4013 66.4659 64.8278 70.5097 74.9756 85.9578 89.8749 95.4716 (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 171.8358 171.8358 171.8358 171.8358 171.8358 171.8358 171.8358 171.8358 171.8358 171.8358 171.8358 171.8358 (66)												
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
63.6138 56.5012 45.9499 34.7870 26.0037 21.9534 23.7214 30.8340 41.3854 52.5482 61.3315 65.3818 (67)												
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
426.0020 430.4225 419.2828 395.5678 365.6318 337.4961 318.6998 314.2792 325.4189 349.1340 379.0700 407.2056 (68)												
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
55.0475 55.0475 55.0475 55.0475 55.0475 55.0475 55.0475 55.0475 55.0475 55.0475 55.0475 55.0475 (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)												
-114.5572 -114.5572 -114.5572 -114.5572 -114.5572 -114.5572 -114.5572 -114.5572 -114.5572 -114.5572 -114.5572 -114.5572 (71)												
Water heating gains (Table 5)												
130.6734 128.3121 121.9080 109.2388 98.6576 92.3137 87.1341 94.7711 104.1328 115.5347 124.8262 128.3220 (72)												
Total internal gains												
735.6152 730.5620 702.4668 654.9197 605.6192 567.0893 544.8815 555.2104 586.2631 632.5430 680.5539 716.2356 (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		17.2800	23.7288	0.6300	0.7000	0.7700	125.3116 (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	305.1202	518.0169	826.5840	1245.0032	1454.2067	1587.4814	1495.1492	1304.0061	1019.5416	649.9295	381.3538	244.5016 (83)
Total gains	1040.7354	1248.5789	1529.0508	1899.9229	2059.8259	2154.5707	2040.0307	1859.2165	1605.8048	1282.4725	1061.9077	960.7372 (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 16.5700 16.6611 16.6903 16.8280 16.8280 16.9037 16.8791 16.9277 16.8791 16.8017 16.7747 16.6903												
alpha 2.1047 2.1107 2.1127 2.1219 2.1219 2.1269 2.1253 2.1285 2.1253 2.1201 2.1183 2.1127												
util living area												
0.9353 0.9081 0.8493 0.7393 0.6053 0.4442 0.3238 0.3415 0.5731 0.7925 0.9034 0.9423 (86)												
MIT 18.7518 18.9906 19.4719 20.0416 20.4760 20.7330 20.8256 20.8222 20.6212 20.0851 19.3490 18.7401 (87)												
Th 2 19.5578 19.5644 19.5665 19.5764 19.5764 19.5817 19.5800 19.5834 19.5800 19.5745 19.5726 19.5665 (88)												
util rest of house												
0.9240 0.8927 0.8239 0.6967 0.5385 0.3509 0.2051 0.2140 0.4766 0.7441 0.8836 0.9320 (89)												
MIT 2 16.6648 17.0053 17.6810 18.4579 19.0127 19.3021 19.3795 19.3826 19.2022 18.5464 17.5291 16.6540 (90)												
Living area fraction												FLA = Living area / (4) = 0.3653 (91)

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

MIT	17.4271	17.7304	18.3352	19.0364	19.5472	19.8247	19.9077	19.9085	19.7205	19.1084	18.1938	17.4160 (92)
Temperature adjustment												0.0000
adjusted MIT	17.4271	17.7304	18.3352	19.0364	19.5472	19.8247	19.9077	19.9085	19.7205	19.1084	18.1938	17.4160 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9014	0.8669	0.7971	0.6782	0.5370	0.3679	0.2339	0.2449	0.4872	0.7249	0.8584	0.9106	(94)
Useful gains	938.1326	1082.4051	1218.7890	1288.4668	1106.0733	792.7183	477.0937	455.2633	782.3334	929.6825	911.5597	874.8851	(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													
	2503.2493	2470.2053	2246.8403	1891.4999	1377.9410	873.6996	495.8982	474.8963	933.4621	1471.7354	2008.4400	2442.9870	(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	1164.4468	932.6018	764.8701	434.1839	202.2696	0.0000	0.0000	0.0000	0.0000	403.2873	789.7538	1166.6678	(98)
Space heating												5858.0811	(98)
Space heating per m2											(98) / (4) =	48.7523	(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													3445.9301 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1164.4468	932.6018	764.8701	434.1839	202.2696	0.0000	0.0000	0.0000	0.0000	403.2873	789.7538	1166.6678	(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)	684.9687	548.5893	449.9236	255.4023	118.9821	0.0000	0.0000	0.0000	0.0000	237.2279	464.5611	686.2752	(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	190.7443	151.0805	130.1093	74.3943	45.8346	21.0010	17.3944	47.6174	78.2248	129.7173	165.4261	190.8740	(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	112.2025	88.8709	76.5349	43.7613	26.9615	12.3535	10.2320	28.0102	46.0146	76.3043	97.3095	112.2788	(219)
Water heating fuel used												730.8342	(219)
Annual totals kWh/year													
Space heating fuel - main system													3445.9301 (211)
Space heating fuel - secondary													0.0000 (215)
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)													449.3758 (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													2778.5298 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3445.9301	19.4400	669.8888	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	730.8342	19.4400	142.0742	(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	449.3758	19.4400	87.3587	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit	-1927.6103	19.4400	-374.7274	(252)
Total energy cost			540.1462	(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	3445.9301	0.5190	1788.4377	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	730.8342	0.5190	379.3029	(264)
Space and water heating			2167.7406	(265)

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 FOR IMPROVED DWELLING 09 Jan 2014

Pumps and fans	80.0000	0.5190	41.5200 (267)
Energy for lighting	449.3758	0.5190	233.2260 (268)
Energy saving/generation technologies			
PV Unit	-1927.6103	0.5190	-1000.4297 (269)
Total kg/year			1442.0569 (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	3445.9301	3.0700	10579.0053 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	730.8342	3.0700	2243.6608 (264)
Space and water heating			12822.6662 (265)
Pumps and fans	80.0000	3.0700	245.6000 (267)
Energy for lighting	449.3758	3.0700	1379.5837 (268)
Energy saving/generation technologies			
PV Unit	-1927.6103	3.0700	-5917.7636 (269)
Primary energy kWh/year			8530.0863 (272)
Primary energy kWh/m2/year			70.9894 (273)

U-VALUE CALCULATOR REPORT

Design SAP
elmhurst energy

Property Reference	SAP 0873 Plot 3	Issued on Date	07/04/2022
Assessment Reference	Rev A	Prop Type Ref	
Project			
Calculation Type	New Build (As Designed)		

SAP Rating	73 C	DER	26.10	TER	29.26
Environmental	76 C	% DER < TER	10.79		
CO ₂ Emissions (t/year)	2.71	DERF	66.26	TERF	71.51
General Requirements Compliance	Pass	% DERF < TERF	7.34		

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 3	Issued on Date	07/04/2022
Assessment Reference	Rev A	Prop Type Ref	
Project			
Calculation Type	New Build (As Designed)		
SAP Rating	73 C	DER	26.10
Environmental	76 C	% DER < TER	10.79
CO ₂ Emissions (t/year)	2.71	DREE	66.26
General Requirements Compliance	Pass	% DPER < TPER	7.34
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 3	Issued on Date	07/04/2022
Assessment Reference	Rev A	Prop Type Ref	
Project			
Calculation Type	New Build (As Designed)		
SAP Rating	73 C	DER	26.10
Environmental	76 C	% DER < TER	10.79
CO ₂ Emissions (t/year)	2.71	DREE	66.26
General Requirements Compliance	Pass	% DPER < TPER	7.34
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 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 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 3	Issued on Date	07/04/2022
Assessment Reference	Rev A	Prop Type Ref	
Project			
Calculation Type	New Build (As Designed)		
SAP Rating	73 C	DER	26.10
Environmental	76 C	% DER < TER	10.79
CO ₂ Emissions (t/year)	2.71	DREE	66.26
General Requirements Compliance	Pass	% DPER < TPER	7.34
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 3	Issued on Date	07/04/2022
Assessment Reference	Rev A	Prop Type Ref	
Project			
Calculation Type	New Build (As Designed)		
SAP Rating	73 C	DER	26.10
Environmental	76 C	% DER < TER	10.79
CO ₂ Emissions (t/year)	2.71	DREE	66.26
General Requirements Compliance	Pass	% DPER < TPER	7.34
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 3	Issued on Date	07/04/2022
Assessment Reference	Rev A	Prop Type Ref	
Project			
Calculation Type	New Build (As Designed)		
SAP Rating	73 C	DER	26.10
Environmental	76 C	% DER < TER	10.79
CO ₂ Emissions (t/year)	2.71	DREE	66.26
General Requirements Compliance	Pass	% DPER < TPER	7.34
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 3	Issued on Date	07/04/2022
Assessment Reference	Rev A	Prop Type Ref	
Project			
Calculation Type	New Build (As Designed)		

SAP Rating	73 C	DER	26.10	TBR	29.26
Environmental	76 C	% DER < TBR	10.79		
CO ₂ Emissions (t/year)	2.71	DREE	66.26	TREE	71.51
General Requirements Compliance	Pass	% DDER < TREE	7.34		

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 3	Issued on Date	07/04/2022
Assessment Reference	Rev A	Prop Type Ref	
Project			
Calculation Type	New Build (As Designed)		

SAP Rating	73 C	DER	26.10	TBR	29.26
Environmental	76 C	% DER < TBR	10.79		
CO ₂ Emissions (t/year)	2.71	DREE	66.26	TREE	71.51
General Requirements Compliance	Pass	% DER < TREE	7.34		

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 3	Issued on Date	07/04/2022
Assessment Reference	Rev A	Prop Type Ref	
Property			
SAP Rating	73 C	DER	26.10
Environmental	76 C	% DER-TER	10.79
CO ₂ Emissions (t/year)	2.71	DERE	66.26
General Requirements Compliance	Pass	% DERE-TERE	7.34
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: 51.57 m	120.16 m ²	2.61 m

7.0 Living Area	43.89	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	75.12	43.68
Stone Clad	Timber Frame	0.21	36.65	29.11
Wall to Garage	Timber Frame	0.45	13.38	11.72
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
Skeillin 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	120.16

12.0 Opening Types

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

Design SAP
elmhurst energy

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	[2] Stone Clad	East							2.21	
Front Elevation	Window	[2] Stone Clad	East	None	0.00					4.67	
Front Elevation	Window	[1] Brick	East	None	0.00					5.87	
North	Solid Door	[3] Wall to Garage	North							1.66	
North Elevation	Window	[2] Stone Clad	North	None	0.00					0.66	
West Elevation	Window	[1] Brick	West	None	0.00					17.28	
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	