



SAP Report Submission for Building Regulations Compliance

Client: Vivid Design Studio

Project: Plot 6, 15-17, Kew Gardens
Bognor Regis, West Sussex, PO21 5RD

Contact: Mark Rogers
Surecalc Limited
[REDACTED]

Report Issue Date: 17/01/2020

EXCELLENCE
IN ENERGY
ASSESSMENT

CODE FOR SUSTAINABLE HOMES

Calculation Type: New Build (As Designed)



Property Reference	sc120973	Issued on Date	17/01/2020
Assessment Reference	001	Prop Type Ref	New Dwelling
Property	Plot 6, 15-17, Kew Gardens, Bognor Regis, West Sussex, PO21 5RD		

SAP Rating	86 B	DER	15.49	TER	19.48
Environmental	89 B	% DER<TER	20.49		
CO ₂ Emissions (t/year)	0.78	DFEE	46.83	TFEE	55.16
General Requirements Compliance	Pass	% DFEE<TFEE	15.09		

Assessor Details	Mr. Mark Rogers, Surecalc Limited	Assessor ID	A320-0001
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Client	Vivid Design Studio, Vivid Design Studio
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ENE 1 - Dwelling Emission Rate calculation

Total floor area	72.04	m ²
DER	15.49	kgCO ₂ /yr/m ²
TER	19.48	kgCO ₂ /yr/m ²
CO ₂ emissions offset from additional allowable electricity generation	0.00	kgCO ₂ /yr/m ² (ZC7)
Residual CO ₂ emissions offset from biofuel CHP	0.00	kgCO ₂ /yr/m ² (ZC5)
Total CO ₂ emissions offset from SAP Section 16 allowances	0.00	kgCO ₂ /yr/m ²
DER accounting for SAP Section 16 allowances	15.49	kgCO ₂ /yr/m ²
Reduction DER/TER	20.49	%
CfSH ENE1 credits achieved	3.1	
CfSH ENE1 level achieved	4	

ENE 2 - Fabric Energy Efficiency calculation

Dwelling type	House, Semi-Detached
Fabric energy efficiency (F.E.E.)	46.83 kWh/m ² /yr
CfSH ENE2 credits achieved	6.7
CfSH ENE1 and 2 overall level achieved	4

ENE 7 - Low and Zero Carbon Technologies calculation

Standard case CO₂ emissions

Total floor area	72.04	m ²
DER	20.39	kgCO ₂ /yr/m ²
CO ₂ emissions from electrical appliances	16.62	kgCO ₂ /yr/m ² (ZC2)
CO ₂ emissions from cooking	2.42	kgCO ₂ /yr/m ² (ZC3)
Standard case total CO ₂ emissions	39.42	kgCO ₂ /yr/m ² (ZC4)
Net Standard case CO ₂ emissions	39.42	kgCO ₂ /yr/m ² (ZC8)

Actual case CO₂ emissions

DER	16.62	kgCO ₂ /yr/m ²
CO ₂ emissions from electrical appliances	16.62	kgCO ₂ /yr/m ² (ZC2)
CO ₂ emissions from cooking	2.42	kgCO ₂ /yr/m ² (ZC3)
Actual case total CO ₂ emissions	35.65	kgCO ₂ /yr/m ² (ZC4)
CO ₂ emissions from Biomass	0.00	kgCO ₂ /yr/m ² (ZC5)
CO ₂ reduction from additional allowable electricity generation	0.00	kgCO ₂ /yr/m ² (ZC7)
Net Actual case CO ₂ emissions	35.65	kgCO ₂ /yr/m ² (ZC8)
Improvement in net actual/net standard case CO ₂ emissions	10	%

ENE7 credits achieved

0

PREDICTED ENERGY ASSESSMENT

surecalc ltd

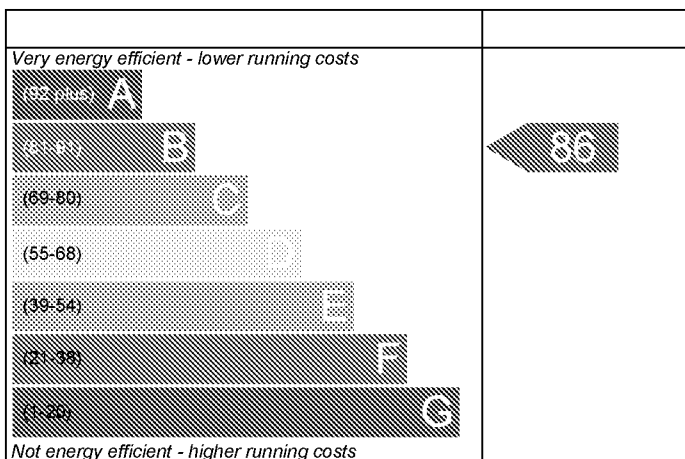
Plot 6, 15-17, Kew Gardens,
Bognor Regis,
West Sussex,
PO21 5RD

Dwelling type: House, Semi-Detached
Date of assessment: 17/01/2020
Produced by: Surecalc Limited
Total floor area: 72.04 m²
DRRN: 0621-3970-9002

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

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

Energy Efficiency Rating

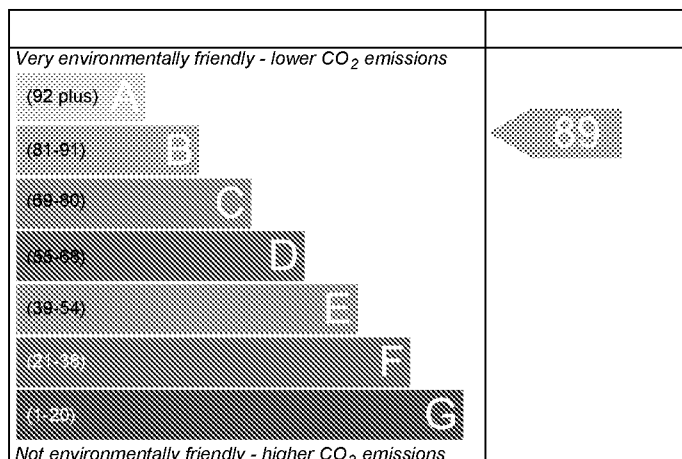


England

EU Directive
2002/91/EC

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

Environmental Impact (CO₂) Rating

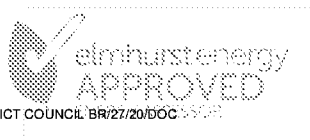


England

EU Directive
2002/91/EC

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

This report has 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)



Property Reference	sc120973	Issued on Date	17/01/2020
Assessment Reference	001	Prop Type Ref	New Dwelling
Property	Plot 6, 15-17, Kew Gardens, Bognor Regis, West Sussex, PO21 5RD		
SAP Rating	86 B	DER	15.49
Environmental	89 B	% DER < TER	19.48
CO ₂ Emissions (t/year)	0.78	DFEE	20.49
General Requirements Compliance	Pass	% DFEE < TFEE	46.83
Assessor Details	Mr. Mark Rogers, Surecalc Limited, [REDACTED]		Assessor ID
Client	Vivid Design Studio, Vivid Design Studio		

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	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	19.48	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	15.49	kgCO ₂ /m ²	Pass
	-3.99 (-20.5%)	kgCO ₂ /m ²	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	55.16	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DFEE)	46.83	kWh/m ² /yr	
	-8.4 (-15.2%)	kWh/m ² /yr	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.24 (max. 0.30)	0.24 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.11 (max. 0.25)	0.11 (max. 0.70)	Pass
Roof	0.11 (max. 0.20)	0.11 (max. 0.35)	Pass
Openings	1.40 (max. 2.00)	1.40 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

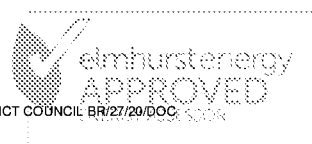
3 Air permeability

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

Limiting System Efficiencies

4 Heating efficiency

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Main heating system

Boiler system with radiators or underfloor - Mains gas
Data from database
Glow-worm ULTIMATE 3 30c-A (H-GB)
Combi boiler
Efficiency: 89.6% SEDBUK2009
Minimum: 88.0%

Pass

Secondary heating system

None

5 Cylinder insulation

Hot water storage

No cylinder

6 Controls

Space heating controls

Time and temperature zone control

Pass

Hot water controls

No cylinder

Boiler interlock

Yes

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 (Southern England)

Slight

Pass

Based on:

Overshading

Average

Windows facing North

1.20 m², No overhang

Windows facing East

4.07 m², No overhang

Windows facing West

6.44 m², No overhang

Air change rate

4.00 ach

Blinds/curtains

None

Criterion 4 - Building performance consistent with DER and DFEE rate

Party Walls

Type

U-value

Filled Cavity with Edge Sealing

0.00

W/m²K

Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals

5.00 (design value)

m³/(h.m²) @ 50 Pa

Maximum

10.0

m³/(h.m²) @ 50 Pa

Pass

10 Key features

Party wall U-value

0.00

W/m²K

Roof U-value

0.11

W/m²K

Floor U-value

0.11

W/m²K

Thermal bridging y-value

0.034

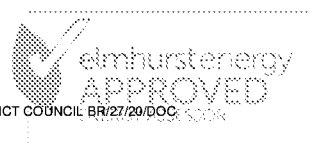
W/m²K

Photovoltaic array

0.90

kW

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SAP Rating	86 B	DER	15.49	TER	19.48	
Environmental	89 B	% DER<TER	20.49			
CO ₂ Emissions (t/year)	0.78	DPEE	46.83	TPEE	55.16	
General Requirements Compliance	Pass	% DPEE<TPEE	15.09			
Assessor Details	Mr. Mark Rogers, Surecalc Limited, [REDACTED]				Assessor ID	A320-0001
Client	Vivid Design Studio, Vivid Design Studio					

FULL SAP CALCULATION PRINTOUT

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

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

DWELLING AS DESIGNED

Semi-Detached House, total floor area 72 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:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 19.48 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 15.49 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)55.2 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)46.8 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.24 (max. 0.30)	0.24 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.11 (max. 0.25)	0.11 (max. 0.70)	OK
Roof	0.11 (max. 0.20)	0.11 (max. 0.35)	OK
Openings	1.40 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

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

4 Heating efficiency

Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Glow-worm ULTIMATE 3 30c-A (H-GB)
Combi boiler
Efficiency: 89.6% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system:

None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls: Time and temperature zone control OK

Hot water controls:

No cylinder

Boiler interlock

Yes 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 (Southern England): Slight OK

Based on:

Overshading: Average
Windows facing North: 1.20 m², No overhang
Windows facing East: 4.07 m², No overhang
Windows facing West: 6.44 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

10 Key Features

Party wall U-value 0.00 W/m²K
Roof U-value 0.11 W/m²K
Floor U-value 0.11 W/m²K
Thermal bridging y-value 0.034 W/m²K
Photovoltaic array 0.90 kW

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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	36.0200 (1b)	x 2.3900 (2b)	= 86.0878 (1b) - (3b)
First floor	36.0200 (1c)	x 2.7600 (2c)	= 99.4152 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	72.0400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 185.5030 (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					3 * 10 = 30.0000 (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) =					30.0000 / (5) = 0.1617 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4117 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3500 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4462	0.4375	0.4287	0.3850	0.3762	0.3325	0.3325	0.3237	0.3500	0.3762	0.3937	0.4112 (22b)
Effective ac	0.5995	0.5957	0.5919	0.5741	0.5708	0.5553	0.5553	0.5524	0.5612	0.5708	0.5775	0.5845 (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
New Dwelling DG Door			2.0200	1.4000	2.8280		(26a)
New Dwelling DG Window (Uw = 1.40)			11.7100	1.3258	15.5246		(27)
Ground Floor			36.0200	0.1100	3.9622		(28a)
External Wall	87.6000	13.7300	73.8700	0.2400	17.7288		(29a)
External Roof	36.0200		36.0200	0.1100	3.9622		(30)
Total net area of external elements Aum(A, m ²)			159.6400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	44.0058		(33)
Party Wall			46.4000	0.0000	0.0000		(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.4509 (36)
Total fabric heat loss						(33) + (36) =	49.4568 (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	36.7020	36.4654	36.2334	35.1439	34.9401	33.9912	33.9912	33.8155	34.3567	34.9401	35.3525	35.7836 (38)
Heat transfer coeff	86.1587	85.9221	85.6902	84.6007	84.3968	83.4480	83.4480	83.2722	83.8135	84.3968	84.8092	85.2403 (39)
Average = Sum(39)m / 12 =												84.5997 (39)
HLP	1.1960	1.1927	1.1895	1.1744	1.1715	1.1584	1.1584	1.1559	1.1634	1.1715	1.1773	1.1832 (40)
HLP (average)												1.1743 (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												2.2946 (42)
Average daily hot water use (litres/day)												88.6971 (43)
Daily hot water use	97.5668	94.0189	90.4710	86.9232	83.3753	79.8274	79.8274	83.3753	86.9232	90.4710	94.0189	97.5668 (44)
Energy conte	144.6888	126.5457	130.5838	113.8462	109.2381	94.2642	87.3496	100.2350	101.4321	118.2093	129.0347	140.1233 (45)
Energy content (annual)										Total = Sum(45)m =		1395.5508 (45)
Distribution loss (46)m = 0.15 x (45)m	21.7033	18.9819	19.5876	17.0769	16.3857	14.1396	13.1024	15.0352	15.2148	17.7314	19.3552	21.0185 (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)

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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)
Combi loss	49.7190	43.2745	46.1031	42.8662	42.4871	39.3669	40.6792	42.4871	42.8662	46.1031	46.3655	49.7190 (61)
Total heat required for water heating calculated for each month	194.4077	169.8202	176.6869	156.7124	151.7252	133.6311	128.0288	142.7221	144.2983	164.3124	175.4002	189.8423 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	194.4077	169.8202	176.6869	156.7124	151.7252	133.6311	128.0288	142.7221	144.2983	164.3124	175.4002	189.8423 (64)
Heat gains from water heating, kWh/month	60.5388	52.8951	54.9449	48.5704	46.9435	41.1846	39.2135	43.9499	44.4427	50.8304	54.4954	59.0208 (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	114.7307	114.7307	114.7307	114.7307	114.7307	114.7307	114.7307	114.7307	114.7307	114.7307	114.7307	114.7307 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	18.7309	16.6366	13.5298	10.2429	7.6567	6.4641	6.9847	9.0790	12.1858	15.4727	18.0589	19.2515 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	202.0107	204.1069	198.8245	187.5787	173.3830	160.0411	151.1278	149.0316	154.3141	165.5598	179.7555	193.0974 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.4731	34.4731	34.4731	34.4731	34.4731	34.4731	34.4731	34.4731	34.4731	34.4731	34.4731	34.4731 (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)	-91.7846	-91.7846	-91.7846	-91.7846	-91.7846	-91.7846	-91.7846	-91.7846	-91.7846	-91.7846	-91.7846	-91.7846 (71)
Water heating gains (Table 5)	81.3693	78.7129	73.8507	67.4589	63.0960	57.2008	52.7064	59.0725	61.7260	68.3204	75.6881	79.3290 (72)
Total internal gains	362.5301	359.8757	346.6242	325.6998	304.5550	284.1252	271.2381	277.6023	288.6451	309.7721	333.9217	352.0971 (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				1.2000	10.6334	0.7100	0.7000			0.7700			4.3948 (74)
East				4.0700	19.6403	0.7100	0.7000			0.7700			27.5316 (76)
West				6.4400	19.6403	0.7100	0.7000			0.7700			43.5635 (80)
Solar gains	75.4899	147.4758	243.3117	356.9652	440.2607	452.1320	429.8394	367.2006	283.5422	175.0243	94.0688	62.1289	(83)
Total gains	438.0200	507.3515	589.9359	682.6650	744.8157	736.2572	701.0775	644.8028	572.1873	484.7964	427.9905	414.2260	(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	58.0647	58.2246	58.3822	59.1340	59.2768	59.9509	59.9509	60.0774	59.6894	59.2768	58.9886	58.6903
alpha	4.8710	4.8816	4.8921	4.9423	4.9518	4.9967	4.9967	5.0052	4.9793	4.9518	4.9326	4.9127
util living area	0.9979	0.9953	0.9861	0.9506	0.8530	0.6785	0.5137	0.5755	0.8372	0.9756	0.9957	0.9984 (86)
MIT	19.7049	19.8637	20.1447	20.5136	20.8058	20.9551	20.9908	20.9844	20.8709	20.4744	20.0236	19.6802 (87)
Th 2	19.9232	19.9258	19.9284	19.9406	19.9428	19.9535	19.9535	19.9554	19.9494	19.9428	19.9382	19.9334 (88)
util rest of house	0.9972	0.9936	0.9811	0.9323	0.8024	0.5861	0.3967	0.4541	0.7626	0.9633	0.9939	0.9978 (89)
MIT 2	18.2014	18.4349	18.8442	19.3749	19.7564	19.9244	19.9502	19.9492	19.8467	19.3314	18.6778	18.1726 (90)
Living area fraction	18.5324	18.7494	19.1305	19.6256	19.9874	20.1513	20.1793	20.1771	20.0721	19.5830	18.9741	18.5045 (92)
Temperature adjustment	18.3824	18.5994	18.9805	19.4756	19.8374	20.0013	20.0293	20.0271	19.9221	19.4330	18.8241	18.3545 (93)
adjusted MIT												-0.1500

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9955	0.9906	0.9748	0.9221	0.7965	0.5906	0.4054	0.4628	0.7603	0.9550	0.9910	0.9966 (94)
Useful gains	436.0577	502.5734	575.0845	629.5144	593.2669	434.8369	284.2336	298.3894	435.0330	462.9808	424.1520	412.7991 (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	1213.3221	1177.0832	1069.4583	894.7037	686.7704	450.7292	286.1672	302.0342	487.9739	745.4799	994.3075	1206.5329 (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	578.2847	453.2706	367.8141	190.9364	69.5666	0.0000	0.0000	0.0000	0.0000	210.1793	410.5120	590.5380 (98)
Space heating	2871.1016 (98)											
Space heating per m2	(98) / (4) = 39.8543 (99)											

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3172.4880 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	578.2847	453.2706	367.8141	190.9364	69.5666	0.0000	0.0000	0.0000	0.0000	210.1793	410.5120	590.5380	(98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)	638.9886	500.8515	406.4244	210.9794	76.8691	0.0000	0.0000	0.0000	0.0000	232.2424	453.6044	652.5282	(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	194.4077	169.8202	176.6869	156.7124	151.7252	133.6311	128.0288	142.7221	144.2983	164.3124	175.4002	189.8423	(64)
Efficiency of water heater (217)m	87.7273	87.5041	86.9554	85.6499	83.3233	80.4000	80.4000	80.4000	80.4000	85.7724	87.2200	87.8163	(217)
Fuel for water heating, kWh/month	221.6047	194.0712	203.1926	182.9686	182.0922	166.2078	159.2398	177.5150	179.4755	191.5679	201.1010	216.1811	(219)
Water heating fuel used												2275.2174	(219)
Annual totals kWh/year													
Space heating fuel - main system												3172.4880	(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)												330.7937	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.90 * 908 * 0.80) =										-522.9240		-522.9240	(233)
Total delivered energy for all uses												5330.5750	(238)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3172.4880	0.2160	685.2574	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2275.2174	0.2160	491.4470	(264)
Space and water heating			1176.7044	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	330.7937	0.5190	171.6819	(268)
Energy saving/generation technologies				
PV Unit	-522.9240	0.5190	-271.3976	(269)
Total CO2, kg/year			1115.9137	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			15.4900	(273)

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

DER		15.4900	ZC1
Total Floor Area		72.0400	
Assumed number of occupants		2.2946	
CO2 emission factor in Table 12 for electricity displaced from grid		0.5190	
CO2 emissions from appliances, equation (L14)		16.6168	ZC2
CO2 emissions from cooking, equation (L16)		2.4163	ZC3
Total CO2 emissions		34.5231	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		34.5231	ZC8

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	36.0200 (1b)	x 2.3900 (2b)	= 86.0878 (1b) - (3b)
First floor	36.0200 (1c)	x 2.7600 (2c)	= 99.4152 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	72.0400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	185.5030 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (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) =					30.0000 / (5) = 0.1617 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4117 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3500 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4462	0.4375	0.4287	0.3850	0.3762	0.3325	0.3325	0.3237	0.3500	0.3762	0.3937	0.4112 (22b)
Effective ac	0.5995	0.5957	0.5919	0.5741	0.5708	0.5553	0.5553	0.5524	0.5612	0.5708	0.5775	0.5845 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K						
TER Semi-glazed door			2.0200	1.2000	2.4240			(26a)					
TER Opening Type (Uw = 1.40)			11.7100	1.3258	15.5246			(27)					
Ground Floor			36.0200	0.1300	4.6826			(28a)					
External Wall	87.6000	13.7300	73.8700	0.1800	13.2966			(29a)					
External Roof	36.0200		36.0200	0.1300	4.6826			(30)					
Total net area of external elements Aum(A, m2)			159.6400					(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)... (30) + (32) =	40.6104			(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)								9.1178 (36)					
Total fabric heat loss						(33) + (36) =		49.7282 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 36.7020	Feb 36.4654	Mar 36.2334	Apr 35.1439	May 34.9401	Jun 33.9912	Jul 33.9912	Aug 33.8155	Sep 34.3567	Oct 34.9401	Nov 35.3525	Dec 35.7836	(38)
Heat transfer coeff	86.4302	86.1936	85.9616	84.8722	84.6683	83.7194	83.7194	83.5437	84.0849	84.6683	85.0807	85.5118	(39)
Average = Sum(39)m / 12 =												84.8712	(39)
HLP	Jan 1.1998	Feb 1.1965	Mar 1.1932	Apr 1.1781	May 1.1753	Jun 1.1621	Jul 1.1621	Aug 1.1597	Sep 1.1672	Oct 1.1753	Nov 1.1810	Dec 1.1870	(40)
HLP (average)												1.1781	(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												2.2946 (42)
Average daily hot water use (litres/day)												88.6971 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	97.5668	94.0189	90.4710	86.9232	83.3753	79.8274	79.8274	83.3753	86.9232	90.4710	94.0189	97.5668 (44)
Energy conte	144.6888	126.5457	130.5838	113.8462	109.2381	94.2642	87.3496	100.2350	101.4321	118.2093	129.0347	140.1233 (45)
Energy content (annual)										Total = Sum(45)m =		1395.5508 (45)
Distribution loss (46)m = 0.15 x (45)m												
	21.7033	18.9819	19.5876	17.0769	16.3857	14.1396	13.1024	15.0352	15.2148	17.7314	19.3552	21.0185 (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												

Regs Region: England

Elmhurst Energy Systems

SAP2012 Calculator (Design

System) version 4.1202



FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	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)
Combi loss	49.7190	43.2745	46.1031	42.8662	42.4871	39.3669	40.6792	42.4871	42.8662	46.1031	46.3655	49.7190 (61)
Total heat required for water heating calculated for each month												
Solar input	194.4077	169.8202	176.6869	156.7124	151.7252	133.6311	128.0288	142.7221	144.2983	164.3124	175.4002	189.8423 (62)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Solar input (sum of months) = Sum(63)m =												0.0000 (63)
Output from w/h												
	194.4077	169.8202	176.6869	156.7124	151.7252	133.6311	128.0288	142.7221	144.2983	164.3124	175.4002	189.8423 (64)
Total per year (kWh/year) = Sum(64)m =												1927.5876 (64)
Heat gains from water heating, kWh/month												
	60.5388	52.8951	54.9449	48.5704	46.9435	41.1846	39.2135	43.9499	44.4427	50.8304	54.4954	59.0208 (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	114.7307	114.7307	114.7307	114.7307	114.7307	114.7307	114.7307	114.7307	114.7307	114.7307	114.7307	114.7307 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	18.7309	16.6366	13.5298	10.2429	7.6567	6.4641	6.9847	9.0790	12.1858	15.4727	18.0589	19.2515 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	202.0107	204.1069	198.8245	187.5787	173.3830	160.0411	151.1278	149.0316	154.3141	165.5598	179.7555	193.0974 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	34.4731	34.4731	34.4731	34.4731	34.4731	34.4731	34.4731	34.4731	34.4731	34.4731	34.4731	34.4731 (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)												
	-91.7846	-91.7846	-91.7846	-91.7846	-91.7846	-91.7846	-91.7846	-91.7846	-91.7846	-91.7846	-91.7846	-91.7846 (71)
Water heating gains (Table 5)												
	81.3693	78.7129	73.8507	67.4589	63.0960	57.2008	52.7064	59.0725	61.7260	68.3204	75.6881	79.3290 (72)
Total internal gains												
	362.5301	359.8757	346.6242	325.6998	304.5550	284.1252	271.2381	277.6023	288.6451	309.7721	333.9217	352.0971 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	g Specific data or Table 6c	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	1.2000	10.6334	0.6300	0.7000	0.7000	0.7000	3.8996 (74)
East	4.0700	19.6403	0.6300	0.7000	0.7000	0.7000	24.4294 (76)
West	6.4400	19.6403	0.6300	0.7000	0.7000	0.7000	38.6549 (80)
Solar gains							
	66.9840	130.8589	215.8963	316.7437	390.6539	401.1875	381.4068
Total gains							
	429.5141	490.7345	562.5205	642.4435	695.2089	685.3127	652.6449

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	57.8823	58.0412	58.1978	58.9449	59.0868	59.7565	59.7565	59.8822	59.4967	59.0868	58.8004	58.5040
alpha	4.8588	4.8694	4.8799	4.9297	4.9391	4.9838	4.9838	4.9921	4.9664	4.9391	4.9200	4.9003
util living area												
	0.9981	0.9959	0.9886	0.9605	0.8789	0.7169	0.5497	0.6108	0.8606	0.9794	0.9961	0.9985 (86)
MIT												
	19.6890	19.8378	20.1071	20.4683	20.7711	20.9421	20.9875	20.9795	20.8502	20.4484	20.0059	19.6662 (87)
Th 2												
	19.9202	19.9228	19.9254	19.9375	19.9398	19.9504	19.9504	19.9524	19.9463	19.9398	19.9352	19.9304 (88)
util rest of house												
	0.9974	0.9945	0.9844	0.9452	0.8331	0.6241	0.4261	0.4845	0.7908	0.9687	0.9945	0.9980 (89)
MIT 2												
	18.1762	18.3952	18.7881	19.3115	19.7146	19.9119	19.9459	19.9439	19.8238	19.2931	18.6500	18.1500 (90)
Living area fraction												
	18.5092	18.7128	19.0785	19.5662	19.9472	20.1387	20.1752	20.1719	20.0498	19.5475	18.9485	18.4838 (92)
Temperature adjustment												
	18.5092	18.7128	19.0785	19.5662	19.9472	20.1387	20.1752	20.1719	20.0498	19.5475	18.9485	18.4838 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9960	0.9921	0.9798	0.9384	0.8335	0.6421	0.4535	0.5123	0.7989	0.9633	0.9923	0.9969 (94)
Useful gains	427.8155	486.8601	551.1520	602.8695	579.4222	440.0087	295.9517	309.1220	431.5880	448.0041	414.1802	405.9760 (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												
	1228.1071	1190.5718	1081.2661	905.2633	698.2768	463.6968	299.3128	315.1217	500.2893	757.5659	1008.0771	1221.4342 (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												
	595.4170	472.8943	394.4049	217.7235	88.4279	0.0000	0.0000	0.0000	0.0000	230.3140	427.6057	606.7009 (98)
Space heating												
												3033.4880 (98)
Space heating per m2												
												(98) / (4) = 42.1084 (99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.4000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3247.8459 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	595.4170	472.8943	394.4049	217.7235	88.4279	0.0000	0.0000	0.0000	0.0000	230.3140	427.6057	606.7009	(98)
Space heating efficiency (main heating system 1)	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)	637.4914	506.3108	422.2750	233.1087	94.6765	0.0000	0.0000	0.0000	0.0000	246.5889	457.8220	649.5727	(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	194.4077	169.8202	176.6869	156.7124	151.7252	133.6311	128.0288	142.7221	144.2983	164.3124	175.4002	189.8423	(64)
Efficiency of water heater (217)m	87.6853	87.4923	87.0140	85.8792	83.7452	80.3000	80.3000	80.3000	80.3000	85.9013	87.2094	87.7689	(216)
Fuel for water heating, kWh/month	221.7107	194.0973	203.0558	182.4801	181.1748	166.4148	159.4381	177.7361	179.6990	191.2805	201.1254	216.2978	(219)
Water heating fuel used												2274.5105	(219)
Annual totals kWh/year													
Space heating fuel - main system												3247.8459	(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)												330.7937	(232)
Total delivered energy for all uses												5928.1500	(238)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	3247.8459	0.2160	701.5347 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2274.5105	0.2160	491.2943 (264)
Space and water heating			1192.8290 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	330.7937	0.5190	171.6819 (268)
Total CO2, kg/m2/year			1403.4359 (272)
Emissions per m2 for space and water heating			16.5579 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.3831 (272b)
Emissions per m2 for pumps and fans			0.5403 (272c)
Target Carbon Dioxide Emission Rate (TER) = (16.5579 * 1.00) + 2.3831 + 0.5403, rounded to 2 d.p.			19.4800 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	36.0200 (1b)	x 2.3900 (2b)	= 86.0878 (1b) - (3b)
First floor	36.0200 (1c)	x 2.7600 (2c)	= 99.4152 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	72.0400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 185.5030 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (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)					30.0000 / (5) = 0.1617 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4117 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3500 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4462	0.4375	0.4287	0.3850	0.3762	0.3325	0.3325	0.3237	0.3500	0.3762	0.3937	0.4112 (22b)
Effective ac	0.5995	0.5957	0.5919	0.5741	0.5708	0.5553	0.5553	0.5524	0.5612	0.5708	0.5775	0.5845 (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
New Dwelling DG Door			2.0200	1.4000	2.8280		(26a)
New Dwelling DG Window (Uw = 1.40)			11.7100	1.3258	15.5246		(27)
Ground Floor			36.0200	0.1100	3.9622		(28a)
External Wall	87.6000	13.7300	73.8700	0.2400	17.7288		(29a)
External Roof	36.0200		36.0200	0.1100	3.9622		(30)
Total net area of external elements Aum(A, m ²)			159.6400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	44.0058		(33)
Party Wall			46.4000	0.0000	0.0000		(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.4509 (36)
Total fabric heat loss						(33) + (36) =	49.4568 (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	36.7020	36.4654	36.2334	35.1439	34.9401	33.9912	33.9912	33.8155	34.3567	34.9401	35.3525	35.7836 (38)
Heat transfer coeff	86.1587	85.9221	85.6902	84.6007	84.3968	83.4480	83.4480	83.2722	83.8135	84.3968	84.8092	85.2403 (39)
Average = Sum(39)m / 12 =												84.5997 (39)
HLP	1.1960	1.1927	1.1895	1.1744	1.1715	1.1584	1.1584	1.1559	1.1634	1.1715	1.1773	1.1832 (40)
HLP (average)												1.1743 (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)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	97.5668	94.0189	90.4710	86.9232	83.3753	79.8274	79.8274	83.3753	86.9232	90.4710	94.0189	97.5668 (44)
Energy conte	144.6888	126.5457	130.5838	113.8462	109.2381	94.2642	87.3496	100.2350	101.4321	118.2093	129.0347	140.1233 (45)
Energy content (annual)										Total = Sum(45)m =		1395.5508 (45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)

Regs Region: England

Elmhurst Energy Systems

SAP2012 Calculator (Design
System) version 4.12r02



FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	30.7464	26.8910	27.7491	24.1923	23.2131	20.0311	18.5618	21.2999	21.5543	25.1195	27.4199	29.7762 (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	114.7307	114.7307	114.7307	114.7307	114.7307	114.7307	114.7307	114.7307	114.7307	114.7307	114.7307	114.7307	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	18.7309	16.6366	13.5298	10.2429	7.6567	6.4641	6.9847	9.0790	12.1858	15.4727	18.0589	19.2515	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	202.0107	204.1069	198.8245	187.5787	173.3830	160.0411	151.1278	149.0316	154.3141	165.5598	179.7555	193.0974	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.4731	34.4731	34.4731	34.4731	34.4731	34.4731	34.4731	34.4731	34.4731	34.4731	34.4731	34.4731	(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)	-91.7846	-91.7846	-91.7846	-91.7846	-91.7846	-91.7846	-91.7846	-91.7846	-91.7846	-91.7846	-91.7846	-91.7846	(71)
Water heating gains (Table 5)	41.3258	40.0163	37.2971	33.6004	31.2004	27.8210	24.9486	28.6289	29.9366	33.7627	38.0832	40.0218	(72)
Total internal gains	319.4866	318.1791	307.0706	288.8413	269.6594	251.7455	240.4804	244.1588	253.8556	272.2144	293.3168	309.7899	(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	1.2000	10.6334	0.7100	0.7000	0.7700	4.3948 (74)
East	4.0700	19.6403	0.7100	0.7000	0.7700	27.5316 (76)
West	6.4400	19.6403	0.7100	0.7000	0.7700	43.5635 (80)

Solar gains	75.4899	147.4758	243.3117	356.9652	440.2607	452.1320	429.8394	367.2006	283.5422	175.0243	94.0688	62.1289	(83)
Total gains	394.9765	465.6549	550.3823	645.8065	709.9201	703.8774	670.3198	611.3593	537.3978	447.2387	387.3856	371.9188	(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	58.0647	58.2246	58.3822	59.1340	59.2768	59.9509	59.9509	60.0774	59.6894	59.2768	58.9886	58.6903	
alpha	4.8710	4.8816	4.8921	4.9423	4.9518	4.9967	4.9967	5.0052	4.9793	4.9518	4.9326	4.9127	
util living area	0.9987	0.9967	0.9895	0.9595	0.8708	0.7018	0.5352	0.6026	0.8618	0.9823	0.9972	0.9990	(86)
MIT	19.6498	19.8109	20.0967	20.4756	20.7836	20.9478	20.9890	20.9809	20.8502	20.4307	19.9719	19.6258	(87)
Th 2	19.9232	19.9258	19.9284	19.9406	19.9428	19.9535	19.9535	19.9554	19.9494	19.9428	19.9382	19.9334	(88)
util rest of house	0.9982	0.9956	0.9857	0.9439	0.8234	0.6091	0.4144	0.4776	0.7923	0.9730	0.9961	0.9987	(89)
MIT 2	18.6927	18.8554	19.1412	19.5195	19.7986	19.9300	19.9507	19.9501	19.8656	19.4840	19.0264	18.6769	(90)
Living area fraction									fLA = Living area / (4) =			0.2202	(91)
MIT	18.9034	19.0658	19.3516	19.7300	20.0154	20.1541	20.1793	20.1770	20.0823	19.6924	19.2345	18.8858	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9034	19.0658	19.3516	19.7300	20.0154	20.1541	20.1793	20.1770	20.0823	19.6924	19.2345	18.8858	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	394.0161	463.0055	540.9730	607.1281	587.2171	442.1129	295.7481	308.9333	431.3270	433.8213	385.4297	371.2455	(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	(95)
Heat loss rate W	1258.2092	1217.1551	1101.2528	916.2233	701.7962	463.4775	298.6877	314.5212	501.3992	767.3702	1029.1198	1251.8214	(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	642.9596	506.7886	416.8482	222.5485	85.2468	0.0000	0.0000	0.0000	0.0000	248.1604	463.4569	655.1485	(98)
Space heating												3241.1575	(98)
Space heating per m2										(98) / (4) =		44.9911	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	784.4108	617.5149	632.8690	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8879	0.9393	0.9144	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	696.4990	580.0570	578.6730	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	908.2692	867.3386	799.9117	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	152.4745	213.7375	164.6016	0.0000	0.0000	0.0000	0.0000	(104)

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Space cooling												530.8137 (104)
Cooled fraction												1.0000 (105)
Intermittency factor (Table 10b)												
	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)	
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	38.1186	53.4344	41.1504	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												132.7034 (107)
Space cooling per m2												1.8421 (108)
Energy for space heating												44.9911 (99)
Energy for space cooling												1.8421 (108)
Total												46.8332 (109)
Dwelling Fabric Energy Efficiency (DFEE)												46.8 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Calculation of Target Fabric Energy Efficiency 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
Calculation of Target Fabric Energy Efficiency 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	36.0200 (1b)	x 2.3900 (2b)	= 86.0878 (1b) - (3b)
First floor	36.0200 (1c)	x 2.7600 (2c)	= 99.4152 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	72.0400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	185.5030 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (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) =					30.0000 / (5) = 0.1617 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4117 (18)
Number of sides sheltered					2 (19)
Shelter factor					(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor					(21) = (18) x (20) = 0.3500 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4462	0.4375	0.4287	0.3850	0.3762	0.3325	0.3325	0.3237	0.3500	0.3762	0.3937	0.4112 (22b)
Effective ac	0.5995	0.5957	0.5919	0.5741	0.5708	0.5553	0.5553	0.5524	0.5612	0.5708	0.5775	0.5845 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Semi-glazed door			2.0200	1.2000	2.4240			(26a)				
TER Opening Type (Uw = 1.40)			11.7100	1.3258	15.5246			(27)				
Ground Floor			36.0200	0.1300	4.6826			(28a)				
External Wall	87.6000	13.7300	73.8700	0.1800	13.2966			(29a)				
External Roof	36.0200		36.0200	0.1300	4.6826			(30)				
Total net area of external elements Aum(A, m2)			159.6400					(31)				
Fabric heat loss, W/K = Sum (A x U)				(26)... (30) + (32) =	40.6104			(33)				
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								250.0000 (35)				
Thermal bridges (Sum(L x Psi) calculated using Appendix K)								9.1178 (36)				
Total fabric heat loss								(33) + (36) = 49.7282 (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	36.7020	36.4654	36.2334	35.1439	34.9401	33.9912	33.9912	33.8155	34.3567	34.9401	35.3525	35.7836 (38)
Average = Sum(39)m / 12 =	86.4302	86.1936	85.9616	84.8722	84.6683	83.7194	83.7194	83.5437	84.0849	84.6683	85.0807	85.5118 (39)
												84.8712 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1998	1.1965	1.1932	1.1781	1.1753	1.1621	1.1621	1.1597	1.1672	1.1753	1.1810	1.1870 (40)
Days in month												1.1781 (40)
	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.2946 (42)
Average daily hot water use (litres/day)												88.6971 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	97.5668	94.0189	90.4710	86.9232	83.3753	79.8274	79.8274	83.3753	86.9232	90.4710	94.0189	97.5668 (44)
Energy content (annual)	144.6888	126.5457	130.5838	113.8462	109.2381	94.2642	87.3496	100.2350	101.4321	118.2093	129.0347	140.1233 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		1395.5508 (45)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												

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Calculation Type: New Build (As Designed)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Heat gains from water heating, kWh/month	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
	30.7464	26.8910	27.7491	24.1923	23.2131	20.0311	18.5618	21.2999	21.5543	25.1195	27.4199	29.7762 (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	114.7307	114.7307	114.7307	114.7307	114.7307	114.7307	114.7307	114.7307	114.7307	114.7307	114.7307	114.7307 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	18.7309	16.6366	13.5298	10.2429	7.6567	6.4641	6.9847	9.0790	12.1858	15.4727	18.0589	19.2515 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	202.0107	204.1069	198.8245	187.5787	173.3830	160.0411	151.1278	149.0316	154.3141	165.5598	179.7555	193.0974 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.4731	34.4731	34.4731	34.4731	34.4731	34.4731	34.4731	34.4731	34.4731	34.4731	34.4731	34.4731 (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)	-91.7846	-91.7846	-91.7846	-91.7846	-91.7846	-91.7846	-91.7846	-91.7846	-91.7846	-91.7846	-91.7846	-91.7846 (71)
Water heating gains (Table 5)	41.3258	40.0163	37.2971	33.6004	31.2004	27.8210	24.9486	28.6289	29.9366	33.7627	38.0832	40.0218 (72)
Total internal gains	319.4866	318.1791	307.0706	288.8413	269.6594	251.7455	240.4804	244.1588	253.8556	272.2144	293.3168	309.7899 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	1.2000	10.6334	0.6300	0.7000	0.7700	3.8996 (74)
East	4.0700	19.6403	0.6300	0.7000	0.7700	24.4294 (76)
West	6.4400	19.6403	0.6300	0.7000	0.7700	38.6549 (80)

Solar gains	66.9840	130.8589	215.8963	316.7437	390.6539	401.1875	381.4068	325.8259	251.5938	155.3033	83.4695	55.1285 (83)
Total gains	386.4706	449.0379	522.9669	605.5851	660.3132	652.9330	621.8872	569.9846	505.4494	427.5177	376.7863	364.9184 (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	57.8823	58.0412	58.1978	58.9449	59.0868	59.7565	59.7565	59.8822	59.4967	59.0868	58.8004	58.5040
alpha	4.8588	4.8694	4.8799	4.9297	4.9391	4.9838	4.9838	4.9921	4.9664	4.9391	4.9200	4.9003
util living area	0.9988	0.9972	0.9916	0.9682	0.8957	0.7414	0.5738	0.6403	0.8842	0.9853	0.9975	0.9991 (86)
MIT	19.6339	19.7849	20.0585	20.4285	20.7457	20.9327	20.9850	20.9749	20.8268	20.4039	19.9542	19.6118 (87)
Th 2	19.9202	19.9228	19.9254	19.9375	19.9398	19.9504	19.9504	19.9524	19.9463	19.9398	19.9352	19.9304 (88)
util rest of house	0.9984	0.9962	0.9884	0.9555	0.8536	0.6492	0.4463	0.5109	0.8206	0.9774	0.9965	0.9988 (89)
MIT 2	18.6745	18.8272	19.1012	19.4730	19.7660	19.9192	19.9466	19.9451	19.8465	19.4559	19.0063	18.6605 (90)
Living area fraction									fLA = Living area / (4) =			0.2202 (91)
MIT	18.8857	19.0381	19.3120	19.6834	19.9816	20.1423	20.1752	20.1718	20.0623	19.6646	19.2150	18.8699 (92)
Temperature adjustment												0.0000
adjusted MIT	18.8857	19.0381	19.3120	19.6834	19.9816	20.1423	20.1752	20.1718	20.0623	19.6646	19.2150	18.8699 (93)

8. Space heating requirement

Utilisation	0.9978	0.9951	0.9860	0.9516	0.8556	0.6676	0.4747	0.5396	0.8290	0.9746	0.9955	0.9983 (94)
Useful gains	385.6122	446.8369	515.6241	576.3013	564.9527	435.8900	295.2048	307.5856	419.0084	416.6566	375.0909	364.3083 (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	1260.6446	1218.6097	1101.3392	915.2085	701.1925	463.9989	299.3141	315.1121	501.3418	767.4834	1030.7512	1254.4534 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	651.0240	518.6313	435.7720	244.0132	101.3624	0.0000	0.0000	0.0000	0.0000	261.0152	472.0754	662.2680 (98)
Space heating												3346.1616 (98)
Space heating per m2										(98) / (4) =		46.4487 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b												
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	786.9626	619.5238	634.9322	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8627	0.9229	0.8948	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	678.9122	571.7280	568.1672	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	848.7237	810.7291	751.5517	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	122.2643	177.8168	136.4381	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												436.5192 (104)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Cooled fraction	FC = cooled area / (4) =										1.0000 (105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	30.5661	44.4542	34.1095	0.0000	0.0000	0.0000 (107)
Space cooling											109.1298 (107)
Space cooling per m2											1.5149 (108)
Energy for space heating											46.4487 (99)
Energy for space cooling											1.5149 (108)
Total											47.9635 (109)
Target Fabric Energy Efficiency (TFEE)											55.2 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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	36.0200 (1b)	x 2.3900 (2b)	= 86.0878 (1b) - (3b)
First floor	36.0200 (1c)	x 2.7600 (2c)	= 99.4152 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	72.0400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	185.5030 (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					3 * 10 = 30.0000 (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) =					30.0000 / (5) = 0.1617 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4117 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3500 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.6000	5.1000	4.8000	4.5000	4.7000	4.2000	4.4000	4.2000	4.4000	4.8000	4.9000	5.1000 (22)
Wind factor	1.4000	1.2750	1.2000	1.1250	1.1750	1.0500	1.1000	1.0500	1.1000	1.2000	1.2250	1.2750 (22a)
Adj infilt rate	0.4899	0.4462	0.4200	0.3937	0.4112	0.3675	0.3850	0.3675	0.3850	0.4200	0.4287	0.4462 (22b)
Effective ac	0.6200	0.5995	0.5882	0.5775	0.5845	0.5675	0.5741	0.5675	0.5741	0.5882	0.5919	0.5995 (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
New Dwelling DG Door			2.0200	1.4000	2.8280		(26a)
New Dwelling DG Window (Uw = 1.40)			11.7100	1.3258	15.5246		(27)
Ground Floor			36.0200	0.1100	3.9622		(28a)
External Wall	87.6000	13.7300	73.8700	0.2400	17.7288		(29a)
External Roof	36.0200		36.0200	0.1100	3.9622		(30)
Total net area of external elements Aum(A, m ²)			159.6400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	44.0058		(33)
Party Wall			46.4000	0.0000	0.0000		(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.4509 (36)
Total fabric heat loss						(33) + (36) =	49.4568 (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	37.9555	36.7020	36.0061	35.3525	35.7836	34.7409	35.1439	34.7409	35.1439	36.0061	36.2334	36.7020 (38)
Heat transfer coeff	87.4122	86.1587	85.4629	84.8092	85.2403	84.1977	84.6007	84.1977	84.6007	85.4629	85.6902	86.1587 (39)
Average = Sum(39)m / 12 =												85.3327 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2134	1.1960	1.1863	1.1773	1.1832	1.1688	1.1744	1.1688	1.1744	1.1863	1.1895	1.1960 (40)
HLP (average)												1.1845 (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												2.2946 (42)
Average daily hot water use (litres/day)												88.6971 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	97.5668	94.0189	90.4710	86.9232	83.3753	79.8274	79.8274	83.3753	86.9232	90.4710	94.0189	97.5668 (44)
Energy conte	144.6888	126.5457	130.5838	113.8462	109.2381	94.2642	87.3496	100.2350	101.4321	118.2093	129.0347	140.1233 (45)
Energy content (annual)										Total = Sum(45)m =		1395.5508 (45)
Distribution loss (46)m = 0.15 x (45)m	21.7033	18.9819	19.5876	17.0769	16.3857	14.1396	13.1024	15.0352	15.2148	17.7314	19.3552	21.0185 (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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF HEAT DEMAND 09 Jan 2014

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)
Combi loss	49.7190	43.2745	46.1031	42.8662	42.4871	39.3669	40.6792	42.4871	42.8662	46.1031	46.3655	49.7190 (61)
Total heat required for water heating calculated for each month	194.4077	169.8202	176.6869	156.7124	151.7252	133.6311	128.0288	142.7221	144.2983	164.3124	175.4002	189.8423 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	194.4077	169.8202	176.6869	156.7124	151.7252	133.6311	128.0288	142.7221	144.2983	164.3124	175.4002	189.8423 (64)
RHI water heating demand												1927.5876 (64)
Heat gains from water heating, kWh/month	60.5388	52.8951	54.9449	48.5704	46.9435	41.1846	39.2135	43.9499	44.4427	50.8304	54.4954	59.0208 (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	137.6769	137.6769	137.6769	137.6769	137.6769	137.6769	137.6769	137.6769	137.6769	137.6769	137.6769	137.6769	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	46.8273	41.5916	33.8245	25.6073	19.1418	16.1603	17.4618	22.6975	30.4645	38.6817	45.1473	48.1287	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	301.5085	304.6372	296.7529	279.9683	258.7807	238.8673	225.5639	222.4352	230.3195	247.1041	268.2917	288.2051	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	51.0623	51.0623	51.0623	51.0623	51.0623	51.0623	51.0623	51.0623	51.0623	51.0623	51.0623	51.0623	(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)	-91.7846	-91.7846	-91.7846	-91.7846	-91.7846	-91.7846	-91.7846	-91.7846	-91.7846	-91.7846	-91.7846	-91.7846	(71)
Water heating gains (Table 5)	81.3693	78.7129	73.8507	67.4589	63.0960	57.2008	52.7064	59.0725	61.7260	68.3204	75.6881	79.3290	(72)
Total internal gains	529.6596	524.8963	504.3827	472.9891	440.9731	412.1830	395.6867	404.1598	422.4646	454.0608	489.0817	515.6174	(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				1.2000	14.6401	0.7100	0.7000	0.7700		6.0508 (74)		
East				4.0700	27.3735	0.7100	0.7000	0.7700		38.3719 (76)		
West				6.4400	27.3735	0.7100	0.7000	0.7700		60.7163 (80)		
Solar gains	105.1391	171.3994	281.8041	427.8613	508.9417	560.7683	529.9804	455.7689	352.3336	218.7030	125.6082	83.9290 (83)
Total gains	634.7987	696.2957	786.1868	900.8504	949.9148	972.9513	925.6671	859.9287	774.7983	672.7638	614.6899	599.5465 (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	57.2320	58.0647	58.5374	58.9886	58.6903	59.4170	59.1340	59.4170	59.1340	58.5374	58.3822	58.0647	
alpha	4.8155	4.8710	4.9025	4.9326	4.9127	4.9611	4.9423	4.9611	4.9423	4.9025	4.8921	4.8710	
util living area	0.9849	0.9767	0.9458	0.8527	0.6780	0.4615	0.3191	0.3223	0.5710	0.8608	0.9659	0.9871	(86)
MIT	20.0934	20.2084	20.4688	20.7643	20.9399	20.9927	20.9991	20.9991	20.9813	20.8092	20.4375	20.0943	(87)
Th 2	19.9093	19.9232	19.9310	19.9382	19.9334	19.9451	19.9406	19.9451	19.9406	19.9310	19.9284	19.9232	(88)
util rest of house	0.9798	0.9691	0.9285	0.8115	0.6052	0.3742	0.2229	0.2197	0.4676	0.8058	0.9522	0.9826	(89)
MIT 2	18.7553	18.9294	19.3004	19.6935	19.8866	19.9417	19.9404	19.9449	19.9313	19.7546	19.2627	18.7673	(90)
Living area fraction									fLA = Living area / (4) =			0.2202	(91)
MIT	19.0499	19.2110	19.5576	19.9293	20.1185	20.1731	20.1735	20.1770	20.1625	19.9868	19.5213	19.0594	(92)
Temperature adjustment												-0.1500	
adjusted MIT	18.8999	19.0610	19.4076	19.7793	19.9685	20.0231	20.0235	20.0270	20.0125	19.8368	19.3713	18.9094	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9731	0.9609	0.9179	0.8045	0.6077	0.3807	0.2305	0.2277	0.4749	0.8001	0.9427	0.9767	(94)
Useful gains	617.7314	669.0545	721.6566	724.7077	577.2690	370.4446	213.3697	195.8298	367.9895	538.2537	579.4578	585.5540	(95)
Ext temp.	5.8000	6.0000	7.5000	9.8000	12.9000	15.6000	17.5000	17.7000	15.6000	12.5000	9.0000	6.0000	(96)
Heat loss rate W	1145.0879	1125.3175	1017.6599	846.3336	602.5202	372.4114	213.4864	195.9282	373.2970	627.0216	888.7225	1112.2598	(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	392.3532	306.6087	220.2265	87.5707	18.7869	0.0000	0.0000	0.0000	0.0000	66.0433	222.6706	391.8691	(98)
Space heating												1706.1289	(98)
RHI space heating demand												1706	(98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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	36.0200 (1b)	x 2.3900 (2b)	= 86.0878 (1b) - (3b)
First floor	36.0200 (1c)	x 2.7600 (2c)	= 99.4152 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	72.0400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	185.5030 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (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) =					30.0000 / (5) = 0.1617 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4117 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3500 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4462	0.4375	0.4287	0.3850	0.3762	0.3325	0.3325	0.3237	0.3500	0.3762	0.3937	0.4112 (22b)
Effective ac	0.5995	0.5957	0.5919	0.5741	0.5708	0.5553	0.5553	0.5524	0.5612	0.5708	0.5775	0.5845 (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
New Dwelling DG Door			2.0200	1.4000	2.8280		(26a)
New Dwelling DG Window (Uw = 1.40)			11.7100	1.3258	15.5246		(27)
Ground Floor			36.0200	0.1100	3.9622		(28a)
External Wall	87.6000	13.7300	73.8700	0.2400	17.7288		(29a)
External Roof	36.0200		36.0200	0.1100	3.9622		(30)
Total net area of external elements Aum(A, m ²)			159.6400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	44.0058		(33)
Party Wall			46.4000	0.0000	0.0000		(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.4509 (36)
Total fabric heat loss						(33) + (36) =	49.4568 (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	36.7020	36.4654	36.2334	35.1439	34.9401	33.9912	33.9912	33.8155	34.3567	34.9401	35.3525	35.7836 (38)
Heat transfer coeff	86.1587	85.9221	85.6902	84.6007	84.3968	83.4480	83.4480	83.2722	83.8135	84.3968	84.8092	85.2403 (39)
Average = Sum(39)m / 12 =												84.5997 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1960	1.1927	1.1895	1.1744	1.1715	1.1584	1.1584	1.1559	1.1634	1.1715	1.1773	1.1832 (40)
HLP (average)												1.1743 (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)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	97.5668	94.0189	90.4710	86.9232	83.3753	79.8274	79.8274	83.3753	86.9232	90.4710	94.0189	97.5668 (44)
Energy conte	144.6888	126.5457	130.5838	113.8462	109.2381	94.2642	87.3496	100.2350	101.4321	118.2093	129.0347	140.1233 (45)
Energy content (annual)										Total = Sum(45)m =		1395.5508 (45)
Distribution loss (46)m = 0.15 x (45)m	21.7033	18.9819	19.5876	17.0769	16.3857	14.1396	13.1024	15.0352	15.2148	17.7314	19.3552	21.0185 (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)

Regs Region: England

Elmhurst Energy Systems

SAP2012 Calculator (Design
System) version 4.12r02



FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

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)
Combi loss	49.7190	43.2745	46.1031	42.8662	42.4871	39.3669	40.6792	42.4871	42.8662	46.1031	46.3655	49.7190 (61)
Total heat required for water heating calculated for each month	194.4077	169.8202	176.6869	156.7124	151.7252	133.6311	128.0288	142.7221	144.2983	164.3124	175.4002	189.8423 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	194.4077	169.8202	176.6869	156.7124	151.7252	133.6311	128.0288	142.7221	144.2983	164.3124	175.4002	189.8423 (64)
Heat gains from water heating, kWh/month	60.5388	52.8951	54.9449	48.5704	46.9435	41.1846	39.2135	43.9499	44.4427	50.8304	54.4954	59.0208 (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	137.6769	137.6769	137.6769	137.6769	137.6769	137.6769	137.6769	137.6769	137.6769	137.6769	137.6769	137.6769 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	46.8273	41.5916	33.8245	25.6073	19.1418	16.1603	17.4618	22.6975	30.4645	38.6817	45.1473	48.1287 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	301.5085	304.6372	296.7529	279.9683	256.7807	238.8673	225.5639	222.4352	230.3195	247.1041	268.2917	288.2051 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	51.0623	51.0623	51.0623	51.0623	51.0623	51.0623	51.0623	51.0623	51.0623	51.0623	51.0623	51.0623 (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)	-91.7846	-91.7846	-91.7846	-91.7846	-91.7846	-91.7846	-91.7846	-91.7846	-91.7846	-91.7846	-91.7846	-91.7846 (71)
Water heating gains (Table 5)	81.3693	78.7129	73.8507	67.4589	63.0960	57.2008	52.7064	59.0725	61.7260	68.3204	75.6881	79.3290 (72)
Total internal gains	529.6596	524.8963	504.3827	472.9891	440.9731	412.1830	395.6867	404.1598	422.4646	454.0608	489.0817	515.6174 (73)

6. Solar gains

[Jan]	Area m ²	Solar flux Table 6a W/m ²	Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	1.2000	10.6334	0.7100	0.7000	0.7700	4.3948 (74)
East	4.0700	19.6403	0.7100	0.7000	0.7700	27.5316 (76)
West	6.4400	19.6403	0.7100	0.7000	0.7700	43.5635 (80)

Solar gains	75.4899	147.4758	243.3117	356.9652	440.2607	452.1320	429.8394	367.2006	283.5422	175.0243	94.0688	62.1289 (83)
Total gains	605.1496	672.3721	747.6944	829.9543	881.2338	864.3150	825.5261	771.3603	706.0068	629.0851	583.1505	577.7463 (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	58.0647	58.2246	58.3822	59.1340	59.2768	59.9509	59.9509	60.0774	59.6894	59.2768	58.9886	58.6903
alpha	4.8710	4.8816	4.8921	4.9423	4.9518	4.9967	4.9967	5.0052	4.9793	4.9518	4.9326	4.9127
util living area	0.9914	0.9846	0.9651	0.9058	0.7805	0.5953	0.4404	0.4890	0.7404	0.9369	0.9841	0.9931 (86)
MIT	19.9154	20.0669	20.3257	20.6471	20.8739	20.9746	20.9953	20.9923	20.9277	20.6255	20.2152	19.8878 (87)
Th 2	19.9232	19.9258	19.9284	19.9406	19.9428	19.9535	19.9535	19.9554	19.9494	19.9428	19.9382	19.9334 (88)
util rest of house	0.9887	0.9797	0.9539	0.8768	0.7212	0.5075	0.3380	0.3819	0.6555	0.9106	0.9781	0.9908 (89)
MIT 2	18.5073	18.7278	19.0991	19.5483	19.8284	19.9380	19.9519	19.9525	19.8970	19.5327	18.9533	18.4746 (90)
Living area fraction	18.8173	19.0226	19.3691	19.7902	20.0586	20.1662	20.1816	20.1815	20.1239	19.7733	19.2311	18.7857 (92)
Temperature adjustment	18.6673	18.8726	19.2191	19.6402	19.9086	20.0162	20.0316	20.0315	19.9739	19.6233	19.0811	18.6357 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9841	0.9732	0.9443	0.8670	0.7191	0.5129	0.3457	0.3898	0.6577	0.9006	0.9714	0.9869 (94)
Ext temp.	595.5336	654.3194	706.0200	719.5912	633.6537	443.3434	285.4155	300.6987	464.3186	566.5518	566.4716	570.1894 (95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Month fracti	1237.8677	1200.5575	1089.9023	908.6311	692.7795	451.9691	286.3597	302.3991	492.3149	761.5381	1016.1064	1230.5037 (97)
Space heating kWh	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 per m ²	477.8966	367.0720	285.6084	136.1087	43.9896	0.0000	0.0000	0.0000	0.0000	145.0698	323.7371	491.2738 (98)
												2270.7560 (98)
												31.5208 (99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													2509.1227 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	477.8966	367.0720	285.6084	136.1087	43.9896	0.0000	0.0000	0.0000	0.0000	145.0698	323.7371	491.2738	(98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)	528.0625	405.6044	315.5894	150.3963	48.6073	0.0000	0.0000	0.0000	0.0000	160.2981	357.7206	542.8440	(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	194.4077	169.8202	176.6869	156.7124	151.7252	133.6311	128.0288	142.7221	144.2983	164.3124	175.4002	189.8423	(64)
Efficiency of water heater (217)m	87.3278	87.0415	86.3540	84.7989	82.4687	80.4000	80.4000	80.4000	80.4000	84.8397	86.6738	87.4385	(217)
Fuel for water heating, kWh/month	222.6185	195.1027	204.6077	184.8047	183.9793	166.2078	159.2398	177.5150	179.4755	193.6739	202.3681	217.1154	(219)
Water heating fuel used												2286.7084	(219)
Annual totals kWh/year													
Space heating fuel - main system												2509.1227	(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)												330.7937	(232)
Energy saving/generation technologies (Appendices M, N and Q)													
PV Unit 0 (0.80 * 0.90 * 908 * 0.80) =										-522.9240		-522.9240	(233)
Total delivered energy for all uses												4678.7007	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2509.1227	3.4800	87.3175 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2286.7084	3.4800	79.5775 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	330.7937	13.1900	43.6317 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-522.9240	13.1900	-68.9737 (252)
Total energy cost			271.4454 (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] =	0.9741 (257)
SAP value		86.4115
SAP rating (Section 12)		86 (258)
SAP band		B

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	2509.1227	0.2160	541.9705 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2286.7084	0.2160	493.9290 (264)
Space and water heating			1035.8995 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	330.7937	0.5190	171.6819 (268)
Energy saving/generation technologies			
PV Unit	-522.9240	0.5190	-271.3976 (269)
Total kg/year			975.1089 (272)
CO2 emissions per m2			13.5400 (273)
EI value			88.8359
EI rating			89 (274)
EI band			B

Calculation of stars for heating and DHW

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9050 = 3.845$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9050 = 0.2387$, stars = 4
Water heating energy efficiency	$3.48 / 0.8405 = 4.141$, stars = 4
Water heating environmental impact	$0.216 / 0.8405 = 0.2570$, stars = 4

Regs Region: England

Elmhurst Energy Systems

SAP2012 Calculator (Design

System) version 4.12r02

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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	36.0200 (1b)	x 2.3900 (2b)	= 86.0878 (1b) - (3b)
First floor	36.0200 (1c)	x 2.7600 (2c)	= 99.4152 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	72.0400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	185.5030 (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					3 * 10 = 30.0000 (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) =					30.0000 / (5) = 0.1617 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4117 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3500 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.6000	5.1000	4.8000	4.5000	4.7000	4.2000	4.4000	4.2000	4.4000	4.8000	4.9000	5.1000 (22)
Wind factor	1.4000	1.2750	1.2000	1.1250	1.1750	1.0500	1.1000	1.0500	1.1000	1.2000	1.2250	1.2750 (22a)
Adj infilt rate	0.4899	0.4462	0.4200	0.3937	0.4112	0.3675	0.3850	0.3675	0.3850	0.4200	0.4287	0.4462 (22b)
Effective ac	0.6200	0.5995	0.5882	0.5775	0.5845	0.5675	0.5741	0.5675	0.5741	0.5882	0.5919	0.5995 (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
New Dwelling DG Door			2.0200	1.4000	2.8280		(26a)
New Dwelling DG Window (Uw = 1.40)			11.7100	1.3258	15.5246		(27)
Ground Floor			36.0200	0.1100	3.9622		(28a)
External Wall	87.6000	13.7300	73.8700	0.2400	17.7288		(29a)
External Roof	36.0200		36.0200	0.1100	3.9622		(30)
Total net area of external elements Aum(A, m ²)			159.6400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	44.0058		(33)
Party Wall			46.4000	0.0000	0.0000		(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.4509 (36)
Total fabric heat loss						(33) + (36) =	49.4568 (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	37.9555	36.7020	36.0061	35.3525	35.7836	34.7409	35.1439	34.7409	35.1439	36.0061	36.2334	36.7020 (38)
Heat transfer coeff	87.4122	86.1587	85.4629	84.8092	85.2403	84.1977	84.6007	84.1977	84.6007	85.4629	85.6902	86.1587 (39)
Average = Sum(39)m / 12 =												85.3327 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2134	1.1960	1.1863	1.1773	1.1832	1.1688	1.1744	1.1688	1.1744	1.1863	1.1895	1.1960 (40)
HLP (average)												1.1845 (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												2.2946 (42)
Average daily hot water use (litres/day)												88.6971 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	97.5668	94.0189	90.4710	86.9232	83.3753	79.8274	79.8274	83.3753	86.9232	90.4710	94.0189	97.5668 (44)
Energy conte	144.6888	126.5457	130.5838	113.8462	109.2381	94.2642	87.3496	100.2350	101.4321	118.2093	129.0347	140.1233 (45)
Energy content (annual)										Total = Sum(45)m =		1395.5508 (45)
Distribution loss (46)m = 0.15 x (45)m	21.7033	18.9819	19.5876	17.0769	16.3857	14.1396	13.1024	15.0352	15.2148	17.7314	19.3552	21.0185 (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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

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)
Combi loss	49.7190	43.2745	46.1031	42.8662	42.4871	39.3669	40.6792	42.4871	42.8662	46.1031	46.3655	49.7190 (61)
Total heat required for water heating calculated for each month	194.4077	169.8202	176.6869	156.7124	151.7252	133.6311	128.0288	142.7221	144.2983	164.3124	175.4002	189.8423 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	194.4077	169.8202	176.6869	156.7124	151.7252	133.6311	128.0288	142.7221	144.2983	164.3124	175.4002	189.8423 (64)
Heat gains from water heating, kWh/month	60.5388	52.8951	54.9449	48.5704	46.9435	41.1846	39.2135	43.9499	44.4427	50.8304	54.4954	59.0208 (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	137.6769	137.6769	137.6769	137.6769	137.6769	137.6769	137.6769	137.6769	137.6769	137.6769	137.6769	137.6769 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	46.8273	41.5916	33.8245	25.6073	19.1418	16.1603	17.4618	22.6975	30.4645	38.6817	45.1473	48.1287 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	301.5085	304.6372	296.7529	279.9683	258.7807	238.8673	225.5639	222.4352	230.3195	247.1041	268.2917	288.2051 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	51.0623	51.0623	51.0623	51.0623	51.0623	51.0623	51.0623	51.0623	51.0623	51.0623	51.0623	51.0623 (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)	-91.7846	-91.7846	-91.7846	-91.7846	-91.7846	-91.7846	-91.7846	-91.7846	-91.7846	-91.7846	-91.7846	-91.7846 (71)
Water heating gains (Table 5)	81.3693	78.7129	73.8507	67.4589	63.0960	57.2008	52.7064	59.0725	61.7260	68.3204	75.6881	79.3290 (72)
Total internal gains	529.6596	524.8963	504.3827	472.9891	440.9731	412.1830	395.6867	404.1598	422.4646	454.0608	489.0817	515.6174 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	1.2000	14.6401	0.7100	0.7000	0.7700	6.0508 (74)
East	4.0700	27.3735	0.7100	0.7000	0.7700	38.3719 (76)
West	6.4400	27.3735	0.7100	0.7000	0.7700	60.7163 (80)

Solar gains	105.1391	171.3994	281.8041	427.8613	508.9417	560.7683	529.9804	455.7689	352.3336	218.7030	125.6082	83.9290 (83)
Total gains	634.7987	696.2957	786.1868	900.8504	949.9148	972.9513	925.6671	859.9287	774.7983	672.7638	614.6899	599.5465 (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	57.2320	58.0647	58.5374	58.9886	58.6903	59.4170	59.1340	59.4170	59.1340	58.5374	58.3822	58.0647
alpha	4.8155	4.8710	4.9025	4.9326	4.9127	4.9611	4.9423	4.9611	4.9423	4.9025	4.8921	4.8710
util living area	0.9849	0.9767	0.9458	0.8527	0.6780	0.4615	0.3191	0.3223	0.5710	0.8608	0.9659	0.9871 (86)
MIT	20.0934	20.2084	20.4688	20.7643	20.9399	20.9927	20.9991	20.9991	20.9813	20.8092	20.4375	20.0943 (87)
Th 2	19.9093	19.9232	19.9310	19.9382	19.9334	19.9451	19.9406	19.9451	19.9406	19.9310	19.9284	19.9232 (88)
util rest of house	0.9798	0.9691	0.9285	0.8115	0.6052	0.3742	0.2229	0.2197	0.4676	0.8058	0.9522	0.9826 (89)
MIT 2	18.7553	18.9294	19.3004	19.6935	19.8866	19.9417	19.9404	19.9449	19.9313	19.7546	19.2627	18.7673 (90)
Living area fraction	fLA = Living area / (4) =											0.2202 (91)
MIT	19.0499	19.2110	19.5576	19.9293	20.1185	20.1731	20.1735	20.1770	20.1625	19.9868	19.5213	19.0594 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.8999	19.0610	19.4076	19.7793	19.9685	20.0231	20.0235	20.0270	20.0125	19.8368	19.3713	18.9094 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	617.7314	669.0545	721.6566	724.7077	577.2690	370.4446	213.3697	195.8298	367.9895	538.2537	579.4578	585.5540 (95)
Ext temp.	5.8000	6.0000	7.5000	9.8000	12.9000	15.6000	17.5000	17.7000	15.6000	12.5000	9.0000	6.0000 (96)
Heat loss rate W	1145.0879	1125.3175	1017.6599	846.3336	602.5202	372.4114	213.4864	195.9282	373.2970	627.0216	888.7225	1112.2598 (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	392.3532	306.6087	220.2265	87.5707	18.7869	0.0000	0.0000	0.0000	0.0000	66.0433	222.6706	391.8691 (98)
Space heating												1706.1289 (98)
Space heating per m2												23.6831 (99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													1885.2253 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	392.3532	306.6087	220.2265	87.5707	18.7869	0.0000	0.0000	0.0000	0.0000	66.0433	222.6706	391.8691	(98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)	433.5395	338.7942	243.3442	96.7632	20.7590	0.0000	0.0000	0.0000	0.0000	72.9760	246.0448	433.0046	(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	194.4077	169.8202	176.6869	156.7124	151.7252	133.6311	128.0288	142.7221	144.2983	164.3124	175.4002	189.8423	(64)
Efficiency of water heater (217)m	86.8838	86.6213	85.7072	83.7506	81.4009	80.4000	80.4000	80.4000	80.4000	83.0576	85.7534	86.9359	(217)
Fuel for water heating, kWh/month	223.7561	196.0489	206.1518	187.1179	186.3925	166.2078	159.2398	177.5150	179.4755	197.8295	204.5403	218.3705	(219)
Water heating fuel used												2302.6457	(219)
Annual totals kWh/year													
Space heating fuel - main system												1885.2253	(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)													330.7937 (232)
Energy saving/generation technologies (Appendices M, N and Q)													
PV Unit 0 (0.80 * 0.90 * 1118 * 0.80) =										-644.1918		-644.1918	(233)
Total delivered energy for all uses													3949.4729 (238)

10a. Fuel costs - using BEDF prices (454)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1885.2253	3.9700	74.8434 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2302.6457	3.9700	91.4150 (247)
Pumps and fans for heating	75.0000	18.2700	13.7025 (249)
Energy for lighting	330.7937	18.2700	60.4360 (250)
Additional standing charges			90.0000 (251)
Energy saving/generation technologies			
PV Unit	-644.1918	18.2700	-117.6938 (252)
Total energy cost			212.7031 (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	1885.2253	0.2160	407.2087 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2302.6457	0.2160	497.3715 (264)
Space and water heating			904.5801 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	330.7937	0.5190	171.6819 (268)
Energy saving/generation technologies			
PV Unit	-644.1918	0.5190	-334.3356 (269)
Total kg/year			780.8515 (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	1885.2253	1.2200	2299.9749 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2302.6457	1.2200	2809.2277 (264)
Space and water heating			5109.2027 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	330.7937	3.0700	1015.5366 (268)
Energy saving/generation technologies			
PV Unit	-644.1918	3.0700	-1977.6689 (269)
Primary energy kWh/year			4377.3204 (272)
Primary energy kWh/m2/year			60.7624 (273)

SAP 2012 EPC IMPROVEMENTS

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

Current energy efficiency rating: B 86
Current environmental impact rating: B 89

(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	Already installed
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	+ 1.4	-£ 34	-207 kg (26.5%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£34	2.87 kg/m²	B 88
Total Savings	£34	2.87 kg/m²	B 91
Potential energy efficiency rating:		B 88	
Potential environmental impact rating:			B 91

Fuel prices for cost data on this page from database revision number 454 TEST (24 Dec 2019)
Recommendation texts revision number 4.9c (22 Feb 2014)

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

	Current	Potential	Saving
Electricity	£74	£83	-£9
Mains gas	£256	£214	£43
Space heating	£179	£179	£0
Water heating	£91	£58	£34
Lighting	£60	£60	£0
Generated (PV)	-£118	-£118	£0

Total cost of fuels	£212	£179	£34
Total cost of uses	£212	£179	£34
Delivered energy	55 kWh/m²	41 kWh/m²	14 kWh/m²
Carbon dioxide emissions	0.8 tonnes	0.6 tonnes	0.2 tonnes
CO2 emissions per m²	11 kg/m²	8 kg/m²	3 kg/m²
Primary energy	61 kWh/m²	45 kWh/m²	16 kWh/m²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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	36.0200 (1b)	x 2.3900 (2b)	= 86.0878 (1b) - (3b)
First floor	36.0200 (1c)	x 2.7600 (2c)	= 99.4152 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	72.0400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 185.5030 (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					3 * 10 = 30.0000 (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)					30.0000 / (5) = 0.1617 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4117 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3500 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4462	0.4375	0.4287	0.3850	0.3762	0.3325	0.3325	0.3237	0.3500	0.3762	0.3937	0.4112 (22b)
Effective ac	0.5995	0.5957	0.5919	0.5741	0.5708	0.5553	0.5553	0.5524	0.5612	0.5708	0.5775	0.5845 (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
New Dwelling DG Door			2.0200	1.4000	2.8280		(26a)
New Dwelling DG Window (Uw = 1.40)			11.7100	1.3258	15.5246		(27)
Ground Floor			36.0200	0.1100	3.9622		(28a)
External Wall	87.6000	13.7300	73.8700	0.2400	17.7288		(29a)
External Roof	36.0200		36.0200	0.1100	3.9622		(30)
Total net area of external elements Aum(A, m ²)			159.6400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	44.0058		(33)
Party Wall			46.4000	0.0000	0.0000		(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.4509 (36)
Total fabric heat loss						(33) + (36) =	49.4568 (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	36.7020	36.4654	36.2334	35.1439	34.9401	33.9912	33.9912	33.8155	34.3567	34.9401	35.3525	35.7836 (38)
Heat transfer coeff	86.1587	85.9221	85.6902	84.6007	84.3968	83.4480	83.4480	83.2722	83.8135	84.3968	84.8092	85.2403 (39)
Average = Sum(39)m / 12 =												84.5997 (39)
HLP	1.1960	1.1927	1.1895	1.1744	1.1715	1.1584	1.1584	1.1559	1.1634	1.1715	1.1773	1.1832 (40)
HLP (average)												1.1743 (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)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	97.5668	94.0189	90.4710	86.9232	83.3753	79.8274	79.8274	83.3753	86.9232	90.4710	94.0189	97.5668 (44)
Energy conte	144.6888	126.5457	130.5838	113.8462	109.2381	94.2642	87.3496	100.2350	101.4321	118.2093	129.0347	140.1233 (45)
Energy content (annual)										Total = Sum(45)m =		1395.5508 (45)
Distribution loss (46)m = 0.15 x (45)m	21.7033	18.9819	19.5876	17.0769	16.3857	14.1396	13.1024	15.0352	15.2148	17.7314	19.3552	21.0185 (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)

Regs Region: England

Elmhurst Energy Systems

SAP2012 Calculator (Design
System) version 4.12r02

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	49.7190	43.2745	46.1031	42.8662	42.4871	39.3669	40.6792	42.4871	42.8662	46.1031	46.3655	49.7190	(61)
Total heat required for water heating calculated for each month	194.4077	169.8202	176.6869	156.7124	151.7252	133.6311	128.0288	142.7221	144.2983	164.3124	175.4002	189.8423	(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													1.2996 (H8)
Utilisation factor													0.5368 (H9)
Collector performance factor													0.8793 (H10)
Dedicated solar storage volume													75.0000 (H11)
Effective solar volume													75.0000 (H13)
Daily hot water demand													88.6971 (H14)
Volume ratio Veff/V													0.8456 (H15)
Solar storage volume factor													0.9665 (H16)
Solar input													-827.2356 (H17)
Solar input	-23.9882	-40.0294	-68.1746	-91.3674	-112.8768	-110.9758	-109.5093	-95.6788	-74.9357	-51.1722	-28.4534	-20.0740	(63)
													-827.2356 (63)
Solar input (sum of months) = Sum(63)m =													
Output from w/h	170.4196	129.7908	108.5123	65.3449	38.8485	22.6553	18.5195	47.0433	69.3626	113.1401	146.9468	169.7683	(64)
Total per year (kWh/year) = Sum(64)m =													1100.3520 (64)
Heat gains from water heating, kWh/month	60.5388	52.8951	54.9449	48.5704	46.9435	41.1846	39.2135	43.9499	44.4427	50.8304	54.4954	59.0208	(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	137.6769	137.6769	137.6769	137.6769	137.6769	137.6769	137.6769	137.6769	137.6769	137.6769	137.6769	137.6769	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	46.8273	41.5916	33.8245	25.6073	19.1418	16.1603	17.4618	22.6975	30.4645	38.6817	45.1473	48.1287	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	301.5085	304.6372	296.7529	279.9683	258.7807	238.8673	225.5639	222.4352	230.3195	247.1041	268.2917	288.2051	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	51.0623	51.0623	51.0623	51.0623	51.0623	51.0623	51.0623	51.0623	51.0623	51.0623	51.0623	51.0623	(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)	-91.7846	-91.7846	-91.7846	-91.7846	-91.7846	-91.7846	-91.7846	-91.7846	-91.7846	-91.7846	-91.7846	-91.7846	(71)
Water heating gains (Table 5)	81.3693	78.7129	73.8507	67.4589	63.0960	57.2008	52.7064	59.0725	61.7260	68.3204	75.6881	79.3290	(72)
Total internal gains	529.6596	524.8963	504.3827	472.9891	440.9731	412.1830	395.6867	404.1598	422.4646	454.0608	489.0817	515.6174	(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				1.2000	10.6334		0.7100		0.7000		0.7700		4.3948 (74)
East				4.0700	19.6403		0.7100		0.7000		0.7700		27.5316 (76)
West				6.4400	19.6403		0.7100		0.7000		0.7700		43.5635 (80)
Solar gains	75.4899	147.4758	243.3117	356.9652	440.2607	452.1320	429.8394	367.2006	283.5422	175.0243	94.0688		62.1289 (83)
Total gains	605.1496	672.3721	747.6944	829.9543	881.2338	864.3150	825.5261	771.3603	706.0068	629.0851	583.1505		577.7463 (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	58.0647	58.2246	58.3822	59.1340	59.2768	59.9509	59.9509	60.0774	59.6894	59.2768	58.9886	58.6903		
alpha	4.8710	4.8816	4.8921	4.9423	4.9518	4.9967	4.9967	5.0052	4.9793	4.9518	4.9326	4.9127		
util living area	0.9914	0.9846	0.9651	0.9058	0.7805	0.5953	0.4404	0.4890	0.7404	0.9369	0.9841	0.9931	(86)	
MIT	19.9154	20.0669	20.3257	20.6471	20.8739	20.9746	20.9953	20.9923	20.9277	20.6255	20.2152	19.8878	(87)	
Th 2	19.9232	19.9258	19.9284	19.9406	19.9428	19.9535	19.9535	19.9554	19.9494	19.9428	19.9382	19.9334	(88)	
util rest of house	0.9887	0.9797	0.9539	0.8768	0.7212	0.5075	0.3380	0.3819	0.6555	0.9106	0.9781	0.9908	(89)	
MIT 2	18.5073	18.7278	19.0991	19.5483	19.8284	19.9380	19.9519	19.9525	19.8970	19.5327	18.9533	18.4746	(90)	
Living area fraction														fLA = Living area / (4) =
MIT	18.8173	19.0226	19.3691	19.7902	20.0586	20.1662	20.1816	20.1815	20.1239	19.7733	19.2311	18.7857	(92)	
Temperature adjustment														-0.1500
adjusted MIT	18.6673	18.8726	19.2191	19.6402	19.9086	20.0162	20.0316	20.0315	19.9739	19.6233	19.0811	18.6357	(93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9841	0.9732	0.9443	0.8670	0.7191	0.5129	0.3457	0.3898	0.6577	0.9006	0.9714	0.9869	(94)

Regs Region: England

Elmhurst Energy Systems

SAP2012 Calculator (Design

System) version 4.1202

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Useful gains	595.5336	654.3194	706.0200	719.5912	633.6537	443.3434	285.4155	300.6987	464.3186	566.5518	566.4716	570.1894 (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	1237.8677	1200.5575	1089.9023	908.6311	692.7795	451.9691	286.3597	302.3991	492.3149	761.5381	1016.1064	1230.5037 (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	477.8966	367.0720	285.6084	136.1087	43.9896	0.0000	0.0000	0.0000	0.0000	145.0698	323.7371	491.2738 (98)
Space heating												2270.7560 (98)
Space heating per m2										(98) / (4) =		31.5208 (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 %)												90.5000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												2509.1227 (211)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	477.8966	367.0720	285.6084	136.1087	43.9896	0.0000	0.0000	0.0000	0.0000	145.0698	323.7371	491.2738 (98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000 (210)
Space heating fuel (main heating system)	528.0625	405.6044	315.5894	150.3963	48.6073	0.0000	0.0000	0.0000	0.0000	160.2981	357.7206	542.8440 (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	170.4196	129.7908	108.5123	65.3449	38.8485	22.6553	18.5195	47.0433	69.3626	113.1401	146.9468	169.7683 (64)
Efficiency of water heater	87.6071	87.6246	87.4745	86.9567	85.4650	80.4000	80.4000	80.4000	80.4000	85.7784	87.0846	80.4000 (216)
Fuel for water heating, kWh/month	194.5272	148.1214	124.0502	75.1465	45.4554	28.1782	23.0342	58.5116	86.2719	131.8981	168.7402	193.6413 (219)
Water heating fuel used												1277.5762 (219)
Annual totals kWh/year												
Space heating fuel - main system												2509.1227 (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)
pump for solar water heating												50.0000 (230g)
Total electricity for the above, kWh/year												125.0000 (231)
Electricity for lighting (calculated in Appendix L)												330.7937 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 0.90 * 908 * 0.80) =									-522.9240			-522.9240 (233)
Total delivered energy for all uses												3719.5686 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2509.1227	3.4800	87.3175 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1277.5762	3.4800	44.4597 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Pump for solar water heating	50.0000	13.1900	6.5950 (249)
Energy for lighting	330.7937	13.1900	43.6317 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-522.9240	13.1900	-68.9737 (252)
Total energy cost			242.9226 (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] =	0.8717 (257)
SAP value		87.8393
SAP rating (Section 12)		88 (258)
SAP band		B

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	2509.1227	0.2160	541.9705 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1277.5762	0.2160	275.9565 (264)
Space and water heating			817.9270 (265)

Regs Region: England

Elmhurst Energy Systems

SAP2012 Calculator (Design

System) version 4.12r02

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	330.7937	0.5190	171.6819 (268)
Energy saving/generation technologies			
PV Unit	-522.9240	0.5190	-271.3976 (269)
Total kg/year			783.0863 (272)
CO2 emissions per m2			10.8700 (273)
EI value			91.0344
EI rating			91 (274)
EI band			B

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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	36.0200 (1b)	x 2.3900 (2b)	= 86.0878 (1b) - (3b)
First floor	36.0200 (1c)	x 2.7600 (2c)	= 99.4152 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	72.0400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 185.5030 (5)

2. Ventilation rate

	main heating	+	secondary heating	+	other	=	total	m3 per hour				
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000 (6a)				
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000 (6b)				
Number of intermittent fans							3 * 10 =	30.0000 (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) =						30.0000 / (5) =	0.1617 (8)				
Pressure test							Yes					
Measured/design AP50							5.0000					
Infiltration rate							0.4117 (18)					
Number of sides sheltered							2 (19)					
Shelter factor							(20) = 1 - [0.075 x (19)] =	0.8500 (20)				
Infiltration rate adjusted to include shelter factor							(21) = (18) x (20) =	0.3500 (21)				
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.6000	5.1000	4.8000	4.5000	4.7000	4.2000	4.4000	4.2000	4.4000	4.8000	4.9000	5.1000 (22)
Wind factor	1.4000	1.2750	1.2000	1.1250	1.1750	1.0500	1.1000	1.0500	1.1000	1.2000	1.2250	1.2750 (22a)
Adj infilt rate	0.4899	0.4462	0.4200	0.3937	0.4112	0.3675	0.3850	0.3675	0.3850	0.4200	0.4287	0.4462 (22b)
Effective ac	0.6200	0.5995	0.5882	0.5775	0.5845	0.5675	0.5741	0.5675	0.5741	0.5882	0.5919	0.5995 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K						
New Dwelling DG Door			2.0200	1.4000	2.8280			(26a)					
New Dwelling DG Window (Uw = 1.40)			11.7100	1.3258	15.5246			(27)					
Ground Floor			36.0200	0.1100	3.9622			(28a)					
External Wall	87.6000	13.7300	73.8700	0.2400	17.7288			(29a)					
External Roof	36.0200		36.0200	0.1100	3.9622			(30)					
Total net area of external elements Aum(A, m2)			159.6400					(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)... (30) + (32) =	44.0058			(33)					
Party Wall			46.4000	0.0000	0.0000			(32)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)								5.4509 (36)					
Total fabric heat loss						(33) + (36) =	49.4568	(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 37.9555	Feb 36.7020	Mar 36.0061	Apr 35.3525	May 35.7836	Jun 34.7409	Jul 35.1439	Aug 34.7409	Sep 35.1439	Oct 36.0061	Nov 36.2334	Dec 36.7020	(38)
Heat transfer coeff	87.4122	86.1587	85.4629	84.8092	85.2403	84.1977	84.6007	84.1977	84.6007	85.4629	85.6902	86.1587	(39)
Average = Sum(39)m / 12 =												85.3327	(39)
HLP	Jan 1.2134	Feb 1.1960	Mar 1.1863	Apr 1.1773	May 1.1832	Jun 1.1688	Jul 1.1744	Aug 1.1688	Sep 1.1744	Oct 1.1863	Nov 1.1895	Dec 1.1960	(40)
HLP (average)												1.1845	(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												2.2946 (42)
Average daily hot water use (litres/day)												88.6971 (43)
Daily hot water use	Jan 97.5668	Feb 94.0189	Mar 90.4710	Apr 86.9232	May 83.3753	Jun 79.8274	Jul 79.8274	Aug 83.3753	Sep 86.9232	Oct 90.4710	Nov 94.0189	Dec 97.5668 (44)
Energy conte	144.6888	126.5457	130.5838	113.8462	109.2381	94.2642	87.3496	100.2350	101.4321	118.2093	129.0347	140.1233 (45)
Energy content (annual)										Total = Sum(45)m =		1395.5508 (45)
Distribution loss (46)m = 0.15 x (45)m	21.7033	18.9819	19.5876	17.0769	16.3857	14.1396	13.1024	15.0352	15.2148	17.7314	19.3552	21.0185 (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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	49.7190	43.2745	46.1031	42.8662	42.4871	39.3669	40.6792	42.4871	42.8662	46.1031	46.3655	49.7190	(61)	
Total heat required for water heating calculated for each month	194.4077	169.8202	176.6869	156.7124	151.7252	133.6311	128.0288	142.7221	144.2983	164.3124	175.4002	189.8423	(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													1306.9326 (H5)	
Overshading factor													0.8000 (H6)	
Solar energy available													2195.6468 (H7)	
Adjustment factor for showers													1.0000 (H7a)	
Solar-to-load ratio													1.5733 (H8)	
Utilisation factor													0.4704 (H9)	
Collector performance factor													0.8793 (H10)	
Dedicated solar storage volume													75.0000 (H11)	
Effective solar volume													75.0000 (H13)	
Daily hot water demand													88.6971 (H14)	
Volume ratio Veff/V													0.8456 (H15)	
Solar storage volume factor													0.9665 (H16)	
Solar input													-877.6618 (H17)	
Solar input	-28.7164	-40.0335	-68.1589	-94.9609	-113.5455	-119.9511	-117.5935	-103.1372	-80.5191	-55.0771	-32.6637	-23.3048	(63)	
													-877.6618 (63)	
Output from w/h	165.6913	129.7866	108.5280	61.7515	38.1797	13.6800	10.4352	39.5849	63.7792	109.2352	142.7365	166.5376	(64)	
													1049.9258 (64)	
Heat gains from water heating, kWh/month	60.5388	52.8951	54.9449	48.5704	46.9435	41.1846	39.2135	43.9499	44.4427	50.8304	54.4954	59.0208	(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	137.6769	137.6769	137.6769	137.6769	137.6769	137.6769	137.6769	137.6769	137.6769	137.6769	137.6769	137.6769	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	46.8273	41.5916	33.8245	25.6073	19.1418	16.1603	17.4618	22.6975	30.4645	38.6817	45.1473	48.1287	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	301.5085	304.6372	296.7529	279.9683	258.7807	238.8673	225.5639	222.4352	230.3195	247.1041	268.2917	288.2051	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	51.0623	51.0623	51.0623	51.0623	51.0623	51.0623	51.0623	51.0623	51.0623	51.0623	51.0623	51.0623	(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)	-91.7846	-91.7846	-91.7846	-91.7846	-91.7846	-91.7846	-91.7846	-91.7846	-91.7846	-91.7846	-91.7846	-91.7846	(71)
Water heating gains (Table 5)	81.3693	78.7129	73.8507	67.4589	63.0960	57.2008	52.7064	59.0725	61.7260	68.3204	75.6881	79.3290	(72)
Total internal gains	529.6596	524.8963	504.3827	472.9891	440.9731	412.1830	395.6867	404.1598	422.4646	454.0608	489.0817	515.6174	(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				1.2000	14.6401		0.7100		0.7000		0.7700		6.0508 (74)
East				4.0700	27.3735		0.7100		0.7000		0.7700		38.3719 (76)
West				6.4400	27.3735		0.7100		0.7000		0.7700		60.7163 (80)
Solar gains	105.1391	171.3994	281.8041	427.8613	508.9417	560.7683	529.9804	455.7689	352.3336	218.7030	125.6082		83.9290 (83)
Total gains	634.7987	696.2957	786.1868	900.8504	949.9148	972.9513	925.6671	859.9287	774.7983	672.7638	614.6899		599.5465 (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	57.2320	58.0647	58.5374	58.9886	58.6903	59.4170	59.1340	59.4170	59.1340	58.5374	58.3822	58.0647	
alpha	4.8155	4.8710	4.9025	4.9326	4.9127	4.9611	4.9423	4.9611	4.9423	4.9025	4.8921	4.8710	
util living area	0.9849	0.9767	0.9458	0.8527	0.6780	0.4615	0.3191	0.3223	0.5710	0.8608	0.9659	0.9871	(86)
MIT	20.0934	20.2084	20.4688	20.7643	20.9399	20.9927	20.9991	20.9991	20.9813	20.8092	20.4375	20.0943	(87)
Th 2	19.9093	19.9232	19.9310	19.9382	19.9334	19.9451	19.9406	19.9451	19.9406	19.9310	19.9284	19.9232	(88)
util rest of house	0.9798	0.9691	0.9285	0.8115	0.6052	0.3742	0.2229	0.2197	0.4676	0.8058	0.9522	0.9826	(89)
MIT 2	18.7553	18.9294	19.3004	19.6935	19.8866	19.9417	19.9404	19.9449	19.9313	19.7546	19.2627	18.7673	(90)
Living area fraction													0.2202 (91)
MIT	19.0499	19.2110	19.5576	19.9293	20.1185	20.1731	20.1735	20.1770	20.1625	19.9868	19.5213	19.0594	(92)
Temperature adjustment													-0.1500
adjusted MIT	18.8999	19.0610	19.4076	19.7793	19.9685	20.0231	20.0235	20.0270	20.0125	19.8368	19.3713	18.9094	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9731	0.9609	0.9179	0.8045	0.6077	0.3807	0.2305	0.2277	0.4749	0.8001	0.9427	0.9767	(94)

Regs Region: England

Elmhurst Energy Systems

SAP2012 Calculator (Design

System) version 4.1202

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

Useful gains	617.7314	669.0545	721.6566	724.7077	577.2690	370.4446	213.3697	195.8298	367.9895	538.2537	579.4578	585.5540 (95)
Ext temp.	5.8000	6.0000	7.5000	9.8000	12.9000	15.6000	17.5000	17.7000	15.6000	12.5000	9.0000	6.0000 (96)
Heat loss rate W	1145.0879	1125.3175	1017.6599	846.3336	602.5202	372.4114	213.4864	195.9282	373.2970	627.0216	888.7225	1112.2598 (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	392.3532	306.6087	220.2265	87.5707	18.7869	0.0000	0.0000	0.0000	0.0000	66.0433	222.6706	391.8691 (98)
Space heating												1706.1289 (98)
Space heating per m2											(98) / (4) =	23.6831 (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 %)												90.5000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												1885.2253 (211)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	392.3532	306.6087	220.2265	87.5707	18.7869	0.0000	0.0000	0.0000	0.0000	66.0433	222.6706	391.8691 (98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000 (210)
Space heating fuel (main heating system)	433.5395	338.7942	243.3442	96.7632	20.7590	0.0000	0.0000	0.0000	0.0000	72.9760	246.0448	433.0046 (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	165.6913	129.7866	108.5280	61.7515	38.1797	13.6800	10.4352	39.5849	63.7792	109.2352	142.7365	166.5376 (64)
Efficiency of water heater	87.2458	87.2406	86.8964	86.0307	83.4722	80.4000	80.4000	80.4000	80.4000	83.9293	86.2668	80.4000 (216)
(217)m	87.2458	87.2406	86.8964	86.0307	83.4722	80.4000	80.4000	80.4000	80.4000	83.9293	86.2668	80.4000 (217)
Fuel for water heating, kWh/month	189.9132	148.7686	124.8935	71.7785	45.7395	17.0150	12.9792	49.2350	79.3273	130.1515	165.4593	190.9137 (219)
Water heating fuel used												1226.1742 (219)
Annual totals kWh/year												
Space heating fuel - main system												1885.2253 (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)
pump for solar water heating												50.0000 (230g)
Total electricity for the above, kWh/year												125.0000 (231)
Electricity for lighting (calculated in Appendix L)												330.7937 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 0.90 * 1118 * 0.80) =										-644.1918		-644.1918 (233)
Total delivered energy for all uses												2923.0014 (238)

10a. Fuel costs - using BEDF prices (454)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1885.2253	3.9700	74.8434 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1226.1742	3.9700	48.6791 (247)
Pumps and fans for heating	75.0000	18.2700	13.7025 (249)
Pump for solar water heating	50.0000	18.2700	9.1350 (249)
Energy for lighting	330.7937	18.2700	60.4360 (250)
Additional standing charges			90.0000 (251)
Energy saving/generation technologies			
PV Unit	-644.1918	18.2700	-117.6938 (252)
Total energy cost			179.1022 (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	1885.2253	0.2160	407.2087 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1226.1742	0.2160	264.8536 (264)
Space and water heating			672.0623 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	330.7937	0.5190	171.6819 (268)
Energy saving/generation technologies			
PV Unit	-644.1918	0.5190	-334.3356 (269)
Total kg/year			574.2837 (272)

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	1885.2253	1.2200	2299.9749 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1226.1742	1.2200	1495.9325 (264)
Space and water heating			3795.9074 (265)
Pumps and fans	125.0000	3.0700	383.7500 (267)
Energy for lighting	330.7937	3.0700	1015.5366 (268)
Energy saving/generation technologies			
PV Unit	-644.1918	3.0700	-1977.6689 (269)
Primary energy kWh/year			3217.5251 (272)
Primary energy kWh/m2/year			44.6630 (273)

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

Overheating Calculation Input Data

Dwelling type	SemiDetached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	East
Overshading	Average or unknown
Thermal mass parameter	250.0
Night ventilation	Yes
Ventilation rate during hot weather (ach)	4.00 (Windows half open)

Overheating Calculation

Summer ventilation heat loss coefficient	244.86 (P1)
Transmission heat loss coefficient	49.46 (37)
Summer heat loss coefficient	294.32 (P2)

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

Solar shading	Z_blinds	Solar access	Z_overhangs	Z_summer
Orientation				
North	1.000	0.90	1.000	0.900 (P8)
East	1.000	0.90	1.000	0.900 (P8)
West	1.000	0.90	1.000	0.900 (P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	1.2000	87.1704	0.7100	0.7000	0.9000	42.1106
East	4.0700	125.2818	0.7100	0.7000	0.9000	205.2692
West	6.4400	125.2818	0.7100	0.7000	0.9000	324.7994

total: 572.1792

	Jun	Jul	Aug	
Solar gains	616	572	500	(P3)
Internal gains	409	393	401	
Total summer gains	1025	965	902	(P5)
Summer gain/loss ratio	3.48	3.28	3.06	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 250.0)	0.25	0.25	0.25	
Threshold temperature	19.13	20.83	20.61	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	

Assessment of likelihood of high internal temperature: Slight

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF STANDARD ENE7 CO2 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF STANDARD ENE7 CO2 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	36.0200 (1b)	x 2.3900 (2b)	= 86.0878 (1b) - (3b)
First floor	36.0200 (1c)	x 2.7600 (2c)	= 99.4152 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	72.0400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 185.5030 (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					3 * 10 = 30.0000 (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)					30.0000 / (5) = 0.1617 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4117 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3500 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4462	0.4375	0.4287	0.3850	0.3762	0.3325	0.3325	0.3237	0.3500	0.3762	0.3937	0.4112 (22b)
Effective ac	0.5995	0.5957	0.5919	0.5741	0.5708	0.5553	0.5553	0.5524	0.5612	0.5708	0.5775	0.5845 (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
New Dwelling DG Door			2.0200	1.4000	2.8280		(26a)
New Dwelling DG Window (Uw = 1.40)			11.7100	1.3258	15.5246		(27)
Ground Floor			36.0200	0.1100	3.9622		(28a)
External Wall	87.6000	13.7300	73.8700	0.2400	17.7288		(29a)
External Roof	36.0200		36.0200	0.1100	3.9622		(30)
Total net area of external elements Aum(A, m ²)			159.6400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	44.0058		(33)
Party Wall			46.4000	0.0000	0.0000		(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.4509 (36)
Total fabric heat loss						(33) + (36) =	49.4568 (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	36.7020	36.4654	36.2334	35.1439	34.9401	33.9912	33.9912	33.8155	34.3567	34.9401	35.3525	35.7836 (38)
Heat transfer coeff	86.1587	85.9221	85.6902	84.6007	84.3968	83.4480	83.4480	83.2722	83.8135	84.3968	84.8092	85.2403 (39)
Average = Sum(39)m / 12 =												84.5997 (39)
HLP	1.1960	1.1927	1.1895	1.1744	1.1715	1.1584	1.1584	1.1559	1.1634	1.1715	1.1773	1.1832 (40)
HLP (average)												1.1743 (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												2.2946 (42)
Average daily hot water use (litres/day)												88.6971 (43)
Daily hot water use	97.5668	94.0189	90.4710	86.9232	83.3753	79.8274	79.8274	83.3753	86.9232	90.4710	94.0189	97.5668 (44)
Energy conte	144.6888	126.5457	130.5838	113.8462	109.2381	94.2642	87.3496	100.2350	101.4321	118.2093	129.0347	140.1233 (45)
Energy content (annual)										Total = Sum(45)m =		1395.5508 (45)
Distribution loss (46)m = 0.15 x (45)m	21.7033	18.9819	19.5876	17.0769	16.3857	14.1396	13.1024	15.0352	15.2148	17.7314	19.3552	21.0185 (46)
Water storage loss:												150.0000 (47)
Store volume												

b) If manufacturer declared loss factor is not known :

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF STANDARD ENE7 CO2 09 Jan 2014

Hot water storage loss factor from Table 2 (kWh/litre/day)													0.0191 (51)
Volume factor from Table 2a													0.9283 (52)
Temperature factor from Table 2b													0.5400 (53)
Enter (49) or (54) in (55)													1.4364 (55)
Total storage loss	44.5282	40.2190	44.5282	43.0918	44.5282	43.0918	44.5282	44.5282	43.0918	44.5282	43.0918	44.5282	(56)
If cylinder contains dedicated solar storage	44.5282	40.2190	44.5282	43.0918	44.5282	43.0918	44.5282	44.5282	43.0918	44.5282	43.0918	44.5282	(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	212.4794	187.7759	198.3744	179.4500	177.0287	159.8680	155.1402	168.0256	167.0359	185.9999	194.6385	207.9139	(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 =													(63)
Output from w/h	212.4794	187.7759	198.3744	179.4500	177.0287	159.8680	155.1402	168.0256	167.0359	185.9999	194.6385	207.9139	(64)
Heat gains from water heating, kWh/month	102.3415	91.0606	97.6516	90.3369	90.5541	83.8259	83.2762	87.5606	86.2092	93.5371	95.3871	100.8235	(65)
Total per year (kWh/year) = Sum(64)m =													(64)

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

Metabolic gains (Table 5), Watts													
(66)m	114.7307	114.7307	114.7307	114.7307	114.7307	114.7307	114.7307	114.7307	114.7307	114.7307	114.7307	114.7307	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	18.7309	16.6366	13.5298	10.2429	7.6567	6.4641	6.9847	9.0790	12.1858	15.4727	18.0589	19.2515	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	202.0107	204.1069	198.8245	187.5787	173.3830	160.0411	151.1278	149.0316	154.3141	165.5598	179.7555	193.0974	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.4731	34.4731	34.4731	34.4731	34.4731	34.4731	34.4731	34.4731	34.4731	34.4731	34.4731	34.4731	(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)	-91.7846	-91.7846	-91.7846	-91.7846	-91.7846	-91.7846	-91.7846	-91.7846	-91.7846	-91.7846	-91.7846	-91.7846	(71)
Water heating gains (Table 5)	137.5558	135.5069	131.2522	125.4679	121.7126	116.4248	111.9304	117.6890	119.7350	125.7219	132.4821	135.5154	(72)
Total internal gains	418.7166	416.6696	404.0256	383.7088	363.1715	343.3493	330.4622	336.2188	346.6541	367.1735	390.7157	408.2836	(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				1.2000	10.6334	0.7100	0.7000	0.7700		4.3948 (74)		
East				4.0700	19.6403	0.7100	0.7000	0.7700		27.5316 (76)		
West				6.4400	19.6403	0.7100	0.7000	0.7700		43.5635 (80)		
Solar gains	75.4899	147.4758	243.3117	356.9652	440.2607	452.1320	429.8394	367.2006	283.5422	175.0243	94.0688	62.1289 (83)
Total gains	494.2065	564.1455	647.3374	740.6740	803.4322	795.4812	760.3015	703.4194	630.1963	542.1979	484.7845	470.4125 (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	58.0647	58.2246	58.3822	59.1340	59.2768	59.9509	59.9509	60.0774	59.6894	59.2768	58.9886	58.6903	
alpha	4.8710	4.8816	4.8921	4.9423	4.9518	4.9967	4.9967	5.0052	4.9793	4.9518	4.9326	4.9127	
util living area	0.9964	0.9925	0.9798	0.9346	0.8221	0.6382	0.4763	0.5324	0.7951	0.9627	0.9926	0.9972	(86)
MIT	19.7764	19.9348	20.2127	20.5698	20.8385	20.9656	20.9934	20.9889	20.8995	20.5380	20.0950	19.7522	(87)
Th 2	19.9232	19.9258	19.9284	19.9406	19.9428	19.9535	19.9535	19.9554	19.9494	19.9428	19.9382	19.9334	(88)
util rest of house	0.9952	0.9900	0.9729	0.9121	0.7670	0.5474	0.3665	0.4177	0.7143	0.9452	0.9897	0.9962	(89)
MIT 2	18.8188	18.9782	19.2542	19.6051	19.8397	19.9387	19.9519	19.9525	19.8972	19.5844	19.1482	18.8028	(90)
Living area fraction	19.0296	19.1888	19.4652	19.8174	20.0596	20.1648	20.1812	20.1806	20.1179	19.7944	19.3566	19.0118	(92)
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	1269.0865	1227.7271	1110.9907	923.6235	705.5219	464.3721	298.8431	314.8226	504.3777	775.9747	1039.4758	1262.5662	(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	578.7904	450.5771	359.8856	180.2845	62.4069	0.0000	0.0000	0.0000	0.0000	197.2900	403.7515	591.0860	(98)
Space heating													(98) / (4) =
Space heating per m2													39.2014 (99)

8. Space heating requirement

Utilisation	0.9938	0.9877	0.9690	0.9089	0.7737	0.5666	0.3908	0.4431	0.7287	0.9421	0.9875	0.9951	(94)
Useful gains	491.1424	557.2255	627.2735	673.2285	621.6416	450.7035	297.1298	311.6871	459.2360	510.8000	478.7098	468.0958	(95)
Heat loss rate W	1269.0865	1227.7271	1110.9907	923.6235	705.5219	464.3721	298.8431	314.8226	504.3777	775.9747	1039.4758	1262.5662	(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	578.7904	450.5771	359.8856	180.2845	62.4069	0.0000	0.0000	0.0000	0.0000	197.2900	403.7515	591.0860	(98)
Space heating													(98) / (4) =
Space heating per m2													39.2014 (99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF STANDARD ENE7 CO2 09 Jan 2014

8c. Space cooling requirement

Not applicable

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

DER	16.6200	ZC1
Total Floor Area	72.0400	
Assumed number of occupants	N	2.2946
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190
CO2 emissions from appliances, equation (L14)		16.6168 ZC2
CO2 emissions from cooking, equation (L16)		2.4163 ZC3
Total CO2 emissions		35.6531 ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000 ZC5
Additional allowable electricity generation, kWh/m ² /year		0.0000 ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000 ZC7
Net CO2 emissions		35.6531 ZC8

U-VALUE CALCULATOR REPORT

surecalc ltd

Property Reference	sc120973	Issued on Date	17/01/2020
Assessment Reference	001	Prop Type Ref	New Dwelling
Project	Plot 6, 15-17, Kew Gardens, Bognor Regis, West Sussex, PO21 5RD		
Calculation Type	New Build (As Designed)		

SAP Rating	86 B	DER	15.49	TER	19.48
Environmental	89 B	% DER < TER	20.49		
CO ₂ Emissions (t/year)	0.78	DREF	46.83	TREF	55.16
General Requirements Compliance	Pass	% DREF < TREF	15.09		

Assessor Details	Mr. Mark Rogers, Surecalc Limited, [REDACTED]	Assessor ID	A320-0001
Client	Vivid Design Studio, Vivid Design Studio		

Building Elements

Roof 000002 - Pitched Roof Insulated Ceiling Vivid

Roof Type: Pitched Roof, insulated flat ceiling

Layer	Description	Thickness (mm)	Conductivity (W/m ² K)	Resistance (m ² K/W)	Fraction (%)
Ext surface				0.0400	
Layer 1	Loft Space				
	Main construction	0	0.0600	0.0600	100.00
Layer 2	Mineral wool				
	Main construction	250	0.0440	5.6818	100.00
	Corrections - Air Gap: Level 0, Fasteners: None or plastic				
Layer 3	Mineral wool quilt				
	Main construction	150	0.0440	3.4091	91.67
	Main construction	150	0.1300	1.1538	8.33
	Corrections - Air Gap: Level 0, Fasteners: None or plastic				
Layer 4	Plasterboard, standard				
	Main construction	12.5	0.2100	0.0595	100.00
Int surface				0.1000	

Total resistance: Upper limit = 9.109 m² K/W Lower limit = 8.873 m² K/W Average = 8.991 m² K/W
Total correction = 0.0030 m² K/W U-value (unrounded) = 0.11 W/m² K

Unheated space: None

Total thickness: 413 mm

U-value: 0.11 W/m² K

Kappa: n/a

U-VALUE CALCULATOR REPORT

surecalc ltd

Property Reference	sc120973	Issued on Date	17/01/2020
Assessment Reference	001	Prop Type Ref	New Dwelling
Project	Plot 6, 15-17, Kew Gardens, Bognor Regis, West Sussex, PO21 5RD		
Calculation Type	New Build (As Designed)		

SAP Rating	86 B	DER	15.49	TBR	19.48
Environmental	89 B	% DER < TBR	20.49		
CO ₂ Emissions (t/year)	0.78	DREE	46.83	TREE	55.16
General Requirements Compliance	Pass	% DPER < TREE	15.09		

Assessor Details	Mr. Mark Rogers, Surecalc Limited, [REDACTED]	Assessor ID	A320-0001
Client	Vivid Design Studio, Vivid Design Studio		

Building Elements

Wall 000001 - Vivid 100 Cavity Wall Thermabead

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	Thermabead Diamond				
	Main construction	100	0.0320	3.1250	100.00
Corrections - Air Gap: Level 0, Fasteners: Wall ties, Cross sectional area: 12.50 mm ² , Lambda: 17.000 W/m.K, per m ² : 2.500					
Layer 3	Supabloc *4				
	Main construction	100	0.1600	0.6250	94.04
	Main construction	100	0.8803	0.1136	5.96
Corrections - Air Gap: Level 1, Fasteners: None or plastic					
Layer 4	airspace/plaster dabs				
	Main construction	15	0.1000	0.1500	80.00
	Main construction	15	0.0882	0.1700	20.00
Corrections - Cavity Unventilated, Emissivity: Normal					
Layer 5	Plasterboard, standard				
	Main construction	12.5	0.2100	0.0595	100.00
Int surface				0.1300	

Total resistance:	Upper limit = 4.227 m ² K/W	Lower limit = 4.129 m ² K/W	Average = 4.178 m ² K/W
	Total correction = 0.0001 m ² K/W	U-value (unrounded) = 0.24 W/m ² K	

Unheated space: None

Total thickness: 330 mm

U-value: 0.24 W/m² K

Kappa: n/a

U-VALUE CALCULATOR REPORT

surecalc ltd

Property Reference	sc120973	Issued on Date	17/01/2020
Assessment Reference	001	Prop Type Ref	New Dwelling
Project	Plot 6, 15-17, Kew Gardens, Bognor Regis, West Sussex, PO21 5RD		
Calculation Type	New Build (As Designed)		

SAP Rating	86 B	DER	15.49	TBR	19.48
Environmental	89 B	% DER<TBR	20.49		
CO ₂ Emissions (t/year)	0.78	DREE	46.83	TREE	55.16
General Requirements Compliance	Pass	% DPER<TPER	15.09		

Assessor Details	Mr. Mark Rogers, Surecalc Limited, [REDACTED]	Assessor ID	A320-0001
Client	Vivid Design Studio, Vivid Design Studio		

Building Elements

Floor 000003 - Vivid GF Beam & Block

Floor Type: Suspended Floor

Area = 36.02 m², Perimeter = 17.01 m, Wall thickness = 300.00 mm, Soil: Unknown

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

Floor height above ground: h = 0.000 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	Celcon Flooring -				
	Main construction	100	0.1500	0.6667	90.91
	Main construction	100	1.0000	0.1000	9.09
Layer 2	Thermafloor TF70 zero ODP				
	Main construction	150	0.0220	6.8182	100.00
	Corrections - Air Gap: Level 1, Fasteners: None or plastic				
Layer 3	Screed				
	Main construction	65	1.1500	0.0565	100.00
Int surface				0.1700	

Total resistance: Upper limit = 7.826 m² K/W Lower limit = 7.655 m² K/W Average = 7.740 m² K/W

Total correction = 0.0078 m² K/W

U-value (unrounded) = 0.11 W/m² K

Unheated space: None

Total thickness: 315 mm

U-value: 0.11 W/m² K

Kappa: n/a

THERMAL BRIDGING

Calculation Type: New Build (As Designed)



Property Reference	sc120973	Issued on Date	17/01/2020	
Assessment Reference	001	Prop Type Ref	New Dwelling	
Property	Plot 6, 15-17, Kew Gardens, Bognor Regis, West Sussex, PO21 5RD			
SAP Rating	86 B	DER	15.49	
Environmental	89 B	% DER < TER	20.49	
CO ₂ Emissions (t/year)	0.78	DER	46.83	
General Requirements Compliance	Pass	% DER < TER	15.09	
Assessor Details	Mr. Mark Rogers, Surecalc Limited, [REDACTED]		Assessor ID	A320-0001
Client	Vivid Design Studio, Vivid Design Studio			

	Junction detail	Source Type	Psi (W/mK)	Length (m)	Result	Reference
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.050	9.64	0.48	IG Hi Therm Lintels
External wall	E3 Sill	Independently assessed	0.027	8.68	0.23	LABC Construction Detail
External wall	E4 Jamb	Independently assessed	0.029	22.20	0.64	LABC Construction Detail
External wall	E5 Ground floor (normal)	Independently assessed	0.048	17.01	0.82	LABC Construction Detail
External wall	E6 Intermediate floor within a dwelling	Independently assessed	0.003	17.01	0.05	LABC Construction Detail
External wall	E10 Eaves (insulation at ceiling level)	Independently assessed	0.083	8.00	0.66	LABC Construction Detail
External wall	E12 Gable (insulation at ceiling level)	Independently assessed	0.054	9.02	0.49	LABC Construction Detail
External wall	E16 Corner (normal)	Independently assessed	0.050	10.30	0.52	LABC Construction Detail
External wall	E18 Party wall between dwellings	Independently assessed	0.044	5.15	0.23	LABC Construction Detail
External wall	E25 Staggered party wall between dwellings	Table K1 - Default	0.120	5.15	0.62	
Party wall	P1 Party wall - Ground floor	Independently assessed	0.043	9.02	0.39	LABC Construction Detail
Party wall	P2 Party wall - Intermediate floor within a dwelling	Table K1 - Default	0.000	9.02	0.00	
Party wall	P4 Party wall - Roof (insulation at ceiling level)	Independently assessed	0.036	9.02	0.32	LABC Construction Detail

Total: 5.45 W/mK:
Y-Value: 0.034 W/m²K: