



SAP Report Submission for Building Regulations Compliance

Client: Vivid Design Studio

Project: Plot 1 , 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	sc120968	Issued on Date	17/01/2020
Assessment Reference	001	Prop Type Ref	New Dwelling
Property	Plot 1, 15-17, Kew Gardens, Bognor Regis, West Sussex, PO21 5RD		

SAP Rating	87 B	DER	15.23	TER	19.25
Environmental	89 B	% DER<TER	20.89		
CO ₂ Emissions (t/year)	0.77	DFEE	45.73	TFEE	54.00
General Requirements Compliance	Pass	% DFEE<TFEE	15.31		

Assessor Details	Mr. Mark Rogers, Surecalc Limited, [REDACTED]	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	15.23	kgCO ₂ /yr/m ²
TER	19.25	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	15.23	kgCO ₂ /yr/m ²
Reduction DER/TER	20.89	%
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.)	45.73 kWh/m ² /yr
CfSH ENE2 credits achieved	7.0
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	20.13	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	39.16	kgCO ₂ /yr/m ² (ZC4)
Net Standard case CO ₂ emissions	39.16	kgCO ₂ /yr/m ² (ZC8)

Actual case CO₂ emissions

DER	16.36	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	35.39	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	35.39	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

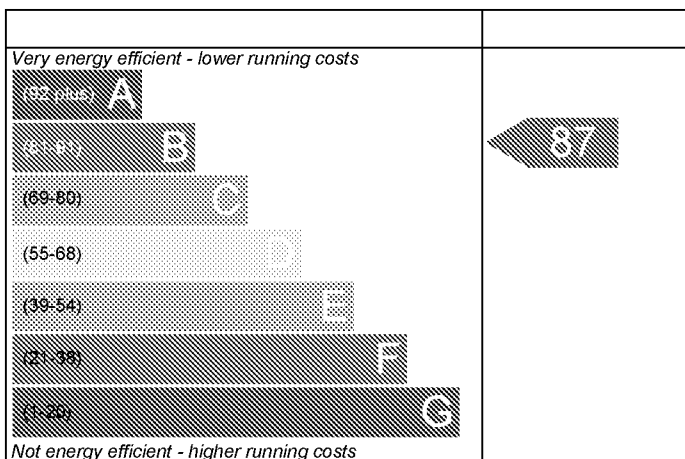
Plot 1 , 15-17, Kew Gardens,
Bognor Regis,
West Sussex,
PO21 5RD

Dwelling type: House, Semi-Detached
Date of assessment: 17/01/2020
Produced by: Surecalc Limited
Total floor area: 72.04 m²
DRRN: 5024-3954-9006

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

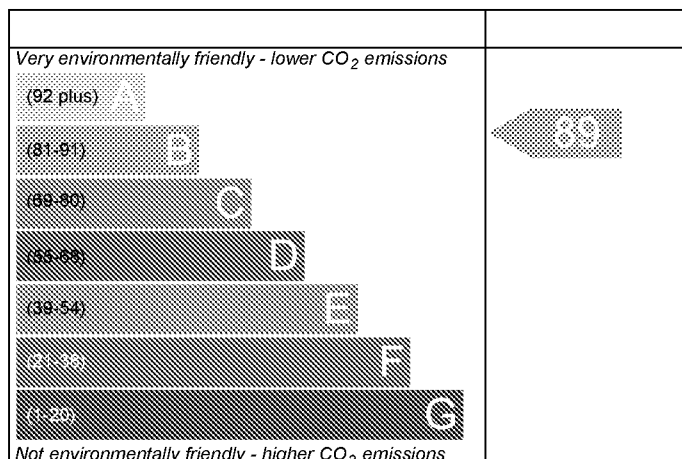


England

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

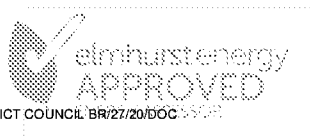


England

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)



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Environmental	89 B	% DER < TER	20.89
CO ₂ Emissions (t/year)	0.77	DFEE	45.73
General Requirements Compliance	Pass	% DFEE < TFEE	15.31
Assessor Details	Mr. Mark Rogers, Surecalc Limited, T 01243 572606		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)	19.25 kgCO ₂ /m ²
Dwelling Carbon Dioxide Emission Rate (DER)	15.23 kgCO ₂ /m ²
	-4.02 (-20.9%) kgCO ₂ /m ²

Pass

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	54.00 kWh/m ² /yr
Dwelling Fabric Energy Efficiency (DFEE)	45.73 kWh/m ² /yr
	-8.3 (-15.4%) kWh/m ² /yr

Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.24 (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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BUILDING REGULATION COMPLIANCE

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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 East

4.07 m², No overhang

Windows facing South

1.20 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

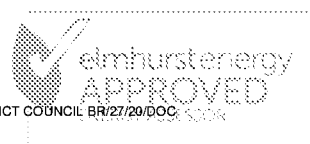
W/m²K

Photovoltaic array

0.90

kW

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Environmental	89 B	% DER<TER	20.89
CO ₂ Emissions (t/year)	0.77	DEFE	45.73
General Requirements Compliance	Pass	% DEFE<TFEE	15.31
Assessor Details	Mr. Mark Rogers, Surecalc Limited, [REDACTED]		Assessor ID
	[REDACTED]		A320-0001
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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) 19.25 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 15.23 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)54.0 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)45.7 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 East: 4.07 m², No overhang
Windows facing South: 1.20 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)
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)

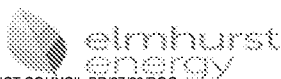
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	97.5668	94.0189	90.4710	86.9232	83.3753	79.8274	79.8274	83.3753	86.9232	90.4710	94.0189	97.5668 (44)
Energy conte	144.6888	126.5457	130.5838	113.8462	109.2381	94.2642	87.3496	100.2350	101.4321	118.2093	129.0347	140.1233 (45)
Energy content (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

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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	
East					4.0700	19.6403	0.7100	0.7000	0.7700		27.5316 (76)	
South					1.2000	46.7521	0.7100	0.7000	0.7700		19.3229 (78)	
West					6.4400	19.6403	0.7100	0.7000	0.7700		43.5635 (80)	
Solar gains	90.4180	170.7230	269.3514	379.6019	456.8571	464.7636	443.6170	386.0672	308.4930	199.1597	111.5514	75.1619 (83)
Total gains	452.9481	530.5986	615.9756	705.3017	761.4121	748.8888	714.8552	663.6695	597.1381	508.9318	445.4731	427.2590 (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	0.9975	0.9942	0.9834	0.9446	0.8444	0.6696	0.5045	0.5610	0.8191	0.9706	0.9949	0.9982 (86)
MIT	19.7239	19.8929	20.1758	20.5361	20.8156	20.9576	20.9915	20.9860	20.8840	20.5016	20.0457	19.6970 (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	0.9967	0.9923	0.9776	0.9247	0.7923	0.5775	0.3893	0.4417	0.7415	0.9562	0.9928	0.9975 (89)
MIT 2	18.2292	18.4773	18.8886	19.4048	19.7671	19.9262	19.9505	19.9499	19.8590	19.3687	18.7098	18.1970 (90)
Living area fraction	18.5583	18.7889	19.1720	19.6539	19.9980	20.1533	20.1797	20.1780	20.0846	19.6181	19.0039	18.5272 (92)
Temperature adjustment	18.4083	18.6389	19.0220	19.5039	19.8480	20.0033	20.0297	20.0280	19.9346	19.4681	18.8539	18.3772 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9949	0.9888	0.9707	0.9144	0.7870	0.5821	0.3979	0.4503	0.7403	0.9473	0.9895	0.9961 (94)
Ext temp.	450.6222	524.6538	597.9234	644.9112	599.2044	435.9619	284.4195	298.8782	442.0406	482.1088	440.7971	425.5846 (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	1215.5515	1180.4789	1073.0092	897.0937	687.6627	450.8934	286.1973	302.1110	489.0211	748.4427	996.8399	1208.4704 (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	569.1074	440.7145	353.4638	181.5714	65.8130	0.0000	0.0000	0.0000	0.0000	198.1525	400.3508	582.4670 (98)
												2791.6404 (98)
												38.7513 (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													3084.6855 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	569.1074	440.7145	353.4638	181.5714	65.8130	0.0000	0.0000	0.0000	0.0000	198.1525	400.3508	582.4670	(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)	628.8480	486.9774	390.5678	200.6314	72.7216	0.0000	0.0000	0.0000	0.0000	218.9530	442.3766	643.6100	(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	87.6950	87.4445	86.8633	85.5230	83.2095	80.4000	80.4000	80.4000	80.4000	85.6240	87.1642	87.7891	(217)
Fuel for water heating, kWh/month	221.6863	194.2033	203.4080	183.2401	182.3413	166.2078	159.2398	177.5150	179.4755	191.8999	201.2296	216.2481	(219)
Water heating fuel used												2276.6948	(219)
Annual totals kWh/year													
Space heating fuel - main system													3084.6855 (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													5244.2500 (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	3084.6855	0.2160	666.2921	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2276.6948	0.2160	491.7661	(264)
Space and water heating			1158.0582	(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			1097.2675	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			15.2300	(273)

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

DER			15.2300	ZC1
Total Floor Area		TFA	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			34.2631	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			34.2631	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												

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		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W	
East	4.0700				19.6403		0.6300		0.7000		0.7700		24.4294 (76)	
South	1.2000				46.7521		0.6300		0.7000		0.7700		17.1456 (78)	
West	6.4400				19.6403		0.6300		0.7000		0.7700		38.6549 (80)	
Solar gains	80.2300	151.4866	239.0020	336.8298	405.3803	412.3958	393.6320	342.5667	273.7333	176.7192	98.9822	66.6929	(83)	
Total gains	442.7601	511.3622	585.6261	662.5296	709.9353	696.5211	664.8702	620.1689	562.3783	486.4913	432.9039	418.7901	(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	57.8823	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	0.9978	0.9951	0.9866	0.9558	0.8716	0.7086	0.5406	0.5968	0.8451	0.9754	0.9955	0.9983 (86)
MIT	19.7060	19.8639	20.1351	20.4894	20.7812	20.9451	20.9884	20.9815	20.8636	20.4731	20.0256	19.6811 (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	0.9970	0.9934	0.9817	0.9391	0.8243	0.6157	0.4186	0.4722	0.7719	0.9630	0.9936	0.9977 (89)
MIT 2	18.2009	18.4330	18.8282	19.3399	19.7261	19.9141	19.9462	19.9449	19.8369	19.3273	18.6785	18.1717 (90)
Living area fraction	18.5322	18.7480	19.1159	19.5930	19.9583	20.1411	20.1757	20.1731	20.0630	19.5795	18.9751	18.5040 (92)
Temperature adjustment	18.5322	18.7480	19.1159	19.5930	19.9583	20.1411	20.1757	20.1731	20.0630	19.5795	18.9751	18.5040 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9955	0.9907	0.9766	0.9323	0.8252	0.6338	0.4456	0.4996	0.7813	0.9573	0.9911	0.9966 (94)
Useful gains	440.7773	506.6173	571.9404	617.6696	585.8662	441.4881	296.2407	309.8373	439.3847	465.7136	429.0547	417.3455 (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	1230.0929	1193.6075	1084.4825	907.5360	699.2206	463.8944	299.3516	315.2167	501.3949	760.2804	1010.3382	1223.1593 (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	587.2508	461.6574	381.3313	208.7038	84.3357	0.0000	0.0000	0.0000	0.0000	219.1577	418.5241	599.5254 (98)
Space heating												2960.4863 (98)
Space heating per m2										(98) / (4) =		41.0950 (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													3169.6856 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	587.2508	461.6574	381.3313	208.7038	84.3357	0.0000	0.0000	0.0000	0.0000	219.1577	418.5241	599.5254	(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)	628.7482	494.2798	408.2777	223.4516	90.2952	0.0000	0.0000	0.0000	0.0000	234.6442	448.0986	641.8902	(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	87.6578	87.4423	86.9377	85.7733	83.6385	80.3000	80.3000	80.3000	80.3000	85.7771	87.1623	87.7457	(216)
Fuel for water heating, kWh/month	221.7802	194.2083	203.2340	182.7054	181.4061	166.4148	159.4381	177.7361	179.6990	191.5574	201.2340	216.3551	(219)
Water heating fuel used												2275.7685	(219)
Annual totals kWh/year													
Space heating fuel - main system													3169.6856 (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													5851.2478 (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	3169.6856	0.2160	684.6521 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2275.7685	0.2160	491.5660 (264)
Space and water heating			1176.2181 (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			1386.8250 (272)
Emissions per m2 for space and water heating			16.3273 (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) = (16.3273 * 1.00) + 2.3831 + 0.5403, rounded to 2 d.p.			19.2500 (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

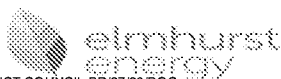
Average daily hot water use (litres/day)

	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



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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
East	4.0700	19.6403	0.7100	0.7000	0.7700	27.5316 (76)
South	1.2000	46.7521	0.7100	0.7000	0.7700	19.3229 (78)
West	6.4400	19.6403	0.7100	0.7000	0.7700	43.5635 (80)

Solar gains	90.4180	170.7230	269.3514	379.6019	456.8571	464.7636	443.6170	386.0672	308.4930	199.1597	111.5514	75.1619	(83)
Total gains	409.9045	488.9021	576.4220	668.4432	726.5165	716.5090	684.0974	630.2260	562.3487	471.3742	404.8682	384.9518	(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	0.9984	0.9960	0.9873	0.9541	0.8624	0.6926	0.5254	0.5870	0.8442	0.9781	0.9966	0.9988	(86)
MIT	19.6689	19.8404	20.1284	20.4992	20.7944	20.9508	20.9899	20.9830	20.8653	20.4589	19.9942	19.6426	(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	0.9979	0.9946	0.9827	0.9369	0.8134	0.6000	0.4063	0.4640	0.7710	0.9670	0.9952	0.9984	(89)
MIT 2	18.7118	18.8847	19.1723	19.5411	19.8069	19.9315	19.9510	19.9507	19.8756	19.5108	19.0485	18.6936	(90)
Living area fraction									fLA = Living area / (4) =			0.2202	(91)
MIT	18.9225	19.0951	19.3828	19.7521	20.0243	20.1559	20.1797	20.1780	20.0935	19.7195	19.2567	18.9026	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9225	19.0951	19.3828	19.7521	20.0243	20.1559	20.1797	20.1780	20.0935	19.7195	19.2567	18.9026	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9972	0.9931	0.9797	0.9332	0.8177	0.6191	0.4327	0.4913	0.7825	0.9639	0.9939	0.9979	(94)
Useful gains	408.7375	485.5085	564.6997	623.7939	594.0900	443.5666	296.0207	309.6577	440.0564	454.3360	402.4131	384.1426	(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	1259.8552	1219.6753	1103.9252	918.0915	702.5444	463.6291	298.7182	314.6001	502.3359	769.6612	1031.0010	1253.2502	(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	633.2316	493.3601	401.1838	211.8943	80.6901	0.0000	0.0000	0.0000	0.0000	234.6019	452.5833	646.6160	(98)
Space heating												3154.1609	(98)
Space heating per m2											(98) / (4) =	43.7835	(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	0.8931	0.9431	0.9215	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	700.5726	582.3578	583.1907	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	923.0334	883.4424	821.9636	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	160.1717	224.0069	177.6471	0.0000	0.0000	0.0000	0.0000	(104)

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Space cooling												561.8257 (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	40.0429	56.0017	44.4118	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												140.4564 (107)
Space cooling per m2												1.9497 (108)
Energy for space heating												43.7835 (99)
Energy for space cooling												1.9497 (108)
Total												45.7332 (109)
Dwelling Fabric Energy Efficiency (DFEE)												45.7 (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												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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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	Specific data or Table 6c	FF	Access factor Table 6d	Gains W
East	4.0700	19.6403	0.6300	0.7000	0.7700	24.4294	(76)
South	1.2000	46.7521	0.6300	0.7000	0.7700	17.1456	(78)
West	6.4400	19.6403	0.6300	0.7000	0.7700	38.6549	(80)

Solar gains	80.2300	151.4866	239.0020	336.8298	405.3803	412.3958	393.6320	342.5667	273.7333	176.7192	98.9822	66.6929	(83)
Total gains	399.7166	469.6657	546.0726	625.6712	675.0396	664.1413	634.1124	586.7254	527.5889	448.9336	392.2990	376.4829	(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	57.8823	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	0.9986	0.9966	0.9899	0.9641	0.8887	0.7328	0.5640	0.6253	0.8693	0.9821	0.9971	0.9990	(86)	
MIT	19.6509	19.8112	20.0870	20.4504	20.7567	20.9361	20.9861	20.9773	20.8421	20.4295	19.9740	19.6267	(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	0.9981	0.9954	0.9862	0.9500	0.8450	0.6404	0.4381	0.4974	0.8017	0.9727	0.9958	0.9986	(89)	
MIT 2	18.6914	18.8533	19.1292	19.4935	19.7747	19.9210	19.9469	19.9459	19.8571	19.4803	19.0260	18.6754	(90)	
Living area fraction									fLA = Living area / (4) =			0.2202	(91)	
MIT	18.9027	19.0642	19.3401	19.7042	19.9909	20.1445	20.1757	20.1730	20.0740	19.6892	19.2347	18.8848	(92)	
Temperature adjustment												0.0000		
adjusted MIT	18.9027	19.0642	19.3401	19.7042	19.9909	20.1445	20.1757	20.1730	20.0740	19.6892	19.2347	18.8848	(93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Useful gains	0.9974	0.9941	0.9834	0.9462	0.8475	0.6589	0.4661	0.5258	0.8113	0.9697	0.9947	0.9981	(94)	
Ext temp.	398.6918	466.8970	537.0285	591.9821	572.0739	437.6232	295.5603	308.4876	428.0480	435.3216	390.2105	375.7622	(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	1262.1102	1220.8600	1103.7520	916.9715	701.9762	464.1807	299.3537	315.2100	502.3208	769.5708	1032.4291	1255.7252	(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	642.3833	506.6631	421.6423	233.9924	96.6473	0.0000	0.0000	0.0000	0.0000	248.6814	462.3974	654.6925	(98)	
Space heating												3267.0996	(98)	
Space heating per m2										(98) / (4) =		45.3512	(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	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	0.8683	0.9271	0.9027	0.0000	0.0000	0.0000	0.0000	(101)	
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	683.3409	574.3755	573.1432	0.0000	0.0000	0.0000	0.0000	(102)	
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	861.8243	825.0183	771.1189	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	128.5080	186.4783	147.2939	0.0000	0.0000	0.0000	0.0000	(104)	
Space cooling												462.2802	(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	32.1270	46.6196	36.8235	0.0000	0.0000	0.0000 (107)
Space cooling											115.5701 (107)
Space cooling per m2											1.6042 (108)
Energy for space heating											45.3512 (99)
Energy for space cooling											1.6042 (108)
Total											46.9554 (109)
Target Fabric Energy Efficiency (TFEE)											54.0 (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	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 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	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)
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	
East				4.0700	27.3735	0.7100		0.7000		0.7700	38.3719 (76)	
South				1.2000	61.3950	0.7100		0.7000		0.7700	25.3749 (78)	
West				6.4400	27.3735	0.7100		0.7000		0.7700	60.7163 (80)	
Solar gains	124.4631	196.1724	308.8227	451.3669	524.9137	573.4491	543.9172	475.7530	379.7758	246.1358	147.2242	100.3513 (83)
Total gains	654.1228	721.0687	813.2054	924.3560	965.8868	985.6321	939.6039	879.9128	802.2404	700.1967	636.3059	615.9688 (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	0.9830	0.9734	0.9392	0.8426	0.6694	0.4559	0.3144	0.3151	0.5537	0.8455	0.9613	0.9857	(86)
MIT	20.1163	20.2366	20.4949	20.7781	20.9432	20.9931	20.9991	20.9992	20.9836	20.8259	20.4608	20.1141	(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	0.9773	0.9648	0.9203	0.8000	0.5967	0.3695	0.2196	0.2147	0.4525	0.7876	0.9461	0.9807	(89)
MIT 2	18.7879	18.9690	19.3353	19.7096	19.8894	19.9419	19.9404	19.9449	19.9325	19.7724	19.2943	18.7955	(90)
Living area fraction									fLA = Living area / (4) =			0.2202	(91)
MIT	19.0804	19.2481	19.5906	19.9448	20.1214	20.1733	20.1735	20.1770	20.1639	20.0044	19.5511	19.0858	(92)
Temperature adjustment												-0.1500	
adjusted MIT	18.9304	19.0981	19.4406	19.7948	19.9714	20.0233	20.0235	20.0270	20.0139	19.8544	19.4011	18.9358	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	634.6174	689.4106	739.6915	733.4824	578.9493	370.5716	213.3795	195.8425	368.8148	548.1329	595.7230	600.1450	(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	1147.7562	1128.5136	1020.4788	847.6546	602.7642	372.4308	213.4883	195.9309	373.4223	628.5252	891.2750	1114.5346	(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	381.7753	295.0772	208.9057	82.2040	17.7183	0.0000	0.0000	0.0000	0.0000	59.8119	212.7974	382.7059	(98)
Space heating												1640.9956	(98)
RHI space heating demand												1641	(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)
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	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
East	4.0700	19.6403	0.7100	0.7000	0.7700	27.5316 (76)
South	1.2000	46.7521	0.7100	0.7000	0.7700	19.3229 (78)
West	6.4400	19.6403	0.7100	0.7000	0.7700	43.5635 (80)

Solar gains	90.4180	170.7230	269.3514	379.6019	456.8571	464.7636	443.6170	386.0672	308.4930	199.1597	111.5514	75.1619 (83)
Total gains	620.0776	695.6192	773.7341	852.5910	897.8302	876.9466	839.3037	790.2270	730.9576	653.2206	600.6331	590.7793 (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	0.9905	0.9824	0.9604	0.8979	0.7716	0.5880	0.4335	0.4780	0.7229	0.9284	0.9820	0.9924 (86)
MIT	19.9338	20.0945	20.3536	20.6649	20.8804	20.9760	20.9956	20.9931	20.9351	20.6478	20.2359	19.9040 (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	0.9875	0.9769	0.9480	0.8673	0.7117	0.5007	0.3325	0.3729	0.6374	0.8997	0.9754	0.9900 (89)
MIT 2	18.5338	18.7672	19.1375	19.5706	19.8350	19.9388	19.9520	19.9528	19.9030	19.5610	18.9827	18.4981 (90)
Living area fraction	18.8420	19.0594	19.4052	19.8115	20.0651	20.1672	20.1818	20.1818	20.1302	19.8002	19.2586	18.8076 (92)
Temperature adjustment	18.6920	18.9094	19.2552	19.6615	19.9151	20.0172	20.0318	20.0318	19.9802	19.6502	19.1086	18.6576 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	609.2930	674.5896	725.7656	731.3437	637.4115	443.9090	285.4960	300.9014	467.9293	581.2579	581.5855	582.3673 (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	1240.0008	1203.7173	1092.9979	910.4328	693.3308	452.0515	286.3730	302.4314	492.8435	763.8115	1018.4406	1232.3710 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	469.2467	355.5738	273.2209	128.9441	41.6040	0.0000	0.0000	0.0000	0.0000	135.8199	314.5357	483.6027 (98)
Space heating												2202.5477 (98)
Space heating per m2												30.5740 (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													2433.7544 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	469.2467	355.5738	273.2209	128.9441	41.6040	0.0000	0.0000	0.0000	0.0000	135.8199	314.5357	483.6027	(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)	518.5046	392.8992	301.9015	142.4797	45.9712	0.0000	0.0000	0.0000	0.0000	150.0772	347.5533	534.3677	(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	87.2879	86.9687	86.2452	84.6652	82.3784	80.4000	80.4000	80.4000	80.4000	84.6765	86.6051	87.4048	(216)
Fuel for water heating, kWh/month	222.7202	195.2658	204.8658	185.0967	184.1807	166.2078	159.2398	177.5150	179.4755	194.0472	202.5288	217.1990	(219)
Water heating fuel used												2288.3425	(219)
Annual totals kWh/year													
Space heating fuel - main system												2433.7544	(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												4604.9665	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2433.7544	3.4800	84.6947 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2288.3425	3.4800	79.6343 (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			268.8795 (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] =	0.9649 (257)
SAP value		86.5399
SAP rating (Section 12)		87 (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	2433.7544	0.2160	525.6909 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2288.3425	0.2160	494.2820 (264)
Space and water heating			1019.9729 (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			959.1823 (272)
CO2 emissions per m2			13.3100 (273)
EI value			89.0182
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	$3.48 / 0.8399 = 4.144$, stars = 4
Water heating environmental impact	$0.216 / 0.8399 = 0.2572$, 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	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 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
East	4.0700	27.3735	0.7100	0.7000	0.7700	38.3719 (76)
South	1.2000	61.3950	0.7100	0.7000	0.7700	25.3749 (78)
West	6.4400	27.3735	0.7100	0.7000	0.7700	60.7163 (80)

Solar gains	124.4631	196.1724	308.8227	451.3669	524.9137	573.4491	543.9172	475.7530	379.7758	246.1358	147.2242	100.3513 (83)
Total gains	654.1228	721.0687	813.2054	924.3560	965.8868	985.6321	939.6039	879.9128	802.2404	700.1967	636.3059	615.9688 (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	0.9830	0.9734	0.9392	0.8426	0.6694	0.4559	0.3144	0.3151	0.5537	0.8455	0.9613	0.9857 (86)
MIT	20.1163	20.2366	20.4949	20.7781	20.9432	20.9931	20.9991	20.9992	20.9836	20.8259	20.4608	20.1141 (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	0.9773	0.9648	0.9203	0.8000	0.5967	0.3695	0.2196	0.2147	0.4525	0.7876	0.9461	0.9807 (89)
MIT 2	18.7879	18.9690	19.3353	19.7096	19.8894	19.9419	19.9404	19.9449	19.9325	19.7724	19.2943	18.7955 (90)
Living area fraction	19.0804	19.2481	19.5906	19.9448	20.1214	20.1733	20.1735	20.1770	20.1639	20.0044	19.5511	19.0858 (92)
Temperature adjustment	18.9304	19.0981	19.4406	19.7948	19.9714	20.0233	20.0235	20.0270	20.0139	19.8544	19.4011	18.9358 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	634.6174	689.4106	739.6915	733.4824	578.9493	370.5716	213.3795	195.8425	368.8148	548.1329	595.7230	600.1450 (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	1147.7562	1128.5136	1020.4788	847.6546	602.7642	372.4308	213.4883	195.9309	373.4223	628.5252	891.2750	1114.5346 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	381.7753	295.0772	208.9057	82.2040	17.7183	0.0000	0.0000	0.0000	0.0000	59.8119	212.7974	382.7059 (98)
Space heating												1640.9956 (98)
Space heating per m2												22.7790 (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													1813.2548 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	381.7753	295.0772	208.9057	82.2040	17.7183	0.0000	0.0000	0.0000	0.0000	59.8119	212.7974	382.7059	(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)	421.8511	326.0521	230.8351	90.8331	19.5782	0.0000	0.0000	0.0000	0.0000	66.0905	235.1353	422.8794	(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	86.8201	86.5294	85.5741	83.6106	81.3493	80.4000	80.4000	80.4000	80.4000	82.8681	85.6391	86.8811	(217)
Fuel for water heating, kWh/month	223.9203	196.2573	206.4723	187.4313	186.5107	166.2078	159.2398	177.5150	179.4755	198.2819	204.8132	218.5081	(219)
Water heating fuel used												2304.6333	(219)
Annual totals kWh/year													
Space heating fuel - main system												1813.2548	(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													3879.4899 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1813.2548	3.9700	71.9862	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	2304.6333	3.9700	91.4939	(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			209.9248	(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	1813.2548	0.2160	391.6630	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2304.6333	0.2160	497.8008	(264)
Space and water heating			889.4638	(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			765.7352	(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	1813.2548	1.2200	2212.1709	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2304.6333	1.2200	2811.6526	(264)
Space and water heating			5023.8234	(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			4291.9411	(272)
Primary energy kWh/m2/year			59.5772	(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 87
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 (27.0%)

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

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	£253	£211	£43
Space heating	£176	£176	£0
Water heating	£91	£58	£34
Lighting	£60	£60	£0
Generated (PV)	-£118	-£118	£0
Total cost of fuels	£209	£176	£34
Total cost of uses	£209	£176	£34
Delivered energy	54 kWh/m²	40 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	60 kWh/m²	43 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)
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

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 (S7)
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	-827.2356 (63)
												Solar input (sum of months) = Sum(63)m = -827.2356 (63)
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			
East				4.0700	19.6403	0.7100	0.7000	0.7700	27.5316 (76)			
South				1.2000	46.7521	0.7100	0.7000	0.7700	19.3229 (78)			
West				6.4400	19.6403	0.7100	0.7000	0.7700	43.5635 (80)			
Solar gains	90.4180	170.7230	269.3514	379.6019	456.8571	464.7636	443.6170	386.0672	308.4930	199.1597	111.5514	75.1619 (83)
Total gains	620.0776	695.6192	773.7341	852.5910	897.8302	876.9466	839.3037	790.2270	730.9576	653.2206	600.6331	590.7793 (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	0.9905	0.9824	0.9604	0.8979	0.7716	0.5880	0.4335	0.4780	0.7229	0.9284	0.9820	0.9924	(86)
MIT	19.9338	20.0945	20.3536	20.6649	20.8804	20.9760	20.9956	20.9931	20.9351	20.6478	20.2359	19.9040	(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	0.9875	0.9769	0.9480	0.8673	0.7117	0.5007	0.3325	0.3729	0.6374	0.8997	0.9754	0.9900	(89)
MIT 2	18.5338	18.7672	19.1375	19.5706	19.8350	19.9388	19.9520	19.9528	19.9030	19.5610	18.9827	18.4981	(90)
Living area fraction									fLA = Living area / (4) =			0.2202	(91)
MIT	18.8420	19.0594	19.4052	19.8115	20.0651	20.1672	20.1818	20.1818	20.1302	19.8002	19.2586	18.8076	(92)
Temperature adjustment												-0.1500	
adjusted MIT	18.6920	18.9094	19.2552	19.6615	19.9151	20.0172	20.0318	20.0318	19.9802	19.6502	19.1086	18.6576	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9826	0.9698	0.9380	0.8578	0.7099	0.5062	0.3402	0.3808	0.6402	0.8898	0.9683	0.9858	(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	609.2930	674.5896	725.7656	731.3437	637.4115	443.9090	285.4960	300.9014	467.9293	581.2579	581.5855	582.3673 (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	1240.0008	1203.7173	1092.9979	910.4328	693.3308	452.0515	286.3730	302.4314	492.8435	763.8115	1018.4406	1232.3710 (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	469.2467	355.5738	273.2209	128.9441	41.6040	0.0000	0.0000	0.0000	0.0000	135.8199	314.5357	483.6027 (98)
Space heating												2202.5477 (98)
Space heating per m2											(98) / (4) =	30.5740 (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												2433.7544 (211)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	469.2467	355.5738	273.2209	128.9441	41.6040	0.0000	0.0000	0.0000	0.0000	135.8199	314.5357	483.6027 (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)	518.5046	392.8992	301.9015	142.4797	45.9712	0.0000	0.0000	0.0000	0.0000	150.0772	347.5533	534.3677 (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	87.5692	87.5587	87.3797	86.8314	85.3243	80.4000	80.4000	80.4000	80.4000	85.6125	87.0192	80.4000 (216)
Fuel for water heating, kWh/month	194.6113	148.2329	124.1848	75.2550	45.5304	28.1782	23.0342	58.5116	86.2719	132.1538	168.8672	87.6394 (217)
Water heating fuel used												193.7124 (219)
Annual totals kWh/year												1278.5436 (219)
Space heating fuel - main system												2433.7544 (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												3645.1676 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2433.7544	3.4800	84.6947 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1278.5436	3.4800	44.4933 (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			240.3335 (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] =	0.8624 (257)
SAP value		87.9690
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	2433.7544	0.2160	525.6909 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1278.5436	0.2160	276.1654 (264)
Space and water heating			801.8564 (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			
Total kg/year	-522.9240	0.5190	-271.3976 (269)
CO2 emissions per m2			767.0157 (272)
EI value			10.6500 (273)
EI rating			91.2184
EI band			91 (274)
			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	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	5.6000	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 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)
Solar input (sum of months) = Sum(63)m =														
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)
Total per year (kWh/year) = Sum(64)m =														
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	
East				4.0700	27.3735		0.7100		0.7000		0.7700		38.3719 (76)	
South				1.2000	61.3950		0.7100		0.7000		0.7700		25.3749 (78)	
West				6.4400	27.3735		0.7100		0.7000		0.7700		60.7163 (80)	
Solar gains	124.4631	196.1724	308.8227	451.3669	524.9137	573.4491	543.9172	475.7530	379.7758	246.1358	147.2242	100.3513	(83)	
Total gains	654.1228	721.0687	813.2054	924.3560	965.8868	985.6321	939.6039	879.9128	802.2404	700.1967	636.3059	615.9688	(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	0.9830	0.9734	0.9392	0.8426	0.6694	0.4559	0.3144	0.3151	0.5537	0.8455	0.9613	0.9857 (86)
MIT	20.1163	20.2366	20.4949	20.7781	20.9432	20.9931	20.9991	20.9992	20.9836	20.8259	20.4608	20.1141 (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	0.9773	0.9648	0.9203	0.8000	0.5967	0.3695	0.2196	0.2147	0.4525	0.7876	0.9461	0.9807 (89)
MIT 2	18.7879	18.9690	19.3353	19.7096	19.8894	19.9419	19.9404	19.9449	19.9325	19.7724	19.2943	18.7955 (90)
Living area fraction									fLA = Living area / (4) =			0.2202 (91)
MIT	19.0804	19.2481	19.5906	19.9448	20.1214	20.1733	20.1735	20.1770	20.1639	20.0044	19.5511	19.0858 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.9304	19.0981	19.4406	19.7948	19.9714	20.0233	20.0235	20.0270	20.0139	19.8544	19.4011	18.9358 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9702	0.9561	0.9096	0.7935	0.5994	0.3760	0.2271	0.2226	0.4597	0.7828	0.9362	0.9743 (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	634.6174	689.4106	739.6915	733.4824	578.9493	370.5716	213.3795	195.8425	368.8148	548.1329	595.7230	600.1450 (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	1147.7562	1128.5136	1020.4788	847.6546	602.7642	372.4308	213.4883	195.9309	373.4223	628.5252	891.2750	1114.5346 (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	381.7753	295.0772	208.9057	82.2040	17.7183	0.0000	0.0000	0.0000	0.0000	59.8119	212.7974	382.7059 (98)
Space heating												1640.9956 (98)
Space heating per m2											(98) / (4) =	22.7790 (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												1813.2548 (211)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	381.7753	295.0772	208.9057	82.2040	17.7183	0.0000	0.0000	0.0000	0.0000	59.8119	212.7974	382.7059 (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)	421.8511	326.0521	230.8351	90.8331	19.5782	0.0000	0.0000	0.0000	0.0000	66.0905	235.1353	422.8794 (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	87.1853	87.1554	86.7732	85.8726	83.3485	80.4000	80.4000	80.4000	80.4000	83.7053	86.1549	80.4000 (216)
(217)m	87.1853	87.1554	86.7732	85.8726	83.3485	80.4000	80.4000	80.4000	80.4000	83.7053	86.1549	87.1793 (217)
Fuel for water heating, kWh/month	190.0451	148.9140	125.0709	71.9106	45.8074	17.0150	12.9792	49.2350	79.3273	130.4998	165.6742	191.0287 (219)
Water heating fuel used												1227.5072 (219)
Annual totals kWh/year												
Space heating fuel - main system												1813.2548 (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												2852.3639 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1813.2548	3.9700	71.9862 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1227.5072	3.9700	48.7320 (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			176.2979 (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	1813.2548	0.2160	391.6630 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1227.5072	0.2160	265.1416 (264)
Space and water heating			656.8046 (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			559.0260 (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	1813.2548	1.2200	2212.1709 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1227.5072	1.2200	1497.5588 (264)
Space and water heating			3709.7297 (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			3131.3474 (272)
Primary energy kWh/m2/year			43.4668 (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 Orientation	Ratio	Z_overhangs	Overhang type
East	0.000	1.000	None
South	0.000	1.000	None
West	0.000	1.000	None

Solar shading Orientation	Z blinds	Solar access	Z overhangs	Z summer
East	1.000	0.90	1.000	0.900 (P8)
South	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
East	4.0700	125.2818	0.7100	0.7000	0.9000	205.2692
South	1.2000	118.5567	0.7100	0.7000	0.9000	57.2728
West	6.4400	125.2818	0.7100	0.7000	0.9000	324.7994
total:						587.3414

Solar gains	Jun	Jul	Aug	(P3)
Internal gains	630	587	523	
Total summer gains	409	393	401	
	1040	980	924	(P5)
Summer gain/loss ratio	3.53	3.33	3.14	(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	19.18	20.88	20.69	(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
East					4.0700	19.6403	0.7100	0.7000			0.7700			27.5316 (76)
South					1.2000	46.7521	0.7100	0.7000			0.7700			19.3229 (78)
West					6.4400	19.6403	0.7100	0.7000			0.7700			43.5635 (80)
Solar gains	90.4180	170.7230	269.3514	379.6019	456.8571	464.7636	443.6170	386.0672	308.4930	199.1597	111.5514			75.1619 (83)
Total gains	509.1345	587.3926	673.3771	763.3107	820.0287	808.1128	774.0792	722.2860	655.1471	566.3333	502.2671			483.4455 (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	0.9959	0.9912	0.9765	0.9277	0.8133	0.6300	0.4683	0.5197	0.7769	0.9563	0.9914	0.9968	(86)
MIT	19.7953	19.9636	20.2428	20.5905	20.8468	20.9675	20.9939	20.9900	20.9098	20.5635	20.1167	19.7688	(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	0.9945	0.9982	0.9685	0.9035	0.7571	0.5396	0.3601	0.4071	0.6943	0.9364	0.9880	0.9957	(89)
MIT 2	18.8376	19.0066	19.2832	19.6234	19.8456	19.9396	19.9520	19.9528	19.9034	19.6076	19.1696	18.8194	(90)
Living area fraction									fLA = Living area / (4) =			0.2202	(91)
Ext MIT	19.0484	19.2173	19.4944	19.8363	20.0660	20.1659	20.1814	20.1811	20.1249	19.8180	19.3781	19.0284	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0484	19.2173	19.4944	19.8363	20.0660	20.1659	20.1814	20.1811	20.1249	19.8180	19.3781	19.0284	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	505.5724	578.9692	649.4123	687.5263	626.7346	451.5888	297.2754	312.0606	464.8541	528.6593	495.0409	480.7788	(94)
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	1270.7065	1230.1747	1113.4958	925.2191	706.0681	464.4641	298.8595	314.8638	504.9713	777.9715	1041.2952	1263.9763	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating	569.2598	437.6101	345.2781	171.1388	59.0242	0.0000	0.0000	0.0000	0.0000	185.4883	393.3031	582.6990	(98)
Space heating per m2													(98) / (4) =
													38.0872 (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	16.3600	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		35.3931 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		35.3931 ZC8

U-VALUE CALCULATOR REPORT

surecalc ltd

Property Reference	sc120968	Issued on Date	17/01/2020
Assessment Reference	001	Prop Type Ref	New Dwelling
Project	Plot 1 , 15-17, Kew Gardens, Bognor Regis, West Sussex, PO21 5RD		
Calculation Type	New Build (As Designed)		

SAP Rating	87 B	DER	15.23	TAR	19.25
Environmental	89 B	% DER < TAR	20.89		
CO ₂ Emissions (t/year)	0.77	DREF	45.73	TREF	54.00
General Requirements Compliance	Pass	% DREF < TREF	15.31		

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	sc120968	Issued on Date	17/01/2020
Assessment Reference	001	Prop Type Ref	New Dwelling
Project	Plot 1 , 15-17, Kew Gardens, Bognor Regis, West Sussex, PO21 5RD		
Calculation Type	New Build (As Designed)		

SAP Rating	87 B	DER	15.23	TBR	19.25
Environmental	89 B	% DER<TBR	20.89		
CO ₂ Emissions (t/year)	0.77	DREE	45.73	TREE	54.00
General Requirements Compliance	Pass	% DPER<TPER	15.31		

Assessor Details	Mr. Mark Rogers, Surecalc Limited, T	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 m² K/W Lower limit = 4.129 m² K/W Average = 4.178 m² K/W
Total correction = 0.0001 m² K/W U-value (unrounded) = 0.24 W/m² 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	sc120968	Issued on Date	17/01/2020
Assessment Reference	001	Prop Type Ref	New Dwelling
Project	Plot 1 , 15-17, Kew Gardens, Bognor Regis, West Sussex, PO21 5RD		
Calculation Type	New Build (As Designed)		

SAP Rating	87 B	DER	15.23	TBR	19.25
Environmental	89 B	% DER<TER	20.89		
CO ₂ Emissions (t/year)	0.77	DREE	45.73	TREE	54.00
General Requirements Compliance	Pass	% DPER<TPER	15.31		

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	sc120968	Issued on Date	17/01/2020
Assessment Reference	001	Prop Type Ref	New Dwelling
Property	Plot 1, 15-17, Kew Gardens, Bognor Regis, West Sussex, PO21 5RD		
SAP Rating	87 B	DER	15.23
Environmental	89 B	% DER<TER	20.89
CO ₂ Emissions (t/year)	0.77	DERE	45.73
General Requirements Compliance	Pass	% DERE<TERE	15.31
Assessor Details	Mr. Mark Rogers, Surecalc Limited, [REDACTED]		Assessor ID
	[REDACTED]		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: