



SAP Report Submission for Building Regulations Compliance

Client: Vivid Design Studio

Project: Plot 2, 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	sc120969	Issued on Date	17/01/2020
Assessment Reference	001	Prop Type Ref	New Dwelling
Property	Plot 2, 15-17, Kew Gardens, Bognor Regis, West Sussex, PO21 5RD		

SAP Rating	87 B	DER	14.75	TER	18.63
Environmental	89 B	% DER<TER	20.82		
CO ₂ Emissions (t/year)	0.86	DFEE	46.35	TFEE	54.51
General Requirements Compliance	Pass	% DFEE<TFEE	14.96		

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	85.4	m ²
DER	14.75	kgCO ₂ /yr/m ²
TER	18.63	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	14.75	kgCO ₂ /yr/m ²
Reduction DER/TER	20.82	%
CfSH ENE1 credits achieved	3.1	
CfSH ENE1 level achieved	4	

ENE 2 - Fabric Energy Efficiency calculation

Dwelling type	House, Semi-Detached	
Fabric energy efficiency (F.E.E.)	46.35	kWh/m ² /yr
CfSH ENE2 credits achieved	6.8	
CfSH ENE1 and 2 overall level achieved	4	

ENE 7 - Low and Zero Carbon Technologies calculation

Standard case CO₂ emissions

Total floor area	85.4	m ²
DER	19.61	kgCO ₂ /yr/m ²
CO ₂ emissions from electrical appliances	15.98	kgCO ₂ /yr/m ² (ZC2)
CO ₂ emissions from cooking	2.11	kgCO ₂ /yr/m ² (ZC3)
Standard case total CO ₂ emissions	37.71	kgCO ₂ /yr/m ² (ZC4)
Net Standard case CO ₂ emissions	37.71	kgCO ₂ /yr/m ² (ZC8)

Actual case CO₂ emissions

DER	15.72	kgCO ₂ /yr/m ²
CO ₂ emissions from electrical appliances	15.98	kgCO ₂ /yr/m ² (ZC2)
CO ₂ emissions from cooking	2.11	kgCO ₂ /yr/m ² (ZC3)
Actual case total CO ₂ emissions	33.82	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	33.82	kgCO ₂ /yr/m ² (ZC8)
Improvement in net actual/net standard case CO ₂ emissions	10	%



ENE7 credits achieved

1

PREDICTED ENERGY ASSESSMENT

surecalc ltd

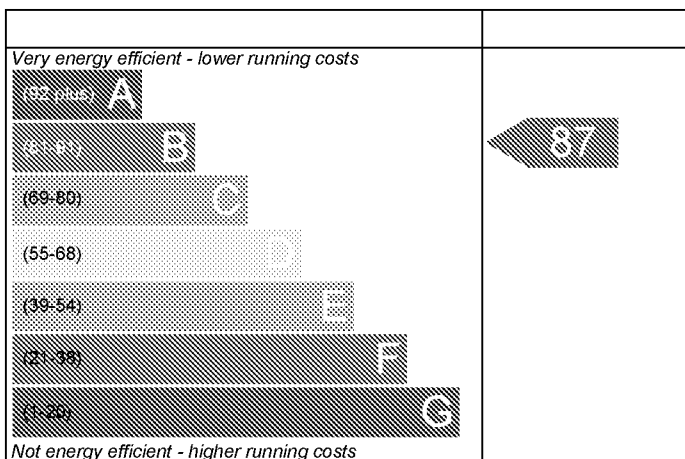
Plot 2, 15-17, Kew Gardens,
Bognor Regis,
West Sussex,
PO21 5RD

Dwelling type: House, Semi-Detached
Date of assessment: 17/01/2020
Produced by: Surecalc Limited
Total floor area: 85.4 m²
DRRN: 7493-2309-9300

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

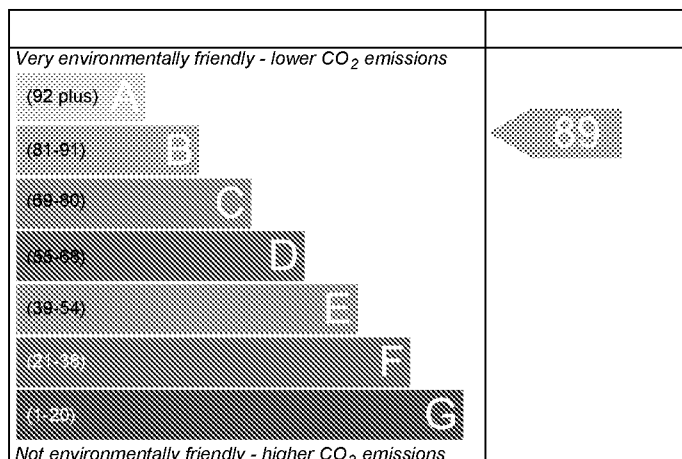


England

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

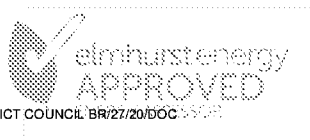


England

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	20.82	
CO ₂ Emissions (t/year)	0.86	DFEE	46.35	
General Requirements Compliance	Pass	% DFEE<TFEE	14.96	
Assessor Details	Mr. Mark Rogers, Surecalc Limited, [REDACTED]		Assessor ID	A320-0001
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)	18.63	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	14.75	kgCO ₂ /m ²	Pass
	-3.88 (-20.8%)	kgCO ₂ /m ²	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	54.51	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DFEE)	46.35	kWh/m ² /yr	
	-8.1 (-14.9%)	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 North

1.80 m², No overhang

Windows facing East

4.07 m², No overhang

Windows facing West

7.26 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

0.032

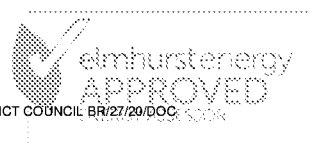
W/m²K

Photovoltaic array

1.10

kW

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FULL SAP CALCULATION PRINTOUT

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Environmental	89 B	% DER<TER	20.82			
CO ₂ Emissions (t/year)	0.86	DPEE	46.35	TPEE	54.51	
General Requirements Compliance	Pass	% DPEE<TPEE	14.96			
Assessor Details	Mr. Mark Rogers, Surecalc Limited, [REDACTED]				Assessor ID	A320-0001
Client	Vivid Design Studio, Vivid Design Studio					

FULL SAP CALCULATION PRINTOUT

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

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

DWELLING AS DESIGNED

Semi-Detached House, total floor area 85 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) 18.63 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 14.75 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)54.5 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)46.4 kWh/m²/yrOK

2 Fabric U-values

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

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

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

4 Heating efficiency

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

Secondary heating system: None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

7 Low energy lights

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

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Southern England): Slight OK

Based on:

Overshading: Average
Windows facing North: 1.80 m², No overhang
Windows facing East: 4.07 m², No overhang
Windows facing West: 7.26 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 0.032 W/m²K
Photovoltaic array 1.10 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	42.7000 (1b)	x 2.3900 (2b)	= 102.0530 (1b) - (3b)
First floor	42.7000 (1c)	x 2.7600 (2c)	= 117.8520 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	85.4000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	219.9050 (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					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Air changes per hour					
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.1819 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4319 (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) =	0.3671 (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	0.4681	0.4589	0.4497	0.4038	0.3946	0.3488	0.3488	0.3396	0.3671	0.3946	0.4130	0.4314 (22b)
Effective ac	0.6095	0.6053	0.6011	0.5615	0.5779	0.5608	0.5608	0.5577	0.5674	0.5779	0.5853	0.5930 (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)			13.1300	1.3258	17.4072		(27)
Ground Floor			42.7000	0.1100	4.6970		(28a)
External Wall	101.3000	15.1500	86.1500	0.2400	20.6760		(29a)
External Roof	42.7000		42.7000	0.1100	4.6970		(30)
Total net area of external elements Aum(A, m ²)			186.7000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	50.3052		(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)							5.9137 (36)
Total fabric heat loss						(33) + (36) =	56.2189 (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	44.2338	43.9251	43.6225	42.2013	41.9354	40.6976	40.6976	40.4684	41.1744	41.9354	42.4733	43.0357 (38)
Heat transfer coeff	100.4527	100.1440	99.8414	98.4203	98.1544	96.9166	96.9166	96.6873	97.3933	98.1544	98.6923	99.2546 (39)
Average = Sum(39)m / 12 =												98.4190 (39)
HLP	1.1763	1.1726	1.1691	1.1525	1.1493	1.1349	1.1349	1.1322	1.1404	1.1493	1.1556	1.1622 (40)
HLP (average)												1.1524 (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												2.5574 (42)
Average daily hot water use (litres/day)												94.9379 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	104.4316	100.6341	96.8366	93.0391	89.2416	85.4441	85.4441	89.2416	93.0391	96.8366	100.6341	104.4316 (44)
Energy content (annual)	154.8691	135.4495	139.7718	121.8564	116.9241	100.8966	93.4956	107.2875	108.5689	126.5266	138.1136	149.9825 (45)
Distribution loss (46)m = 0.15 x (45)m	23.2304	20.3174	20.9658	18.2785	17.5386	15.1345	14.0243	16.0931	16.2853	18.9790	20.7170	22.4974 (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 4.1202

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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	50.9589	46.0274	49.3469	45.8823	45.4765	42.1368	43.5414	45.4765	45.8823	49.3469	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month	205.8280	181.4769	189.1186	167.7387	162.4007	143.0334	137.0369	152.7641	154.4512	175.8734	187.4287	200.9414 (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	205.8280	181.4769	189.1186	167.7387	162.4007	143.0334	137.0369	152.7641	154.4512	175.8734	187.4287	200.9414 (64)
Heat gains from water heating, kWh/month	64.2337	56.5438	58.8108	51.9878	50.2464	44.0823	41.9726	47.0422	47.5697	54.4068	58.2516	62.6089 (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	127.8692	127.8692	127.8692	127.8692	127.8692	127.8692	127.8692	127.8692	127.8692	127.8692	127.8692	127.8692 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.5981	19.1832	15.6008	11.8108	8.8287	7.4536	8.0539	10.4687	14.0511	17.8411	20.8232	22.1983 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	230.3561	232.7465	226.7228	213.8991	197.7115	182.4975	172.3335	169.9432	175.9668	188.7905	204.9781	220.1922 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.7869	35.7869	35.7869	35.7869	35.7869	35.7869	35.7869	35.7869	35.7869	35.7869	35.7869	35.7869 (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)	-102.2953	-102.2953	-102.2953	-102.2953	-102.2953	-102.2953	-102.2953	-102.2953	-102.2953	-102.2953	-102.2953	-102.2953 (71)
Water heating gains (Table 5)	86.3356	84.1426	79.0468	72.2053	67.5355	61.2255	56.4148	63.2288	66.0691	73.1274	80.9049	84.1517 (72)
Total internal gains	402.6505	400.4330	385.7312	362.2760	338.4365	315.5373	301.1630	308.0015	320.4478	344.1198	371.0670	390.9030 (73)

6. Solar gains

[Jan]				Area m ²	Solar flux Table 6a W/m ²	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d			Gains W
North				1.8000	10.6334	0.7100	0.7000			0.7700			6.5923 (74)
East				4.0700	19.6403	0.7100	0.7000			0.7700			27.5316 (76)
West				7.2600	19.6403	0.7100	0.7000			0.7700			49.1104 (80)
Solar gains	83.2343	162.5262	268.3174	394.4893	487.6411	501.3577	476.3999	406.1828	312.9052	192.8987	103.6960	68.5223	(83)
Total gains	485.8848	562.9592	654.0486	756.7653	826.0776	816.8949	777.5629	714.1843	633.3529	537.0185	474.7630	459.4253	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	21.0000 (85)											
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	59.0383	59.2203	59.3997	60.2575	60.4207	61.1924	61.1924	61.3375	60.8928	60.4207	60.0914	59.7509
alpha	4.9359	4.9480	4.9600	5.0172	5.0280	5.0795	5.0795	5.0892	5.0595	5.0280	5.0061	4.9834
util living area	0.9984	0.9964	0.9893	0.9599	0.8728	0.7038	0.5364	0.6004	0.8587	0.9808	0.9968	0.9988 (86)
MIT	19.6949	19.8485	20.1225	20.4894	20.7890	20.9500	20.9897	20.9824	20.8588	20.4566	20.0128	19.6738 (87)
Th 2	19.9390	19.9419	19.9448	19.9582	19.9607	19.9725	19.9725	19.9746	19.9679	19.9607	19.9556	19.9503 (88)
util rest of house	0.9979	0.9952	0.9853	0.9446	0.8262	0.6123	0.4173	0.4777	0.7893	0.9709	0.9954	0.9984 (89)
MIT 2	18.1979	18.4243	18.8246	19.3568	19.7541	19.9394	19.9687	19.9674	19.8524	19.3206	18.6746	18.1751 (90)
Living area fraction	18.5462	18.7557	19.1266	19.6204	19.9949	20.1745	20.2063	20.2035	20.0866	19.5849	18.9860	18.5238 (92)
Temperature adjustment	18.3962	18.6057	18.9766	19.4704	19.8449	20.0245	20.0563	20.0535	19.9366	19.4349	18.8360	-0.1500
adjusted MIT	18.3962	18.6057	18.9766	19.4704	19.8449	20.0245	20.0563	20.0535	19.9366	19.4349	18.8360	18.3738 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9966	0.9928	0.9801	0.9352	0.8202	0.6173	0.4274	0.4876	0.7868	0.9638	0.9932	0.9974 (94)
Ext temp.	484.2559	558.9016	641.0496	707.7600	677.5099	504.2786	332.3067	348.2190	498.3103	517.5637	471.5235	458.2531 (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	1416.0056	1372.5414	1245.6784	1040.3367	799.4554	525.7248	334.9683	353.2520	568.4444	867.1845	1158.2476	1406.8179 (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	693.2218	546.7659	449.8438	239.4552	90.7274	0.0000	0.0000	0.0000	0.0000	260.1179	494.4414	705.7322 (98)
												3480.3056 (98)
												40.7530 (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													3845.6415 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	693.2218	546.7659	449.8438	239.4552	90.7274	0.0000	0.0000	0.0000	0.0000	260.1179	494.4414	705.7322	(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)	765.9909	604.1612	497.0650	264.5914	100.2513	0.0000	0.0000	0.0000	0.0000	287.4231	546.3441	779.8146	(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	205.8280	181.4769	189.1186	167.7387	162.4007	143.0334	137.0369	152.7641	154.4512	175.8734	187.4287	200.9414	(64)
Efficiency of water heater (217)m	87.9700	87.7529	87.2557	86.0472	83.7501	80.4000	80.4000	80.4000	80.4000	86.1352	87.4793	88.0486	(216)
Fuel for water heating, kWh/month	233.9752	206.8044	216.7407	194.9380	193.9110	177.9023	170.4439	190.0050	192.1035	204.1831	214.2549	228.2163	(219)
Water heating fuel used												2423.4784	(219)
Annual totals kWh/year													
Space heating fuel - main system													3845.6415 (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)													381.4286 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.10 * 908 * 0.80) =										-639.1294			-639.1294 (233)
Total delivered energy for all uses													6086.4192 (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	3845.6415	0.2160	830.6586	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2423.4784	0.2160	523.4713	(264)
Space and water heating			1354.1299	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	381.4286	0.5190	197.9615	(268)
Energy saving/generation technologies				
PV Unit	-639.1294	0.5190	-331.7082	(269)
Total CO2, kg/year			1259.3082	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			14.7500	(273)

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

DER			14.7500	ZC1
Total Floor Area		TFA	85.4000	
Assumed number of occupants		N	2.5574	
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190	
CO2 emissions from appliances, equation (L14)			15.9841	ZC2
CO2 emissions from cooking, equation (L16)			2.1121	ZC3
Total CO2 emissions			32.8462	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			32.8462	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	42.7000 (1b)	x 2.3900 (2b)	= 102.0530 (1b) - (3b)
First floor	42.7000 (1c)	x 2.7600 (2c)	= 117.8520 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	85.4000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	219.9050 (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) = 0.1364 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3864 (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) =	0.3285 (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	0.4188	0.4106	0.4024	0.3613	0.3531	0.3120	0.3120	0.3038	0.3285	0.3531	0.3695	0.3859 (22b)
Effective ac	0.5877	0.5843	0.5809	0.5653	0.5623	0.5487	0.5487	0.5462	0.5539	0.5623	0.5683	0.5745 (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)			13.1300	1.3258	17.4072			(27)				
Ground Floor			42.7000	0.1300	5.5510			(28a)				
External Wall	101.3000	15.1500	86.1500	0.1800	15.5070			(29a)				
External Roof	42.7000		42.7000	0.1300	5.5510			(30)				
Total net area of external elements Aum(A, m2)			186.7000					(31)				
Fabric heat loss, W/K = Sum (A x U)				(26)... (30) + (32) =	46.4402			(33)				
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								250.0000 (35)				
Thermal bridges (Sum(L x Psi) calculated using Appendix K)								9.9912 (36)				
Total fabric heat loss						(33) + (36) =		56.4314 (37)				
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 42.6479	Feb 42.4008	Mar 42.1586	Apr 41.0209	May 40.8081	Jun 39.8172	Jul 39.8172	Aug 39.6337	Sep 40.1989	Oct 40.8081	Nov 41.2387	Dec 41.6889 (38)
Heat transfer coeff	99.0793	98.8322	98.5900	97.4523	97.2395	96.2486	96.2486	96.0651	96.6303	97.2395	97.6701	98.1202 (39)
Average = Sum(39)m / 12 =												97.4513 (39)
HLP	Jan 1.1602	Feb 1.1573	Mar 1.1544	Apr 1.1411	May 1.1386	Jun 1.1270	Jul 1.1270	Aug 1.1249	Sep 1.1315	Oct 1.1386	Nov 1.1437	Dec 1.1489 (40)
HLP (average)												1.1411 (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												2.5574 (42)
Average daily hot water use (litres/day)												94.9379 (43)
Daily hot water use	Jan 104.4316	Feb 100.6341	Mar 96.8366	Apr 93.0391	May 89.2416	Jun 85.4441	Jul 85.4441	Aug 89.2416	Sep 93.0391	Oct 96.8366	Nov 100.6341	Dec 104.4316 (44)
Energy conte	154.8691	135.4495	139.7718	121.8564	116.9241	100.8966	93.4956	107.2875	108.5689	126.5266	138.1136	149.9825 (45)
Energy content (annual)										Total = Sum(45)m =		1493.7422 (45)
Distribution loss (46)m = 0.15 x (45)m												
23.2304	20.3174	20.9658	18.2785	17.5386	15.1345	14.0243	16.0931	16.2853	18.9790	20.7170	22.4974 (46)	
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												

Regs Region: England

Elmhurst Energy Systems

SAP2012 Calculator (Design

System) version 4.12r02

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	50.9589	46.0274	49.3469	45.8823	45.4765	42.1368	43.5414	45.4765	45.8823	49.3469	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month												
	205.8280	181.4769	189.1186	167.7387	162.4007	143.0334	137.0369	152.7641	154.4512	175.8734	187.4287	200.9414 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h	205.8280	181.4769	189.1186	167.7387	162.4007	143.0334	137.0369	152.7641	154.4512	175.8734	187.4287	200.9414 (64)
								Total per year (kWh/year) = Sum(64)m =				2058.0920 (64)
Heat gains from water heating, kWh/month												
	64.2337	56.5438	58.8108	51.9878	50.2464	44.0823	41.9726	47.0422	47.5697	54.4068	58.2516	62.6089 (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	127.8692	127.8692	127.8692	127.8692	127.8692	127.8692	127.8692	127.8692	127.8692	127.8692	127.8692	127.8692 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	21.5981	19.1832	15.6008	11.8108	8.8287	7.4536	8.0539	10.4687	14.0511	17.8411	20.8232	22.1983 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	230.3561	232.7465	226.7228	213.8991	197.7115	182.4975	172.3335	169.9432	175.9668	188.7905	204.9781	220.1922 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	35.7869	35.7869	35.7869	35.7869	35.7869	35.7869	35.7869	35.7869	35.7869	35.7869	35.7869	35.7869 (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)												
	-102.2953	-102.2953	-102.2953	-102.2953	-102.2953	-102.2953	-102.2953	-102.2953	-102.2953	-102.2953	-102.2953	-102.2953 (71)
Water heating gains (Table 5)												
	86.3356	84.1426	79.0468	72.2053	67.5355	61.2255	56.4148	63.2288	66.0691	73.1274	80.9049	84.1517 (72)
Total internal gains	402.6505	400.4330	385.7312	362.2760	338.4365	315.5373	301.1630	308.0015	320.4478	344.1198	371.0670	390.9030 (73)

6. Solar gains

[Jan]	Area m ²	Solar flux Table 6a W/m ²	Specific data or Table 6b	g	Specific data or Table 6c	FF	Access factor Table 6d	Gains W
North	1.8000	10.6334	0.6300		0.7000	0.7700		5.8495 (74)
East	4.0700	19.6403	0.6300		0.7000	0.7700		24.4294 (76)
West	7.2600	19.6403	0.6300		0.7000	0.7700		43.5768 (80)

Solar gains	73.8557	144.2133	238.0845	350.0398	432.6956	444.8667	422.7210	360.4157	277.6483	171.1636	92.0119	60.8015 (83)
Total gains	476.5063	544.6463	623.8156	712.3158	771.1322	760.4039	723.8840	668.4172	598.0960	515.2834	463.0789	451.7045 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	59.8566	60.0063	60.1537	60.8560	60.9892	61.6171	61.6171	61.7348	61.3737	60.9892	60.7203	60.4417
alpha	4.9904	5.0004	5.0102	5.0571	5.0659	5.1078	5.1078	5.1157	5.0916	5.0659	5.0480	5.0294
util living area	0.9986	0.9969	0.9911	0.9675	0.8939	0.7376	0.5687	0.6318	0.8777	0.9836	0.9971	0.9989 (86)
MIT	19.7061	19.8488	20.1085	20.4603	20.7631	20.9391	20.9870	20.9784	20.8435	20.4441	20.0137	19.6832 (87)
Th 2	19.9520	19.9543	19.9566	19.9674	19.9694	19.9788	19.9788	19.9806	19.9752	19.9694	19.9653	19.9611 (88)
util rest of house												
	0.9981	0.9958	0.9878	0.9547	0.8521	0.6471	0.4451	0.5061	0.8133	0.9750	0.9959	0.9985 (89)
MIT 2	18.2234	18.4335	18.8132	19.3244	19.7321	19.9373	19.9739	19.9714	19.8438	19.3098	18.6827	18.1963 (90)
Living area fraction												
									fLA = Living area / (4) =			
MIT	18.5683	18.7628	19.1145	19.5887	19.9720	20.1704	20.2096	20.2057	20.0764	19.5737	18.9924	18.5423 (92)
Temperature adjustment												
adjusted MIT	18.5683	18.7628	19.1145	19.5887	19.9720	20.1704	20.2096	20.2057	20.0764	19.5737	18.9924	18.5423 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9971	0.9940	0.9840	0.9486	0.8522	0.6655	0.4740	0.5354	0.8209	0.9704	0.9942	0.9978 (94)
Useful gains	475.1155	541.3772	613.8558	675.6951	657.1956	506.0500	343.1215	357.8376	490.9498	500.0247	460.3850	450.6928 (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												
	1413.6981	1370.0868	1243.6681	1041.6403	804.3648	536.1461	347.4209	365.5922	577.5035	872.5985	1161.5312	1407.2657 (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												
	698.3055	556.8928	468.5803	263.4805	109.4939	0.0000	0.0000	0.0000	0.0000	277.1948	504.8253	711.6902 (98)
Space heating												
Space heating per m ²												3590.4634 (98)
										(98) / (4) =		42.0429 (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													3844.1792 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	698.3055	556.8928	468.5803	263.4805	109.4939	0.0000	0.0000	0.0000	0.0000	277.1948	504.8253	711.6902	(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)	747.6504	596.2450	501.6920	282.0991	117.2311	0.0000	0.0000	0.0000	0.0000	296.7825	540.4981	761.9810	(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	205.8280	181.4769	189.1186	167.7387	162.4007	143.0334	137.0369	152.7641	154.4512	175.8734	187.4287	200.9414	(64)
Efficiency of water heater (217)m	87.8836	87.6892	87.2446	86.1834	84.0831	80.3000	80.3000	80.3000	80.3000	86.1917	87.4228	87.9640	(216)
Fuel for water heating, kWh/month	234.2054	206.9547	216.7683	194.6300	193.1430	178.1238	170.6562	190.2417	192.3427	204.0492	214.3933	228.4360	(219)
Water heating fuel used												2423.9442	(219)
Annual totals kWh/year													
Space heating fuel - main system												3844.1792	(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)												381.4286	(232)
Total delivered energy for all uses												6724.5520	(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	3844.1792	0.2160	830.3427 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2423.9442	0.2160	523.5719 (264)
Space and water heating			1353.9146 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	381.4286	0.5190	197.9615 (268)
Total CO2, kg/m2/year			1590.8011 (272)
Emissions per m2 for space and water heating			15.8538 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.3180 (272b)
Emissions per m2 for pumps and fans			0.4558 (272c)
Target Carbon Dioxide Emission Rate (TER) = (15.8538 * 1.00) + 2.3180 + 0.4558, rounded to 2 d.p.			18.6300 (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	42.7000 (1b)	x 2.3900 (2b)	= 102.0530 (1b) - (3b)
First floor	42.7000 (1c)	x 2.7600 (2c)	= 117.8520 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	85.4000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 219.9050 (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) = 0.1364 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3864 (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) =	0.3285 (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	0.4188	0.4106	0.4024	0.3613	0.3531	0.3120	0.3120	0.3038	0.3285	0.3531	0.3695	0.3859 (22b)
Effective ac	0.5877	0.5843	0.5809	0.5653	0.5623	0.5487	0.5487	0.5462	0.5539	0.5623	0.5683	0.5745 (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)			13.1300	1.3258	17.4072		(27)
Ground Floor			42.7000	0.1100	4.6970		(28a)
External Wall	101.3000	15.1500	86.1500	0.2400	20.6760		(29a)
External Roof	42.7000		42.7000	0.1100	4.6970		(30)
Total net area of external elements Aum(A, m ²)			186.7000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	50.3052		(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)							5.9137 (36)
Total fabric heat loss						(33) + (36) =	56.2189 (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	42.6479	42.4008	42.1586	41.0209	40.8081	39.8172	39.8172	39.6337	40.1989	40.8081	41.2387	41.6889 (38)
Heat transfer coeff	98.8668	98.6197	98.3775	97.2399	97.0270	96.0361	96.0361	95.8526	96.4178	97.0270	97.4576	97.9078 (39)
Average = Sum(39)m / 12 =												97.2388 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1577	1.1548	1.1520	1.1386	1.1361	1.1245	1.1245	1.1224	1.1290	1.1361	1.1412	1.1465 (40)
HLP (average)												1.1386 (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												2.5574 (42)
Average daily hot water use (litres/day)												94.9379 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	104.4316	100.6341	96.8366	93.0391	89.2416	85.4441	85.4441	89.2416	93.0391	96.8366	100.6341	104.4316 (44)
Energy conte	154.8691	135.4495	139.7718	121.8564	116.9241	100.8966	93.4956	107.2875	108.5689	126.5266	138.1136	149.9825 (45)
Energy content (annual)												Total = Sum(45)m = 1493.7422 (45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)

Regs Region: England

Elmhurst Energy Systems

SAP2012 Calculator (Design

System) version 4.12r02

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	32.9097	28.7830	29.7015	25.8945	24.8464	21.4405	19.8678	22.7986	23.0709	26.8869	29.3491	31.8713 (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	127.8692	127.8692	127.8692	127.8692	127.8692	127.8692	127.8692	127.8692	127.8692	127.8692	127.8692	127.8692	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.5981	19.1832	15.6008	11.8108	8.8287	7.4536	8.0539	10.4687	14.0511	17.8411	20.8232	22.1983	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	230.3561	232.7465	226.7228	213.8991	197.7115	182.4975	172.3335	169.9432	175.9668	188.7905	204.9781	220.1922	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.7869	35.7869	35.7869	35.7869	35.7869	35.7869	35.7869	35.7869	35.7869	35.7869	35.7869	35.7869	(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)	-102.2953	-102.2953	-102.2953	-102.2953	-102.2953	-102.2953	-102.2953	-102.2953	-102.2953	-102.2953	-102.2953	-102.2953	(71)
Water heating gains (Table 5)	44.2334	42.8319	39.9214	35.9646	33.3957	29.7785	26.7040	30.6433	32.0429	36.1383	40.7627	42.8377	(72)
Total internal gains	357.5484	356.1223	343.6057	323.0353	301.2967	281.0903	268.4522	272.4159	283.4216	304.1307	327.9248	346.5890	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	1.8000	10.6334	0.7100	0.7000	0.7700	6.5923 (74)
East	4.0700	19.6403	0.7100	0.7000	0.7700	27.5316 (76)
West	7.2600	19.6403	0.7100	0.7000	0.7700	49.1104 (80)

Solar gains	83.2343	162.5262	268.3174	394.4893	487.6411	501.3577	476.3999	406.1828	312.9052	192.8987	103.6960	68.5223 (83)
Total gains	440.7826	518.6485	611.9232	717.5245	788.9378	782.4480	744.8521	678.5988	596.3268	497.0293	431.6207	415.1113 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.9853	60.1356	60.2836	60.9889	61.1227	61.7534	61.7534	61.8716	61.5089	61.1227	60.8527	60.5729	
alpha	4.9990	5.0090	5.0189	5.0659	5.0748	5.1169	5.1169	5.1248	5.1006	5.0748	5.0568	5.0382	
util living area	0.9990	0.9975	0.9918	0.9665	0.8860	0.7220	0.5534	0.6229	0.8782	0.9859	0.9979	0.9993	(86)
MIT	19.6704	19.8239	20.0990	20.4676	20.7758	20.9451	20.9885	20.9798	20.8437	20.4277	19.9823	19.6464	(87)
Th 2	19.9540	19.9563	19.9586	19.9694	19.9714	19.9808	19.9808	19.9826	19.9772	19.9714	19.9673	19.9631	(88)
util rest of house	0.9987	0.9966	0.9887	0.9533	0.8424	0.6313	0.4324	0.4983	0.8140	0.9783	0.9970	0.9990	(89)
MIT 2	18.7378	18.8928	19.1682	19.5370	19.8194	19.9556	19.9779	19.9768	19.8875	19.5050	19.0601	18.7211	(90)
Living area fraction													(91)
MIT	18.9548	19.1094	19.3848	19.7535	20.0419	20.1859	20.2131	20.2102	20.1100	19.7197	19.2746	18.9364	(92)
Temperature adjustment													(93)
adjusted MIT	18.9548	19.1094	19.3848	19.7535	20.0419	20.1859	20.2131	20.2102	20.1100	19.7197	19.2746	18.9364	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	439.9818	516.3942	603.6343	681.5336	667.3536	509.3022	343.2311	358.0030	491.2925	485.0010	429.9655	414.5552	(94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(95)
Heat loss rate W	1448.8720	1401.3300	1267.5719	1055.3945	809.3908	536.4446	346.9850	365.2139	579.4711	884.8576	1186.5103	1442.8079	(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	750.6143	594.6769	493.9696	269.1799	105.6756	0.0000	0.0000	0.0000	0.0000	297.4934	544.7123	765.0201	(98)
Space heating												3821.3419	(98)
Space heating per m2												44.7464	(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	902.7397	710.6674	728.4801	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8799	0.9349	0.9077	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	794.3582	664.3867	661.2706	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1010.8486	964.9334	889.2701	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	155.8731	223.6067	169.6316	0.0000	0.0000	0.0000	0.0000	(104)

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Space cooling												549.1114 (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	38.9683	55.9017	42.4079	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												137.2779 (107)
Space cooling per m2												1.6075 (108)
Energy for space heating												44.7464 (99)
Energy for space cooling												1.6075 (108)
Total												46.3539 (109)
Dwelling Fabric Energy Efficiency (DFEE)												46.4 (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	42.7000 (1b)	x 2.3900 (2b)	= 102.0530 (1b) - (3b)
First floor	42.7000 (1c)	x 2.7600 (2c)	= 117.8520 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	85.4000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	219.9050 (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) = 0.1364 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3864 (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) =	0.3285 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
Effective ac	0.4188	0.4106	0.4024	0.3613	0.3531	0.3120	0.3120	0.3038	0.3285	0.3531	0.3695	0.3859 (22b)
	0.5877	0.5843	0.5809	0.5653	0.5623	0.5487	0.5487	0.5462	0.5539	0.5623	0.5683	0.5745 (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)			13.1300	1.3258	17.4072			(27)				
Ground Floor			42.7000	0.1300	5.5510			(28a)				
External Wall	101.3000	15.1500	86.1500	0.1800	15.5070			(29a)				
External Roof	42.7000		42.7000	0.1300	5.5510			(30)				
Total net area of external elements Aum(A, m2)			186.7000					(31)				
Fabric heat loss, W/K = Sum (A x U)				(26)... (30) + (32) =	46.4402			(33)				
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								250.0000 (35)				
Thermal bridges (Sum(L x Psi) calculated using Appendix K)								9.9912 (36)				
Total fabric heat loss						(33) + (36) =		56.4314 (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	42.6479	42.4008	42.1586	41.0209	40.8081	39.8172	39.8172	39.6337	40.1989	40.8081	41.2387	41.6889 (38)
Average = Sum(39)m / 12 =	99.0793	98.8322	98.5900	97.4523	97.2395	96.2486	96.2486	96.0651	96.6303	97.2395	97.6701	98.1202 (39)
												97.4513 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1602	1.1573	1.1544	1.1411	1.1386	1.1270	1.1270	1.1249	1.1315	1.1386	1.1437	1.1489 (40)
Days in month												1.1411 (40)
	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.5574 (42)
Average daily hot water use (litres/day)												94.9379 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												
Energy conte	104.4316	100.6341	96.8366	93.0391	89.2416	85.4441	85.4441	89.2416	93.0391	96.8366	100.6341	104.4316 (44)
Energy content (annual)	154.8691	135.4495	139.7718	121.8564	116.9241	100.8966	93.4956	107.2875	108.5689	126.5266	138.1136	149.9825 (45)
Distribution loss	Total = Sum(45)m = 1493.7422 (45)											
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												

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Calculation Type: New Build (As Designed)



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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)
	32.9097	28.7830	29.7015	25.8945	24.8464	21.4405	19.8678	22.7986	23.0709	26.8869	29.3491	31.8713 (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	127.8692	127.8692	127.8692	127.8692	127.8692	127.8692	127.8692	127.8692	127.8692	127.8692	127.8692	127.8692	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.5981	19.1832	15.6008	11.8108	8.8287	7.4536	8.0539	10.4687	14.0511	17.8411	20.8232	22.1983	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	230.3561	232.7465	226.7228	213.8991	197.7115	182.4975	172.3335	169.9432	175.9668	188.7905	204.9781	220.1922	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.7869	35.7869	35.7869	35.7869	35.7869	35.7869	35.7869	35.7869	35.7869	35.7869	35.7869	35.7869	(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)	-102.2953	-102.2953	-102.2953	-102.2953	-102.2953	-102.2953	-102.2953	-102.2953	-102.2953	-102.2953	-102.2953	-102.2953	(71)
Water heating gains (Table 5)	44.2334	42.8319	39.9214	35.9646	33.3957	29.7785	26.7040	30.6433	32.0429	36.1383	40.7627	42.8377	(72)
Total internal gains	357.5484	356.1223	343.6057	323.0353	301.2967	281.0903	268.4522	272.4159	283.4216	304.1307	327.9248	346.5890	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d			Gains W	
North					1.8000	10.6334	0.6300		0.7000			0.7700			5.8495 (74)
East					4.0700	19.6403	0.6300		0.7000			0.7700			24.4294 (76)
West					7.2600	19.6403	0.6300		0.7000			0.7700			43.5768 (80)
Solar gains	73.8557	144.2133	238.0845	350.0398	432.6956	444.8667	422.7210	360.4157	277.6483	171.1636	92.0119	60.8015			(83)
Total gains	431.4041	500.3356	581.6902	673.0750	733.9923	725.9570	691.1732	632.8317	561.0698	475.2943	419.9367	407.3905			(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.8566	60.0063	60.1537	60.8560	60.9892	61.6171	61.6171	61.7348	61.3737	60.9892	60.7203	60.4417	
alpha	4.9904	5.0004	5.0102	5.0571	5.0659	5.1078	5.1078	5.1157	5.0916	5.0659	5.0480	5.0294	
util living area	0.9991	0.9979	0.9934	0.9739	0.9089	0.7608	0.5923	0.6605	0.8988	0.9883	0.9981	0.9993	(86)
MIT	19.6569	19.8008	20.0641	20.4232	20.7386	20.9297	20.9844	20.9736	20.8207	20.4032	19.9668	19.6347	(87)
Th 2	19.9520	19.9543	19.9566	19.9674	19.9694	19.9788	19.9788	19.9806	19.9752	19.9694	19.9653	19.9611	(88)
util rest of house	0.9988	0.9971	0.9909	0.9632	0.8708	0.6715	0.4652	0.5323	0.8407	0.9819	0.9974	0.9991	(89)
MIT 2	18.7227	18.8682	19.1322	19.4935	19.7876	19.9454	19.9747	19.9727	19.8692	19.4797	19.0430	18.7077	(90)
Living area fraction									fLA = Living area / (4) =			0.2327	(91)
MIT	18.9400	19.0852	19.3490	19.7098	20.0089	20.1744	20.2096	20.2056	20.0906	19.6946	19.2579	18.9234	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9400	19.0852	19.3490	19.7098	20.0089	20.1744	20.2096	20.2056	20.0906	19.6946	19.2579	18.9234	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9983	0.9963	0.9889	0.9599	0.8725	0.6902	0.4951	0.5624	0.8486	0.9796	0.9966	0.9988	(94)
Ext temp.	430.6901	498.4697	575.2592	646.0593	640.4015	501.0542	342.1969	355.9241	476.1308	465.6073	418.5058	406.8877	(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	1450.5249	1401.9533	1266.7846	1053.4430	807.9499	536.5306	347.4236	365.5839	578.8757	884.3528	1187.4660	1444.6640	(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	758.7571	607.1410	514.4949	293.3162	124.6561	0.0000	0.0000	0.0000	0.0000	311.5467	553.6513	772.1056	(98)
Space heating												3935.6689	(98)
Space heating per m2										(98) / (4) =		46.0851	(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	904.7369	712.2397	730.0948	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8538	0.9176	0.8874	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	772.5095	653.5663	647.9091	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	944.8202	902.1918	835.7761	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	124.0637	184.9774	139.7731	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												448.8142	(104)

Regs Region: England

Elmhurst Energy Systems

SAP2012 Calculator (Design

System) version 4.1202

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET 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	31.0159	46.2443	34.9433	0.0000	0.0000	0.0000 (107)
Space cooling											112.2035 (107)
Space cooling per m2											1.3139 (108)
Energy for space heating											46.0851 (99)
Energy for space cooling											1.3139 (108)
Total											47.3990 (109)
Target Fabric Energy Efficiency (TFEE)											54.5 (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	42.7000 (1b)	x 2.3900 (2b)	= 102.0530 (1b) - (3b)
First floor	42.7000 (1c)	x 2.7600 (2c)	= 117.8520 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	85.4000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	219.9050 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.1819 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4319 (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) =	0.3671 (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												
Effective ac	0.5140	0.4681	0.4405	0.4130	0.4314	0.3855	0.4038	0.3855	0.4038	0.4405	0.4497	0.4681 (22b)
	0.6321	0.6095	0.5970	0.5853	0.5930	0.5743	0.5815	0.5743	0.5815	0.5970	0.6011	0.6095 (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)			13.1300	1.3258	17.4072		(27)
Ground Floor			42.7000	0.1100	4.6970		(28a)
External Wall	101.3000	15.1500	86.1500	0.2400	20.6760		(29a)
External Roof	42.7000		42.7000	0.1100	4.6970		(30)
Total net area of external elements Aum(A, m ²)			186.7000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	50.3052		(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)							5.9137 (36)
Total fabric heat loss						(33) + (36) =	56.2189 (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	45.8689	44.2338	43.3261	42.4733	43.0357	41.6756	42.2013	41.6756	42.2013	43.3261	43.6225	44.2338 (38)
Heat transfer coeff	102.0878	100.4527	99.5450	98.6923	99.2546	97.8946	98.4203	97.8946	98.4203	99.5450	99.8414	100.4527 (39)
Average = Sum(39)m / 12 =												99.4751 (39)
HLP	1.1954	1.1763	1.1656	1.1556	1.1622	1.1463	1.1525	1.1463	1.1525	1.1656	1.1691	1.1763 (40)
HLP (average)												1.1636 (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												2.5574 (42)
Average daily hot water use (litres/day)												94.9379 (43)
Daily hot water use	104.4316	100.6341	96.8366	93.0391	89.2416	85.4441	85.4441	89.2416	93.0391	96.8366	100.6341	104.4316 (44)
Energy conte	154.8691	135.4495	139.7718	121.8564	116.9241	100.8966	93.4956	107.2875	108.5689	126.5266	138.1136	149.9825 (45)
Energy content (annual)										Total = Sum(45)m =		1493.7422 (45)
Distribution loss (46)m = 0.15 x (45)m	23.2304	20.3174	20.9658	18.2785	17.5386	15.1345	14.0243	16.0931	16.2853	18.9790	20.7170	22.4974 (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)	
Combi loss	50.9589	46.0274	49.3469	45.8823	45.4765	42.1368	43.5414	45.4765	45.8823	49.3469	49.3151	50.9589 (61)	
Total heat required for water heating calculated for each month													
Solar input	205.8280	181.4769	189.1186	167.7387	162.4007	143.0334	137.0369	152.7641	154.4512	175.8734	187.4287	200.9414 (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)	
Output from w/h								Solar input (sum of months) = Sum(63)m =					0.0000 (63)
	205.8280	181.4769	189.1186	167.7387	162.4007	143.0334	137.0369	152.7641	154.4512	175.8734	187.4287	200.9414 (64)	
RHI water heating demand								Total per year (kWh/year) = Sum(64)m =					2058.0920 (64)
Heat gains from water heating, kWh/month													2058 (64)
	64.2337	56.5438	58.8108	51.9878	50.2464	44.0823	41.9726	47.0422	47.5697	54.4068	58.2516	62.6089 (65)	

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	153.4430	153.4430	153.4430	153.4430	153.4430	153.4430	153.4430	153.4430	153.4430	153.4430	153.4430	153.4430 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	53.9952	47.9580	39.0021	29.5271	22.0718	18.6340	20.1347	26.1718	35.1278	44.6028	52.0580	55.4959 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	343.8150	347.3828	338.3922	319.2524	295.0918	272.3843	257.2143	253.6465	262.6371	281.7769	305.9375	328.6450 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.9017	52.9017	52.9017	52.9017	52.9017	52.9017	52.9017	52.9017	52.9017	52.9017	52.9017	52.9017 (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)	-102.2953	-102.2953	-102.2953	-102.2953	-102.2953	-102.2953	-102.2953	-102.2953	-102.2953	-102.2953	-102.2953	-102.2953 (71)
Water heating gains (Table 5)	86.3356	84.1426	79.0468	72.2053	67.5355	61.2255	56.4148	63.2288	66.0691	73.1274	80.9049	84.1517 (72)
Total internal gains	591.1952	586.5327	563.4905	528.0342	491.7485	459.2931	440.8131	450.0965	470.8833	506.5564	545.9498	575.3420 (73)

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
North				1.8000	14.6401	0.7100	0.7000	0.7700	9.0762 (74)			
East				4.0700	27.3735	0.7100	0.7000	0.7700	38.3719 (76)			
West				7.2600	27.3735	0.7100	0.7000	0.7700	68.4473 (80)			
Solar gains	115.8954	188.8947	310.8840	473.1424	564.1153	622.2562	587.8045	504.5014	389.0178	241.0767	138.4386	92.5351 (83)
Total gains	707.0906	775.4275	874.3745	1001.1766	1055.8638	1081.5493	1028.6176	954.5979	859.9011	747.6332	684.3884	667.8770 (84)

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	58.0927	59.0383	59.5766	60.0914	59.7509	60.5810	60.2575	60.5810	60.2575	59.5766	59.3997	59.0383
alpha	4.8728	4.9359	4.9718	5.0061	4.9834	5.0387	5.0172	5.0387	5.0172	4.9718	4.9600	4.9359
util living area	0.9881	0.9814	0.9553	0.8719	0.7034	0.4819	0.3340	0.3375	0.5957	0.8796	0.9723	0.9899 (86)
MIT	20.0695	20.1837	20.4423	20.7446	20.9327	20.9918	20.9990	20.9990	20.9789	20.7933	20.4163	20.0744 (87)
Th 2	19.9237	19.9390	19.9476	19.9556	19.9503	19.9632	19.9582	19.9632	19.9582	19.9476	19.9448	19.9390 (88)
util rest of house	0.9839	0.9751	0.9406	0.8340	0.6313	0.3927	0.2351	0.2320	0.4911	0.8290	0.9609	0.9863 (89)
MIT 2	18.7317	18.9066	19.2784	19.6864	19.8969	19.9593	19.9580	19.9630	19.9475	19.7523	19.2464	18.7504 (90)
Living area fraction									fLa = Living area / (4) =			0.2327 (91)
MIT	19.0430	19.2037	19.5492	19.9326	20.1379	20.1996	20.2002	20.2041	20.1875	19.9945	19.5186	19.0585 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.8930	19.0537	19.3992	19.7826	19.9879	20.0496	20.0502	20.0541	20.0375	19.8445	19.3686	18.9085 (93)

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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	42.7000 (1b)	x 2.3900 (2b)	= 102.0530 (1b) - (3b)
First floor	42.7000 (1c)	x 2.7600 (2c)	= 117.8520 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	85.4000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	219.9050 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.1819 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4319 (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) =	0.3671 (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	0.4681	0.4589	0.4497	0.4038	0.3946	0.3488	0.3488	0.3396	0.3671	0.3946	0.4130	0.4314 (22b)
Effective ac	0.6095	0.6053	0.6011	0.5815	0.5779	0.5608	0.5608	0.5577	0.5674	0.5779	0.5853	0.5930 (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)			13.1300	1.3258	17.4072		(27)
Ground Floor			42.7000	0.1100	4.6970		(28a)
External Wall	101.3000	15.1500	86.1500	0.2400	20.6760		(29a)
External Roof	42.7000		42.7000	0.1100	4.6970		(30)
Total net area of external elements Aum(A, m ²)			186.7000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	50.3052		(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)							5.9137 (36)
Total fabric heat loss						(33) + (36) =	56.2189 (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	44.2338	43.9251	43.6225	42.2013	41.9354	40.6976	40.6976	40.4684	41.1744	41.9354	42.4733	43.0357 (38)
Heat transfer coeff	100.4527	100.1440	99.8414	98.4203	98.1544	96.9166	96.9166	96.6873	97.3933	98.1544	98.6923	99.2546 (39)
Average = Sum(39)m / 12 =												98.4190 (39)
HLP	1.1763	1.1726	1.1691	1.1525	1.1493	1.1349	1.1349	1.1322	1.1404	1.1493	1.1556	1.1622 (40)
HLP (average)												1.1524 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

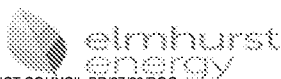
Assumed occupancy												2.5574 (42)
Average daily hot water use (litres/day)												94.9379 (43)
Daily hot water use	104.4316	100.6341	96.8366	93.0391	89.2416	85.4441	85.4441	89.2416	93.0391	96.8366	100.6341	104.4316 (44)
Energy conte	154.8691	135.4495	139.7718	121.8564	116.9241	100.8966	93.4956	107.2875	108.5689	126.5266	138.1136	149.9825 (45)
Energy content (annual)										Total = Sum(45)m =		1493.7422 (45)
Distribution loss (46)m = 0.15 x (45)m	23.2304	20.3174	20.9658	18.2785	17.5386	15.1345	14.0243	16.0931	16.2853	18.9790	20.7170	22.4974 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)

Regs Region: England

Elmhurst Energy Systems

SAP2012 Calculator (Design

System) version 4.12r02



FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	50.9589	46.0274	49.3469	45.8823	45.4765	42.1368	43.5414	45.4765	45.8823	49.3469	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month	205.8280	181.4769	189.1186	167.7387	162.4007	143.0334	137.0369	152.7641	154.4512	175.8734	187.4287	200.9414 (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	205.8280	181.4769	189.1186	167.7387	162.4007	143.0334	137.0369	152.7641	154.4512	175.8734	187.4287	200.9414 (64)
Heat gains from water heating, kWh/month	64.2337	56.5438	58.8108	51.9878	50.2464	44.0823	41.9726	47.0422	47.5697	54.4068	58.2516	62.6089 (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	153.4430	153.4430	153.4430	153.4430	153.4430	153.4430	153.4430	153.4430	153.4430	153.4430	153.4430	153.4430 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	53.9952	47.9580	39.0021	29.0718	22.0718	18.6340	20.1347	26.1718	35.1278	44.6028	52.0580	55.4959 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	343.8150	347.3828	338.3922	319.2524	295.0918	272.3843	257.2143	253.6465	262.6371	281.7769	305.9375	328.6450 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.9017	52.9017	52.9017	52.9017	52.9017	52.9017	52.9017	52.9017	52.9017	52.9017	52.9017	52.9017 (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)	-102.2953	-102.2953	-102.2953	-102.2953	-102.2953	-102.2953	-102.2953	-102.2953	-102.2953	-102.2953	-102.2953	-102.2953 (71)
Water heating gains (Table 5)	86.3356	84.1426	79.0468	72.2053	67.5355	61.2255	56.4148	63.2288	66.0691	73.1274	80.9049	84.1517 (72)
Total internal gains	591.1952	586.5327	563.4905	528.0342	491.7485	459.2931	440.8131	450.0965	470.8833	506.5564	545.9498	575.3420 (73)

6. Solar gains

[Jan]												
				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d	Gains W
North				1.8000	10.6334		0.7100		0.7000		0.7700	6.5923 (74)
East				4.0700	19.6403		0.7100		0.7000		0.7700	27.5316 (76)
West				7.2600	19.6403		0.7100		0.7000		0.7700	49.1104 (80)
Solar gains	83.2343	162.5262	268.3174	394.4893	487.6411	501.3577	476.3999	406.1828	312.9052	192.8987	103.6960	68.5223 (83)
Total gains	674.4295	749.0589	831.8079	922.5234	979.3896	960.6507	917.2130	856.2793	783.7884	699.4551	649.6457	643.8643 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	59.0383	59.2203	59.3997	60.2575	60.4207	61.1924	61.1924	61.3375	60.8928	60.4207	60.0914	59.7509
alpha	4.9359	4.9480	4.9600	5.0172	5.0280	5.0795	5.0795	5.0892	5.0595	5.0280	5.0061	4.9834
util living area	0.9933	0.9878	0.9717	0.9203	0.8034	0.6190	0.4598	0.5103	0.7648	0.9476	0.9874	0.9946 (86)
MIT	19.8972	20.0446	20.2993	20.6241	20.8615	20.9718	20.9948	20.9914	20.9201	20.6062	20.1976	19.8730 (87)
Th 2	19.9390	19.9419	19.9448	19.9582	19.9607	19.9725	19.9725	19.9746	19.9679	19.9607	19.9556	19.9503 (88)
util rest of house	0.9912	0.9839	0.9624	0.8945	0.7468	0.5307	0.3551	0.4012	0.6823	0.9249	0.9826	0.9929 (89)
MIT 2	18.4923	18.7078	19.0751	19.5345	19.8328	19.9549	19.9707	19.9713	19.9087	19.5228	18.9413	18.4653 (90)
Living area fraction	18.8191	19.0188	19.3599	19.7881	20.0721	20.1915	20.2090	20.2087	20.1440	19.7749	19.2336	18.7929 (92)
Temperature adjustment	18.6691	18.8688	19.2099	19.6381	19.9221	20.0415	20.0590	20.0587	19.9940	19.6249	19.0836	18.6429 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	665.9349	732.8410	793.4429	816.4047	729.1086	515.7591	333.9466	351.4291	536.5875	640.3558	634.6465	637.2394 (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	1443.4194	1398.8957	1268.9797	1056.8429	807.0378	527.3695	335.2300	353.7487	574.0369	885.8324	1182.6870	1433.5216 (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	578.4485	447.5888	353.7993	173.1155	57.9794	0.0000	0.0000	0.0000	0.0000	182.6346	394.5891	592.4340 (98)
Space heating												2780.5892 (98)
Space heating per m ²												32.5596 (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													3072.4743 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	578.4485	447.5888	353.7993	173.1155	57.9794	0.0000	0.0000	0.0000	0.0000	182.6346	394.5891	592.4340	(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)	639.1696	494.5732	390.9385	191.2878	64.0656	0.0000	0.0000	0.0000	0.0000	201.8062	436.0101	654.6232	(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	205.8280	181.4769	189.1186	167.7387	162.4007	143.0334	137.0369	152.7641	154.4512	175.8734	187.4287	200.9414	(64)
Efficiency of water heater (217)m	87.6116	87.3350	86.7059	85.2310	82.8321	80.4000	80.4000	80.4000	80.4000	85.2466	86.9812	87.7094	(216)
Fuel for water heating, kWh/month	234.9325	207.7941	218.1152	196.8048	196.0602	177.9023	170.4439	190.0050	192.1035	206.3115	215.4818	229.0991	(219)
Water heating fuel used													2435.0538 (219)
Annual totals kWh/year													
Space heating fuel - main system													3072.4743 (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)													381.4286 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.10 * 908 * 0.80) =										-639.1294			-639.1294 (233)
Total delivered energy for all uses													5324.8273 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3072.4743	3.4800	106.9221 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2435.0538	3.4800	84.7399 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	381.4286	13.1900	50.3104 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-639.1294	13.1900	-84.3012 (252)
Total energy cost			287.5637 (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] =	0.9262 (257)
SAP value		87.0795
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	3072.4743	0.2160	663.6544 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2435.0538	0.2160	525.9716 (264)
Space and water heating			1189.6261 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	381.4286	0.5190	197.9615 (268)
Energy saving/generation technologies			
PV Unit	-639.1294	0.5190	-331.7082 (269)
Total kg/year			1094.8044 (272)
CO2 emissions per m2			12.8200 (273)
EI value			88.7497
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	$3.48 / 0.8427 = 4.130$, stars = 4
Water heating environmental impact	$0.216 / 0.8427 = 0.2563$, stars = 4

Regs Region: England

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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	42.7000 (1b)	x 2.3900 (2b)	= 102.0530 (1b) - (3b)
First floor	42.7000 (1c)	x 2.7600 (2c)	= 117.8520 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	85.4000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	219.9050 (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					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.1819 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4319 (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) =	0.3671 (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												
Effective ac	0.5140	0.4681	0.4405	0.4130	0.4314	0.3855	0.4038	0.3855	0.4038	0.4405	0.4497	0.4681 (22b)
	0.6321	0.6095	0.5970	0.5853	0.5930	0.5743	0.5815	0.5743	0.5815	0.5970	0.6011	0.6095 (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)			13.1300	1.3258	17.4072		(27)
Ground Floor			42.7000	0.1100	4.6970		(28a)
External Wall	101.3000	15.1500	86.1500	0.2400	20.6760		(29a)
External Roof	42.7000		42.7000	0.1100	4.6970		(30)
Total net area of external elements Aum(A, m ²)			186.7000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	50.3052		(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)							5.9137 (36)
Total fabric heat loss						(33) + (36) =	56.2189 (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	45.8689	44.2338	43.3261	42.4733	43.0357	41.6756	42.2013	41.6756	42.2013	43.3261	43.6225	44.2338 (38)
Heat transfer coeff	102.0878	100.4527	99.5450	98.6923	99.2546	97.8946	98.4203	97.8946	98.4203	99.5450	99.8414	100.4527 (39)
Average = Sum(39)m / 12 =												99.3751 (39)
HLP	1.1954	1.1763	1.1656	1.1556	1.1622	1.1463	1.1525	1.1463	1.1525	1.1656	1.1691	1.1763 (40)
HLP (average)												1.1636 (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												2.5574 (42)
Average daily hot water use (litres/day)												94.9379 (43)
Daily hot water use	104.4316	100.6341	96.8366	93.0391	89.2416	85.4441	85.4441	89.2416	93.0391	96.8366	100.6341	104.4316 (44)
Energy conte	154.8691	135.4495	139.7718	121.8564	116.9241	100.8966	93.4956	107.2875	108.5689	126.5266	138.1136	149.9825 (45)
Energy content (annual)												Total = Sum(45)m = 1493.7422 (45)
Distribution loss (46)m = 0.15 x (45)m	23.2304	20.3174	20.9658	18.2785	17.5386	15.1345	14.0243	16.0931	16.2853	18.9790	20.7170	22.4974 (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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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	50.9589	46.0274	49.3469	45.8823	45.4765	42.1368	43.5414	45.4765	45.8823	49.3469	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month	205.8280	181.4769	189.1186	167.7387	162.4007	143.0334	137.0369	152.7641	154.4512	175.8734	187.4287	200.9414 (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	205.8280	181.4769	189.1186	167.7387	162.4007	143.0334	137.0369	152.7641	154.4512	175.8734	187.4287	200.9414 (64)
Heat gains from water heating, kWh/month	64.2337	56.5438	58.8108	51.9878	50.2464	44.0823	41.9726	47.0422	47.5697	54.4068	58.2516	62.6089 (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	153.4430	153.4430	153.4430	153.4430	153.4430	153.4430	153.4430	153.4430	153.4430	153.4430	153.4430	153.4430 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	53.9952	47.9580	39.0021	29.0718	18.6340	20.1347	26.1718	35.1278	44.6028	52.0580	55.4959	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	343.8150	347.3828	338.3922	319.2524	295.0918	272.3843	257.2143	253.6465	262.6371	281.7769	305.9375	328.6450 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.9017	52.9017	52.9017	52.9017	52.9017	52.9017	52.9017	52.9017	52.9017	52.9017	52.9017	52.9017 (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)	-102.2953	-102.2953	-102.2953	-102.2953	-102.2953	-102.2953	-102.2953	-102.2953	-102.2953	-102.2953	-102.2953	-102.2953 (71)
Water heating gains (Table 5)	86.3356	84.1426	79.0468	72.2053	67.5355	61.2255	56.4148	63.2288	66.0691	73.1274	80.9049	84.1517 (72)
Total internal gains	591.1952	586.5327	563.4905	528.0342	491.7485	459.2931	440.8131	450.0965	470.8833	506.5564	545.9498	575.3420 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
North				1.8000	14.6401	0.7100	0.7000	0.7700	9.0762 (74)			
East				4.0700	27.3735	0.7100	0.7000	0.7700	38.3719 (76)			
West				7.2600	27.3735	0.7100	0.7000	0.7700	68.4473 (80)			
Solar gains	115.8954	188.8947	310.8840	473.1424	564.1153	622.2562	587.8045	504.5014	389.0178	241.0767	138.4386	92.5351 (83)
Total gains	707.0906	775.4275	874.3745	1001.1766	1055.8638	1081.5493	1028.6176	954.5979	859.9011	747.6332	684.3884	667.8770 (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	58.0927	59.0383	59.5766	60.0914	59.7509	60.5810	60.2575	60.5810	60.2575	59.5766	59.3997	59.0383
alpha	4.8728	4.9359	4.9718	5.0061	4.9834	5.0387	5.0172	5.0387	5.0172	4.9718	4.9600	4.9359
util living area	0.9881	0.9814	0.9553	0.8719	0.7034	0.4819	0.3340	0.3375	0.5957	0.8796	0.9723	0.9899 (86)
MIT	20.0695	20.1837	20.4423	20.7446	20.9327	20.9918	20.9990	20.9990	20.9789	20.7933	20.4163	20.0744 (87)
Th 2	19.9237	19.9390	19.9476	19.9556	19.9503	19.9632	19.9582	19.9632	19.9582	19.9476	19.9448	19.9390 (88)
util rest of house	0.9839	0.9751	0.9406	0.8340	0.6313	0.3927	0.2351	0.2320	0.4911	0.8290	0.9609	0.9863 (89)
MIT 2	18.7317	18.9066	19.2784	19.6864	19.8969	19.9593	19.9580	19.9630	19.9475	19.7523	19.2464	18.7504 (90)
Living area fraction	19.0430	19.2037	19.5492	19.9326	20.1379	20.1996	20.2002	20.2041	20.1875	19.9945	19.5186	19.0585 (92)
Temperature adjustment	18.8930	19.0537	19.3992	19.7826	19.9879	20.0496	20.0502	20.0541	20.0375	19.8445	19.3686	18.9085 (93)
adjusted MIT												

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	691.7654	750.6308	813.8959	827.7027	669.4756	432.9148	250.8318	230.3141	429.4332	615.3827	651.8466	655.3830 (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	1336.6370	1311.2803	1184.5038	985.2067	703.5109	435.5870	250.9920	230.4498	436.7364	731.1114	1035.2149	1296.6898 (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	479.7845	376.7565	275.7323	113.4029	25.3223	0.0000	0.0000	0.0000	0.0000	86.1022	276.0252	477.1323 (98)
Space heating per m2												24.7103 (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													2331.7768 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	479.7845	376.7565	275.7323	113.4029	25.3223	0.0000	0.0000	0.0000	0.0000	86.1022	276.0252	477.1323	(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)	530.1486	416.3055	304.6766	125.3070	27.9804	0.0000	0.0000	0.0000	0.0000	95.1406	305.0002	527.2180	(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	205.8280	181.4769	189.1186	167.7387	162.4007	143.0334	137.0369	152.7641	154.4512	175.8734	187.4287	200.9414	(64)
Efficiency of water heater (217)m	87.2110	86.9491	86.0996	84.1899	81.6289	80.4000	80.4000	80.4000	80.4000	83.4613	86.1246	87.2519	(217)
Fuel for water heating, kWh/month	236.0115	208.7162	219.6509	199.2384	198.9501	177.9023	170.4439	190.0050	192.1035	210.7244	217.6252	230.3003	(219)
Water heating fuel used												2451.6717	(219)
Annual totals kWh/year													
Space heating fuel - main system												2331.7768	(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)													381.4286 (232)
Energy saving/generation technologies (Appendices M,N and Q)													
PV Unit 0 (0.80 * 1.10 * 1118 * 0.80) =										-787.3456		-787.3456	(233)
Total delivered energy for all uses													4452.5317 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2331.7768	3.9700	92.5715 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2451.6717	3.9700	97.3314 (247)
Pumps and fans for heating	75.0000	18.2700	13.7025 (249)
Energy for lighting	381.4286	18.2700	69.6870 (250)
Additional standing charges			90.0000 (251)
Energy saving/generation technologies			
PV Unit	-787.3456	18.2700	-143.8480 (252)
Total energy cost			219.4444 (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	2331.7768	0.2160	503.6638 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2451.6717	0.2160	529.5611 (264)
Space and water heating			1033.2249 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	381.4286	0.5190	197.9615 (268)
Energy saving/generation technologies			
PV Unit	-787.3456	0.5190	-408.6323 (269)
Total kg/year			861.4790 (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	2331.7768	1.2200	2844.7677 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2451.6717	1.2200	2991.0395 (264)
Space and water heating			5835.8073 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	381.4286	3.0700	1170.9859 (268)
Energy saving/generation technologies			
PV Unit	-787.3456	3.0700	-2417.1509 (269)
Primary energy kWh/year			4819.8923 (272)
Primary energy kWh/m2/year			56.4390 (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	+ 1.3	-£ 35	-214 kg (24.9%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£35	2.51 kg/m²	B 88
Total Savings	£35	2.51 kg/m²	B 91
Potential energy efficiency rating:			B 88
Potential environmental impact rating:			B 91

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

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

	Current	Potential	Saving
Electricity	£83	£93	-£9
Mains gas	£280	£236	£44
Space heating	£196	£196	£0
Water heating	£97	£62	£35
Lighting	£70	£70	£0
Generated (PV)	-£144	-£144	£0
Total cost of fuels	£219	£185	£35
Total cost of uses	£219	£184	£35
Delivered energy	52 kWh/m²	40 kWh/m²	12 kWh/m²
Carbon dioxide emissions	0.9 tonnes	0.6 tonnes	0.2 tonnes
CO2 emissions per m²	10 kg/m²	8 kg/m²	3 kg/m²
Primary energy	56 kWh/m²	42 kWh/m²	14 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	42.7000 (1b)	x 2.3900 (2b)	= 102.0530 (1b) - (3b)
First floor	42.7000 (1c)	x 2.7600 (2c)	= 117.8520 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	85.4000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 219.9050 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.1819 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4319 (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) =	0.3671 (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	0.4681	0.4589	0.4497	0.4038	0.3946	0.3488	0.3488	0.3396	0.3671	0.3946	0.4130	0.4314 (22b)
Effective ac	0.6095	0.6053	0.6011	0.5615	0.5779	0.5608	0.5608	0.5577	0.5674	0.5779	0.5853	0.5930 (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)			13.1300	1.3258	17.4072		(27)
Ground Floor			42.7000	0.1100	4.6970		(28a)
External Wall	101.3000	15.1500	86.1500	0.2400	20.6760		(29a)
External Roof	42.7000		42.7000	0.1100	4.6970		(30)
Total net area of external elements Aum(A, m ²)			186.7000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	50.3052		(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)							5.9137 (36)
Total fabric heat loss						(33) + (36) =	56.2189 (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	44.2338	43.9251	43.6225	42.2013	41.9354	40.6976	40.6976	40.4684	41.1744	41.9354	42.4733	43.0357 (38)
Heat transfer coeff	100.4527	100.1440	99.8414	98.4203	98.1544	96.9166	96.9166	96.6873	97.3933	98.1544	98.6923	99.2546 (39)
Average = Sum(39)m / 12 =												98.4190 (39)
HLP	1.1763	1.1726	1.1691	1.1525	1.1493	1.1349	1.1349	1.1322	1.1404	1.1493	1.1556	1.1622 (40)
HLP (average)												1.1524 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

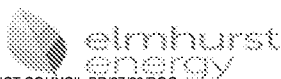
Assumed occupancy												2.5574 (42)
Average daily hot water use (litres/day)												94.9379 (43)
Daily hot water use	104.4316	100.6341	96.8366	93.0391	89.2416	85.4441	85.4441	89.2416	93.0391	96.8366	100.6341	104.4316 (44)
Energy conte	154.8691	135.4495	139.7718	121.8564	116.9241	100.8966	93.4956	107.2875	108.5689	126.5266	138.1136	149.9825 (45)
Energy content (annual)										Total = Sum(45)m =		1493.7422 (45)
Distribution loss (46)m = 0.15 x (45)m	23.2304	20.3174	20.9658	18.2785	17.5386	15.1345	14.0243	16.0931	16.2853	18.9790	20.7170	22.4974 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)

Regs Region: England

Elmhurst Energy Systems

SAP2012 Calculator (Design

System) version 4.12r02



FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	50.9589	46.0274	49.3469	45.8823	45.4765	42.1368	43.5414	45.4765	45.8823	49.3469	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month	205.8280	181.4769	189.1186	167.7387	162.4007	143.0334	137.0369	152.7641	154.4512	175.8734	187.4287	200.9414	(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													1.2141 (H8)
Utilisation factor													0.5612 (H9)
Collector performance factor													0.8793 (H10)
Dedicated solar storage volume													75.0000 (H11)
Effective solar volume													75.0000 (H13)
Daily hot water demand													94.9379 (H14)
Volume ratio Veff/V													0.7900 (H15)
Solar storage volume factor													0.9529 (H16)
Solar input													-852.6929 (H17)
Solar input	-24.7264	-41.2612	-70.2726	-94.1792	-116.3504	-114.3910	-112.8793	-98.6232	-77.2417	-52.7470	-29.3291	-20.6918	(63)
													-852.6929 (63)
Solar input (sum of months) = Sum(63)m =													
Output from w/h	181.1016	140.2157	118.8460	73.5595	46.0502	28.6424	24.1576	54.1409	77.2094	123.1264	158.0996	180.2496	(64)
Total per year (kWh/year) = Sum(64)m =													1205.3991 (64)
Heat gains from water heating, kWh/month	64.2337	56.5438	58.8108	51.9878	50.2464	44.0823	41.9726	47.0422	47.5697	54.4068	58.2516	62.6089	(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	153.4430	153.4430	153.4430	153.4430	153.4430	153.4430	153.4430	153.4430	153.4430	153.4430	153.4430	153.4430	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	53.9952	47.9580	39.0021	29.5271	22.0718	18.6340	20.1347	26.1718	35.1278	44.6028	52.0580	55.4959	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	343.8150	347.3828	338.3922	319.2524	295.0918	272.3843	257.2143	253.6465	262.6371	281.7769	305.9375	328.6450	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.9017	52.9017	52.9017	52.9017	52.9017	52.9017	52.9017	52.9017	52.9017	52.9017	52.9017	52.9017	(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)	-102.2953	-102.2953	-102.2953	-102.2953	-102.2953	-102.2953	-102.2953	-102.2953	-102.2953	-102.2953	-102.2953	-102.2953	(71)
Water heating gains (Table 5)	86.3356	84.1426	79.0468	72.2053	67.5355	61.2255	56.4148	63.2288	66.0691	73.1274	80.9049	84.1517	(72)
Total internal gains	591.1952	586.5327	563.4905	528.0342	491.7485	459.2931	440.8131	450.0965	470.8833	506.5564	545.9498	575.3420	(73)

6. Solar gains

[Jan]			Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W				
North			1.8000	10.6334	0.7100	0.7000	0.7700	6.5923 (74)				
East			4.0700	19.6403	0.7100	0.7000	0.7700	27.5316 (76)				
West			7.2600	19.6403	0.7100	0.7000	0.7700	49.1104 (80)				
Solar gains	83.2343	162.5262	268.3174	394.4893	487.6411	501.3577	476.3999	406.1828	312.9052	192.8987	103.6960	68.5223 (83)
Total gains	674.4295	749.0589	831.8079	922.5234	979.3896	960.6507	917.2130	856.2793	783.7884	699.4551	649.6457	643.8643 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.0383	59.2203	59.3997	60.2575	60.4207	61.1924	61.1924	61.3375	60.8928	60.4207	60.0914	59.7509	
alpha	4.9359	4.9480	4.9600	5.0172	5.0280	5.0795	5.0795	5.0892	5.0595	5.0280	5.0061	4.9834	
util living area	0.9933	0.9878	0.9717	0.9203	0.8034	0.6190	0.4598	0.5103	0.7648	0.9476	0.9874	0.9946	(86)
MIT	19.8972	20.0446	20.2993	20.6241	20.8615	20.9718	20.9948	20.9914	20.9201	20.6062	20.1976	19.8730	(87)
Th 2	19.9390	19.9419	19.9448	19.9582	19.9607	19.9725	19.9725	19.9746	19.9679	19.9607	19.9556	19.9503	(88)
util rest of house	0.9912	0.9839	0.9624	0.8945	0.7468	0.5307	0.3551	0.4012	0.6823	0.9249	0.9826	0.9929	(89)
MIT 2	18.4923	18.7078	19.0751	19.5345	19.8328	19.9549	19.9707	19.9713	19.9087	19.5228	18.9413	18.4653	(90)
Living area fraction									fLA = Living area / (4) =			0.2327	(91)
MIT	18.8191	19.0188	19.3599	19.7881	20.0721	20.1915	20.2090	20.2087	20.1440	19.7749	19.2336	18.7929	(92)
Temperature adjustment												-0.1500	
adjusted MIT	18.6691	18.8688	19.2099	19.6381	19.9221	20.0415	20.0590	20.0587	19.9940	19.6249	19.0836	18.6429	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9874	0.9783	0.9539	0.8850	0.7445	0.5369	0.3641	0.4104	0.6846	0.9155	0.9769	0.9897	(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	665.9349	732.8410	793.4429	816.4047	729.1086	515.7591	333.9466	351.4291	536.5875	640.3558	634.6465	637.2394 (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	1443.4194	1398.8957	1268.9797	1056.8429	807.0378	527.3695	335.2300	353.7487	574.0369	885.8324	1182.6870	1433.5216 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	578.4485	447.5888	353.7993	173.1155	57.9794	0.0000	0.0000	0.0000	0.0000	182.6346	394.5891	592.4340 (98)
Space heating												2780.5892 (98)
Space heating per m2											(98) / (4) =	32.5596 (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												3072.4743 (211)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	578.4485	447.5888	353.7993	173.1155	57.9794	0.0000	0.0000	0.0000	0.0000	182.6346	394.5891	592.4340 (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)	639.1696	494.5732	390.9385	191.2878	64.0656	0.0000	0.0000	0.0000	0.0000	201.8062	436.0101	654.6232 (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	181.1016	140.2157	118.8460	73.5595	46.0502	28.6424	24.1576	54.1409	77.2094	123.1264	158.0996	180.2496 (64)
Efficiency of water heater	87.8681	87.8670	87.7289	87.2322	85.7326	80.4000	80.4000	80.4000	80.4000	86.1424	87.3607	80.4000 (216)
Fuel for water heating, kWh/month	206.1061	159.5772	135.4697	84.3261	53.7138	35.6249	30.0468	67.3394	96.0316	142.9337	180.9734	87.9234 (217)
Water heating fuel used												205.0075 (219)
Annual totals kWh/year												1397.1503 (219)
Space heating fuel - main system												3072.4743 (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)												381.4286 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 1.10 * 908 * 0.80) =									-639.1294			-639.1294 (233)
Total delivered energy for all uses												4336.9238 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3072.4743	3.4800	106.9221 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1397.1503	3.4800	48.6208 (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	381.4286	13.1900	50.3104 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-639.1294	13.1900	-84.3012 (252)
Total energy cost			258.0397 (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] =	0.8311 (257)
SAP value		88.4060
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	3072.4743	0.2160	663.6544 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1397.1503	0.2160	301.7845 (264)
Space and water heating			965.4389 (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	381.4286	0.5190	197.9615 (268)
Energy saving/generation technologies			
PV Unit			
Total kg/year	-639.1294	0.5190	-331.7082 (269)
CO2 emissions per m2			896.5672 (272)
EI value			10.5000 (273)
EI rating			90.7868
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	42.7000 (1b)	x 2.3900 (2b)	= 102.0530 (1b) - (3b)
First floor	42.7000 (1c)	x 2.7600 (2c)	= 117.8520 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	85.4000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 219.9050 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					40.0000 / (5) = 0.1819 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4319 (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) =	0.3671 (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												
Effective ac	0.5140	0.4681	0.4405	0.4130	0.4314	0.3855	0.4038	0.3855	0.4038	0.4405	0.4497	0.4681 (22b)
	0.6321	0.6095	0.5970	0.5853	0.5930	0.5743	0.5815	0.5743	0.5815	0.5970	0.6011	0.6095 (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)			13.1300	1.3258	17.4072		(27)
Ground Floor			42.7000	0.1100	4.6970		(28a)
External Wall	101.3000	15.1500	86.1500	0.2400	20.6760		(29a)
External Roof	42.7000		42.7000	0.1100	4.6970		(30)
Total net area of external elements Aum(A, m ²)			186.7000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	50.3052		(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)							5.9137 (36)
Total fabric heat loss						(33) + (36) =	56.2189 (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	45.8689	44.2338	43.3261	42.4733	43.0357	41.6756	42.2013	41.6756	42.2013	43.3261	43.6225	44.2338 (38)
Heat transfer coeff	102.0878	100.4527	99.5450	98.6923	99.2546	97.8946	98.4203	97.8946	98.4203	99.5450	99.8414	100.4527 (39)
Average = Sum(39)m / 12 =												99.3751 (39)
HLP	1.1954	1.1763	1.1656	1.1556	1.1622	1.1463	1.1525	1.1463	1.1525	1.1656	1.1691	1.1763 (40)
HLP (average)												1.1636 (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												2.5574 (42)
Average daily hot water use (litres/day)												94.9379 (43)
Daily hot water use	104.4316	100.6341	96.8366	93.0391	89.2416	85.4441	85.4441	89.2416	93.0391	96.8366	100.6341	104.4316 (44)
Energy conte	154.8691	135.4495	139.7718	121.8564	116.9241	100.8966	93.4956	107.2875	108.5689	126.5266	138.1136	149.9825 (45)
Energy content (annual)										Total = Sum(45)m =		1493.7422 (45)
Distribution loss (46)m = 0.15 x (45)m	23.2304	20.3174	20.9658	18.2785	17.5386	15.1345	14.0243	16.0931	16.2853	18.9790	20.7170	22.4974 (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	0.0000	(57)
Combi loss	50.9589	46.0274	49.3469	45.8823	45.4765	42.1368	43.5414	45.4765	45.8823	49.3469	49.3151	50.9589			(61)
Total heat required for water heating calculated for each month	205.8280	181.4769	189.1186	167.7387	162.4007	143.0334	137.0369	152.7641	154.4512	175.8734	187.4287	200.9414			(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													1.4699		(H8)
Utilisation factor													0.4935		(H9)
Collector performance factor													0.8793		(H10)
Dedicated solar storage volume													75.0000		(H11)
Effective solar volume													75.0000		(H13)
Daily hot water demand													94.9379		(H14)
Volume ratio Veff/V													0.7900		(H15)
Solar storage volume factor													0.9529		(H16)
Solar input													-907.9231		(H17)
Solar input	-29.7065	-41.4139	-70.5090	-98.2350	-117.4605	-124.0869	-121.6481	-106.6933	-83.2954	-56.9762	-33.7900		-24.1083		(63)
													-907.9231		(63)
Solar input (sum of months) = Sum(63)m =															
Output from w/h	176.1215	140.0630	118.6096	69.5037	44.9402	18.9465	15.3888	46.0708	71.1558	118.8973	153.6387	176.8331			(64)
Total per year (kWh/year) = Sum(64)m =													1150.1690		(64)
Heat gains from water heating, kWh/month	64.2337	56.5438	58.8108	51.9878	50.2464	44.0823	41.9726	47.0422	47.5697	54.4068	58.2516	62.6089			(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	153.4430	153.4430	153.4430	153.4430	153.4430	153.4430	153.4430	153.4430	153.4430	153.4430	153.4430	153.4430			(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	53.9952	47.9580	39.0021	29.5271	22.0718	18.6340	20.1347	26.1718	35.1278	44.6028	52.0580	55.4959			(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	343.8150	347.3828	338.3922	319.2524	295.0918	272.3843	257.2143	253.6465	262.6371	281.7769	305.9375	328.6450			(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.9017	52.9017	52.9017	52.9017	52.9017	52.9017	52.9017	52.9017	52.9017	52.9017	52.9017	52.9017			(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)	-102.2953	-102.2953	-102.2953	-102.2953	-102.2953	-102.2953	-102.2953	-102.2953	-102.2953	-102.2953	-102.2953	-102.2953			(71)
Water heating gains (Table 5)	86.3356	84.1426	79.0468	72.2053	67.5355	61.2255	56.4148	63.2288	66.0691	73.1274	80.9049	84.1517			(72)
Total internal gains	591.1952	586.5327	563.4905	528.0342	491.7485	459.2931	440.8131	450.0965	470.8833	506.5564	545.9498	575.3420			(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
North				1.8000	14.6401		0.7100		0.7000		0.7700		9.0762 (74)
East				4.0700	27.3735		0.7100		0.7000		0.7700		38.3719 (76)
West				7.2600	27.3735		0.7100		0.7000		0.7700		68.4473 (80)
Solar gains	115.8954	188.8947	310.8840	473.1424	564.1153	622.2562	587.8045	504.5014	389.0178	241.0767	138.4386		92.5351 (83)
Total gains	707.0906	775.4275	874.3745	1001.1766	1055.8638	1081.5493	1028.6176	954.5979	859.9011	747.6332	684.3884		667.8770 (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	58.0927	59.0383	59.5766	60.0914	59.7509	60.5810	60.2575	60.5810	60.2575	59.5766	59.3997	59.0383				
alpha	4.8728	4.9359	4.9718	5.0061	4.9834	5.0387	5.0172	5.0387	5.0172	4.9718	4.9600	4.9359				
util living area	0.9881	0.9814	0.9553	0.8719	0.7034	0.4819	0.3340	0.3375	0.5957	0.8796	0.9723	0.9899				(86)
MIT	20.0695	20.1837	20.4423	20.7446	20.9327	20.9918	20.9990	20.9990	20.9789	20.7933	20.4163	20.0744				(87)
Th 2	19.9237	19.9390	19.9476	19.9556	19.9503	19.9632	19.9582	19.9632	19.9582	19.9476	19.9448	19.9390				(88)
util rest of house	0.9839	0.9751	0.9406	0.8340	0.6313	0.3927	0.2351	0.2320	0.4911	0.8290	0.9609	0.9863				(89)
MIT 2	18.7317	18.9066	19.2784	19.6864	19.8969	19.9593	19.9580	19.9630	19.9475	19.7523	19.2464	18.7504				(90)
Living area fraction																(91)
MIT	19.0430	19.2037	19.5492	19.9326	20.1379	20.1996	20.2002	20.2041	20.1875	19.9945	19.5186	19.0585				(92)
Temperature adjustment																(93)
adjusted MIT	18.8930	19.0537	19.3992	19.7826	19.9879	20.0496	20.0502	20.0541	20.0375	19.8445	19.3686	18.9085				

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9783	0.9680	0.9308	0.8267	0.6341	0.4003	0.2439	0.2413	0.4994	0.8231	0.9525	0.9813	(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	691.7654	750.6308	813.8959	827.7027	669.4756	432.9148	250.8318	230.3141	429.4332	615.3827	651.8466	655.3830 (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	1336.6370	1311.2803	1184.5038	985.2067	703.5109	435.5870	250.9920	230.4498	436.7364	731.1114	1035.2149	1296.6898 (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	479.7845	376.7565	275.7323	113.4029	25.3223	0.0000	0.0000	0.0000	0.0000	86.1022	276.0252	477.1323 (98)
Space heating												2110.2580 (98)
Space heating per m2											(98) / (4) =	24.7103 (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												2331.7768 (211)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	479.7845	376.7565	275.7323	113.4029	25.3223	0.0000	0.0000	0.0000	0.0000	86.1022	276.0252	477.1323 (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)	530.1486	416.3055	304.6766	125.3070	27.9804	0.0000	0.0000	0.0000	0.0000	95.1406	305.0002	527.2180 (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	176.1215	140.0630	118.6096	69.5037	44.9402	18.9465	15.3888	46.0708	71.1558	118.8973	153.6387	176.8331 (64)
Efficiency of water heater	87.5469	87.5204	87.2050	86.3767	83.7693	80.4000	80.4000	80.4000	80.4000	84.3540	86.6095	80.4000 (216)
(217)m	87.5469	87.5204	87.2050	86.3767	83.7693	80.4000	80.4000	80.4000	80.4000	84.3540	86.6095	87.5269 (217)
Fuel for water heating, kWh/month	201.1738	160.0348	136.0124	80.4657	53.6476	23.5653	19.1403	57.3019	88.5022	140.9503	177.3924	202.0329 (219)
Water heating fuel used												1340.2197 (219)
Annual totals kWh/year												
Space heating fuel - main system												2331.7768 (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)												381.4286 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 1.10 * 1118 * 0.80) =									-787.3456			-787.3456 (233)
Total delivered energy for all uses												3391.0797 (238)

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

	Fuel	Fuel price	Fuel cost
	kWh/year	p/kWh	f/year
Space heating - main system 1	2331.7768	3.9700	92.5715 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1340.2197	3.9700	53.2067 (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	381.4286	18.2700	69.6870 (250)
Additional standing charges			90.0000 (251)
Energy saving/generation technologies			
PV Unit	-787.3456	18.2700	-143.8480 (252)
Total energy cost			184.4547 (255)

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

	Energy	Emission factor	Emissions
	kWh/year	kg CO2/kWh	kg CO2/year
Space heating - main system 1	2331.7768	0.2160	503.6638 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1340.2197	0.2160	289.4875 (264)
Space and water heating			793.1513 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	381.4286	0.5190	197.9615 (268)
Energy saving/generation technologies			
PV Unit	-787.3456	0.5190	-408.6323 (269)
Total kg/year			647.3554 (272)

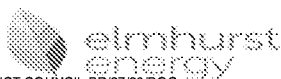
13a. Primary energy - Individual heating systems including micro-CHP

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 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	2331.7768	1.2200	2844.7677 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1340.2197	1.2200	1635.0681 (264)
Space and water heating			4479.8358 (265)
Pumps and fans	125.0000	3.0700	383.7500 (267)
Energy for lighting	381.4286	3.0700	1170.9859 (268)
Energy saving/generation technologies			
PV Unit	-787.3456	3.0700	-2417.1509 (269)
Primary energy kWh/year			3617.4209 (272)
Primary energy kWh/m2/year			42.3586 (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	290.27 (P1)
Transmission heat loss coefficient	56.22 (37)
Summer heat loss coefficient	346.49 (P2)

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

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

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	1.8000	87.1704	0.7100	0.7000	0.9000	63.1660
East	4.0700	125.2818	0.7100	0.7000	0.9000	205.2692
West	7.2600	125.2818	0.7100	0.7000	0.9000	366.1558

total: 634.5910

Solar gains	Jun	Jul	Aug	(P3)
Internal gains	684	635	554	
Total summer gains	456	438	447	
	1140	1072	1001	(P5)
Summer gain/loss ratio	3.29	3.10	2.89	(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	18.94	20.65	20.44	(P7)
Likelihood of high internal temperature	Not significant	Slight	Not significant	

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	42.7000 (1b)	x 2.3900 (2b)	= 102.0530 (1b) - (3b)
First floor	42.7000 (1c)	x 2.7600 (2c)	= 117.8520 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	85.4000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	219.9050 (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					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.1819 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4319 (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) =	0.3671 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
Effective ac	0.4681	0.4589	0.4497	0.4038	0.3946	0.3488	0.3488	0.3396	0.3671	0.3946	0.4130	0.4314 (22b)
	0.6095	0.6053	0.6011	0.5815	0.5779	0.5608	0.5608	0.5577	0.5674	0.5779	0.5853	0.5930 (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)			13.1300	1.3258	17.4072		(27)
Ground Floor			42.7000	0.1100	4.6970		(28a)
External Wall	101.3000	15.1500	86.1500	0.2400	20.6760		(29a)
External Roof	42.7000		42.7000	0.1100	4.6970		(30)
Total net area of external elements Aum(A, m ²)			186.7000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	50.3052		(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)							5.9137 (36)
Total fabric heat loss						(33) + (36) =	56.2189 (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	44.2338	43.9251	43.6225	42.2013	41.9354	40.6976	40.6976	40.4684	41.1744	41.9354	42.4733	43.0357 (38)
Heat transfer coeff	100.4527	100.1440	99.8414	98.4203	98.1544	96.9166	96.9166	96.6873	97.3933	98.1544	98.6923	99.2546 (39)
Average = Sum(39)m / 12 =												98.4190 (39)
HLP	1.1763	1.1726	1.1691	1.1525	1.1493	1.1349	1.1349	1.1322	1.1404	1.1493	1.1556	1.1622 (40)
HLP (average)												1.1524 (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												2.5574 (42)
Average daily hot water use (litres/day)												94.9379 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	104.4316	100.6341	96.8366	93.0391	89.2416	85.4441	85.4441	89.2416	93.0391	96.8366	100.6341	104.4316 (44)
Energy content (annual)	154.8691	135.4495	139.7718	121.8564	116.9241	100.8966	93.4956	107.2875	108.5689	126.5266	138.1136	149.9825 (45)
Distribution loss (46)m = 0.15 x (45)m	23.2304	20.3174	20.9658	18.2785	17.5386	15.1345	14.0243	16.0931	16.2853	18.9790	20.7170	22.4974 (46)
Water storage loss:												
Store volume												150.0000 (47)

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	222.6597	196.6797	207.5624	187.4602	184.7147	166.5004	161.2862	175.0781	174.1727	194.3172	203.7174	217.7731	(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	222.6597	196.6797	207.5624	187.4602	184.7147	166.5004	161.2862	175.0781	174.1727	194.3172	203.7174	217.7731	(64)
Heat gains from water heating, kWh/month	105.7265	94.0211	100.7066	93.0003	93.1097	86.0312	85.3197	89.9056	88.5822	96.3026	98.4058	104.1016	(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	127.8692	127.8692	127.8692	127.8692	127.8692	127.8692	127.8692	127.8692	127.8692	127.8692	127.8692	127.8692	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.5981	19.1832	15.6008	11.8108	8.8287	7.4536	8.0539	10.4687	14.0511	17.8411	20.8232	22.1983	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	230.3561	232.7465	226.7228	213.8991	197.7115	182.4975	172.3335	169.9432	175.9668	188.7905	204.9781	220.1922	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.7869	35.7869	35.7869	35.7869	35.7869	35.7869	35.7869	35.7869	35.7869	35.7869	35.7869	35.7869	(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)	-102.2953	-102.2953	-102.2953	-102.2953	-102.2953	-102.2953	-102.2953	-102.2953	-102.2953	-102.2953	-102.2953	-102.2953	(71)
Water heating gains (Table 5)	142.1054	139.9124	135.3583	129.1671	125.1475	119.4877	114.6771	120.8408	123.0308	129.4389	136.6748	139.9216	(72)
Total internal gains	458.4203	456.2028	442.0427	419.2378	396.0485	373.7995	359.4253	365.6135	377.4095	400.4313	426.8368	446.6728	(73)

6. Solar gains

[Jan]												
	Area m2			Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
North	1.8000			10.6334		0.7100		0.7000		0.7700		6.5923 (74)
East	4.0700			19.6403		0.7100		0.7000		0.7700		27.5316 (76)
West	7.2600			19.6403		0.7100		0.7000		0.7700		49.1104 (80)
Solar gains	83.2343	162.5262	268.3174	394.4893	487.6411	501.3577	476.3999	406.1828	312.9052	192.8987	103.6960	68.5223 (83)
Total gains	541.6546	618.7290	710.3601	813.7271	883.6896	875.1572	835.8251	771.7963	690.3147	593.3299	530.5328	515.1951 (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	59.0383	59.2203	59.3997	60.2575	60.4207	61.1924	61.1924	61.3375	60.8928	60.4207	60.0914	59.7509	
alpha	4.9359	4.9480	4.9600	5.0172	5.0280	5.0795	5.0795	5.0892	5.0595	5.0280	5.0061	4.9834	
util living area	0.9974	0.9946	0.9849	0.9479	0.8473	0.6678	0.5019	0.5610	0.8236	0.9716	0.9947	0.9980	(86)
MIT	19.7553	19.9082	20.1802	20.5388	20.8196	20.9605	20.9923	20.9870	20.8860	20.5113	20.0727	19.7345	(87)
Th 2	19.9390	19.9419	19.9448	19.9582	19.9607	19.9725	19.9725	19.9746	19.9679	19.9607	19.9556	19.9503	(88)
util rest of house	0.9966	0.9927	0.9795	0.9290	0.7963	0.5770	0.3890	0.4436	0.7475	0.9577	0.9926	0.9973	(89)
MIT 2	18.8104	18.9649	19.2362	19.5928	19.8429	19.9551	19.9706	19.9711	19.9068	19.5751	19.1403	18.7988	(90)
Living area fraction	19.0303	19.1844	19.4559	19.8129	20.0701	20.1890	20.2083	20.2075	20.1346	19.7930	19.3572	19.0165	(92)
MIT	19.0303	19.1844	19.4559	19.8129	20.0701	20.1890	20.2083	20.2075	20.1346	19.7930	19.3572	19.0165	(93)
Temperature adjustment													
adjusted MIT	19.0303	19.1844	19.4559	19.8129	20.0701	20.1890	20.2083	20.2075	20.1346	19.7930	19.3572	19.0165	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	539.2412	613.1389	693.5024	753.3705	708.9781	522.5885	347.2610	363.6329	525.5888	566.5013	525.6900	513.3945	(94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1479.6941	1430.4935	1293.5317	1074.0531	821.5632	541.6678	349.7065	368.1326	587.7331	902.3289	1209.6954	1470.6057	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	699.6970	549.2623	446.4218	230.8915	83.7633	0.0000	0.0000	0.0000	0.0000	249.8557	492.4839	712.1651	(98)
Space heating													(98)
Space heating per m2													(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	15.7200	ZC1
Total Floor Area	85.4000	
Assumed number of occupants	N	2.5574
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190
CO2 emissions from appliances, equation (L14)		15.9841 ZC2
CO2 emissions from cooking, equation (L16)		2.1121 ZC3
Total CO2 emissions		33.8162 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		33.8162 ZC8

U-VALUE CALCULATOR REPORT

surecalc ltd

Property Reference	sc120969	Issued on Date	17/01/2020
Assessment Reference	001	Prop Type Ref	New Dwelling
Project	Plot 2, 15-17, Kew Gardens, Bognor Regis, West Sussex, PO21 5RD		
Calculation Type	New Build (As Designed)		

SAP Rating	87 B	DER	14.75	TAR	18.63
Environmental	89 B	% DER < TAR	20.82		
CO ₂ Emissions (t/year)	0.86	DREF	46.35	TREF	54.51
General Requirements Compliance	Pass	% DREF < TREF	14.96		

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	sc120969	Issued on Date	17/01/2020
Assessment Reference	001	Prop Type Ref	New Dwelling
Project	Plot 2, 15-17, Kew Gardens, Bognor Regis, West Sussex, PO21 5RD		
Calculation Type	New Build (As Designed)		

SAP Rating	87 B	DER	14.75	TBR	18.63
Environmental	89 B	% DER < TBR	20.82		
CO ₂ Emissions (t/year)	0.86	DREE	46.35	TREE	54.51
General Requirements Compliance	Pass	% DPER < TPER	14.96		

Assessor Details	Mr. Mark Rogers, Surecalc Limited	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
Layer 4	airspace/plaster dabs				
	Main construction	15	0.1000	0.1500	80.00
	Main construction	15	0.0882	0.1700	20.00
Layer 5	Plasterboard, standard				
	Main construction	12.5	0.2100	0.0595	100.00
	Corrections - Cavity Unventilated, Emissivity: Normal				
Int surface				0.1300	

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

Unheated space: None

Total thickness: 330 mm

U-value: 0.24 W/m² K

Kappa: n/a

U-VALUE CALCULATOR REPORT

surecalc ltd

Property Reference	sc120969	Issued on Date	17/01/2020
Assessment Reference	001	Prop Type Ref	New Dwelling
Project	Plot 2, 15-17, Kew Gardens, Bognor Regis, West Sussex, PO21 5RD		
Calculation Type	New Build (As Designed)		

SAP Rating	87 B	DER	14.75	TER	18.63
Environmental	89 B	% DER<TER	20.82		
CO ₂ Emissions (t/year)	0.86	DREF	46.35	TREE	54.51
General Requirements Compliance	Pass	% DPER<TPER	14.96		

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 = 42.70 m², Perimeter = 19.67 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	sc120969	Issued on Date	17/01/2020
Assessment Reference	001	Prop Type Ref	New Dwelling
Property	Plot 2, 15-17, Kew Gardens, Bognor Regis, West Sussex, PO21 5RD		
SAP Rating	87 B	DER	14.75
Environmental	89 B	% DER<TER	20.82
CO ₂ Emissions (t/year)	0.86	DERE	46.35
General Requirements Compliance	Pass	% DERE<TERE	14.96
Assessor Details	Mr. Mark Rogers, Surecalc Limited, [REDACTED]		Assessor ID
			A320-0001
Client	Vivid Design Studio, Vivid Design Studio		

	Junction detail	Source Type	Psi (W/mK)	Length (m)	Result	Reference
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.050	10.92	0.55	IG Hi Therm Lintels
External wall	E3 Sill	Independently assessed	0.027	9.96	0.27	LABC Construction Detail
External wall	E4 Jamb	Independently assessed	0.029	26.70	0.77	LABC Construction Detail
External wall	E5 Ground floor (normal)	Independently assessed	0.048	19.67	0.94	LABC Construction Detail
External wall	E6 Intermediate floor within a dwelling	Independently assessed	0.003	19.67	0.06	LABC Construction Detail
External wall	E10 Eaves (insulation at ceiling level)	Independently assessed	0.083	8.44	0.70	LABC Construction Detail
External wall	E12 Gable (insulation at ceiling level)	Independently assessed	0.054	10.16	0.55	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: 5.91 W/mK:
Y-Value: 0.032 W/m²K: