



SAP Report Submission for Building Regulations Compliance

Client: Vivid Design Studio

Project: Plot 3, 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	sc120970	Issued on Date	17/01/2020
Assessment Reference	001	Prop Type Ref	New Dwelling
Property	Plot 3, 15-17, Kew Gardens, Bognor Regis, West Sussex, PO21 5RD		

SAP Rating	87 B	DER	14.25	TER	17.98
Environmental	89 B	% DER<TER	20.75		
CO ₂ Emissions (t/year)	0.84	DFEE	42.64	TFEE	51.21
General Requirements Compliance	Pass	% DFEE<TFEE	16.73		

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	14.25	kgCO ₂ /yr/m ²
TER	17.98	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	14.25	kgCO ₂ /yr/m ²
Reduction DER/TER	20.75	%
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.)	42.64	kWh/m ² /yr
CfSH ENE2 credits achieved	7.8	
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	18.70	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	36.80	kgCO ₂ /yr/m ² (ZC4)
Net Standard case CO ₂ emissions	36.80	kgCO ₂ /yr/m ² (ZC8)

Actual case CO₂ emissions

DER	15.17	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	33.27	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	33.27	kgCO ₂ /yr/m ² (ZC8)
Improvement in net actual/net standard case CO ₂ emissions	10	%



ENE7 credits achieved

0

PREDICTED ENERGY ASSESSMENT

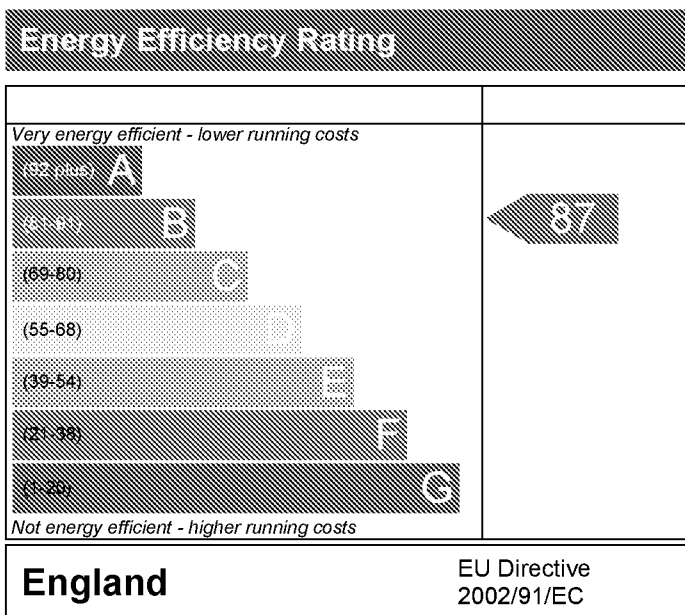
surecalc ltd

Plot 3, 15-17, Kew Gardens,
Bognor Regis,
West Sussex,
PO21 5RD

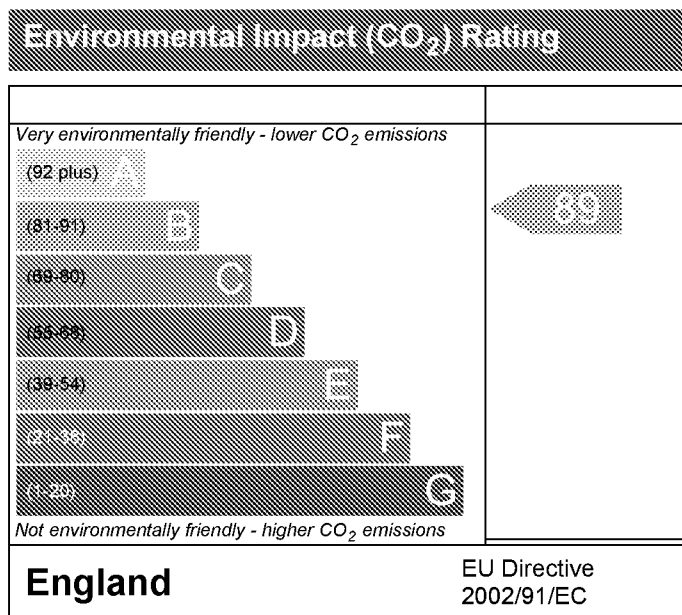
Dwelling type: House, Semi-Detached
Date of assessment: 17/01/2020
Produced by: Surecalc Limited
Total floor area: 85.4 m²
DRRN: 3072-3953-0943

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

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



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



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

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

BUILDING REGULATION COMPLIANCE

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Environmental	89 B	% DER<TER	20.75			
CO ₂ Emissions (t/year)	0.84	DFEE	42.64	TFEE	51.21	
General Requirements Compliance	Pass	% DFEE<TFEE	16.73			
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)	17.98	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	14.25	kgCO ₂ /m ²	Pass
	-3.73 (-20.7%)	kgCO ₂ /m ²	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	51.21	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DFEE)	42.64	kWh/m ² /yr	
	-8.6 (-16.8%)	kWh/m ² /yr	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

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

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

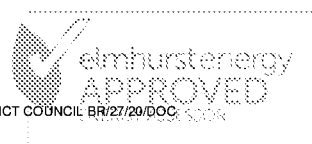
3 Air permeability

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

Limiting System Efficiencies

4 Heating efficiency

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Main heating system

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

Pass

Secondary heating system

None

5 Cylinder insulation

Hot water storage

No cylinder

6 Controls

Space heating controls

Time and temperature zone control

Pass

Hot water controls

No cylinder

Boiler interlock

Yes

Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings

100

%

Minimum

75

%

Pass

8 Mechanical ventilation

Not applicable

Criterion 3 - Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)

Slight

Pass

Based on:

Overshading

Average

Windows facing East

4.07 m², No overhang

Windows facing South

1.80 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

0.031

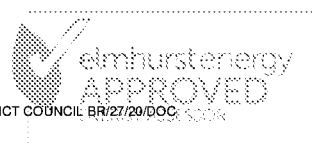
W/m²K

Photovoltaic array

1.00

kW

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FULL SAP CALCULATION PRINTOUT

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Environmental	89 B	% DER<TER	20.75			
CO ₂ Emissions (t/year)	0.84	DPER	42.64	TPER	51.21	
General Requirements Compliance	Pass	% DPER<TPER	16.73			
Assessor Details	Mr. Mark Rogers, Surecalc Limited, T [REDACTED] [REDACTED]				Assessor ID	A320-0001
Client	Vivid Design Studio, Vivid Design Studio					

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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) 17.98 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 14.29 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)51.2 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)42.6 kWh/m²/yrOK

2 Fabric U-values

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

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

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

4 Heating efficiency

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

Secondary heating system: None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

7 Low energy lights

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

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Southern England): Slight OK

Based on:

Overshading: Average
Windows facing East: 4.07 m², No overhang
Windows facing South: 1.80 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 0.031 W/m²K
Photovoltaic array 1.00 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)
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	88.7900	15.1500	73.6400	0.2400	17.6736		(29a)
External Roof	42.7000		42.7000	0.1100	4.6970		(30)
Total net area of external elements Aum(A, m ²)			174.1900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	47.3028		(33)
Party Wall			52.3400	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)							5.4061 (36)
Total fabric heat loss						(33) + (36) =	52.7089 (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	96.9427	96.6340	96.3314	94.9102	94.6443	93.4065	93.4065	93.1773	93.8833	94.6443	95.1822	95.7446 (39)
Average = Sum(39)m / 12 =												94.9089 (39)
HLP	1.1352	1.1315	1.1280	1.1114	1.1082	1.0938	1.0938	1.0911	1.0993	1.1082	1.1145	1.1211 (40)
HLP (average)												1.1113 (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 4.1202

FULL SAP CALCULATION PRINTOUT

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	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 m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W

East	4.0700	19.6403	0.7100	0.7000	0.7700	27.5316 (76)
South	1.8000	46.7521	0.7100	0.7000	0.7700	28.9843 (78)
West	7.2600	19.6403	0.7100	0.7000	0.7700	49.1104 (80)

Solar gains	105.6263	197.3968	307.3770	428.4443	512.5358	520.3051	497.0664	434.4828	350.3314	229.1018	129.9199	88.0718 (83)
Total gains	508.2768	597.8298	693.1081	790.7203	850.9723	835.8423	798.2294	742.4842	670.7792	573.2216	500.9868	478.9748 (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	61.1759	61.3713	61.5641	62.4860	62.6615	63.4919	63.4919	63.6481	63.1694	62.6615	62.3074	61.9414
alpha	5.0784	5.0914	5.1043	5.1657	5.1774	5.2328	5.2328	5.2432	5.2113	5.1774	5.1538	5.1294
util living area	0.9981	0.9953	0.9857	0.9496	0.8519	0.6750	0.5070	0.5631	0.8240	0.9737	0.9958	0.9986 (86)
MIT	19.7742	19.9398	20.2121	20.5598	20.8280	20.9626	20.9930	20.9883	20.8945	20.5277	20.0878	19.7505 (87)
Th 2	19.9722	19.9752	19.9780	19.9916	19.9941	20.0059	20.0059	20.0081	20.0014	19.9941	19.9890	19.9836 (88)
util rest of house	0.9974	0.9936	0.9807	0.9315	0.8025	0.5862	0.3966	0.4489	0.7496	0.9608	0.9941	0.9981 (89)
MIT 2	18.3372	18.5809	18.9775	19.4788	19.8284	19.9816	20.0034	20.0034	19.9181	19.4449	18.8075	18.3108 (90)
Living area fraction	18.6716	18.8970	19.2648	19.7303	20.0610	20.2099	20.2337	20.2326	20.1453	19.6969	19.1054	18.6458 (92)
Temperature adjustment	18.5216	18.7470	19.1148	19.5803	19.9110	20.0599	20.0837	20.0826	19.9953	19.5469	18.9554	18.4958 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9960	0.9908	0.9747	0.9222	0.7978	0.5914	0.4054	0.4578	0.7491	0.9529	0.9915	0.9970 (94)
Ext temp.	506.2511	592.3197	675.5865	729.2180	678.9275	494.2783	323.6289	339.8802	502.4718	546.2334	496.7172	477.5462 (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	1378.6773	1338.0945	1215.1998	1013.6678	777.1235	509.9866	325.3962	343.1310	553.4688	846.7703	1128.4241	1368.7409 (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	649.0851	501.1606	401.4723	204.8038	73.0579	0.0000	0.0000	0.0000	0.0000	223.5995	454.8289	663.0488 (98)
												3171.0570 (98)
												37.1316 (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													3503.9304 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	649.0851	501.1606	401.4723	204.8038	73.0579	0.0000	0.0000	0.0000	0.0000	223.5995	454.8289	663.0488	(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)	717.2211	553.7687	443.6158	226.3025	80.7269	0.0000	0.0000	0.0000	0.0000	247.0712	502.5734	732.6506	(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	87.8432	87.5753	87.0003	85.6552	83.2839	80.4000	80.4000	80.4000	80.4000	85.7571	87.2996	87.9310	(217)
Fuel for water heating, kWh/month	234.3129	207.2238	217.3771	195.8302	194.9964	177.9023	170.4439	190.0050	192.1035	205.0833	214.6959	228.5217	(219)
Water heating fuel used												2428.4960	(219)
Annual totals kWh/year													
Space heating fuel - main system												3503.9304	(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 * 1.00 * 908 * 0.80) =										-581.0267		-581.0267	(233)
Total delivered energy for all uses												5807.8283	(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	3503.9304	0.2160	756.8490 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2428.4960	0.2160	524.5551 (264)
Space and water heating			1281.4041 (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	-581.0267	0.5190	-301.5529 (269)
Total CO2, kg/year			1216.7377 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			14.2500 (273)

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

DER		14.2500	ZC1
Total Floor Area		85.4000	
Assumed number of occupants		2.5574	
CO2 emission factor in Table 12 for electricity displaced from grid		0.5190	
CO2 emissions from appliances, equation (L14)		15.9841	ZC2
CO2 emissions from cooking, equation (L16)		2.1121	ZC3
Total CO2 emissions		32.3462	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		32.3462	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	88.7900	15.1500	73.6400	0.1800	13.2552			(29a)				
External Roof	42.7000		42.7000	0.1300	5.5510			(30)				
Total net area of external elements Aum(A, m2)			174.1900					(31)				
Fabric heat loss, W/K = Sum (A x U)				(26)... (30) + (32) =	44.1884			(33)				
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								250.0000 (35)				
Thermal bridges (Sum(L x Psi) calculated using Appendix K)								9.8704 (36)				
Total fabric heat loss						(33) + (36) =		54.0588 (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	96.7067	96.4596	96.2174	95.0797	94.8669	93.8760	93.8760	93.6925	94.2577	94.8669	95.2975	95.7476 (39)
Average = Sum(39)m / 12 =												95.0787 (39)
HLP	Jan 1.1324	Feb 1.1295	Mar 1.1267	Apr 1.1133	May 1.1109	Jun 1.0993	Jul 1.0993	Aug 1.0971	Sep 1.1037	Oct 1.1109	Nov 1.1159	Dec 1.1212 (40)
HLP (average)												1.1133 (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												
	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

Combi 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)
Total heat required for water heating calculated for each month	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)
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)
Output from w/h	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)
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 m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
East												4.0700	19.6403	0.6300	0.7000	0.7700	24.4294 (76)
South												1.8000	46.7521	0.6300	0.7000	0.7700	25.7185 (78)
West												7.2600	19.6403	0.6300	0.7000	0.7700	43.5768 (80)
Solar gains	93.7248	175.1549	272.7429	380.1689	454.7852	461.6791	441.0589	385.5270	310.8575	203.2875	115.2810	78.1482 (83)					
Total gains	496.3753	575.5879	658.4741	742.4449	793.2218	777.2164	742.2219	693.5284	631.3052	547.4073	486.3480	469.0512 (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	61.3252	61.4823	61.6370	62.3746	62.5145	63.1744	63.1744	63.2981	62.9185	62.5145	62.2320	61.9394	
alpha	5.0883	5.0988	5.1091	5.1583	5.1676	5.2116	5.2116	5.2199	5.1946	5.1676	5.1488	5.1293	
util living area	0.9983	0.9960	0.9885	0.9603	0.8790	0.7155	0.5446	0.6007	0.8508	0.9782	0.9964	0.9987	(86)
MIT	19.7649	19.9186	20.1780	20.5156	20.7950	20.9504	20.9902	20.9840	20.8744	20.5003	20.0704	19.7396	(87)
Th 2	19.9745	19.9768	19.9791	19.9899	19.9920	20.0014	20.0014	20.0032	19.9978	19.9920	19.9879	19.9836	(88)
util rest of house	0.9977	0.9946	0.9843	0.9452	0.8343	0.6261	0.4272	0.4809	0.7809	0.9673	0.9949	0.9983	(89)
MIT 2	18.3253	18.5512	18.9297	19.4181	19.7895	19.9682	19.9978	19.9966	19.8956	19.4055	18.7815	18.2948	(90)
Living area fraction	18.6603	18.8693	19.2201	19.6735	20.0235	20.1967	20.2287	20.2263	20.1233	19.6603	19.0814	18.6309	(92)
Temperature adjustment	18.6603	18.8693	19.2201	19.6735	20.0235	20.1967	20.2287	20.2263	20.1233	19.6603	19.0814	18.6309	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	494.6730	571.2525	645.3608	697.3983	663.0945	501.1465	337.4373	352.8756	499.3774	526.8232	482.8820	467.8350	(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	1388.7341	1347.4743	1223.8980	1024.3407	789.6206	525.3958	340.6455	358.4968	567.7466	859.5183	1141.7945	1381.7280	(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	665.1815	521.6210	430.4316	235.3986	94.1354	0.0000	0.0000	0.0000	0.0000	247.5251	474.4170	679.9364	(98)
Space heating													(98) / (4) =
Space heating per m2													39.2113 (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													3585.2748 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	665.1815	521.6210	430.4316	235.3986	94.1354	0.0000	0.0000	0.0000	0.0000	247.5251	474.4170	679.9364	(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)	712.1858	558.4808	460.8476	252.0327	100.7874	0.0000	0.0000	0.0000	0.0000	265.0162	507.9411	727.9833	(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	87.7906	87.5575	87.0575	85.9043	83.7328	80.3000	80.3000	80.3000	80.3000	85.9114	87.2908	87.8786	(216)
Fuel for water heating, kWh/month	234.4533	207.2660	217.2341	195.2624	193.9510	178.1238	170.6562	190.2417	192.3427	204.7148	214.7177	228.6579	(219)
Water heating fuel used													2427.6216 (219)
Annual totals kWh/year													
Space heating fuel - main system													3585.2748 (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													6469.3251 (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	3585.2748	0.2160	774.4194 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2427.6216	0.2160	524.3663 (264)
Space and water heating			1298.7856 (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			1535.6721 (272)
Emissions per m2 for space and water heating			15.2083 (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) = (15.2083 * 1.00) + 2.3180 + 0.4558, rounded to 2 d.p.			17.9800 (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	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 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	88.7900	15.1500	73.6400	0.2400	17.6736		(29a)
External Roof	42.7000		42.7000	0.1100	4.6970		(30)
Total net area of external elements Aum(A, m ²)			174.1900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	47.3028		(33)
Party Wall			52.3400	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)							5.4061 (36)
Total fabric heat loss						(33) + (36) =	52.7089 (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	95.3568	95.1097	94.8675	93.7298	93.5170	92.5261	92.5261	92.3426	92.9078	93.5170	93.9476	94.3977 (39)
Average = Sum(39)m / 12 =												93.7288 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1166	1.1137	1.1109	1.0975	1.0950	1.0834	1.0834	1.0813	1.0879	1.0950	1.1001	1.1054 (40)
HLP (average)												1.0975 (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



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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
East	4.0700	19.6403	0.7100	0.7000	0.7700	27.5316 (76)
South	1.8000	46.7521	0.7100	0.7000	0.7700	28.9843 (78)
West	7.2600	19.6403	0.7100	0.7000	0.7700	49.1104 (80)

Solar gains	105.6263	197.3968	307.3770	428.4443	512.5358	520.3051	497.0664	434.4828	350.3314	229.1018	129.9199	88.0718	(83)
Total gains	463.1747	553.5191	650.9827	751.4796	813.8324	801.3954	765.5186	706.8987	633.7530	533.2325	457.8446	434.6608	(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	62.1933	62.3549	62.5141	63.2729	63.4169	64.0960	64.0960	64.2234	63.8327	63.4169	63.1262	62.8252	
alpha	5.1462	5.1570	5.1676	5.2182	5.2278	5.2731	5.2731	5.2816	5.2555	5.2278	5.2084	5.1883	
util living area	0.9988	0.9966	0.9889	0.9573	0.8659	0.6929	0.5227	0.5839	0.8449	0.9800	0.9972	0.9991	(86)
MIT	19.7499	19.9155	20.1894	20.5395	20.8167	20.9589	20.9923	20.9866	20.8825	20.5001	20.0574	19.7232	(87)
Th 2	19.9873	19.9897	19.9920	20.0028	20.0049	20.0144	20.0144	20.0161	20.0107	20.0049	20.0008	19.9965	(88)
util rest of house	0.9983	0.9955	0.9848	0.9414	0.8192	0.6044	0.4104	0.4676	0.7745	0.9699	0.9961	0.9988	(89)
MIT 2	18.8438	19.0109	19.2844	19.6329	19.8827	19.9959	20.0124	20.0124	19.9458	19.6024	19.1618	18.8245	(90)
Living area fraction									fLA = Living area / (4) =			0.2327	(91)
MIT	19.0546	19.2214	19.4950	19.8438	20.1000	20.2199	20.2404	20.2391	20.1638	19.8113	19.3702	19.0336	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0546	19.2214	19.4950	19.8438	20.1000	20.2199	20.2404	20.2391	20.1638	19.8113	19.3702	19.0336	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	462.1524	550.3454	639.4239	705.1684	670.7770	500.0044	334.3317	349.8309	498.7073	515.7991	455.5870	433.9672	(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	1406.9533	1362.0994	1232.7984	1025.7636	785.5456	519.9903	336.8324	354.5080	563.3728	861.4087	1152.7549	1400.2594	(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	702.9319	545.4987	441.4706	230.8291	85.3878	0.0000	0.0000	0.0000	0.0000	257.1336	501.9609	718.9214	(98)
Space heating												3484.1339	(98)
Space heating per m2										(98) / (4) =		40.7978	(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	869.7452	684.6930	701.8037	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9033	0.9509	0.9312	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	785.6808	651.0487	653.4951	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1032.9949	989.0890	922.3480	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	178.0662	251.5020	200.0266	0.0000	0.0000	0.0000	0.0000	(104)

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Space cooling												629.5947 (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	44.5165	62.8755	50.0066	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												157.3987 (107)
Space cooling per m2												1.8431 (108)
Energy for space heating												40.7978 (99)
Energy for space cooling												1.8431 (108)
Total												42.6409 (109)
Dwelling Fabric Energy Efficiency (DFEE)												42.6 (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	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Air changes per hour					
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1364 (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	88.7900	15.1500	73.6400	0.1800	13.2552			(29a)				
External Roof	42.7000		42.7000	0.1300	5.5510			(30)				
Total net area of external elements Aum(A, m2)			174.1900					(31)				
Fabric heat loss, W/K = Sum (A x U)				(26)... (30) + (32) =	44.1884			(33)				
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								250.0000 (35)				
Thermal bridges (Sum(L x Psi) calculated using Appendix K)								9.8704 (36)				
Total fabric heat loss						(33) + (36) =		54.0588 (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	96.7067	96.4596	96.2174	95.0797	94.8669	93.8760	93.8760	93.6925	94.2577	94.8669	95.2975	95.7476 (39)
Average = Sum(39)m / 12 =												95.0787 (39)
HLP	Jan 1.1324	Feb 1.1295	Mar 1.1267	Apr 1.1133	May 1.1109	Jun 1.0993	Jul 1.0993	Aug 1.0971	Sep 1.1037	Oct 1.1109	Nov 1.1159	Dec 1.1212 (40)
HLP (average)												1.1133 (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)
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	Specific data or Table 6b	Specific data or Table 6c	FF	Access factor Table 6d	Gains W
East	4.0700	19.6403	0.6300		0.7000	0.7700	24.4294 (76)
South	1.8000	46.7521	0.6300		0.7000	0.7700	25.7185 (78)
West	7.2600	19.6403	0.6300		0.7000	0.7700	43.5768 (80)

Solar gains	93.7248	175.1549	272.7429	380.1689	454.7852	461.6791	441.0589	385.5270	310.8575	203.2875	115.2810	78.1482 (83)
Total gains	451.2731	531.2772	616.3487	703.2042	756.0819	742.7695	709.5111	657.9429	594.2791	507.4182	443.2058	424.7372 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	61.3252	61.4823	61.6370	62.3746	62.5145	63.1744	63.1744	63.2981	62.9185	62.5145	62.2320	61.9394	
alpha	5.0883	5.0988	5.1091	5.1583	5.1676	5.2116	5.2116	5.2199	5.1946	5.1676	5.1488	5.1293	
util living area	0.9989	0.9972	0.9913	0.9678	0.8951	0.7390	0.5671	0.6283	0.8739	0.9841	0.9976	0.9992 (86)	
MIT	19.7156	19.8706	20.1340	20.4797	20.7724	20.9424	20.9882	20.9805	20.8547	20.4603	20.0235	19.6909 (87)	
Th 2	19.9745	19.9768	19.9791	19.9899	19.9920	20.0014	20.0014	20.0032	19.9978	19.9920	19.9879	19.9836 (88)	
util rest of house	0.9985	0.9963	0.9881	0.9551	0.8540	0.6500	0.4462	0.5053	0.8093	0.9758	0.9966	0.9989 (89)	
MIT 2	18.7993	18.9557	19.2194	19.5661	19.8359	19.9745	19.9984	19.9975	19.9147	19.5535	19.1176	18.7819 (90)	
Living area fraction									fLA = Living area / (4) =			0.2327 (91)	
MIT	19.0125	19.1686	19.4322	19.7787	20.0538	20.1997	20.2287	20.2262	20.1334	19.7645	19.3283	18.9934 (92)	
Temperature adjustment												0.0000	
adjusted MIT	19.0125	19.1686	19.4322	19.7787	20.0538	20.1997	20.2287	20.2262	20.1334	19.7645	19.3283	18.9934 (93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9980	0.9952	0.9859	0.9518	0.8569	0.6691	0.4746	0.5342	0.8196	0.9733	0.9957	0.9985 (94)	
Useful gains	450.3786	528.7250	607.6387	669.2947	647.8921	496.9693	336.7366	351.4705	487.0504	493.8562	441.3081	424.1198 (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	1422.7927	1376.3426	1244.3029	1034.3439	792.4954	525.6772	340.6456	358.4869	568.6932	869.4075	1165.3303	1416.4343 (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	723.4761	569.5990	473.6781	262.8354	107.5849	0.0000	0.0000	0.0000	0.0000	279.4101	521.2959	738.2820 (98)	
Space heating												3676.1616 (98)	
Space heating per m2										(98) / (4) =		43.0464 (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	882.4344	694.6824	712.0631	0.0000	0.0000	0.0000	0.0000 (100)	
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8739	0.9323	0.9088	0.0000	0.0000	0.0000	0.0000 (101)	
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	771.1294	647.6454	647.1250	0.0000	0.0000	0.0000	0.0000 (102)	
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	964.4711	923.6257	865.1269	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	139.2060	205.3294	162.1934	0.0000	0.0000	0.0000	0.0000 (104)	
Space cooling												506.7288 (104)	

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 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	34.8015	51.3323	40.5484	0.0000	0.0000	0.0000 (107)
Space cooling											126.6822 (107)
Space cooling per m2											1.4834 (108)
Energy for space heating											43.0464 (99)
Energy for space cooling											1.4834 (108)
Total											44.5298 (109)
Target Fabric Energy Efficiency (TFEE)											51.2 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF HEAT DEMAND 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	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	88.7900	15.1500	73.6400	0.2400	17.6736		(29a)
External Roof	42.7000		42.7000	0.1100	4.6970		(30)
Total net area of external elements Aum(A, m ²)			174.1900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	47.3028		(33)
Party Wall			52.3400	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)							5.4061 (36)
Total fabric heat loss						(33) + (36) =	52.7089 (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	98.5778	96.9427	96.0349	95.1822	95.7446	94.3845	94.9102	94.3845	94.9102	96.0349	96.3314	96.9427 (39)
Average = Sum(39)m / 12 =												95.8650 (39)
HLP	1.1543	1.1352	1.1245	1.1145	1.1211	1.1052	1.1114	1.1052	1.1114	1.1245	1.1280	1.1352 (40)
HLP (average)												1.1225 (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 HEAT DEMAND 09 Jan 2014

If cylinder contains dedicated solar storage												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	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)												
RHI water heating demand												
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)
(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		Specific data or Table 6c	FF	Access factor Table 6d		Gains W	
East				4.0700	27.3735	0.7100			0.7000	0.7700		38.3719 (76)	
South				1.8000	61.3950	0.7100			0.7000	0.7700		38.0623 (78)	
West				7.2600	27.3735	0.7100			0.7000	0.7700		68.4473 (80)	
Solar gains	144.8815	226.0542	351.4120	508.4008	588.0733	641.2775	608.7097	534.4776	430.1811	282.2260	170.8627	117.1685	(83)
Total gains	736.0767	812.5870	914.9025	1036.4349	1079.8218	1100.5706	1049.5228	984.5741	901.0644	788.7824	716.8124	692.5105	(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	60.1612	61.1759	61.7542	62.3074	61.9414	62.8340	62.4860	62.8340	62.4860	61.7542	61.5641	61.1759	
alpha	5.0107	5.0784	5.1169	5.1538	5.1294	5.1889	5.1657	5.1889	5.1657	5.1169	5.1043	5.0784	
util living area	0.9854	0.9763	0.9439	0.8491	0.6755	0.4585	0.3159	0.3158	0.5551	0.8505	0.9650	0.9878	(86)
MIT	20.1505	20.2714	20.5217	20.7941	20.9491	20.9944	20.9993	20.9994	20.9863	20.8393	20.4874	20.1508	(87)
Th 2	19.9567	19.9722	19.9809	19.9890	19.9836	19.9966	19.9916	19.9966	19.9916	19.9809	19.9780	19.9722	(88)
util rest of house	0.9804	0.9687	0.9265	0.8085	0.6053	0.3756	0.2252	0.2201	0.4579	0.7951	0.9512	0.9835	(89)
MIT 2	18.8722	19.0560	19.4129	19.7751	19.9437	19.9939	19.9914	19.9965	19.9847	19.8332	19.3704	18.8846	(90)
Living area fraction	19.1696	19.3387	19.6709	20.0122	20.1776	20.2267	20.2259	20.2298	20.2178	20.0673	19.6303	19.1792	(91)
MIT	19.0196	19.1887	19.5209	19.8622	20.0276	20.0767	20.0759	20.0798	20.0678	19.9173	19.4803	19.0292	(92)
Temperature adjustment													
adjusted MIT	19.0196	19.1887	19.5209	19.8622	20.0276	20.0767	20.0759	20.0798	20.0678	19.9173	19.4803	19.0292	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9743	0.9611	0.9168	0.8027	0.6085	0.3823	0.2329	0.2281	0.4655	0.7911	0.9424	0.9781	(94)
Ext temp.	717.1627	780.9372	838.7967	831.9721	657.0484	420.7136	244.3821	224.5378	419.4200	624.0069	675.5169	677.3326	(95)
Heat loss rate W	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)
Month fracti	1303.1586	1278.5518	1154.4278	957.7441	682.4323	422.5304	244.4831	224.6188	424.0370	712.3171	1009.5842	1263.0882	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating	435.9809	334.3970	234.8295	90.5558	18.8856	0.0000	0.0000	0.0000	0.0000	65.7028	240.5284	435.8021	(98)
RHI space heating demand												1856.6823	(98)
												1857	(98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	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	88.7900	15.1500	73.6400	0.2400	17.6736		(29a)
External Roof	42.7000		42.7000	0.1100	4.6970		(30)
Total net area of external elements Aum(A, m ²)			174.1900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	47.3028		(33)
Party Wall			52.3400	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)							5.4061 (36)
Total fabric heat loss						(33) + (36) =	52.7089 (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	96.9427	96.6340	96.3314	94.9102	94.6443	93.4065	93.4065	93.1773	93.8833	94.6443	95.1822	95.7446 (39)
Average = Sum(39)m / 12 =												94.9089 (39)
HLP	1.1352	1.1315	1.1280	1.1114	1.1082	1.0938	1.0938	1.0911	1.0993	1.1082	1.1145	1.1211 (40)
HLP (average)												1.1113 (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	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	29.0271	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
East				4.0700	19.6403		0.7100		0.7000		0.7700		27.5316 (76)
South				1.8000	46.7521		0.7100		0.7000		0.7700		28.9843 (78)
West				7.2600	19.6403		0.7100		0.7000		0.7700		49.1104 (80)
Solar gains	105.6263	197.3968	307.3770	428.4443	512.5358	520.3051	497.0664	434.4828	350.3314	229.1018	129.9199	88.0718	(83)
Total gains	696.8215	783.9296	870.8674	956.4785	1004.2843	979.5981	937.8795	884.5793	821.2147	735.6582	675.8696	663.4137	(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	61.1759	61.3713	61.5641	62.4860	62.6615	63.4919	63.4919	63.6481	63.1694	62.6615	62.3074	61.9414
alpha	5.0784	5.0914	5.1043	5.1657	5.1774	5.2328	5.2328	5.2432	5.2113	5.1774	5.1538	5.1294
util living area	0.9921	0.9846	0.9642	0.9039	0.7783	0.5914	0.4349	0.4789	0.7260	0.9330	0.9844	0.9937 (86)
MIT	19.9771	20.1350	20.3849	20.6856	20.8907	20.9795	20.9966	20.9944	20.9428	20.6698	20.2720	19.9506 (87)
Th 2	19.9722	19.9752	19.9780	19.9916	19.9941	20.0059	20.0059	20.0081	20.0014	19.9941	19.9890	19.9836 (88)
util rest of house	0.9896	0.9798	0.9530	0.8752	0.7207	0.5075	0.3384	0.3786	0.6437	0.9062	0.9787	0.9917 (89)
MIT 2	18.6321	18.8622	19.2205	19.6418	19.8947	19.9933	20.0047	20.0060	19.9601	19.6330	19.0724	18.6020 (90)
Living area fraction	18.9451	19.1584	19.4914	19.8847	20.1265	20.2228	20.2355	20.2360	20.1887	19.8743	19.3515	18.9158 (92)
Temperature adjustment	18.7951	19.0084	19.3414	19.7347	19.9765	20.0728	20.0855	20.0860	20.0387	19.7243	19.2015	18.7658 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	686.7091	763.3124	822.1792	828.8509	722.6390	502.9195	324.7305	341.9730	531.3939	660.0592	657.2737	655.6355 (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	1405.1890	1363.3459	1237.0345	1028.3197	783.3192	511.1931	325.5691	343.4497	557.5487	863.5590	1151.8517	1394.5923 (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	534.5491	403.2226	308.6523	143.6176	45.1460	0.0000	0.0000	0.0000	0.0000	151.4038	356.0961	549.7838 (98)
Space heating	2492.4713 (98)											
Space heating per m ²	29.1858 (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													2754.1120 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	534.5491	403.2226	308.6523	143.6176	45.1460	0.0000	0.0000	0.0000	0.0000	151.4038	356.0961	549.7838	(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)	590.6620	445.5498	341.0523	158.6934	49.8851	0.0000	0.0000	0.0000	0.0000	167.2971	393.4764	607.4959	(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	87.4461	87.1038	86.3774	84.7635	82.4003	80.4000	80.4000	80.4000	80.4000	84.7770	86.7424	87.5560	(216)
Fuel for water heating, kWh/month	235.3771	208.3455	218.9446	197.8903	197.0873	177.9023	170.4439	190.0050	192.1035	207.4543	216.0751	229.5004	(219)
Water heating fuel used												2441.1294	(219)
Annual totals kWh/year													
Space heating fuel - main system												2754.1120	(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 * 1.00 * 908 * 0.80) =										-581.0267		-581.0267	(233)
Total delivered energy for all uses												5070.6433	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2754.1120	3.4800	95.8431 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2441.1294	3.4800	84.9513 (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	-581.0267	13.1900	-76.6374 (252)
Total energy cost			284.3599 (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] =	0.9159 (257)
SAP value		87.2234
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	2754.1120	0.2160	594.8882 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2441.1294	0.2160	527.2840 (264)
Space and water heating			1122.1721 (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	-581.0267	0.5190	-301.5529 (269)
Total kg/year			1057.5057 (272)
CO2 emissions per m2			12.3800 (273)
EI value			89.1330
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	$3.48 / 0.8406 = 4.140$, stars = 4
Water heating environmental impact	$0.216 / 0.8406 = 0.2569$, stars = 4

Regs Region: England

Elmhurst Energy Systems

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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

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	88.7900	15.1500	73.6400	0.2400	17.6736		(29a)
External Roof	42.7000		42.7000	0.1100	4.6970		(30)
Total net area of external elements Aum(A, m ²)			174.1900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	47.3028		(33)
Party Wall			52.3400	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)							5.4061 (36)
Total fabric heat loss						(33) + (36) =	52.7089 (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	98.5778	96.9427	96.0349	95.1822	95.7446	94.3845	94.9102	94.3845	94.9102	96.0349	96.3314	96.9427 (39)
Average = Sum(39)m / 12 =												95.8650 (39)
HLP	1.1543	1.1352	1.1245	1.1145	1.1211	1.1052	1.1114	1.1052	1.1114	1.1245	1.1280	1.1352 (40)
HLP (average)												1.1225 (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
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FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	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
East				4.0700	27.3735	0.7100	0.7000			0.7700			38.3719 (76)
South				1.8000	61.3950	0.7100	0.7000			0.7700			38.0623 (78)
West				7.2600	27.3735	0.7100	0.7000			0.7700			68.4473 (80)
Solar gains	144.8815	226.0542	351.4120	508.4008	588.0733	641.2775	608.7097	534.4776	430.1811	282.2260	170.8627	117.1685	(83)
Total gains	736.0767	812.5870	914.9025	1036.4349	1079.8218	1100.5706	1049.5228	984.5741	901.0644	788.7824	716.8124	692.5105	(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	60.1612	61.1759	61.7542	62.3074	61.9414	62.8340	62.4860	62.8340	62.4860	61.7542	61.5641	61.1759
alpha	5.0107	5.0784	5.1169	5.1538	5.1294	5.1889	5.1657	5.1889	5.1657	5.1169	5.1043	5.0784
util living area	0.9854	0.9763	0.9439	0.8491	0.6755	0.4585	0.3159	0.3158	0.5551	0.8505	0.9650	0.9878 (86)
MIT	20.1505	20.2714	20.5217	20.7941	20.9491	20.9944	20.9993	20.9994	20.9863	20.8393	20.4874	20.1508 (87)
Th 2	19.9567	19.9722	19.9809	19.9890	19.9836	19.9966	19.9916	19.9966	19.9916	19.9809	19.9780	19.9722 (88)
util rest of house	0.9804	0.9687	0.9265	0.8085	0.6053	0.3756	0.2252	0.2201	0.4579	0.7951	0.9512	0.9835 (89)
MIT 2	18.8722	19.0560	19.4129	19.7751	19.9437	19.9939	19.9914	19.9965	19.9847	19.8332	19.3704	18.8846 (90)
Living area fraction	19.1696	19.3387	19.6709	20.0122	20.1776	20.2267	20.2259	20.2298	20.2178	20.0673	19.6303	19.1792 (92)
Temperature adjustment	19.0196	19.1887	19.5209	19.8622	20.0276	20.0767	20.0759	20.0798	20.0678	19.9173	19.4803	19.0292 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9743	0.9611	0.9168	0.8027	0.6085	0.3823	0.2329	0.2281	0.4655	0.7911	0.9424	0.9781 (94)
Ext temp.	717.1627	780.9372	838.7967	831.9721	657.0484	420.7136	244.3821	224.5378	419.4200	624.0069	675.5169	677.3326 (95)
Heat loss rate W	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)
Month fracti	1303.1586	1278.5518	1154.4278	957.7441	682.4323	422.5304	244.4831	224.6188	424.0370	712.3171	1009.5842	1263.0882 (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 m2	435.9809	334.3970	234.8295	90.5558	18.8856	0.0000	0.0000	0.0000	0.0000	65.7028	240.5284	435.8021 (98)
												1856.6823 (98)
												21.7410 (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													2051.5826 (211)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	435.9809	334.3970	234.8295	90.5558	18.8856	0.0000	0.0000	0.0000	0.0000	65.7028	240.5284	435.8021	(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)	481.7469	369.4994	259.4802	100.0617	20.8681	0.0000	0.0000	0.0000	0.0000	72.5998	265.7772	481.5493	(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	86.9952	86.6699	85.6976	83.6739	81.3457	80.4000	80.4000	80.4000	80.4000	82.9168	85.7806	87.0491	(216)
Fuel for water heating, kWh/month	236.5969	209.3887	220.6813	200.4672	199.6425	177.9023	170.4439	190.0050	192.1035	212.1084	218.4979	230.8369	(219)
Water heating fuel used												2458.6744	(219)
Annual totals kWh/year													
Space heating fuel - main system												2051.5826	(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 * 1.00 * 1118 * 0.80) =										-715.7687		-715.7687	(233)
Total delivered energy for all uses												4250.9169	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2051.5826	3.9700	81.4478 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2458.6744	3.9700	97.6094 (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	-715.7687	18.2700	-130.7709 (252)
Total energy cost			221.6758 (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	2051.5826	0.2160	443.1418 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2458.6744	0.2160	531.0737 (264)
Space and water heating			974.2155 (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	-715.7687	0.5190	-371.4840 (269)
Total kg/year			839.6180 (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	2051.5826	1.2200	2502.9308 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2458.6744	1.2200	2999.5827 (264)
Space and water heating			5502.5135 (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	-715.7687	3.0700	-2197.4099 (269)
Primary energy kWh/year			4706.3395 (272)
Primary energy kWh/m2/year			55.1094 (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	-215 kg (25.6%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£35	2.51 kg/m²	B 89
Total Savings	£35	2.51 kg/m²	B 91

Potential energy efficiency rating: B 89
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	£269	£225	£44
Space heating	£185	£185	£0
Water heating	£98	£63	£35
Lighting	£70	£70	£0
Generated (PV)	-£131	-£131	£0
Total cost of fuels	£221	£187	£35
Total cost of uses	£222	£187	£35
Delivered energy	50 kWh/m²	37 kWh/m²	12 kWh/m²
Carbon dioxide emissions	0.8 tonnes	0.6 tonnes	0.2 tonnes
CO2 emissions per m²	10 kg/m²	7 kg/m²	3 kg/m²
Primary energy	55 kWh/m²	41 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)
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	88.7900	15.1500	73.6400	0.2400	17.6736		(29a)
External Roof	42.7000		42.7000	0.1100	4.6970		(30)
Total net area of external elements Aum(A, m ²)			174.1900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	47.3028		(33)
Party Wall			52.3400	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)							5.4061 (36)
Total fabric heat loss						(33) + (36) =	52.7089 (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	96.9427	96.6340	96.3314	94.9102	94.6443	93.4065	93.4065	93.1773	93.8833	94.6443	95.1822	95.7446 (39)
Average = Sum(39)m / 12 =												94.9089 (39)
HLP	1.1352	1.1315	1.1280	1.1114	1.1082	1.0938	1.0938	1.0911	1.0993	1.1082	1.1145	1.1211 (40)
HLP (average)												1.1113 (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	
East				4.0700	19.6403	0.7100		0.7000		0.7700		27.5316 (76)	
South				1.8000	46.7521	0.7100		0.7000		0.7700		28.9843 (78)	
West				7.2600	19.6403	0.7100		0.7000		0.7700		49.1104 (80)	
Solar gains	105.6263	197.3968	307.3770	428.4443	512.5358	520.3051	497.0664	434.4828	350.3314	229.1018	129.9199	88.0718	(83)
Total gains	696.8215	783.9296	870.8674	956.4785	1004.2843	979.5981	937.8795	884.5793	821.2147	735.6582	675.8696	663.4137	(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	61.1759	61.3713	61.5641	62.4860	62.6615	63.4919	63.4919	63.6481	63.1694	62.6615	62.3074	61.9414	
alpha	5.0784	5.0914	5.1043	5.1657	5.1774	5.2328	5.2328	5.2432	5.2113	5.1774	5.1538	5.1294	
util living area	0.9921	0.9846	0.9642	0.9039	0.7783	0.5914	0.4349	0.4789	0.7260	0.9330	0.9844	0.9937	(86)
MIT	19.9771	20.1350	20.3849	20.6856	20.8907	20.9795	20.9966	20.9944	20.9428	20.6698	20.2720	19.9506	(87)
Th 2	19.9722	19.9752	19.9780	19.9916	19.9941	20.0059	20.0059	20.0081	20.0014	19.9941	19.9890	19.9836	(88)
util rest of house	0.9896	0.9798	0.9530	0.8752	0.7207	0.5075	0.3384	0.3786	0.6437	0.9062	0.9787	0.9917	(89)
MIT 2	18.6321	18.8622	19.2205	19.6418	19.8947	19.9933	20.0047	20.0060	19.9601	19.6330	19.0724	18.6020	(90)
Living area fraction									fLA = Living area / (4) =			0.2327	(91)
MIT	18.9451	19.1584	19.4914	19.8847	20.1265	20.2228	20.2355	20.2360	20.1887	19.8743	19.3515	18.9158	(92)
Temperature adjustment												-0.1500	
adjusted MIT	18.7951	19.0084	19.3414	19.7347	19.9765	20.0728	20.0855	20.0860	20.0387	19.7243	19.2015	18.7658	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9855	0.9737	0.9441	0.8666	0.7196	0.5134	0.3462	0.3866	0.6471	0.8972	0.9725	0.9883	(94)

Regs Region: England

Elmhurst Energy Systems

SAP2012 Calculator (Design

System) version 4.1202

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Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Useful gains	686.7091	763.3124	822.1792	828.8509	722.6390	502.9195	324.7305	341.9730	531.3939	660.0592	657.2737	655.6355 (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												
Month fracti	1405.1890	1363.3459	1237.0345	1028.3197	783.3192	511.1931	325.5691	343.4497	557.5487	863.5590	1151.8517	1394.5923 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating	534.5491	403.2226	308.6523	143.6176	45.1460	0.0000	0.0000	0.0000	0.0000	151.4038	356.0961	549.7838 (98)
Space heating per m2											(98) / (4) =	29.1858 (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												2754.1120 (211)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	534.5491	403.2226	308.6523	143.6176	45.1460	0.0000	0.0000	0.0000	0.0000	151.4038	356.0961	549.7838 (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)	590.6620	445.5498	341.0523	158.6934	49.8851	0.0000	0.0000	0.0000	0.0000	167.2971	393.4764	607.4959 (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	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	87.7117	87.6588	87.4461	86.8065	85.1017	80.4000	80.4000	80.4000	80.4000	85.6731	87.1344	80.4000 (216)
Fuel for water heating, kWh/month	206.4738	159.9562	135.9078	84.7397	54.1120	35.6249	30.0468	67.3394	96.0316	143.7166	181.4433	87.7774 (217)
Water heating fuel used												205.3485 (219)
Annual totals kWh/year												1400.7407 (219)
Space heating fuel - main system												2754.1120 (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 * 1.00 * 908 * 0.80) =									-581.0267			-581.0267 (233)
Total delivered energy for all uses												4080.2546 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2754.1120	3.4800	95.8431 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1400.7407	3.4800	48.7458 (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	-581.0267	13.1900	-76.6374 (252)
Total energy cost			254.7494 (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] =	0.8205 (257)
SAP value		88.5539
SAP rating (Section 12)		89 (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	2754.1120	0.2160	594.8882 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1400.7407	0.2160	302.5600 (264)
Space and water heating			897.4482 (265)

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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	-581.0267	0.5190	-301.5529 (269)
Total kg/year			858.7318 (272)
CO2 emissions per m2			10.0600 (273)
EI value			91.1756
EI rating			91 (274)
EI band			B

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	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	88.7900	15.1500	73.6400	0.2400	17.6736		(29a)
External Roof	42.7000		42.7000	0.1100	4.6970		(30)
Total net area of external elements Aum(A, m ²)			174.1900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	47.3028		(33)
Party Wall			52.3400	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)							5.4061 (36)
Total fabric heat loss						(33) + (36) =	52.7089 (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	98.5778	96.9427	96.0349	95.1822	95.7446	94.3845	94.9102	94.3845	94.9102	96.0349	96.3314	96.9427 (39)
Average = Sum(39)m / 12 =												95.8650 (39)
HLP	1.1543	1.1352	1.1245	1.1145	1.1211	1.1052	1.1114	1.1052	1.1114	1.1245	1.1280	1.1352 (40)
HLP (average)												1.1225 (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)

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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	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		-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
East				4.0700	27.3735		0.7100		0.7000		0.7700		38.3719 (76)
South				1.8000	61.3950		0.7100		0.7000		0.7700		38.0623 (78)
West				7.2600	27.3735		0.7100		0.7000		0.7700		68.4473 (80)
Solar gains	144.8815	226.0542	351.4120	508.4008	588.0733	641.2775	608.7097	534.4776	430.1811	282.2260	170.8627		117.1685 (83)
Total gains	736.0767	812.5870	914.9025	1036.4349	1079.8218	1100.5706	1049.5228	984.5741	901.0644	788.7824	716.8124		692.5105 (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	60.1612	61.1759	61.7542	62.3074	61.9414	62.8340	62.4860	62.8340	62.4860	61.7542	61.5641	61.1759					
alpha	5.0107	5.0784	5.1169	5.1538	5.1294	5.1889	5.1657	5.1889	5.1657	5.1169	5.1043	5.0784					
util living area	0.9854	0.9763	0.9439	0.8491	0.6755	0.4585	0.3159	0.3158	0.5551	0.8505	0.9650	0.9878					(86)
MIT	20.1505	20.2714	20.5217	20.7941	20.9491	20.9944	20.9993	20.9994	20.9863	20.8393	20.4874	20.1508					(87)
Th 2	19.9567	19.9722	19.9809	19.9890	19.9836	19.9966	19.9916	19.9966	19.9916	19.9809	19.9780	19.9722					(88)
util rest of house	0.9804	0.9687	0.9265	0.8085	0.6053	0.3756	0.2252	0.2201	0.4579	0.7951	0.9512	0.9835					(89)
MIT 2	18.8722	19.0560	19.4129	19.7751	19.9437	19.9939	19.9914	19.9965	19.9847	19.8332	19.3704	18.8846					(90)
Living area fraction																	
MIT	19.1696	19.3387	19.6709	20.0122	20.1776	20.2267	20.2259	20.2298	20.2178	20.0673	19.6303	19.1792					(92)
Temperature adjustment																	
adjusted MIT	19.0196	19.1887	19.5209	19.8622	20.0276	20.0767	20.0759	20.0798	20.0678	19.9173	19.4803	19.0292					(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
	0.9743	0.9611	0.9168	0.8027	0.6085	0.3823	0.2329	0.2281	0.4655	0.7911	0.9424	0.9781					(94)

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Useful gains	717.1627	780.9372	838.7967	831.9721	657.0484	420.7136	244.3821	224.5378	419.4200	624.0069	675.5169	677.3326 (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	1303.1586	1278.5518	1154.4278	957.7441	682.4323	422.5304	244.4831	224.6188	424.0370	712.3171	1009.5842	1263.0882 (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	435.9809	334.3970	234.8295	90.5558	18.8856	0.0000	0.0000	0.0000	0.0000	65.7028	240.5284	435.8021 (98)
Space heating												1856.6823 (98)
Space heating per m2										(98) / (4) =		21.7410 (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												2051.5826 (211)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	435.9809	334.3970	234.8295	90.5558	18.8856	0.0000	0.0000	0.0000	0.0000	65.7028	240.5284	435.8021 (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)	481.7469	369.4994	259.4802	100.0617	20.8681	0.0000	0.0000	0.0000	0.0000	72.5998	265.7772	481.5493 (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	87.3430	87.2639	86.8391	85.8186	83.1457	80.4000	80.4000	80.4000	80.4000	83.7257	86.2755	80.4000 (216)
(217)m	87.3430	87.2639	86.8391	85.8186	83.1457	80.4000	80.4000	80.4000	80.4000	83.7257	86.2755	87.3333 (217)
Fuel for water heating, kWh/month	201.6436	160.5052	136.5855	80.9890	54.0499	23.5653	19.1403	57.3019	88.5022	142.0081	178.0792	202.4807 (219)
Water heating fuel used												1344.8510 (219)
Annual totals kWh/year												
Space heating fuel - main system												2051.5826 (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 * 1.00 * 1118 * 0.80) =									-715.7687			-715.7687 (233)
Total delivered energy for all uses												3187.0935 (238)

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

	Fuel	Fuel price	Fuel cost
	kWh/year	p/kWh	f/year
Space heating - main system 1	2051.5826	3.9700	81.4478 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1344.8510	3.9700	53.3906 (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	-715.7687	18.2700	-130.7709 (252)
Total energy cost			186.5920 (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	2051.5826	0.2160	443.1418 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1344.8510	0.2160	290.4878 (264)
Space and water heating			733.6297 (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	-715.7687	0.5190	-371.4840 (269)
Total kg/year			624.9822 (272)

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	2051.5826	1.2200	2502.9308 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1344.8510	1.2200	1640.7182 (264)
Space and water heating			4143.6490 (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	-715.7687	3.0700	-2197.4099 (269)
Primary energy kWh/year			3500.9750 (272)
Primary energy kWh/m2/year			40.9950 (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	52.71 (37)
Summer heat loss coefficient	342.98 (P2)

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

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

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
East	4.0700	125.2818	0.7100	0.7000	0.9000	205.2692
South	1.8000	118.5567	0.7100	0.7000	0.9000	85.9092
West	7.2600	125.2818	0.7100	0.7000	0.9000	366.1558

total: 657.3343

	Jun	Jul	Aug	
Solar gains	705	657	587	(P3)
Internal gains	456	438	447	
Total summer gains	1161	1095	1034	(P5)
Summer gain/loss ratio	3.39	3.19	3.02	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 250.0)	0.25	0.25	0.25	
Threshold temperature	19.04	20.74	20.57	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	

Assessment of likelihood of high internal temperature: Slight

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF STANDARD ENE7 CO2 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	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												
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	88.7900	15.1500	73.6400	0.2400	17.6736		(29a)
External Roof	42.7000		42.7000	0.1100	4.6970		(30)
Total net area of external elements Aum(A, m ²)			174.1900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	47.3028		(33)
Party Wall			52.3400	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)							5.4061 (36)
Total fabric heat loss						(33) + (36) =	52.7089 (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	96.9427	96.6340	96.3314	94.9102	94.6443	93.4065	93.4065	93.1773	93.8833	94.6443	95.1822	95.7446 (39)
Average = Sum(39)m / 12 =												94.9089 (39)
HLP	1.1352	1.1315	1.1280	1.1114	1.1082	1.0938	1.0938	1.0911	1.0993	1.1082	1.1145	1.1211 (40)
HLP (average)												1.1113 (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:												
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
East				4.0700	19.6403	0.7100	0.7000	0.7700		27.5316 (76)
South				1.8000	46.7521	0.7100	0.7000	0.7700		28.9843 (78)
West				7.2600	19.6403	0.7100	0.7000	0.7700		49.1104 (80)
Solar gains	105.6263	197.3968	307.3770	428.4443	512.5358	520.3051	497.0664	434.4828	350.3314	229.1018 129.9199 88.0718 (83)
Total gains	564.0467	653.5997	749.4196	847.6821	908.5843	894.1046	856.4916	800.0963	727.7409	629.5331 556.7567 534.7446 (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	61.1759	61.3713	61.5641	62.4860	62.6615	63.4919	63.4919	63.6481	63.1694	62.6615	62.3074	61.9414	
alpha	5.0784	5.0914	5.1043	5.1657	5.1774	5.2328	5.2328	5.2432	5.2113	5.1774	5.1538	5.1294	
util living area	0.9969	0.9930	0.9802	0.9355	0.8245	0.6393	0.4744	0.5261	0.7865	0.9620	0.9933	0.9976	(86)
MIT	19.8348	19.9994	20.2689	20.6064	20.8548	20.9708	20.9949	20.9914	20.9163	20.5803	20.1477	19.8115	(87)
Th 2	19.9722	19.9752	19.9780	19.9916	19.9941	20.0059	20.0059	20.0081	20.0014	19.9941	19.9890	19.9836	(88)
util rest of house	0.9959	0.9906	0.9735	0.9137	0.7713	0.5520	0.3701	0.4176	0.7076	0.9446	0.9906	0.9969	(89)
MIT 2	18.9163	19.0821	19.3500	19.6835	19.9008	19.9933	20.0047	20.0058	19.9580	19.6678	19.2415	18.9023	(90)
Living area fraction									fLA = Living area / (4) =			0.2327	(91)
Ext temp.	19.1300	19.2956	19.5638	19.8982	20.1227	20.2207	20.2351	20.2351	20.1809	19.8801	19.4524	19.1138	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1300	19.2956	19.5638	19.8982	20.1227	20.2207	20.2351	20.2351	20.1809	19.8801	19.4524	19.1138	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9947	0.9886	0.9700	0.9113	0.7788	0.5717	0.3945	0.4430	0.7232	0.9421	0.9887	0.9959	(94)
Ext temp.	561.0757	646.1201	726.9627	772.4977	707.5851	511.1458	337.9164	354.4408	526.2938	593.0777	550.4721	532.5697	(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	1437.6613	1391.1000	1258.4524	1043.8423	797.1654	525.0141	339.5392	357.3486	570.8982	878.3098	1175.7263	1427.9173	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating	652.1796	500.6265	395.4283	195.3681	66.6477	0.0000	0.0000	0.0000	0.0000	212.2126	450.1830	666.1387	(98)
Space heating per m2												3138.7845	(98)
										(98) / (4) =		36.7539	(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	15.1700	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		33.2662 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		33.2662 ZC8

U-VALUE CALCULATOR REPORT

surecalc ltd

Property Reference	sc120970	Issued on Date	17/01/2020
Assessment Reference	001	Prop Type Ref	New Dwelling
Project	Plot 3, 15-17, Kew Gardens, Bognor Regis, West Sussex, PO21 5RD		
Calculation Type	New Build (As Designed)		

SAP Rating	87 B	DER	14.25	TER	17.98
Environmental	89 B	% DER < TER	20.75		
CO ₂ Emissions (t/year)	0.84	DREF	42.64	TREF	51.21
General Requirements Compliance	Pass	% DREF < TREF	16.73		

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	sc120970	Issued on Date	17/01/2020
Assessment Reference	001	Prop Type Ref	New Dwelling
Project	Plot 3, 15-17, Kew Gardens, Bognor Regis, West Sussex, PO21 5RD		
Calculation Type	New Build (As Designed)		

SAP Rating	87 B	DER	14.25	TBR	17.98
Environmental	89 B	% DER < TBR	20.75		
CO ₂ Emissions (t/year)	0.84	DREE	42.64	TREE	51.21
General Requirements Compliance	Pass	% DPER < TREE	16.73		

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

Building Elements

Wall 000001 - Vivid 100 Cavity Wall Thermabead

Wall Type: Standard Wall

Layer	Description	Thickness (mm)	Conductivity (W/m ² K)	Resistance (m ² K/W)	Fraction (%)
Ext surface				0.0400	
Layer 1	Brick, outer leaf				
	Main construction	102	0.7700	0.1325	82.81
	Main construction	102	0.9407	0.1084	17.19
Layer 2	Thermabead Diamond				
	Main construction	100	0.0320	3.1250	100.00
Corrections - Air Gap: Level 0, Fasteners: Wall ties, Cross sectional area: 12.50 mm ² , Lambda: 17.000 W/m.K, per m ² : 2.500					
Layer 3	Supabloc *4				
	Main construction	100	0.1600	0.6250	94.04
	Main construction	100	0.8803	0.1136	5.96
Corrections - Air Gap: Level 1, Fasteners: None or plastic					
Layer 4	airspace/plaster dabs				
	Main construction	15	0.1000	0.1500	80.00
	Main construction	15	0.0882	0.1700	20.00
Corrections - Cavity Unventilated, Emissivity: Normal					
Layer 5	Plasterboard, standard				
	Main construction	12.5	0.2100	0.0595	100.00
Int surface				0.1300	

Total resistance:	Upper limit = 4.227 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	sc120970	Issued on Date	17/01/2020
Assessment Reference	001	Prop Type Ref	New Dwelling
Project	Plot 3, 15-17, Kew Gardens, Bognor Regis, West Sussex, PO21 5RD		
Calculation Type	New Build (As Designed)		

SAP Rating	87 B	DER	14.25	TBR	17.98
Environmental	89 B	% DER < TBR	20.75		
CO ₂ Emissions (t/year)	0.84	DREE	42.64	TREE	51.21
General Requirements Compliance	Pass	% DPER < TPER	16.73		

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 = 17.24 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	sc120970	Issued on Date	17/01/2020
Assessment Reference	001	Prop Type Ref	New Dwelling
Property	Plot 3, 15-17, Kew Gardens, Bognor Regis, West Sussex, PO21 5RD		
SAP Rating	87 B	DER	14.25
Environmental	89 B	% DER<TER	20.75
CO ₂ Emissions (t/year)	0.84	DERE	42.64
General Requirements Compliance	Pass	% DERE<TERE	16.73
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	17.24	0.83	LABC Construction Detail
External wall	E6 Intermediate floor within a dwelling	Independently assessed	0.003	17.24	0.05	LABC Construction Detail
External wall	E10 Eaves (insulation at ceiling level)	Independently assessed	0.083	4.22	0.35	LABC Construction Detail
External wall	E12 Gable (insulation at ceiling level)	Independently assessed	0.054	14.38	0.78	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	10.30	0.45	LABC Construction Detail
Party wall	P1 Party wall - Ground floor	Independently assessed	0.043	10.16	0.44	LABC Construction Detail
Party wall	P2 Party wall - Intermediate floor within a dwelling	Table K1 - Default	0.000	10.16	0.00	
Party wall	P4 Party wall - Roof (insulation at ceiling level)	Independently assessed	0.036	10.16	0.37	LABC Construction Detail
External roof	R5 Ridge (inverted)	Table K1 - Default	0.040	1.00	0.04	

Total: 5.41 W/mK:
Y-Value: 0.031 W/m²K: