



SAP Report Submission for Building Regulations Compliance

Client: Vivid Design Studio

Project: Plot 4, 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	sc120971	Issued on Date	17/01/2020
Assessment Reference	001	Prop Type Ref	New Dwelling
Property	Plot 4, 15-17, Kew Gardens, Bognor Regis, West Sussex, PO21 5RD		

SAP Rating	87 B	DER	14.58	TER	18.28
Environmental	89 B	% DER<TER	20.25		
CO ₂ Emissions (t/year)	0.86	DFEE	44.06	TFEE	52.70
General Requirements Compliance	Pass	% DFEE<TFEE	16.41		

Assessor Details	Mr. Mark Rogers, Surecalc Limited, T[REDACTED] 95,	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	14.58	kgCO ₂ /yr/m ²
TER	18.28	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	14.58	kgCO ₂ /yr/m ²
Reduction DER/TER	20.25	%
CfSH ENE1 credits achieved	3.0	
CfSH ENE1 level achieved	4	

ENE 2 - Fabric Energy Efficiency calculation

Dwelling type	House, Semi-Detached
Fabric energy efficiency (F.E.E.)	44.06 kWh/m ² /yr
CfSH ENE2 credits achieved	7.4
CfSH ENE1 and 2 overall level achieved	4

ENE 7 - Low and Zero Carbon Technologies calculation

Standard case CO₂ emissions

Total floor area	85.4	m ²
DER	19.04	kgCO ₂ /yr/m ²
CO ₂ emissions from electrical appliances	15.98	kgCO ₂ /yr/m ² (ZC2)
CO ₂ emissions from cooking	2.11	kgCO ₂ /yr/m ² (ZC3)
Standard case total CO ₂ emissions	37.14	kgCO ₂ /yr/m ² (ZC4)
Net Standard case CO ₂ emissions	37.14	kgCO ₂ /yr/m ² (ZC8)

Actual case CO₂ emissions

DER	15.51	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	33.61	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	33.61	kgCO ₂ /yr/m ² (ZC8)
Improvement in net actual/net standard case CO ₂ emissions	10	%



ENE7 credits achieved

0

PREDICTED ENERGY ASSESSMENT

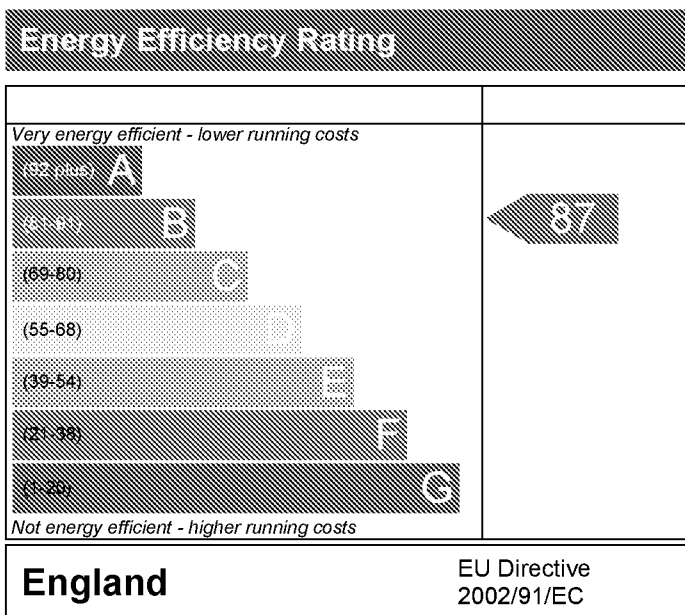
surecalc ltd

Plot 4, 15-17, Kew Gardens,
Bognor Regis,
West Sussex,
PO21 5RD

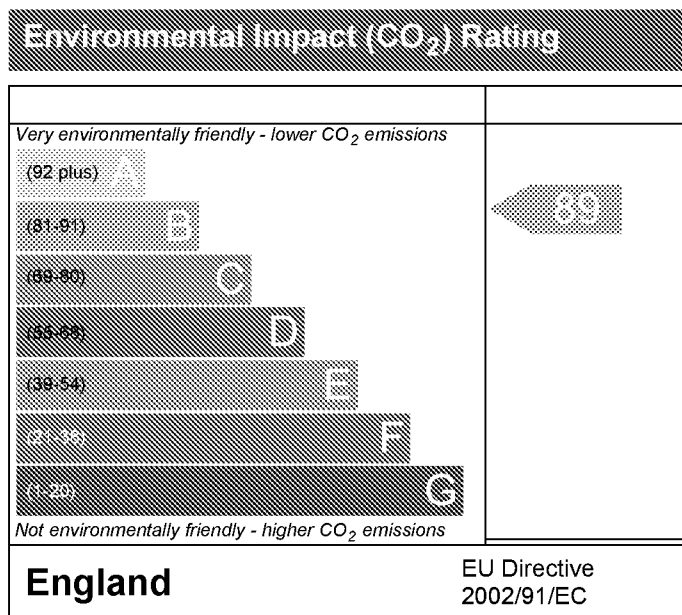
Dwelling type: House, Semi-Detached
Date of assessment: 17/01/2020
Produced by: Surecalc Limited
Total floor area: 85.4 m²
DRRN: 5528-3961-9006

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

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



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	20.25			
CO ₂ Emissions (t/year)	0.86	DFEE	44.06	TFEE	52.70	
General Requirements Compliance	Pass	% DFEE<TFEE	16.41			
Assessor Details	Mr. Mark Rogers, Surecalc Limited, [REDACTED], [REDACTED]				Assessor ID	A320-0001
Client	Vivid Design Studio, Vivid Design Studio					

SUMMARY FOR INPUT DATA FOR New Build (As Designed)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	18.28	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	14.58	kgCO ₂ /m ²	Pass
	-3.70 (-20.2%)	kgCO ₂ /m ²	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	52.70	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DFEE)	44.06	kWh/m ² /yr	
	-8.6 (-16.3%)	kWh/m ² /yr	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

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

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

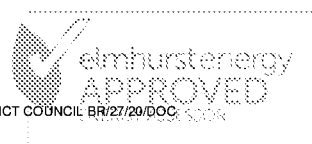
3 Air permeability

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

Limiting System Efficiencies

4 Heating efficiency

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Main heating system

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

Pass

Secondary heating system

None

5 Cylinder insulation

Hot water storage

No cylinder

6 Controls

Space heating controls

Time and temperature zone control

Pass

Hot water controls

No cylinder

Boiler interlock

Yes

Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings

100

%

Minimum

75

%

Pass

8 Mechanical ventilation

Not applicable

Criterion 3 - Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)

Slight

Pass

Based on:

Overshading

Average

Windows facing North

1.80 m², No overhang

Windows facing East

4.07 m², No overhang

Windows facing West

7.26 m², No overhang

Air change rate

4.00 ach

Blinds/curtains

None

Criterion 4 - Building performance consistent with DER and DFEE rate

Party Walls

Type

U-value

Filled Cavity with Edge Sealing

0.00

W/m²K

Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals

5.00 (design value)

m³/(h.m²) @ 50 Pa

Maximum

10.0

m³/(h.m²) @ 50 Pa

Pass

10 Key features

Party wall U-value

0.00

W/m²K

Roof U-value

0.11

W/m²K

Floor U-value

0.11

W/m²K

Thermal bridging y-value

0.031

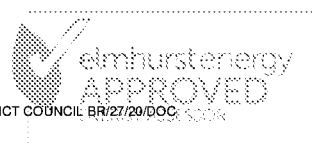
W/m²K

Photovoltaic array

1.00

kW

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General Requirements Compliance	Pass	% DPER<TPER	16.41
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	[REDACTED]		A320-0001
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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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

DWELLING AS DESIGNED

Semi-Detached House, total floor area 85 m²

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

1a TER and DER

Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.28 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 14.59 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)52.7 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)44.1 kWh/m²/yrOK

2 Fabric U-values

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

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

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

4 Heating efficiency

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

Secondary heating system: None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

7 Low energy lights

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

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Southern England): Slight OK

Based on:

Overshading: Average
Windows facing North: 1.80 m², No overhang
Windows facing East: 4.07 m², No overhang
Windows facing West: 7.26 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

10 Key Features

Party wall U-value 0.00 W/m²K
Roof U-value 0.11 W/m²K
Floor U-value 0.11 W/m²K
Thermal bridging y-value 0.031 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	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 4.1202

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
North				1.8000	10.6334	0.7100	0.7000			0.7700			6.5923 (74)
East				4.0700	19.6403	0.7100	0.7000			0.7700			27.5316 (76)
West				7.2600	19.6403	0.7100	0.7000			0.7700			49.1104 (80)
Solar gains	83.2343	162.5262	268.3174	394.4893	487.6411	501.3577	476.3999	406.1828	312.9052	192.8987	103.6960	68.5223	(83)
Total gains	485.8848	562.9592	654.0486	756.7653	826.0776	816.8949	777.5629	714.1843	633.3529	537.0185	474.7630	459.4253	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	21.0000 (85)											
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	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	0.9984	0.9964	0.9888	0.9572	0.8635	0.6871	0.5195	0.5829	0.8483	0.9798	0.9967	0.9988 (86)
MIT	19.7497	19.9022	20.1718	20.5304	20.8151	20.9594	20.9922	20.9863	20.8773	20.4923	20.0594	19.7291 (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	0.9979	0.9951	0.9848	0.9412	0.8160	0.5981	0.4069	0.4659	0.7781	0.9695	0.9954	0.9984 (89)
MIT 2	18.3015	18.5262	18.9200	19.4394	19.8141	19.9793	20.0031	20.0025	19.9019	19.3961	18.7662	18.2794 (90)
Living area fraction	18.6385	18.8464	19.2112	19.6932	20.0470	20.2073	20.2332	20.2314	20.1288	19.6512	19.0671	18.6167 (92)
Temperature adjustment	18.4885	18.6964	19.0612	19.5432	19.8970	20.0573	20.0832	20.0814	19.9788	19.5012	18.9171	18.4667 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9967	0.9928	0.9796	0.9321	0.8107	0.6030	0.4159	0.4749	0.7763	0.9624	0.9932	0.9975 (94)
Ext temp.	484.2888	558.9025	640.7335	705.4085	669.7042	492.5951	323.3649	339.1723	491.6443	516.8503	471.5276	458.2841 (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	1375.4705	1333.1976	1210.0416	1010.1489	775.7991	509.7513	325.3551	343.0242	551.9231	842.4448	1124.7790	1365.9600 (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	663.0392	520.3263	423.5653	219.4131	78.9346	0.0000	0.0000	0.0000	0.0000	242.2423	470.3410	675.3108 (98)
												3293.1726 (98)
												38.5617 (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													3638.8648 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	663.0392	520.3263	423.5653	219.4131	78.9346	0.0000	0.0000	0.0000	0.0000	242.2423	470.3410	675.3108	(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)	732.6400	574.9462	468.0279	242.4455	87.2206	0.0000	0.0000	0.0000	0.0000	267.6710	519.7138	746.1998	(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	87.8847	87.6527	87.1218	85.8286	83.4460	80.4000	80.4000	80.4000	80.4000	85.9579	87.3725	87.9659	(217)
Fuel for water heating, kWh/month	234.2025	207.0409	217.0739	195.4346	194.6178	177.9023	170.4439	190.0050	192.1035	204.6041	214.5169	228.4309	(219)
Water heating fuel used												2426.3763	(219)
Annual totals kWh/year													
Space heating fuel - main system												3638.8648	(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												5940.6430	(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	3638.8648	0.2160	785.9948 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2426.3763	0.2160	524.0973 (264)
Space and water heating			1310.0921 (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			1245.4257 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			14.5800 (273)

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

DER		14.5800	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		32.6762	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		32.6762	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	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)
	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	Specific data or Table 6b	g Specific data or Table 6c	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	1.8000	10.6334	0.6300	0.7000	0.7000	0.7000	5.8495 (74)
East	4.0700	19.6403	0.6300	0.7000	0.7000	0.7000	24.4294 (76)
West	7.2600	19.6403	0.6300	0.7000	0.7000	0.7000	43.5768 (80)

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

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	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	0.9986	0.9969	0.9909	0.9661	0.8886	0.7269	0.5570	0.6200	0.8716	0.9830	0.9971	0.9989	(86)
MIT	19.7432	19.8851	20.1418	20.4882	20.7818	20.9466	20.9891	20.9816	20.8568	20.4683	20.0451	19.7205	(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	0.9981	0.9958	0.9875	0.9529	0.8461	0.6376	0.4376	0.4979	0.8064	0.9742	0.9959	0.9986	(89)
MIT 2	18.2936	18.5024	18.8777	19.3808	19.7743	19.9653	19.9973	19.9954	19.8782	19.3609	18.7447	18.2669	(90)
Living area fraction	18.6309	18.8241	19.1718	19.6385	20.0087	20.1936	20.2281	20.2249	20.1059	19.6186	19.0473	18.6051	(91)
MIT	18.6309	18.8241	19.1718	19.6385	20.0087	20.1936	20.2281	20.2249	20.1059	19.6186	19.0473	18.6051	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6309	18.8241	19.1718	19.6385	20.0087	20.1936	20.2281	20.2249	20.1059	19.6186	19.0473	18.6051	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	475.1370	541.3858	613.7196	674.5832	653.0748	498.8829	337.0128	351.8048	487.2484	499.6824	460.3935	450.7128	(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	1385.8909	1343.1171	1219.2516	1021.0090	788.2207	525.1069	340.5910	358.3608	566.1045	855.5652	1138.5466	1379.2584	(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	677.6008	538.7634	450.5158	249.4265	100.5485	0.0000	0.0000	0.0000	0.0000	264.7768	488.2703	690.8379	(98)
Space heating												3460.7401	(98)
Space heating per m2												40.5239	(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													3705.2892 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	677.6008	538.7634	450.5158	249.4265	100.5485	0.0000	0.0000	0.0000	0.0000	264.7768	488.2703	690.8379	(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)	725.4827	576.8345	482.3510	267.0520	107.6537	0.0000	0.0000	0.0000	0.0000	283.4869	522.7733	739.6552	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	205.8280	181.4769	189.1186	167.7387	162.4007	143.0334	137.0369	152.7641	154.4512	175.8734	187.4287	200.9414	(64)
Efficiency of water heater	87.6263	87.6230	87.1587	86.0482	83.8837	80.3000	80.3000	80.3000	80.3000	86.0788	87.3524	87.9086	(216)
Fuel for water heating, kWh/month	234.3581	207.1109	216.9819	194.9358	193.6021	178.1238	170.6562	190.2417	192.3427	204.3169	214.5663	228.5800	(219)
Water heating fuel used													2425.8164 (219)
Annual totals kWh/year													
Space heating fuel - main system													3705.2892 (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													6587.5343 (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	3705.2892	0.2160	800.3425 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2425.8164	0.2160	523.9764 (264)
Space and water heating			1324.3188 (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			1561.2053 (272)
Emissions per m2 for space and water heating			15.5072 (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) = (15.5072 * 1.00) + 2.3180 + 0.4558, rounded to 2 d.p.			18.2800 (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)
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)
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)

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If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	32.9097	28.7830	29.7015	25.8945	24.8464	21.4405	19.8678	22.7986	23.0709	26.8869	29.3491	31.8713 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	127.8692	127.8692	127.8692	127.8692	127.8692	127.8692	127.8692	127.8692	127.8692	127.8692	127.8692	127.8692	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.5981	19.1832	15.6008	11.8108	8.8287	7.4536	8.0539	10.4687	14.0511	17.8411	20.8232	22.1983	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	230.3561	232.7465	226.7228	213.8991	197.7115	182.4975	172.3335	169.9432	175.9668	188.7905	204.9781	220.1922	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.7869	35.7869	35.7869	35.7869	35.7869	35.7869	35.7869	35.7869	35.7869	35.7869	35.7869	35.7869	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-102.2953	-102.2953	-102.2953	-102.2953	-102.2953	-102.2953	-102.2953	-102.2953	-102.2953	-102.2953	-102.2953	-102.2953	(71)
Water heating gains (Table 5)	44.2334	42.8319	39.9214	35.9646	33.3957	29.7785	26.7040	30.6433	32.0429	36.1383	40.7627	42.8377	(72)
Total internal gains	357.5484	356.1223	343.6057	323.0353	301.2967	281.0903	268.4522	272.4159	283.4216	304.1307	327.9248	346.5890	(73)

6. Solar gains

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

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

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	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	0.9990	0.9975	0.9915	0.9642	0.8774	0.7055	0.5361	0.6051	0.8689	0.9851	0.9979	0.9993 (86)	
MIT	19.7253	19.8776	20.1484	20.5089	20.8028	20.9553	20.9913	20.9843	20.8633	20.4635	20.0287	19.7016 (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	0.9987	0.9966	0.9884	0.9505	0.8328	0.6169	0.4215	0.4861	0.8036	0.9773	0.9970	0.9991 (89)	
MIT 2	18.8192	18.9731	19.2442	19.6046	19.8720	19.9940	20.0122	20.0116	19.9329	19.5675	19.1333	18.8030 (90)	
Living area fraction									fLA = Living area / (4) =			0.2327 (91)	
MIT	19.0300	19.1835	19.4546	19.8150	20.0886	20.2177	20.2400	20.2379	20.1494	19.7760	19.3416	19.0121 (92)	
Temperature adjustment												0.0000	
adjusted MIT	19.0300	19.1835	19.4546	19.8150	20.0886	20.2177	20.2400	20.2379	20.1494	19.7760	19.3416	19.0121 (93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	440.0050	516.4067	603.4425	679.7027	660.3705	497.9142	333.9662	348.8312	485.5647	484.5743	429.9803	414.5754 (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	1404.6095	1358.5035	1228.9660	1023.0617	784.4720	519.7831	336.7934	354.4042	562.0356	858.1093	1150.0701	1398.2251 (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	717.6658	565.8890	465.3894	247.2184	92.3315	0.0000	0.0000	0.0000	0.0000	277.9100	518.4646	731.8354 (98)	
Space heating												3616.7042 (98)	
Space heating per m2												(98) / (4) =	42.3502 (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	0.8965	0.9462	0.9220	0.0000	0.0000	0.0000	0.0000 (101)	
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	779.7555	647.8383	647.0599	0.0000	0.0000	0.0000	0.0000 (102)	
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1010.8486	964.9334	889.2701	0.0000	0.0000	0.0000	0.0000 (103)	
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)	
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	166.3870	235.9187	180.2044	0.0000	0.0000	0.0000	0.0000 (104)	

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Space cooling												582.5102 (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	41.5968	58.9797	45.0511	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												145.6275 (107)
Space cooling per m2												1.7052 (108)
Energy for space heating												42.3502 (99)
Energy for space cooling												1.7052 (108)
Total												44.0554 (109)
Dwelling Fabric Energy Efficiency (DFEE)												44.1 (109)

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CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

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

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Air changes per hour					
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1364 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3864 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3285 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	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	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	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	1.1324	1.1295	1.1267	1.1133	1.1109	1.0993	1.0993	1.0971	1.1037	1.1109	1.1159	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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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	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	1.8000	10.6334	0.6300	0.7000	0.7700	5.8495 (74)
East	4.0700	19.6403	0.6300	0.7000	0.7700	24.4294 (76)
West	7.2600	19.6403	0.6300	0.7000	0.7700	43.5768 (80)

Solar gains	73.8557	144.2133	238.0845	350.0398	432.6956	444.8667	422.7210	360.4157	277.6483	171.1636	92.0119	60.8015 (83)
Total gains	431.4041	500.3356	581.6902	673.0750	733.9923	725.9570	691.1732	632.8317	561.0698	475.2943	419.9367	407.3905 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	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	0.9991	0.9979	0.9933	0.9729	0.9043	0.7506	0.5805	0.6488	0.8937	0.9880	0.9982	0.9993	(86)
MIT	19.6938	19.8369	20.0973	20.4513	20.7580	20.9380	20.9869	20.9774	20.8348	20.4273	19.9980	19.6718	(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	0.9988	0.9972	0.9908	0.9619	0.8654	0.6621	0.4575	0.5239	0.8347	0.9815	0.9974	0.9991	(89)
MIT 2	18.7775	18.9222	19.1833	19.5394	19.8243	19.9721	19.9980	19.9965	19.9006	19.5218	19.0923	18.7629	(90)
Living area fraction									fLA = Living area / (4) =			0.2327	(91)
MIT	18.9907	19.1350	19.3959	19.7515	20.0415	20.1969	20.2281	20.2247	20.1180	19.7325	19.3030	18.9743	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9907	19.1350	19.3959	19.7515	20.0415	20.1969	20.2281	20.2247	20.1180	19.7325	19.3030	18.9743	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9984	0.9963	0.9888	0.9586	0.8677	0.6809	0.4864	0.5533	0.8431	0.9792	0.9966	0.9988	(94)
Useful gains	430.7055	498.4828	575.1854	645.2317	636.8564	494.3207	336.2147	350.1217	473.0490	465.4100	418.5183	406.9010	(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	1420.6880	1373.1046	1240.8128	1031.7604	791.3331	525.4107	340.5899	358.3465	567.2411	866.3704	1162.9148	1414.6078	(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	736.5469	587.7459	495.2268	278.3007	114.9307	0.0000	0.0000	0.0000	0.0000	298.3146	535.9655	749.7338	(98)
Space heating												3796.7649	(98)
Space heating per m2										(98) / (4) =		44.4586	(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	0.8662	0.9266	0.8983	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	764.4016	643.7104	639.6519	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	944.8202	902.1918	835.7761	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	129.9014	192.3102	145.9164	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												468.1280	(104)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Cooled fraction	FC = cooled area / (4) =										1.0000 (105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	32.4753	48.0775	36.4791	0.0000	0.0000	0.0000 (107)
Space cooling											117.0320 (107)
Space cooling per m2											1.3704 (108)
Energy for space heating											44.4586 (99)
Energy for space cooling											1.3704 (108)
Total											45.8290 (109)
Target Fabric Energy Efficiency (TFEE)											52.7 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Calculation of Heat Demand 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
Calculation of Heat Demand 09 Jan 2014

1. Overall dwelling dimensions

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

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					40.0000 / (5) = 0.1819 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4319 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3671 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.6000	5.1000	4.8000	4.5000	4.7000	4.2000	4.4000	4.2000	4.4000	4.8000	4.9000	5.1000 (22)
Wind factor	1.4000	1.2750	1.2000	1.1250	1.1750	1.0500	1.1000	1.0500	1.1000	1.2000	1.2250	1.2750 (22a)
Adj infilt rate												
Effective ac	0.5140	0.4681	0.4405	0.4130	0.4314	0.3855	0.4038	0.3855	0.4038	0.4405	0.4497	0.4681 (22b)
	0.6321	0.6095	0.5970	0.5853	0.5930	0.5743	0.5815	0.5743	0.5815	0.5970	0.6011	0.6095 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
New Dwelling DG Door			2.0200	1.4000	2.8280		(26a)
New Dwelling DG Window (Uw = 1.40)			13.1300	1.3258	17.4072		(27)
Ground Floor			42.7000	0.1100	4.6970		(28a)
External Wall	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)
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)
RHI water heating demand	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)
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	FF Specific data or Table 6c	Access factor Table 6d		Gains W		

North				1.8000	14.6401	0.7100	0.7000	0.7700		9.0762 (74)		
East				4.0700	27.3735	0.7100	0.7000	0.7700		38.3719 (76)		
West				7.2600	27.3735	0.7100	0.7000	0.7700		68.4473 (80)		

Solar gains	115.8954	188.8947	310.8840	473.1424	564.1153	622.2562	587.8045	504.5014	389.0178	241.0767	138.4386	92.5351 (83)
Total gains	707.0906	775.4275	874.3745	1001.1766	1055.8638	1081.5493	1028.6176	954.5979	859.9011	747.6332	684.3884	667.8770 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
tau	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	0.9876	0.9804	0.9523	0.8626	0.6873	0.4662	0.3223	0.3256	0.5787	0.8709	0.9707	0.9895	(86)	
MIT	20.1209	20.2348	20.4876	20.7759	20.9449	20.9939	20.9993	20.9993	20.9835	20.8175	20.4572	20.1253	(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	0.9834	0.9740	0.9370	0.8239	0.6169	0.3820	0.2298	0.2270	0.4787	0.8194	0.9588	0.9858	(89)	
MIT 2	18.8298	19.0044	19.3670	19.7540	19.9402	19.9937	19.9914	19.9965	19.9832	19.8096	19.3290	18.8480	(90)	
Living area fraction									fLA = Living area / (4) =			0.2327	(91)	
MIT	19.1302	19.2907	19.6278	19.9918	20.1740	20.2264	20.2259	20.2298	20.2159	20.0441	19.5915	19.1452	(92)	
Temperature adjustment												-0.1500		
adjusted MIT	18.9802	19.1407	19.4778	19.8418	20.0240	20.0764	20.0759	20.0798	20.0659	19.8941	19.4415	18.9952	(93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Useful gains	691.4007	749.7842	810.9864	818.4324	654.5171	420.5375	244.3692	224.5212	418.2289	608.7518	650.5181	655.1032	(94)	
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	1299.2726	1273.8901	1150.2827	955.7964	682.0798	422.5045	244.4806	224.6155	423.8633	710.0958	1005.8457	1259.7865	(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	452.2567	352.1992	252.4364	98.9021	20.5066	0.0000	0.0000	0.0000	0.0000	75.4000	255.8359	449.8843	(98)	
Space heating												1957.4213	(98)	
RHI space heating demand												1957	(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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	50.9589	46.0274	49.3469	45.8823	45.4765	42.1368	43.5414	45.4765	45.8823	49.3469	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month	205.8280	181.4769	189.1186	167.7387	162.4007	143.0334	137.0369	152.7641	154.4512	175.8734	187.4287	200.9414 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	205.8280	181.4769	189.1186	167.7387	162.4007	143.0334	137.0369	152.7641	154.4512	175.8734	187.4287	200.9414 (64)
Heat gains from water heating, kWh/month	64.2337	56.5438	58.8108	51.9878	50.2464	44.0823	41.9726	47.0422	47.5697	54.4068	58.2516	62.6089 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	153.4430	153.4430	153.4430	153.4430	153.4430	153.4430	153.4430	153.4430	153.4430	153.4430	153.4430	153.4430 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	53.9952	47.9580	39.0021	29.0718	18.6340	20.1347	26.1718	35.1278	44.6028	52.0580	55.4959	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	343.8150	347.3828	338.3922	319.2524	295.0918	272.3843	257.2143	253.6465	262.6371	281.7769	305.9375	328.6450 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.9017	52.9017	52.9017	52.9017	52.9017	52.9017	52.9017	52.9017	52.9017	52.9017	52.9017	52.9017 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-102.2953	-102.2953	-102.2953	-102.2953	-102.2953	-102.2953	-102.2953	-102.2953	-102.2953	-102.2953	-102.2953	-102.2953 (71)
Water heating gains (Table 5)	86.3356	84.1426	79.0468	72.2053	67.5355	61.2255	56.4148	63.2288	66.0691	73.1274	80.9049	84.1517 (72)
Total internal gains	591.1952	586.5327	563.4905	528.0342	491.7485	459.2931	440.8131	450.0965	470.8833	506.5564	545.9498	575.3420 (73)

6. Solar gains

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

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	21.0000 (85)											
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	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	0.9931	0.9873	0.9700	0.9144	0.7903	0.6016	0.4444	0.4938	0.7499	0.9438	0.9868	0.9945 (86)
MIT	19.9534	20.0993	20.3486	20.6623	20.8823	20.9779	20.9962	20.9936	20.9334	20.6408	20.2452	19.9296 (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	0.9909	0.9833	0.9604	0.8877	0.7336	0.5169	0.3460	0.3908	0.6684	0.9203	0.9819	0.9927 (89)
MIT 2	18.5978	18.8112	19.1702	19.6124	19.8862	19.9922	20.0046	20.0057	19.9524	19.5958	19.0342	18.5717 (90)
Living area fraction	18.9132	19.1109	19.4444	19.8567	20.1179	20.2216	20.2353	20.2355	20.1806	19.8390	19.3160	18.8876 (92)
Temperature adjustment	18.7632	18.9609	19.2944	19.7067	19.9679	20.0716	20.0853	20.0855	20.0306	19.6890	19.1660	18.7376 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	665.8182	732.4088	791.8399	810.6788	716.8908	502.1023	324.6208	341.6923	525.9641	637.3727	634.2122	637.1719 (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	1402.1029	1358.7576	1232.5020	1025.6623	782.5129	511.0790	325.5518	343.4067	556.7883	860.2185	1148.4655	1391.8982 (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	547.7958	420.9064	327.8526	154.7881	48.8228	0.0000	0.0000	0.0000	0.0000	165.7973	370.2624	561.5163 (98)
Space heating	2597.7417 (98)											
Space heating per m ²	30.4185 (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													2870.4329 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	547.7958	420.9064	327.8526	154.7881	48.8228	0.0000	0.0000	0.0000	0.0000	165.7973	370.2624	561.5163	(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)	605.2993	465.0899	362.2681	171.0366	53.9479	0.0000	0.0000	0.0000	0.0000	183.2014	409.1297	620.4600	(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	87.4980	87.1999	86.5238	84.9500	82.5289	80.4000	80.4000	80.4000	80.4000	85.0034	86.8340	87.5998	(216)
Fuel for water heating, kWh/month	235.2374	208.1160	218.5741	197.4559	196.7803	177.9023	170.4439	190.0050	192.1035	206.9016	215.8472	229.3855	(219)
Water heating fuel used												2438.7530	(219)
Annual totals kWh/year													
Space heating fuel - main system												2870.4329	(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												5184.5877	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2870.4329	3.4800	99.8911 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2438.7530	3.4800	84.8686 (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			288.3252 (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] =	0.9287 (257)
SAP value		87.0453
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	2870.4329	0.2160	620.0135 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2438.7530	0.2160	526.7706 (264)
Space and water heating			1146.7841 (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			1082.1177 (272)
CO2 emissions per m2			12.6700 (273)
EI value			88.8801
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	$3.48 / 0.8414 = 4.136$, stars = 4
Water heating environmental impact	$0.216 / 0.8414 = 0.2567$, stars = 4

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

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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
System) version 4.12r02

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
North			1.8000		14.6401		0.7100		0.7000		0.7700		9.0762 (74)
East			4.0700		27.3735		0.7100		0.7000		0.7700		38.3719 (76)
West			7.2600		27.3735		0.7100		0.7000		0.7700		68.4473 (80)
Solar gains	115.8954	188.8947	310.8840	473.1424	564.1153	622.2562	587.8045	504.5014	389.0178	241.0767	138.4386	92.5351	(83)
Total gains	707.0906	775.4275	874.3745	1001.1766	1055.8638	1081.5493	1028.6176	954.5979	859.9011	747.6332	684.3884	667.8770	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	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	0.9876	0.9804	0.9523	0.8626	0.6873	0.4662	0.3223	0.3256	0.5787	0.8709	0.9707	0.9895 (86)
MIT	20.1209	20.2348	20.4876	20.7759	20.9449	20.9939	20.9993	20.9993	20.9835	20.8175	20.4572	20.1253 (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	0.9834	0.9740	0.9370	0.8239	0.6169	0.3820	0.2298	0.2270	0.4787	0.8194	0.9588	0.9858 (89)
MIT 2	18.8298	19.0044	19.3670	19.7540	19.9402	19.9937	19.9914	19.9965	19.9832	19.8096	19.3290	18.8480 (90)
Living area fraction	19.1302	19.2907	19.6278	19.9918	20.1740	20.2264	20.2259	20.2298	20.2159	20.0441	19.5915	19.1452 (92)
Temperature adjustment	18.9802	19.1407	19.4778	19.8418	20.0240	20.0764	20.0759	20.0798	20.0659	19.8941	19.4415	18.9952 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	691.4007	749.7842	810.9864	818.4324	654.5171	420.5375	244.3692	224.5212	418.2289	608.7518	650.5181	655.1032 (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	1299.2726	1273.8901	1150.2827	955.7964	682.0798	422.5045	244.4806	224.6155	423.8633	710.0958	1005.8457	1259.7865 (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	452.2567	352.1992	252.4364	98.9021	20.5066	0.0000	0.0000	0.0000	0.0000	75.4000	255.8359	449.8843 (98)
Space heating												1957.4213 (98)
Space heating per m2												22.9206 (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													2162.8964 (211)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	452.2567	352.1992	252.4364	98.9021	20.5066	0.0000	0.0000	0.0000	0.0000	75.4000	255.8359	449.8843	(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)	499.7312	389.1704	278.9353	109.2841	22.6593	0.0000	0.0000	0.0000	0.0000	83.3149	282.6916	497.1097	(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	87.0786	86.7924	85.8793	83.8719	81.4187	80.4000	80.4000	80.4000	80.4000	83.1858	85.9353	87.1210	(216)
Fuel for water heating, kWh/month	236.3703	209.0930	220.2144	199.9939	199.4635	177.9023	170.4439	190.0050	192.1035	211.4225	218.1044	230.6464	(219)
Water heating fuel used												2455.7631	(219)
Annual totals kWh/year													
Space heating fuel - main system												2162.8964	(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												4359.3195	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2162.8964	3.9700	85.8670 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2455.7631	3.9700	97.4938 (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			225.9794 (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	2162.8964	0.2160	467.1856 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2455.7631	0.2160	530.4448 (264)
Space and water heating			997.6305 (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			863.0330 (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	2162.8964	1.2200	2638.7336 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2455.7631	1.2200	2996.0310 (264)
Space and water heating			5634.7646 (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			4838.5906 (272)
Primary energy kWh/m2/year			56.6580 (273)

SAP 2012 EPC IMPROVEMENTS

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

Current energy efficiency rating: B 87
Current environmental impact rating: B 89

(For testing purposes):		
A		Not considered
B		Not considered
C		Not considered
D		Not considered
E	Low energy lighting	Already installed
F		Not considered
G		Not considered
H		Not considered
I		Not considered
J		Not considered
K		Not considered
M		Not considered
N	Solar water heating	Recommended
O		Not considered
P		Not considered
R		Not considered
S		Not considered
T		Not considered
U	Solar photovoltaic panels	Already installed
A2		Not considered
A3		Not considered
T2		Not considered
W		Not considered
X		Not considered
Y		Not considered
J2		Not considered
Q2		Not considered
Z1		Not considered
Z2		Not considered
Z3		Not considered
Z4		Not considered
Z5		Not considered
V2	Wind turbine	Not applicable
L2		Not considered
Q3		Not considered
O3		Not considered

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.3	-£ 35	-214 kg (24.8%)

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

Potential energy efficiency rating: B 88
Potential environmental impact rating: B 91

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

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

	Current	Potential	Saving
Electricity	£83	£93	-£9
Mains gas	£273	£229	£44
Space heating	£190	£190	£0
Water heating	£97	£62	£35
Lighting	£70	£70	£0
Generated (PV)	-£131	-£131	£0

Total cost of fuels	£225	£191	£35
Total cost of uses	£226	£191	£35
Delivered energy	51 kWh/m²	39 kWh/m²	12 kWh/m²
Carbon dioxide emissions	0.9 tonnes	0.6 tonnes	0.2 tonnes
CO2 emissions per m²	10 kg/m²	8 kg/m²	3 kg/m²
Primary energy	57 kWh/m²	43 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)
Solar input (sum of months) = Sum(63)m =													-852.6929 (63)
Output from w/h	181.1016	140.2157	118.8460	73.5595	46.0502	28.6424	24.1576	54.1409	77.2094	123.1264	158.0996	180.2496	(64)
Total per year (kWh/year) = Sum(64)m =													1205.3991 (64)
Heat gains from water heating, kWh/month	64.2337	56.5438	58.8108	51.9878	50.2464	44.0823	41.9726	47.0422	47.5697	54.4068	58.2516	62.6089	(65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	153.4430	153.4430	153.4430	153.4430	153.4430	153.4430	153.4430	153.4430	153.4430	153.4430	153.4430	153.4430	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	53.9952	47.9580	39.0021	29.5271	22.0718	18.6340	20.1347	26.1718	35.1278	44.6028	52.0580	55.4959	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	343.8150	347.3828	338.3922	319.2524	295.0918	272.3843	257.2143	253.6465	262.6371	281.7769	305.9375	328.6450	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.9017	52.9017	52.9017	52.9017	52.9017	52.9017	52.9017	52.9017	52.9017	52.9017	52.9017	52.9017	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-102.2953	-102.2953	-102.2953	-102.2953	-102.2953	-102.2953	-102.2953	-102.2953	-102.2953	-102.2953	-102.2953	-102.2953	(71)
Water heating gains (Table 5)	86.3356	84.1426	79.0468	72.2053	67.5355	61.2255	56.4148	63.2288	66.0691	73.1274	80.9049	84.1517	(72)
Total internal gains	591.1952	586.5327	563.4905	528.0342	491.7485	459.2931	440.8131	450.0965	470.8833	506.5564	545.9498	575.3420	(73)

6. Solar gains

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

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	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	0.9931	0.9873	0.9700	0.9144	0.7903	0.6016	0.4444	0.4938	0.7499	0.9438	0.9868	0.9945	(86)
MIT	19.9534	20.0993	20.3486	20.6623	20.8823	20.9779	20.9962	20.9936	20.9334	20.6408	20.2452	19.9296	(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	0.9909	0.9833	0.9604	0.8877	0.7336	0.5169	0.3460	0.3908	0.6684	0.9203	0.9819	0.9927	(89)
MIT 2	18.5978	18.8112	19.1702	19.6124	19.8862	19.9922	20.0046	20.0057	19.9524	19.5958	19.0342	18.5717	(90)
Living area fraction													0.2327 (91)
MIT	18.9132	19.1109	19.4444	19.8567	20.1179	20.2216	20.2353	20.2355	20.1806	19.8390	19.3160	18.8876	(92)
Temperature adjustment													-0.1500
adjusted MIT	18.7632	18.9609	19.2944	19.7067	19.9679	20.0716	20.0853	20.0855	20.0306	19.6890	19.1660	18.7376	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9872	0.9778	0.9520	0.8788	0.7320	0.5227	0.3539	0.3990	0.6711	0.9112	0.9762	0.9896	(94)

Regs Region: England

Elmhurst Energy Systems

SAP2012 Calculator (Design

System) version 4.1202

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Useful gains	665.8182	732.4088	791.8399	810.6788	716.8908	502.1023	324.6208	341.6923	525.9641	637.3727	634.2122	637.1719 (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	1402.1029	1358.7576	1232.5020	1025.6623	782.5129	511.0790	325.5518	343.4067	556.7883	860.2185	1148.4655	1391.8982 (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	547.7958	420.9064	327.8526	154.7881	48.8228	0.0000	0.0000	0.0000	0.0000	165.7973	370.2624	561.5163 (98)
Space heating per m2											(98) / (4) =	30.4185 (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												2870.4329 (211)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	547.7958	420.9064	327.8526	154.7881	48.8228	0.0000	0.0000	0.0000	0.0000	165.7973	370.2624	561.5163 (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)	605.2993	465.0899	362.2681	171.0366	53.9479	0.0000	0.0000	0.0000	0.0000	183.2014	409.1297	620.4600 (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	87.7608	87.7456	87.5731	86.9801	85.2989	80.4000	80.4000	80.4000	80.4000	85.9013	87.2214	80.4000 (216)
Fuel for water heating, kWh/month	206.3582	159.7980	135.7106	84.5705	53.9869	35.6249	30.0468	67.3394	96.0316	143.3347	181.2624	87.8192 (217)
Water heating fuel used												205.2508 (219)
Annual totals kWh/year												1399.3149 (219)
Space heating fuel - main system												2870.4329 (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												4195.1497 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2870.4329	3.4800	99.8911 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1399.3149	3.4800	48.6962 (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			258.7477 (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] =	0.8334 (257)
SAP value		88.3742
SAP rating (Section 12)		88 (258)
SAP band		B

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	2870.4329	0.2160	620.0135 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1399.3149	0.2160	302.2520 (264)
Space and water heating			922.2655 (265)

Regs Region: England

Elmhurst Energy Systems

SAP2012 Calculator (Design

System) version 4.12r02

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	381.4286	0.5190	197.9615 (268)
Energy saving/generation technologies			
PV Unit	-581.0267	0.5190	-301.5529 (269)
Total kg/year			883.5491 (272)
CO2 emissions per m2			10.3500 (273)
EI value			90.9206
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	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 EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	49.3469	45.8823	45.4765	42.1368	43.5414	45.4765	45.8823	49.3469	49.3151	50.9589	(61)	
Total heat required for water heating calculated for each month	205.8280	181.4769	189.1186	167.7387	162.4007	143.0334	137.0369	152.7641	154.4512	175.8734	187.4287	200.9414	(62)	
Aperture area of solar collector												3.0000	(H1)	
Zero-loss collector efficiency												0.7000	(H2)	
Collector heat loss coefficient												1.8000	(H3)	
Collector 2nd order heat loss coefficient												0.0050	(H3a)	
Collector effective heat loss coefficient												1.8063	(H3b)	
Collector performance ratio												2.5804	(H4)	
Annual solar radiation per m2												1306.9326	(H5)	
Overshading factor												0.8000	(H6)	
Solar energy available												2195.6468	(H7)	
Adjustment factor for showers												1.0000	(H7a)	
Solar-to-load ratio												1.4699	(H8)	
Utilisation factor												0.4935	(H9)	
Collector performance factor												0.8793	(H10)	
Dedicated solar storage volume												75.0000	(H11)	
Effective solar volume												75.0000	(H13)	
Daily hot water demand												94.9379	(H14)	
Volume ratio Veff/V												0.7900	(H15)	
Solar storage volume factor												0.9529	(H16)	
Solar input												-907.9231	(H17)	
Solar input	-29.7065	-41.4139	-70.5090	-98.2350	-117.4605	-124.0869	-121.6481	-106.6933	-83.2954	-56.9762	-33.7900	-24.1083	(63)	
												-907.9231	(63)	
Solar input (sum of months) = Sum(63)m =														
Output from w/h	176.1215	140.0630	118.6096	69.5037	44.9402	18.9465	15.3888	46.0708	71.1558	118.8973	153.6387	176.8331	(64)	
												1150.1690	(64)	
Total per year (kWh/year) = Sum(64)m =														
Heat gains from water heating, kWh/month	64.2337	56.5438	58.8108	51.9878	50.2464	44.0823	41.9726	47.0422	47.5697	54.4068	58.2516	62.6089	(65)	

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	153.4430	153.4430	153.4430	153.4430	153.4430	153.4430	153.4430	153.4430	153.4430	153.4430	153.4430	153.4430	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	53.9952	47.9580	39.0021	29.5271	22.0718	18.6340	20.1347	26.1718	35.1278	44.6028	52.0580	55.4959	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	343.8150	347.3828	338.3922	319.2524	295.0918	272.3843	257.2143	253.6465	262.6371	281.7769	305.9375	328.6450	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.9017	52.9017	52.9017	52.9017	52.9017	52.9017	52.9017	52.9017	52.9017	52.9017	52.9017	52.9017	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-102.2953	-102.2953	-102.2953	-102.2953	-102.2953	-102.2953	-102.2953	-102.2953	-102.2953	-102.2953	-102.2953	-102.2953	(71)
Water heating gains (Table 5)	86.3356	84.1426	79.0468	72.2053	67.5355	61.2255	56.4148	63.2288	66.0691	73.1274	80.9049	84.1517	(72)
Total internal gains	591.1952	586.5327	563.4905	528.0342	491.7485	459.2931	440.8131	450.0965	470.8833	506.5564	545.9498	575.3420	(73)

6. Solar gains

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

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	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	0.9876	0.9804	0.9523	0.8626	0.6873	0.4662	0.3223	0.3256	0.5787	0.8709	0.9707	0.9895	(86)
MIT	20.1209	20.2348	20.4876	20.7759	20.9449	20.9939	20.9993	20.9993	20.9835	20.8175	20.4572	20.1253	(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	0.9834	0.9740	0.9370	0.8239	0.6169	0.3820	0.2298	0.2270	0.4787	0.8194	0.9588	0.9858	(89)
MIT 2	18.8298	19.0044	19.3670	19.7540	19.9402	19.9937	19.9914	19.9965	19.9832	19.8096	19.3290	18.8480	(90)
Living area fraction									fLA = Living area / (4) =			0.2327	(91)
MIT	19.1302	19.2907	19.6278	19.9918	20.1740	20.2264	20.2259	20.2298	20.2159	20.0441	19.5915	19.1452	(92)
Temperature adjustment												-0.1500	
adjusted MIT	18.9802	19.1407	19.4778	19.8418	20.0240	20.0764	20.0759	20.0798	20.0659	19.8941	19.4415	18.9952	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9778	0.9669	0.9275	0.8175	0.6199	0.3888	0.2376	0.2352	0.4864	0.8142	0.9505	0.9809	(94)

Regs Region: England

Elmhurst Energy Systems

SAP2012 Calculator (Design

System) version 4.1202

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Calculation of EPC Costs, Emissions and Primary Energy for Improved Dwelling 09 Jan 2014

Useful gains	691.4007	749.7842	810.9864	818.4324	654.5171	420.5375	244.3692	224.5212	418.2289	608.7518	650.5181	655.1032 (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	1299.2726	1273.8901	1150.2827	955.7964	682.0798	422.5045	244.4806	224.6155	423.8633	710.0958	1005.8457	1259.7865 (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	452.2567	352.1992	252.4364	98.9021	20.5066	0.0000	0.0000	0.0000	0.0000	75.4000	255.8359	449.8843 (98)
Space heating												1957.4213 (98)
Space heating per m2											(98) / (4) =	22.9206 (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												2162.8964 (211)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	452.2567	352.1992	252.4364	98.9021	20.5066	0.0000	0.0000	0.0000	0.0000	75.4000	255.8359	449.8843 (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)	499.7312	389.1704	278.9353	109.2841	22.6593	0.0000	0.0000	0.0000	0.0000	83.3149	282.6916	497.1097 (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	87.4219	87.3769	87.0061	86.0392	83.3134	80.4000	80.4000	80.4000	80.4000	84.0397	86.4263	80.4000 (216)
Fuel for water heating, kWh/month	201.4614	160.2976	136.3233	80.7814	53.9411	23.5653	19.1403	57.3019	88.5022	141.4776	177.7684	202.3215 (219)
Water heating fuel used												1342.8821 (219)
Annual totals kWh/year												
Space heating fuel - main system												2162.8964 (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												3296.4385 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2162.8964	3.9700	85.8670 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1342.8821	3.9700	53.3124 (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			190.9330 (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	2162.8964	0.2160	467.1856 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1342.8821	0.2160	290.0625 (264)
Space and water heating			757.2482 (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			648.6007 (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	2162.8964	1.2200	2638.7336 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1342.8821	1.2200	1638.3162 (264)
Space and water heating			4277.0498 (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			3634.3759 (272)
Primary energy kWh/m2/year			42.5571 (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
North	0.000	1.000	None
East	0.000	1.000	None
West	0.000	1.000	None

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

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

total: 634.5910

Solar gains	Jun	Jul	Aug	(P3)
Internal gains	684	635	554	
Total summer gains	456	438	447	
	1140	1072	1001	(P5)
Summer gain/loss ratio	3.32	3.13	2.92	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 250.0)	0.25	0.25	0.25	
Threshold temperature	18.97	20.68	20.47	(P7)
Likelihood of high internal temperature	Not significant	Slight	Not significant	
Assessment of likelihood of high internal temperature:	Slight			

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF STANDARD ENE7 CO2 09 Jan 2014

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

1. Overall dwelling dimensions

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

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.1819 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4319 (18)
Number of sides sheltered					2 (19)
Shelter factor					(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor					(21) = (18) x (20) = 0.3671 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4681	0.4589	0.4497	0.4038	0.3946	0.3488	0.3488	0.3396	0.3671	0.3946	0.4130	0.4314 (22b)
Effective ac	0.6095	0.6053	0.6011	0.5815	0.5779	0.5608	0.5608	0.5577	0.5674	0.5779	0.5853	0.5930 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
New Dwelling DG Door			2.0200	1.4000	2.8280		(26a)
New Dwelling DG Window (Uw = 1.40)			13.1300	1.3258	17.4072		(27)
Ground Floor			42.7000	0.1100	4.6970		(28a)
External Wall	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:												150.0000 (47)
Store volume												

b) If manufacturer declared loss factor is not known :

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF STANDARD ENE7 CO2 09 Jan 2014

Hot water storage loss factor from Table 2 (kWh/litre/day)													0.0191 (51)
Volume factor from Table 2a													0.9283 (52)
Temperature factor from Table 2b													0.5400 (53)
Enter (49) or (54) in (55)													1.4364 (55)
Total storage loss	44.5282	40.2190	44.5282	43.0918	44.5282	43.0918	44.5282	44.5282	43.0918	44.5282	43.0918	44.5282	(56)
If cylinder contains dedicated solar storage	44.5282	40.2190	44.5282	43.0918	44.5282	43.0918	44.5282	44.5282	43.0918	44.5282	43.0918	44.5282	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month	222.6597	196.6797	207.5624	187.4602	184.7147	166.5004	161.2862	175.0781	174.1727	194.3172	203.7174	217.7731	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Solar input (sum of months) = Sum(63)m =													(63)
Output from w/h	222.6597	196.6797	207.5624	187.4602	184.7147	166.5004	161.2862	175.0781	174.1727	194.3172	203.7174	217.7731	(64)
Heat gains from water heating, kWh/month	105.7265	94.0211	100.7066	93.0003	93.1097	86.0312	85.3197	89.9056	88.5822	96.3026	98.4058	104.1016	(65)
Total per year (kWh/year) = Sum(64)m =													(64)

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

Metabolic gains (Table 5), Watts													
(66)m	127.8692	127.8692	127.8692	127.8692	127.8692	127.8692	127.8692	127.8692	127.8692	127.8692	127.8692	127.8692	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.5981	19.1832	15.6008	11.8108	8.8287	7.4536	8.0539	10.4687	14.0511	17.8411	20.8232	22.1983	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	230.3561	232.7465	226.7228	213.8991	197.7115	182.4975	172.3335	169.9432	175.9668	188.7905	204.9781	220.1922	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.7869	35.7869	35.7869	35.7869	35.7869	35.7869	35.7869	35.7869	35.7869	35.7869	35.7869	35.7869	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-102.2953	-102.2953	-102.2953	-102.2953	-102.2953	-102.2953	-102.2953	-102.2953	-102.2953	-102.2953	-102.2953	-102.2953	(71)
Water heating gains (Table 5)	142.1054	139.9124	135.3583	129.1671	125.1475	119.4877	114.6771	120.8408	123.0308	129.4389	136.6748	139.9216	(72)
Total internal gains	458.4203	456.2028	442.0427	419.2378	396.0485	373.7995	359.4253	365.6135	377.4095	400.4313	426.8368	446.6728	(73)

6. Solar gains

[Jan]												Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North												1.8000	10.6334	0.7100	0.7000	0.7700	6.5923 (74)
East												4.0700	19.6403	0.7100	0.7000	0.7700	27.5316 (76)
West												7.2600	19.6403	0.7100	0.7000	0.7700	49.1104 (80)
Solar gains	83.2343	162.5262	268.3174	394.4893	487.6411	501.3577	476.3999	406.1828	312.9052	192.8987	103.6960	68.5223 (83)					
Total gains	541.6546	618.7290	710.3601	813.7271	883.6896	875.1572	835.8251	771.7963	690.3147	593.3299	530.5328	515.1951 (84)					

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
tau	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	0.9974	0.9945	0.9842	0.9442	0.8365	0.6506	0.4856	0.5437	0.8112	0.9698	0.9946	0.9980	(86)
MIT	19.8105	19.9622	20.2296	20.5790	20.8437	20.9684	20.9943	20.9900	20.9025	20.5469	20.1196	19.7902	(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	0.9966	0.9926	0.9786	0.9245	0.7847	0.5628	0.3791	0.4324	0.7350	0.9553	0.9924	0.9974	(89)
MIT 2	18.8921	19.0454	19.3120	19.6589	19.8927	19.9921	20.0045	20.0054	19.9496	19.6370	19.2138	18.8810	(90)
Living area fraction	19.1058	19.2587	19.5255	19.8730	20.1140	20.2193	20.2348	20.2345	20.1713	19.8487	19.4246	19.0925	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1058	19.2587	19.5255	19.8730	20.1140	20.2193	20.2348	20.2345	20.1713	19.8487	19.4246	19.0925	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	539.2568	613.0735	692.9284	750.0891	699.5049	509.7812	337.7015	353.8785	517.3539	565.2607	525.6293	513.4155	(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	1435.3145	1387.5389	1254.7670	1041.4476	796.3338	524.8781	339.5158	357.2892	569.9926	875.3363	1173.0817	1425.8796	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	666.6669	520.4408	418.0079	209.7781	72.0408	0.0000	0.0000	0.0000	0.0000	230.6962	466.1657	678.8733	(98)
Space heating													3262.6697 (98)
Space heating per m2													(98) / (4) = 38.2046 (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	15.5100	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		33.6062 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		33.6062 ZC8

U-VALUE CALCULATOR REPORT

surecalc ltd

Property Reference	sc120971	Issued on Date	17/01/2020
Assessment Reference	001	Prop Type Ref	New Dwelling
Project	Plot 4, 15-17, Kew Gardens, Bognor Regis, West Sussex, PO21 5RD		
Calculation Type	New Build (As Designed)		

SAP Rating	87 B	DER	14.58	TER	18.28
Environmental	89 B	% DER < TER	20.25		
CO ₂ Emissions (t/year)	0.86	DREF	44.06	TREF	52.70
General Requirements Compliance	Pass	% DREF < TREF	16.41		

Assessor Details	Mr. Mark Rogers, Surecalc Limited, Tel: 01243 772055, mark@surecalc.co.uk			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	sc120971	Issued on Date	17/01/2020
Assessment Reference	001	Prop Type Ref	New Dwelling
Project	Plot 4, 15-17, Kew Gardens, Bognor Regis, West Sussex, PO21 5RD		
Calculation Type	New Build (As Designed)		

SAP Rating	87 B	DER	14.58	TBR	18.28
Environmental	89 B	% DER < TBR	20.25		
CO ₂ Emissions (t/year)	0.86	DREE	44.06	TREE	52.70
General Requirements Compliance	Pass	% DPER < TREE	16.41		

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

Building Elements

Wall 000001 - Vivid 100 Cavity Wall Thermabead

Wall Type: Standard Wall

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

Total resistance: Upper limit = 4.227 m² K/W Lower limit = 4.129 m² K/W Average = 4.178 m² K/W
Total correction = 0.0001 m² K/W U-value (unrounded) = 0.24 W/m² K

Unheated space: None

Total thickness: 330 mm

U-value: 0.24 W/m² K

Kappa: n/a

U-VALUE CALCULATOR REPORT

surecalc ltd

Property Reference	sc120971	Issued on Date	17/01/2020
Assessment Reference	001	Prop Type Ref	New Dwelling
Project	Plot 4, 15-17, Kew Gardens, Bognor Regis, West Sussex, PO21 5RD		
Calculation Type	New Build (As Designed)		

SAP Rating	87 B	DER	14.58	TBR	18.28
Environmental	89 B	% DER < TBR	20.25		
CO ₂ Emissions (t/year)	0.86	DREE	44.06	TREE	52.70
General Requirements Compliance	Pass	% DPER < TPER	16.41		

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	sc120971	Issued on Date	17/01/2020
Assessment Reference	001	Prop Type Ref	New Dwelling
Property	Plot 4, 15-17, Kew Gardens, Bognor Regis, West Sussex, PO21 5RD		
SAP Rating	87 B	DER	14.58
Environmental	89 B	% DER<TER	20.25
CO ₂ Emissions (t/year)	0.86	DERE	44.06
General Requirements Compliance	Pass	% DERE<TERE	16.41
Assessor Details	Mr. Mark Rogers, Surecalc Limited, T 01243 855266		Assessor ID
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: