

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.51
Printed on 01 July 2022 at 09:53:49

Project Information:

Assessed By: Ben Tunningley (STRO027495)

Building Type: End-terrace House

Dwelling Details:

NEW DWELLING DESIGN STAGE

Total Floor Area: 87.34m²

Site Reference : Chain Road

Plot Reference: Plot 001

Address : Plot 001, Chain Road, Manchester, M9

Client Details:

Name: Great Places

Address :

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 system: Mains gas

Fuel factor: 1.00 (mains gas)

Target Carbon Dioxide Emission Rate (TER) 17.7 kg/m²

Dwelling Carbon Dioxide Emission Rate (DER) 17.10 kg/m²

OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 50.2 kWh/m²

Dwelling Fabric Energy Efficiency (DFEE) 44.2 kWh/m²

OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.20 (max. 0.30)	0.20 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.15 (max. 0.25)	0.15 (max. 0.70)	OK
Roof	0.09 (max. 0.20)	0.09 (max. 0.35)	OK
Openings	1.31 (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: Database: (rev 500, product index 018119):
Boiler systems with radiators or underfloor heating - mains gas
Brand name: Vaillant
Model: ecoTEC sustain 28
Model qualifier: VUW 286/7-2 (H-GB)
(Combi)
Efficiency 89.1 % SEDBUK2009
Minimum 88.0 %

OK

Secondary heating system: None

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5 Cylinder insulation

Hot water Storage: No cylinder

6 Controls

Space heating controls: Programmer, room thermostat and TRVs **OK**
 Hot water controls: No cylinder thermostat

No cylinder
 Boiler interlock: Yes **OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings: 100.0%
 Minimum: 75.0% **OK**

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (West Pennines): Not significant **OK**

Based on:

Overshading: Very Little
 Windows facing: North East 5.83m²
 Windows facing: South West 7.13m²
 Ventilation rate: 4.00
 Blinds/curtains: None

10 Key features

Roofs U-value: 0.09 W/m²K
 Party Walls U-value: 0 W/m²K

Code for Sustainable Homes Report

For use with Nov 2010 addendum 2014 England

Assessor and House Details

Assessor Name: Ben Tunningley
Property Address: Plot 001
Chain Road
Manchester
M9

Assessor Number: STRO027495

Buiding regulation assessment

	kg/m ² /year
TER	17.7
DER	17.1

ENE 1 Assessment - Dwelling Emission Rate

Total Energy Type CO₂ Emissions for Codes Levels 1 - 5

	%	kg/m ² /year	
DER from SAP 2012 DER Worksheet		17.1	(ZC1)
TER		17.7	
Residual CO2 emissions offset from biofuel CHP		0	(ZC5)
CO2 emissions offset from additional allowable electricity generation		0	(ZC7)
Total CO2 emissions offset from SAP Section 16 allowances		0	
DER accounting for SAP Section 16 allowances		17.1	
% improvement DER/TER	3.4		

Total Energy Type CO2 Emissions for Codes Levels 6

	kg/m ² /year	
DER accounting for SAP Section 16 allowances	17.1	(ZC1)
CO2 emissions from appliances, equation (L14)	15.82	(ZC2)
CO2 emissions from cooking, equation (L16)	2.07	(ZC3)
Net CO2 emissions	36.1	(ZC8)

Result:

Credits awarded for ENE 1 = 0.5

Code Level = 3

ENE 2 - Fabric energy Efficiency

Fabric energy Efficiency: 44.24

Credits awarded for ENE 2 = 7.4

ENE 7 - Low or Zero Carbon (LZC) Technologies

Reduction in CO2 Emissions

	%	kg/m ² /year	
Standard Case CO2 emissions		36.09	
Standard DER		18.19	
Actual Case CO2 emissions		36.09	
Actual DER		18.19	
Reduction in CO2 emissions	0		

Credits awarded for ENE 7 = 0

Technologies eligible to contribute to achieving the requirements of this issue must produce energy from renewable sources and meet all other ancillary requirements as defined by Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC.

The following requirements must also be met:

- Where not provided by accredited external renewables there must be a direct supply of energy produced to the dwelling under assessment.
- Where covered by the Microgeneration Certification Scheme (MCS), technologies under 50kWe or 300kWth must be certified.
- Combined Heat and Power (CHP) schemes above 50kWe must be certified under the CHPQA standard.
- All technologies must be accounted for by SAP.

CHP schemes fuelled by mains gas are eligible to contribute to performance against this issue. Where these schemes are above 50kWe they must be certified under the CHPQA.

It is the responsibility of the Accredited OCDEA and Code Assessor to ensure all technologies use in the calculation are appropriate before awarding credits.

SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: Ben Tunningley **Stroma Number:** STRO027495
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.51

Property Address: Plot 001

Address : Plot 001, Chain Road, Manchester, M9

1. Overall dwelling dimensions:

	Area(m ²)		Av. Height(m)		Volume(m ³)
Ground floor	43.67 (1a)	x	2.42 (2a)	=	105.68 (3a)
First floor	43.67 (1b)	x	2.67 (2b)	=	116.6 (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	87.34 (4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	222.28 (5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m ³ per hour
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0 (6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0 (6b)
Number of intermittent fans							3	x 10 =	30 (7a)
Number of passive vents							0	x 10 =	0 (7b)
Number of flueless gas fires							0	x 40 =	0 (7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.13 (8)
<i>If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)</i>			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
<i>if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35</i>			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)			0.38 (18)
<i>Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used</i>			
Number of sides sheltered			2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.85 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.33 (21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
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SAP WorkSheet: New dwelling design stage

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18
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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

	0.42	0.41	0.4	0.36	0.35	0.31	0.31	0.3	0.33	0.35	0.37	0.38
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Calculate effective air change rate for the applicable case

If mechanical ventilation:

(23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)

(23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =

(23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0
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(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0
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(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0
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(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.59	0.58	0.58	0.56	0.56	0.55	0.55	0.55	0.55	0.56	0.57	0.57
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(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.59	0.58	0.58	0.56	0.56	0.55	0.55	0.55	0.55	0.56	0.57	0.57
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(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			2.15	x 1.4	= 3.01		(26)
Windows Type 1			5.83	x 1/[1/(1.3)+0.04]	= 7.2		(27)
Windows Type 2			7.13	x 1/[1/(1.3)+0.04]	= 8.81		(27)
Floor			43.67	x 0.15	= 6.5505	75	3275.25 (28)
Walls	95.39	15.11	80.28	x 0.2	= 16.06	60	4816.8 (29)
Roof	43.67	0	43.67	x 0.09	= 3.93	9	393.03 (30)
Total area of elements, m²			182.73				(31)
Party wall			43.63	x 0	= 0	70	3054.1 (32)
Internal wall **			82			9	738 (32c)
Internal wall **			105			9	945 (32c)
Internal floor			43.67			18	786.0599 (32d)
Internal ceiling			43.67			9	393.03 (32e)

* for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 45.56 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 14401.27 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 164.89 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f

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can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K

12.88

(36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss

(33) + (36) =

58.44

(37)

Ventilation heat loss calculated monthly

(38)m = 0.33 x (25)m x (5)

(38)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
43.06	42.81	42.57	41.43	41.21	40.22	40.22	40.04	40.6	41.21	41.65	42.1

(38)

Heat transfer coefficient, W/K

(39)m = (37) + (38)m

(39)m=

101.5	101.25	101.01	99.87	99.65	98.66	98.66	98.47	99.04	99.65	100.08	100.54
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Average = Sum(39)_{1...12} /12=

99.86

(39)

Heat loss parameter (HLP), W/m²K

(40)m = (39)m ÷ (4)

(40)m=

1.16	1.16	1.16	1.14	1.14	1.13	1.13	1.13	1.13	1.14	1.15	1.15
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Average = Sum(40)_{1...12} /12=

1.14

(40)

Number of days in month (Table 1a)

(41)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

2.59

(42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)²)] + 0.0013 x (TFA -13.9)

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36

95.65

(43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=

105.22	101.39	97.57	93.74	89.91	86.09	86.09	89.91	93.74	97.57	101.39	105.22
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Total = Sum(44)_{1...12} =

1147.85

(44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=

156.04	136.47	140.83	122.78	117.81	101.66	94.2	108.1	109.39	127.48	139.16	151.11
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Total = Sum(45)_{1...12} =

1505.01

(45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=

23.41	20.47	21.12	18.42	17.67	15.25	14.13	16.21	16.41	19.12	20.87	22.67
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(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel

0

(47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day):

0

(48)

Temperature factor from Table 2b

0

(49)

Energy lost from water storage, kWh/year

(48) x (49) =

0

(50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day)

0

(51)

If community heating see section 4.3

Volume factor from Table 2a

0

(52)

Temperature factor from Table 2b

0

(53)

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Energy lost from water storage, kWh/year

$$(47) \times (51) \times (52) \times (53) =$$

0
0

(54)

Enter (50) or (54) in (55)

(55)

Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

(56)m=	0	0	0	0	0	0	0	0	0	0	0
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(56)

If cylinder contains dedicated solar storage, (57)m = (56)m × [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	0	0	0	0	0	0	0	0	0	0	0
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(57)

Primary circuit loss (annual) from Table 3

0

(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0
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(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	18.76	16.9	18.58	17.8	18.26	17.52	18.01	18.17	17.67	18.44	18.04	18.71
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(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	174.8	153.37	159.4	140.57	136.06	119.18	112.21	126.27	127.06	145.93	157.19	169.83
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(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRs and/or WWHRs applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0
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(63)

Output from water heater

(64)m=	174.8	153.37	159.4	140.57	136.06	119.18	112.21	126.27	127.06	145.93	157.19	169.83
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Output from water heater (annual)_{1...12}

1721.87

(64)

Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(65)m=	56.57	49.6	51.47	45.27	43.73	38.18	35.82	40.48	40.79	47	50.78	54.92
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(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

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=	155.25	155.25	155.25	155.25	155.25	155.25	155.25	155.25	155.25	155.25	155.25	155.25

(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	53.35	47.38	38.53	29.17	21.81	18.41	19.89	25.86	34.71	44.07	51.43	54.83
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(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	349.4	353.03	343.89	324.44	299.89	276.81	261.39	257.77	266.9	286.35	310.91	333.98
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(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	53.11	53.11	53.11	53.11	53.11	53.11	53.11	53.11	53.11	53.11	53.11	53.11
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(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3
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(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-103.5	-103.5	-103.5	-103.5	-103.5	-103.5	-103.5	-103.5	-103.5	-103.5	-103.5	-103.5
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(71)

Water heating gains (Table 5)

(72)m=	76.04	73.81	69.18	62.88	58.78	53.03	48.15	54.41	56.65	63.17	70.53	73.82
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(72)

Total internal gains =

$$(66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m$$

(73)m=	586.65	582.09	559.47	524.35	488.34	456.11	437.3	445.9	466.12	501.46	540.73	570.5
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(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

SAP WorkSheet: New dwelling design stage

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast 0.9x	1	x	5.83	x	11.28	x	0.46	x	1.11	=	30.26	(75)
Northeast 0.9x	1	x	5.83	x	22.97	x	0.46	x	1.11	=	61.59	(75)
Northeast 0.9x	1	x	5.83	x	41.38	x	0.46	x	1.11	=	110.97	(75)
Northeast 0.9x	1	x	5.83	x	67.96	x	0.46	x	1.11	=	182.24	(75)
Northeast 0.9x	1	x	5.83	x	91.35	x	0.46	x	1.11	=	244.97	(75)
Northeast 0.9x	1	x	5.83	x	97.38	x	0.46	x	1.11	=	261.17	(75)
Northeast 0.9x	1	x	5.83	x	91.1	x	0.46	x	1.11	=	244.32	(75)
Northeast 0.9x	1	x	5.83	x	72.63	x	0.46	x	1.11	=	194.77	(75)
Northeast 0.9x	1	x	5.83	x	50.42	x	0.46	x	1.11	=	135.22	(75)
Northeast 0.9x	1	x	5.83	x	28.07	x	0.46	x	1.11	=	75.27	(75)
Northeast 0.9x	1	x	5.83	x	14.2	x	0.46	x	1.11	=	38.07	(75)
Northeast 0.9x	1	x	5.83	x	9.21	x	0.46	x	1.11	=	24.71	(75)
Southwest 0.9x	1	x	7.13	x	36.79		0.46	x	1.11	=	120.68	(79)
Southwest 0.9x	1	x	7.13	x	62.67		0.46	x	1.11	=	205.56	(79)
Southwest 0.9x	1	x	7.13	x	85.75		0.46	x	1.11	=	281.25	(79)
Southwest 0.9x	1	x	7.13	x	106.25		0.46	x	1.11	=	348.48	(79)
Southwest 0.9x	1	x	7.13	x	119.01		0.46	x	1.11	=	390.33	(79)
Southwest 0.9x	1	x	7.13	x	118.15		0.46	x	1.11	=	387.51	(79)
Southwest 0.9x	1	x	7.13	x	113.91		0.46	x	1.11	=	373.6	(79)
Southwest 0.9x	1	x	7.13	x	104.39		0.46	x	1.11	=	342.38	(79)
Southwest 0.9x	1	x	7.13	x	92.85		0.46	x	1.11	=	304.54	(79)
Southwest 0.9x	1	x	7.13	x	69.27		0.46	x	1.11	=	227.18	(79)
Southwest 0.9x	1	x	7.13	x	44.07		0.46	x	1.11	=	144.54	(79)
Southwest 0.9x	1	x	7.13	x	31.49		0.46	x	1.11	=	103.27	(79)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m= 150.93 267.15 392.22 530.73 635.3 648.67 617.91 537.15 439.75 302.45 182.62 127.98 (83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m= 737.59 849.23 951.69 1055.08 1123.64 1104.79 1055.21 983.05 905.88 803.91 723.35 698.48 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C)

21

(85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(86)m=	0.97	0.95	0.92	0.84	0.7	0.54	0.4	0.45	0.67	0.87	0.95	0.98

(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m= 19.57 19.8 20.13 20.52 20.8 20.95 20.99 20.98 20.88 20.51 19.97 19.52 (87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m= 19.95 19.95 19.95 19.97 19.97 19.98 19.98 19.98 19.97 19.97 19.96 19.96 (88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m= 0.97 0.94 0.9 0.8 0.65 0.46 0.31 0.35 0.59 0.84 0.94 0.97 (89)

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Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.67	18.89	19.21	19.59	19.83	19.95	19.97	19.97	19.9	19.59	19.07	18.63	(90)
--------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------	-------	-------	------

fLA = Living area ÷ (4) =	0.15	(91)
---------------------------	------	------

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.8	19.03	19.35	19.73	19.98	20.1	20.13	20.13	20.05	19.73	19.21	18.76	(92)
--------	------	-------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------	------

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.8	19.03	19.35	19.73	19.98	20.1	20.13	20.13	20.05	19.73	19.21	18.76	(93)
--------	------	-------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------	------

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

Utilisation factor for gains, hm:

(94)m=	0.96	0.93	0.89	0.8	0.65	0.47	0.33	0.37	0.6	0.83	0.93	0.96	(94)
--------	------	------	------	-----	------	------	------	------	-----	------	------	------	------

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	706.3	792.29	844.26	839.31	732.96	522.18	344.13	360.84	541.04	668.73	674.99	673.21	(95)
--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
--------	-----	-----	-----	-----	------	------	------	------	------	------	-----	-----	------

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1472.04	1430.65	1298.43	1081.48	825.18	542.77	347.99	366.84	589.7	909.65	1211.95	1464.14	(97)
--------	---------	---------	---------	---------	--------	--------	--------	--------	-------	--------	---------	---------	------

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	569.71	428.98	337.91	174.36	68.62	0	0	0	0	179.25	386.61	588.45		
Total per year (kWh/year) = Sum(98) _{1...5,9...12} =													2733.88	(98)

Space heating requirement in kWh/m²/year

31.3	(99)
------	------

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

Space heating:

Fraction of space heat from secondary/supplementary system

0	(201)
---	-------

Fraction of space heat from main system(s)

$$(202) = 1 - (201) =$$

1	(202)
---	-------

Fraction of total heating from main system 1

$$(204) = (202) \times [1 - (203)] =$$

1	(204)
---	-------

Efficiency of main space heating system 1

93	(206)
----	-------

Efficiency of secondary/supplementary heating system, %

0	(208)
---	-------

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

kWh/year

Space heating requirement (calculated above)

569.71	428.98	337.91	174.36	68.62	0	0	0	0	179.25	386.61	588.45
--------	--------	--------	--------	-------	---	---	---	---	--------	--------	--------

$$(211)m = \{[(98)m \times (204)]\} \times 100 \div (206) \quad (211)$$

612.59	461.26	363.34	187.49	73.78	0	0	0	0	192.74	415.71	632.74
--------	--------	--------	--------	-------	---	---	---	---	--------	--------	--------

$$\text{Total (kWh/year) = Sum(211)}_{1...5,10...12} = 2939.65 \quad (211)$$

Space heating fuel (secondary), kWh/month

$$= \{[(98)m \times (201)]\} \times 100 \div (208)$$

(215)m=	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215) _{1...5,10...12} =												0	(215)

Water heating

Output from water heater (calculated above)

174.8	153.37	159.4	140.57	136.06	119.18	112.21	126.27	127.06	145.93	157.19	169.83
-------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------

Efficiency of water heater	87	(216)
----------------------------	----	-------

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(217)m=

89.28	89.19	89.02	88.64	87.98	87	87	87	87	88.63	89.11	89.31
-------	-------	-------	-------	-------	----	----	----	----	-------	-------	-------

 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=

195.8	171.96	179.07	158.59	154.65	136.98	128.97	145.13	146.04	164.65	176.4	190.15
-------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	--------

Total = Sum(219a)_{1...12} =

1948.41

 (219)

Annual totals

Space heating fuel used, main system 1

kWh/year

kWh/year

Water heating fuel used

Electricity for pumps, fans and electric keep-hot

central heating pump:

30

 (230c)

boiler with a fan-assisted flue

45

 (230e)

Total electricity for the above, kWh/year

sum of (230a)...(230g) =

75

 (231)

Electricity for lighting

376.86

 (232)

Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =

5339.92

 (338)

10a. Fuel costs - individual heating systems:

	Fuel kWh/year	Fuel Price (Table 12)	Fuel Cost £/year		
Space heating - main system 1	(211) x	<table><tr><td>3.48</td></tr></table> x 0.01 =	3.48	<table><tr><td>102.3</td></tr></table> (240)	102.3
3.48					
102.3					
Space heating - main system 2	(213) x	<table><tr><td>0</td></tr></table> x 0.01 =	0	<table><tr><td>0</td></tr></table> (241)	0
0					
0					
Space heating - secondary	(215) x	<table><tr><td>13.19</td></tr></table> x 0.01 =	13.19	<table><tr><td>0</td></tr></table> (242)	0
13.19					
0					
Water heating cost (other fuel)	(219)	<table><tr><td>3.48</td></tr></table> x 0.01 =	3.48	<table><tr><td>67.8</td></tr></table> (247)	67.8
3.48					
67.8					
Pumps, fans and electric keep-hot	(231)	<table><tr><td>13.19</td></tr></table> x 0.01 =	13.19	<table><tr><td>9.89</td></tr></table> (249)	9.89
13.19					
9.89					
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a					
Energy for lighting	(232)	<table><tr><td>13.19</td></tr></table> x 0.01 =	13.19	<table><tr><td>49.71</td></tr></table> (250)	49.71
13.19					
49.71					
Additional standing charges (Table 12)			<table><tr><td>120</td></tr></table> (251)	120	
120					
Appendix Q items: repeat lines (253) and (254) as needed					
Total energy cost	(245)...(247) + (250)...(254) =		<table><tr><td>349.7</td></tr></table> (255)	349.7	
349.7					

11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		<table><tr><td>0.42</td></tr></table>	0.42	(256)
0.42				
Energy cost factor (ECF)	$[(255) \times (256)] \div [(4) + 45.0] =$	<table><tr><td>1.11</td></tr></table>	1.11	(257)
1.11				
SAP rating (Section 12)		<table><tr><td>84.52</td></tr></table>	84.52	(258)
84.52				

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year		
Space heating (main system 1)	(211) x	<table><tr><td>0.216</td></tr></table> =	0.216	<table><tr><td>634.96</td></tr></table> (261)	634.96
0.216					
634.96					
Space heating (secondary)	(215) x	<table><tr><td>0.519</td></tr></table> =	0.519	<table><tr><td>0</td></tr></table> (263)	0
0.519					
0					
Water heating	(219) x	<table><tr><td>0.216</td></tr></table> =	0.216	<table><tr><td>420.86</td></tr></table> (264)	420.86
0.216					
420.86					

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Space and water heating	(261) + (262) + (263) + (264) =			1055.82	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	195.59	(268)
Total CO ₂ , kg/year	sum of (265)...(271) =			1290.33	(272)
CO₂ emissions per m²	(272) ÷ (4) =			14.77	(273)
El rating (section 14)				87	(274)

13a. Primary Energy

	Energy kWh/year	Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x	1.22	=	3586.37	(261)
Space heating (secondary)	(215) x	3.07	=	0	(263)
Energy for water heating	(219) x	1.22	=	2377.06	(264)
Space and water heating	(261) + (262) + (263) + (264) =			5963.43	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	3.07	=	230.25	(267)
Electricity for lighting	(232) x	0	=	1156.95	(268)
'Total Primary Energy	sum of (265)...(271) =			7350.63	(272)
Primary energy kWh/m²/year	(272) ÷ (4) =			84.16	(273)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name: Ben Tunningley **Stroma Number:** STRO027495
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.51

Property Address: Plot 001

Address : Plot 001, Chain Road, Manchester, M9

1. Overall dwelling dimensions:

	Area(m ²)		Av. Height(m)		Volume(m ³)
Ground floor	43.67	(1a) x	2.42	(2a) =	105.68
First floor	43.67	(1b) x	2.67	(2b) =	116.6
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	87.34	(4)			
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	222.28

2. Ventilation rate:

	main heating		secondary heating		other		total		m ³ per hour
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0
Number of open flues	0	+	0	+	0	=	0	x 20 =	0
Number of intermittent fans							3	x 10 =	30
Number of passive vents							0	x 10 =	0
Number of flueless gas fires							0	x 40 =	0

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.13
<i>If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)</i>			
Number of storeys in the dwelling (ns)			0
Additional infiltration		[(9)-1]x0.1 =	0
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0
<i>if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35</i>			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0
If no draught lobby, enter 0.05, else enter 0			0
Percentage of windows and doors draught stripped			0
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)			0.38
<i>Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used</i>			
Number of sides sheltered			2
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.85
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.33

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
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Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18
---------	------	------	------	-----	------	------	------	------	---	------	------	------

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

	0.42	0.41	0.4	0.36	0.35	0.31	0.31	0.3	0.33	0.35	0.37	0.38
--	------	------	-----	------	------	------	------	-----	------	------	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)

0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =

0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0
---------	---	---	---	---	---	---	---	---	---	---	---	---

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0
---------	---	---	---	---	---	---	---	---	---	---	---	---

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0
---------	---	---	---	---	---	---	---	---	---	---	---	---

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.59	0.58	0.58	0.56	0.56	0.55	0.55	0.55	0.55	0.56	0.57	0.57
---------	------	------	------	------	------	------	------	------	------	------	------	------

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.59	0.58	0.58	0.56	0.56	0.55	0.55	0.55	0.55	0.56	0.57	0.57
--------	------	------	------	------	------	------	------	------	------	------	------	------

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			2.15	x 1.4	= 3.01		(26)
Windows Type 1			5.83	x 1/[1/(1.3)+0.04]	= 7.2		(27)
Windows Type 2			7.13	x 1/[1/(1.3)+0.04]	= 8.81		(27)
Floor			43.67	x 0.15	= 6.5505	75	3275.25 (28)
Walls	95.39	15.11	80.28	x 0.2	= 16.06	60	4816.8 (29)
Roof	43.67	0	43.67	x 0.09	= 3.93	9	393.03 (30)
Total area of elements, m²			182.73				(31)
Party wall			43.63	x 0	= 0	70	3054.1 (32)
Internal wall **			82			9	738 (32c)
Internal wall **			105			9	945 (32c)
Internal floor			43.67			18	786.0599 (32d)
Internal ceiling			43.67			9	393.03 (32e)

* for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 45.56 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 14401.27 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 164.89 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f

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can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K

12.88

(36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss

(33) + (36) =

58.44

(37)

Ventilation heat loss calculated monthly

(38)m = 0.33 x (25)m x (5)

(38)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
43.06	42.81	42.57	41.43	41.21	40.22	40.22	40.04	40.6	41.21	41.65	42.1

(38)

Heat transfer coefficient, W/K

(39)m = (37) + (38)m

(39)m=

101.5	101.25	101.01	99.87	99.65	98.66	98.66	98.47	99.04	99.65	100.08	100.54
-------	--------	--------	-------	-------	-------	-------	-------	-------	-------	--------	--------

Average = Sum(39)_{1...12} / 12 =

99.86

(39)

Heat loss parameter (HLP), W/m²K

(40)m = (39)m ÷ (4)

(40)m=

1.16	1.16	1.16	1.14	1.14	1.13	1.13	1.13	1.13	1.14	1.15	1.15
------	------	------	------	------	------	------	------	------	------	------	------

Average = Sum(40)_{1...12} / 12 =

1.14

(40)

Number of days in month (Table 1a)

(41)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

2.59

(42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA - 13.9)²)] + 0.0013 x (TFA - 13.9)

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36

95.65

(43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=

105.22	101.39	97.57	93.74	89.91	86.09	86.09	89.91	93.74	97.57	101.39	105.22
--------	--------	-------	-------	-------	-------	-------	-------	-------	-------	--------	--------

Total = Sum(44)_{1...12} =

1147.85

(44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=

156.04	136.47	140.83	122.78	117.81	101.66	94.2	108.1	109.39	127.48	139.16	151.11
--------	--------	--------	--------	--------	--------	------	-------	--------	--------	--------	--------

Total = Sum(45)_{1...12} =

1505.01

(45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=

23.41	20.47	21.12	18.42	17.67	15.25	14.13	16.21	16.41	19.12	20.87	22.67
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel

0

(47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day):

0

(48)

Temperature factor from Table 2b

0

(49)

Energy lost from water storage, kWh/year

(48) x (49) =

0

(50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day)

0

(51)

If community heating see section 4.3

Volume factor from Table 2a

0

(52)

Temperature factor from Table 2b

0

(53)

DER WorkSheet: New dwelling design stage

Energy lost from water storage, kWh/year

$$(47) \times (51) \times (52) \times (53) =$$

0
0

(54)

Enter (50) or (54) in (55)

(55)

Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

(56)m=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

(56)

If cylinder contains dedicated solar storage, (57)m = (56)m × [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

(57)

Primary circuit loss (annual) from Table 3

0

(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=

18.76	16.9	18.58	17.8	18.26	17.52	18.01	18.17	17.67	18.44	18.04	18.71
-------	------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------

(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=

174.8	153.37	159.4	140.57	136.06	119.18	112.21	126.27	127.06	145.93	157.19	169.83
-------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------

(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRs and/or WWHRs applies, see Appendix G)

(63)m=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

(63)

Output from water heater

(64)m=

174.8	153.37	159.4	140.57	136.06	119.18	112.21	126.27	127.06	145.93	157.19	169.83
-------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------

Output from water heater (annual)_{1...12}

1721.87

(64)

Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(65)m=

56.57	49.6	51.47	45.27	43.73	38.18	35.82	40.48	40.79	47	50.78	54.92
-------	------	-------	-------	-------	-------	-------	-------	-------	----	-------	-------

(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

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

Metabolic gains (Table 5), Watts

(66)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
129.38	129.38	129.38	129.38	129.38	129.38	129.38	129.38	129.38	129.38	129.38	129.38

(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=

22.11	19.64	15.97	12.09	9.04	7.63	8.25	10.72	14.39	18.27	21.32	22.73
-------	-------	-------	-------	------	------	------	-------	-------	-------	-------	-------

(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=

234.1	236.53	230.41	217.37	200.92	185.46	175.13	172.7	178.83	191.86	208.31	223.77
-------	--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------

(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=

35.94	35.94	35.94	35.94	35.94	35.94	35.94	35.94	35.94	35.94	35.94	35.94
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(69)

Pumps and fans gains (Table 5a)

(70)m=

3	3	3	3	3	3	3	3	3	3	3	3
---	---	---	---	---	---	---	---	---	---	---	---

(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=

-103.5	-103.5	-103.5	-103.5	-103.5	-103.5	-103.5	-103.5	-103.5	-103.5	-103.5	-103.5
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

(71)

Water heating gains (Table 5)

(72)m=

76.04	73.81	69.18	62.88	58.78	53.03	48.15	54.41	56.65	63.17	70.53	73.82
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(72)

Total internal gains =

$$(66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m$$

(73)m=

397.06	394.79	380.37	357.16	333.56	310.93	296.34	302.65	314.67	338.11	364.97	385.13
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

DER WorkSheet: New dwelling design stage

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast 0.9x	0.77	x	5.83	x	11.28	x	0.46	x	1.11	=	23.3	(75)
Northeast 0.9x	0.77	x	5.83	x	22.97	x	0.46	x	1.11	=	47.43	(75)
Northeast 0.9x	0.77	x	5.83	x	41.38	x	0.46	x	1.11	=	85.45	(75)
Northeast 0.9x	0.77	x	5.83	x	67.96	x	0.46	x	1.11	=	140.33	(75)
Northeast 0.9x	0.77	x	5.83	x	91.35	x	0.46	x	1.11	=	188.63	(75)
Northeast 0.9x	0.77	x	5.83	x	97.38	x	0.46	x	1.11	=	201.1	(75)
Northeast 0.9x	0.77	x	5.83	x	91.1	x	0.46	x	1.11	=	188.12	(75)
Northeast 0.9x	0.77	x	5.83	x	72.63	x	0.46	x	1.11	=	149.97	(75)
Northeast 0.9x	0.77	x	5.83	x	50.42	x	0.46	x	1.11	=	104.12	(75)
Northeast 0.9x	0.77	x	5.83	x	28.07	x	0.46	x	1.11	=	57.96	(75)
Northeast 0.9x	0.77	x	5.83	x	14.2	x	0.46	x	1.11	=	29.32	(75)
Northeast 0.9x	0.77	x	5.83	x	9.21	x	0.46	x	1.11	=	19.03	(75)
Southwest 0.9x	0.77	x	7.13	x	36.79		0.46	x	1.11	=	92.92	(79)
Southwest 0.9x	0.77	x	7.13	x	62.67		0.46	x	1.11	=	158.28	(79)
Southwest 0.9x	0.77	x	7.13	x	85.75		0.46	x	1.11	=	216.56	(79)
Southwest 0.9x	0.77	x	7.13	x	106.25		0.46	x	1.11	=	268.33	(79)
Southwest 0.9x	0.77	x	7.13	x	119.01		0.46	x	1.11	=	300.56	(79)
Southwest 0.9x	0.77	x	7.13	x	118.15		0.46	x	1.11	=	298.38	(79)
Southwest 0.9x	0.77	x	7.13	x	113.91		0.46	x	1.11	=	287.67	(79)
Southwest 0.9x	0.77	x	7.13	x	104.39		0.46	x	1.11	=	263.63	(79)
Southwest 0.9x	0.77	x	7.13	x	92.85		0.46	x	1.11	=	234.49	(79)
Southwest 0.9x	0.77	x	7.13	x	69.27		0.46	x	1.11	=	174.93	(79)
Southwest 0.9x	0.77	x	7.13	x	44.07		0.46	x	1.11	=	111.3	(79)
Southwest 0.9x	0.77	x	7.13	x	31.49		0.46	x	1.11	=	79.52	(79)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=

116.22	205.7	302.01	408.66	489.18	499.48	475.79	413.61	338.61	232.89	140.61	98.55
--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------

 (83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=

513.28	600.5	682.38	765.82	822.74	810.41	772.14	716.26	653.29	571	505.58	483.68
--------	-------	--------	--------	--------	--------	--------	--------	--------	-----	--------	--------

 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C)

21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

(86)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.99	0.98	0.97	0.92	0.83	0.68	0.53	0.58	0.8	0.95	0.98	0.99

 (86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=

19.26	19.47	19.82	20.26	20.64	20.88	20.96	20.95	20.77	20.27	19.68	19.22
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=

19.95	19.95	19.95	19.97	19.97	19.98	19.98	19.98	19.97	19.97	19.96	19.96
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=

0.99	0.98	0.96	0.9	0.79	0.6	0.42	0.47	0.74	0.93	0.98	0.99
------	------	------	-----	------	-----	------	------	------	------	------	------

 (89)

DER WorkSheet: New dwelling design stage

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.36	18.58	18.92	19.36	19.71	19.91	19.96	19.96	19.83	19.37	18.8	18.33	(90)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------	------

fLA = Living area ÷ (4) =	0.15	(91)
---------------------------	------	------

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.5	18.72	19.06	19.49	19.85	20.06	20.12	20.11	19.97	19.51	18.93	18.47	(92)
--------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.5	18.72	19.06	19.49	19.85	20.06	20.12	20.11	19.97	19.51	18.93	18.47	(93)
--------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

Utilisation factor for gains, hm:

(94)m=	0.98	0.97	0.95	0.89	0.78	0.61	0.44	0.49	0.74	0.92	0.97	0.99	(94)
--------	------	------	------	------	------	------	------	------	------	------	------	------	------

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	505.41	584.31	647.39	682.91	642.59	492.04	336.88	349.97	482.71	524.95	492.53	477.6	(95)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	------

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
--------	-----	-----	-----	-----	------	------	------	------	------	------	-----	-----	------

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1441.45	1398.84	1268.26	1057.98	812.17	538.67	347	365.37	581.47	887.94	1184.29	1434.63	(97)
--------	---------	---------	---------	---------	--------	--------	-----	--------	--------	--------	---------	---------	------

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	696.42	547.36	461.93	270.05	126.16	0	0	0	0	270.07	498.06	712.03		
Total per year (kWh/year) = Sum(98) _{1...5,9...12} =													3582.08	(98)

Space heating requirement in kWh/m²/year

41.01	(99)
-------	------

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

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

Fraction of space heat from main system(s) (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 93 (206)

Efficiency of secondary/supplementary heating system, % 0 (208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----------

Space heating requirement (calculated above)

696.42	547.36	461.93	270.05	126.16	0	0	0	0	270.07	498.06	712.03
--------	--------	--------	--------	--------	---	---	---	---	--------	--------	--------

(211)m = {[(98)m x (204)] } x 100 ÷ (206) (211)

748.83	588.56	496.7	290.38	135.66	0	0	0	0	290.4	535.55	765.62
--------	--------	-------	--------	--------	---	---	---	---	-------	--------	--------

Total (kWh/year) =Sum(211)_{1...5,10...12} = 3851.7 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215) _{1...5,10...12} =												0	(215)

Water heating

Output from water heater (calculated above)

174.8	153.37	159.4	140.57	136.06	119.18	112.21	126.27	127.06	145.93	157.19	169.83
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Efficiency of water heater 87 (216)

DER WorkSheet: New dwelling design stage

(217)m=

89.38	89.33	89.21	88.95	88.42	87	87	87	87	88.92	89.26	89.41
-------	-------	-------	-------	-------	----	----	----	----	-------	-------	-------

 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=

195.57	171.7	178.68	158.03	153.89	136.98	128.97	145.13	146.04	164.1	176.11	189.95
--------	-------	--------	--------	--------	--------	--------	--------	--------	-------	--------	--------

Total = Sum(219a)_{1...12} =

1945.16

 (219)

Annual totals

Space heating fuel used, main system 1

kWh/year

kWh/year

Water heating fuel used

Electricity for pumps, fans and electric keep-hot

central heating pump:

30

 (230c)

boiler with a fan-assisted flue

45

 (230e)

Total electricity for the above, kWh/year

sum of (230a)...(230g) =

75

 (231)

Electricity for lighting

390.5

 (232)

Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =

6262.36

 (238)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating (main system 1)	(211) x	0.216 =	831.97 (261)
Space heating (secondary)	(215) x	0.519 =	0 (263)
Water heating	(219) x	0.216 =	420.15 (264)
Space and water heating	(261) + (262) + (263) + (264) =		1252.12 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519 =	38.93 (267)
Electricity for lighting	(232) x	0.519 =	202.67 (268)
Total CO2, kg/year	sum of (265)...(271) =		1493.72 (272)
Dwelling CO2 Emission Rate	(272) ÷ (4) =		17.1 (273)
El rating (section 14)			85 (274)

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name: Ben Tunningley **Stroma Number:** STRO027495
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.51

Property Address: Plot 001

Address : Plot 001, Chain Road, Manchester, M9

1. Overall dwelling dimensions:

	Area(m ²)		Av. Height(m)		Volume(m ³)
Ground floor	43.67	(1a) x	2.42	(2a) =	105.68
First floor	43.67	(1b) x	2.67	(2b) =	116.6
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	87.34	(4)			
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	222.28

2. Ventilation rate:

	main heating		secondary heating		other		total		m ³ per hour
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0
Number of open flues	0	+	0	+	0	=	0	x 20 =	0
Number of intermittent fans							3	x 10 =	30
Number of passive vents							0	x 10 =	0
Number of flueless gas fires							0	x 40 =	0

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.13
<i>If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)</i>			
Number of storeys in the dwelling (ns)			0
Additional infiltration		[(9)-1]x0.1 =	0
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0
<i>if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35</i>			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0
If no draught lobby, enter 0.05, else enter 0			0
Percentage of windows and doors draught stripped			0
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)			0.38
<i>Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used</i>			
Number of sides sheltered			2
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.85
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.33

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
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TER WorkSheet: New dwelling design stage

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18
---------	------	------	------	-----	------	------	------	------	---	------	------	------

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

	0.42	0.41	0.4	0.36	0.35	0.31	0.31	0.3	0.33	0.35	0.37	0.38
--	------	------	-----	------	------	------	------	-----	------	------	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

(23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)

(23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =

(23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0
---------	---	---	---	---	---	---	---	---	---	---	---	---

(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0
---------	---	---	---	---	---	---	---	---	---	---	---	---

(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0
---------	---	---	---	---	---	---	---	---	---	---	---	---

(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.59	0.58	0.58	0.56	0.56	0.55	0.55	0.55	0.55	0.56	0.57	0.57
---------	------	------	------	------	------	------	------	------	------	------	------	------

(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.59	0.58	0.58	0.56	0.56	0.55	0.55	0.55	0.55	0.56	0.57	0.57
--------	------	------	------	------	------	------	------	------	------	------	------	------

(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			2.15	x 1	= 2.15		(26)
Windows Type 1			5.83	x 1/[1/(1.4)+0.04]	= 7.73		(27)
Windows Type 2			7.13	x 1/[1/(1.4)+0.04]	= 9.45		(27)
Floor			43.67	x 0.13	= 5.6771		(28)
Walls	95.39	15.11	80.28	x 0.18	= 14.45		(29)
Roof	43.67	0	43.67	x 0.13	= 5.68		(30)
Total area of elements, m²			182.73				(31)
Party wall			43.63	x 0	= 0		(32)
Internal wall **			82				(32c)
Internal wall **			105				(32c)
Internal floor			43.67				(32d)
Internal ceiling			43.67				(32e)

* for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 45.14 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 14401.27 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f

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can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K

9.41 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss

(33) + (36) =

54.55 (37)

Ventilation heat loss calculated monthly

(38)m = 0.33 x (25)m x (5)

(38)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
43.06	42.81	42.57	41.43	41.21	40.22	40.22	40.04	40.6	41.21	41.65	42.1

(38)

Heat transfer coefficient, W/K

(39)m = (37) + (38)m

(39)m=

97.61	97.36	97.12	95.98	95.77	94.77	94.77	94.59	95.15	95.77	96.2	96.65
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------

Average = Sum(39)_{1...12} / 12 =

95.98 (39)

Heat loss parameter (HLP), W/m²K

(40)m = (39)m ÷ (4)

(40)m=

1.12	1.11	1.11	1.1	1.1	1.09	1.09	1.08	1.09	1.1	1.1	1.11
------	------	------	-----	-----	------	------	------	------	-----	-----	------

Average = Sum(40)_{1...12} / 12 =

1.1 (40)

Number of days in month (Table 1a)

(41)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

2.59

(42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA - 13.9)²)] + 0.0013 x (TFA - 13.9)

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36

95.65

(43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=

105.22	101.39	97.57	93.74	89.91	86.09	86.09	89.91	93.74	97.57	101.39	105.22
--------	--------	-------	-------	-------	-------	-------	-------	-------	-------	--------	--------

Total = Sum(44)_{1...12} =

1147.85 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=

156.04	136.47	140.83	122.78	117.81	101.66	94.2	108.1	109.39	127.48	139.16	151.11
--------	--------	--------	--------	--------	--------	------	-------	--------	--------	--------	--------

Total = Sum(45)_{1...12} =

1505.01 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=

23.41	20.47	21.12	18.42	17.67	15.25	14.13	16.21	16.41	19.12	20.87	22.67
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel

0

(47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day):

0

(48)

Temperature factor from Table 2b

0

(49)

Energy lost from water storage, kWh/year

(48) x (49) =

0

(50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day)

0

(51)

If community heating see section 4.3

Volume factor from Table 2a

0

(52)

Temperature factor from Table 2b

0

(53)

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Energy lost from water storage, kWh/year

$$(47) \times (51) \times (52) \times (53) =$$

0
0

(54)

Enter (50) or (54) in (55)

(55)

Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

(56)m=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

(56)

If cylinder contains dedicated solar storage, (57)m = (56)m × [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

(57)

Primary circuit loss (annual) from Table 3

0

(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=

50.96	46.03	49.72	46.23	45.82	42.45	43.87	45.82	46.23	49.72	49.32	50.96
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=

207	182.5	190.55	169	163.63	144.11	138.07	153.92	155.62	177.2	188.47	202.07
-----	-------	--------	-----	--------	--------	--------	--------	--------	-------	--------	--------

(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRs and/or WWHRs applies, see Appendix G)

(63)m=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

(63)

Output from water heater

(64)m=

207	182.5	190.55	169	163.63	144.11	138.07	153.92	155.62	177.2	188.47	202.07
-----	-------	--------	-----	--------	--------	--------	--------	--------	-------	--------	--------

Output from water heater (annual)_{1...12}

2072.13

(64)

Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(65)m=

64.62	56.88	59.25	52.38	50.63	44.41	42.29	47.4	47.93	54.82	58.6	62.99
-------	-------	-------	-------	-------	-------	-------	------	-------	-------	------	-------

(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

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

Metabolic gains (Table 5), Watts

(66)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
129.38	129.38	129.38	129.38	129.38	129.38	129.38	129.38	129.38	129.38	129.38	129.38

(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=

22.11	19.64	15.97	12.09	9.04	7.63	8.25	10.72	14.39	18.27	21.32	22.73
-------	-------	-------	-------	------	------	------	-------	-------	-------	-------	-------

(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=

234.1	236.53	230.41	217.37	200.92	185.46	175.13	172.7	178.83	191.86	208.31	223.77
-------	--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------

(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=

35.94	35.94	35.94	35.94	35.94	35.94	35.94	35.94	35.94	35.94	35.94	35.94
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(69)

Pumps and fans gains (Table 5a)

(70)m=

3	3	3	3	3	3	3	3	3	3	3	3
---	---	---	---	---	---	---	---	---	---	---	---

(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=

-103.5	-103.5	-103.5	-103.5	-103.5	-103.5	-103.5	-103.5	-103.5	-103.5	-103.5	-103.5
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

(71)

Water heating gains (Table 5)

(72)m=

86.86	84.65	79.64	72.75	68.04	61.69	56.84	63.71	66.57	73.68	81.39	84.66
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(72)

Total internal gains =

$$(66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m$$

(73)m=

407.88	405.63	390.83	367.03	342.82	319.59	305.03	311.94	324.59	348.61	375.83	395.97
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

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Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast 0.9x	0.77	x	5.83	x	11.28	x	0.63	x	0.7	=	20.1	(75)
Northeast 0.9x	0.77	x	5.83	x	22.97	x	0.63	x	0.7	=	40.92	(75)
Northeast 0.9x	0.77	x	5.83	x	41.38	x	0.63	x	0.7	=	73.73	(75)
Northeast 0.9x	0.77	x	5.83	x	67.96	x	0.63	x	0.7	=	121.08	(75)
Northeast 0.9x	0.77	x	5.83	x	91.35	x	0.63	x	0.7	=	162.75	(75)
Northeast 0.9x	0.77	x	5.83	x	97.38	x	0.63	x	0.7	=	173.51	(75)
Northeast 0.9x	0.77	x	5.83	x	91.1	x	0.63	x	0.7	=	162.32	(75)
Northeast 0.9x	0.77	x	5.83	x	72.63	x	0.63	x	0.7	=	129.4	(75)
Northeast 0.9x	0.77	x	5.83	x	50.42	x	0.63	x	0.7	=	89.84	(75)
Northeast 0.9x	0.77	x	5.83	x	28.07	x	0.63	x	0.7	=	50.01	(75)
Northeast 0.9x	0.77	x	5.83	x	14.2	x	0.63	x	0.7	=	25.29	(75)
Northeast 0.9x	0.77	x	5.83	x	9.21	x	0.63	x	0.7	=	16.42	(75)
Southwest 0.9x	0.77	x	7.13	x	36.79		0.63	x	0.7	=	80.17	(79)
Southwest 0.9x	0.77	x	7.13	x	62.67		0.63	x	0.7	=	136.57	(79)
Southwest 0.9x	0.77	x	7.13	x	85.75		0.63	x	0.7	=	186.86	(79)
Southwest 0.9x	0.77	x	7.13	x	106.25		0.63	x	0.7	=	231.52	(79)
Southwest 0.9x	0.77	x	7.13	x	119.01		0.63	x	0.7	=	259.33	(79)
Southwest 0.9x	0.77	x	7.13	x	118.15		0.63	x	0.7	=	257.45	(79)
Southwest 0.9x	0.77	x	7.13	x	113.91		0.63	x	0.7	=	248.21	(79)
Southwest 0.9x	0.77	x	7.13	x	104.39		0.63	x	0.7	=	227.47	(79)
Southwest 0.9x	0.77	x	7.13	x	92.85		0.63	x	0.7	=	202.33	(79)
Southwest 0.9x	0.77	x	7.13	x	69.27		0.63	x	0.7	=	150.94	(79)
Southwest 0.9x	0.77	x	7.13	x	44.07		0.63	x	0.7	=	96.03	(79)
Southwest 0.9x	0.77	x	7.13	x	31.49		0.63	x	0.7	=	68.61	(79)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m= 100.28 177.49 260.58 352.6 422.08 430.96 410.53 356.87 292.16 200.94 121.33 85.03 (83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m= 508.16 583.12 651.42 719.63 764.9 750.56 715.56 668.81 616.75 549.56 497.15 481 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C)

21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(86)m=	1	1	0.99	0.97	0.9	0.74	0.57	0.63	0.87	0.98	1	1

(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m= 19.79 19.93 20.17 20.49 20.78 20.94 20.99 20.98 20.87 20.5 20.09 19.76 (87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m= 19.99 19.99 19.99 20 20 20.01 20.01 20.01 20.01 20 20 20 (88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

	1	0.99	0.99	0.95	0.86	0.65	0.45	0.5	0.8	0.97	0.99	1
(89)m=												

(89)

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Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.36	18.58	18.93	19.4	19.78	19.97	20.01	20.01	19.9	19.42	18.81	18.33	(90)
--------	-------	-------	-------	------	-------	-------	-------	-------	------	-------	-------	-------	------

fLA = Living area ÷ (4) =

0.15 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.58	18.79	19.12	19.57	19.93	20.12	20.16	20.16	20.05	19.58	19.01	18.55	(92)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.58	18.79	19.12	19.57	19.93	20.12	20.16	20.16	20.05	19.58	19.01	18.55	(93)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

Utilisation factor for gains, hm:

(94)m=	1	0.99	0.98	0.95	0.85	0.66	0.47	0.52	0.8	0.96	0.99	1	(94)
--------	---	------	------	------	------	------	------	------	-----	------	------	---	------

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	506.35	578.74	639.51	681.31	651.45	496.92	333.84	349.25	494.47	529.2	493.47	479.7	(95)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	--------	-------	------

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
--------	-----	-----	-----	-----	------	------	------	------	------	------	-----	-----	------

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1394.03	1352.05	1225.85	1023.8	788.34	523.42	337.26	355.28	565.85	860.39	1145.58	1387.16	(97)
--------	---------	---------	---------	--------	--------	--------	--------	--------	--------	--------	---------	---------	------

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	660.43	519.66	436.23	246.59	101.85	0	0	0	0	246.41	469.51	675.15	
Total per year (kWh/year) = Sum(98) _{1...5,9...12} =												3355.84	(98)

Space heating requirement in kWh/m²/year

38.42 (99)

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

Space heating:

Fraction of space heat from secondary/supplementary system

0 (201)

Fraction of space heat from main system(s)

(202) = 1 – (201) =

1 (202)

Fraction of total heating from main system 1

(204) = (202) × [1 – (203)] =

1 (204)

Efficiency of main space heating system 1

93.4 (206)

Efficiency of secondary/supplementary heating system, %

0 (208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

kWh/year

Space heating requirement (calculated above)

660.43	519.66	436.23	246.59	101.85	0	0	0	0	246.41	469.51	675.15
--------	--------	--------	--------	--------	---	---	---	---	--------	--------	--------

(211)m = {[(98)m x (204)] } x 100 ÷ (206)

(211)

707.1	556.39	467.06	264.02	109.04	0	0	0	0	263.82	502.69	722.86
-------	--------	--------	--------	--------	---	---	---	---	--------	--------	--------

Total (kWh/year) =Sum(211)_{1...5,10...12} =

3592.98 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215) _{1...5,10...12} =												0	(215)

Water heating

Output from water heater (calculated above)

207	182.5	190.55	169	163.63	144.11	138.07	153.92	155.62	177.2	188.47	202.07
-----	-------	--------	-----	--------	--------	--------	--------	--------	-------	--------	--------

Efficiency of water heater

80.3 (216)

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(217)m=

87.77	87.54	87.07	86	83.9	80.3	80.3	80.3	80.3	85.88	87.26	87.85
-------	-------	-------	----	------	------	------	------	------	-------	-------	-------

 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=

235.85	208.48	218.84	196.51	195.03	179.47	171.94	191.68	193.79	206.33	216	230.01
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-----	--------

Total = Sum(219a)_{1...12} =

2443.93

 (219)

Annual totals

Space heating fuel used, main system 1

kWh/year

kWh/year

Water heating fuel used

Electricity for pumps, fans and electric keep-hot

central heating pump:

30

(230c)

boiler with a fan-assisted flue

45

(230e)

Total electricity for the above, kWh/year

sum of (230a)...(230g) =

75

(231)

Electricity for lighting

390.5

(232)

Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =

6502.41

(238)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year
Space heating (main system 1)	(211) x	0.216	=	776.08 (261)
Space heating (secondary)	(215) x	0.519	=	0 (263)
Water heating	(219) x	0.216	=	527.89 (264)
Space and water heating	(261) + (262) + (263) + (264) =			1303.97 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93 (267)
Electricity for lighting	(232) x	0.519	=	202.67 (268)
Total CO2, kg/year	sum of (265)...(271) =			1545.57 (272)

TER =

17.7

(273)

SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 01 July 2022

Property Details: Plot 001

Dwelling type:	End-terrace House
Located in:	England
Region:	West Pennines
Cross ventilation possible:	Yes
Number of storeys:	2
Front of dwelling faces:	North East
Overshading:	Very Little
Overhangs:	None
Thermal mass parameter:	Calculated 164.89
Night ventilation:	False
Blinds, curtains, shutters:	None
Ventilation rate during hot weather (ach):	4 (Windows open half the time)

Overheating Details:

Summer ventilation heat loss coefficient:	293.41	(P1)
Transmission heat loss coefficient:	58.4	
Summer heat loss coefficient:	351.85	(P2)

Overhangs:

Orientation:	Ratio:	Z_overhangs:
North East (front)	0	1
South West (rear)	0	1

Solar shading:

Orientation:	Z blinds:	Solar access:	Overhangs:	Z summer:	
North East (front)	1	1	1	1	(P8)
South West (rear)	1	1	1	1	(P8)

Solar gains:

Orientation		Area	Flux	g_	FF	Shading	Gains
North East (front)	1 x	5.83	89.66	0.46	0	1	240.44
South West (rear)	1 x	7.13	112.1	0.46	0	1	367.67
Total							608.11 (P3/P4)

Internal gains:

	June	July	August
Internal gains	453.11	434.3	442.9
Total summer gains	1111.52	1042.41	962.95 (P5)
Summer gain/loss ratio	3.16	2.96	2.74 (P6)
Mean summer external temperature (West Pennines)	14.7	16.4	16.3
Thermal mass temperature increment	0.85	0.85	0.85
Threshold temperature	18.7	20.21	19.88 (P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant

Assessment of likelihood of high internal temperature: Not significant

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

Property Reference	Plot 001			Issued on Date	26/02/2024
Assessment Reference	plot 1 chain	Prop Type Ref	22186		
Property	68 Victoria Avenue, Blackley, MANCHESTER, M9 0RE				
SAP Rating	85 B	DER	16.99	TER	17.70
Environmental	87 B	% DER<TER	3.99		
CO ₂ Emissions (t/year)	1.26	DFEE	43.74	TFEE	50.21
General Requirements Compliance	Pass	% DFEE<TFEE	12.88		
Assessor Details	Mr. Patrick McGuigan, JSP Sustainability Ltd, Tel: 01904 435 325, technical@jspsustainability.co.uk			Assessor ID	Y128-0001
Client					

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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

DWELLING AS BUILT

End-Terrace House, total floor area 87 m²

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

1a TER and DER

Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 17.70 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 16.99 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)50.2 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)43.7 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.20 (max. 0.30)	0.20 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.15 (max. 0.25)	0.15 (max. 0.70)	OK
Roof	0.09 (max. 0.20)	0.09 (max. 0.35)	OK
Openings	1.31 (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: 4.40 (measured in this dwelling)
Maximum 10.0 OK

4 Heating efficiency

Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Vaillant ecoTEC sustain 28 VUW 286/7-2 (H-GB)
Combi boiler
Efficiency: 89.1% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls: Programmer, room thermostat and TRVs 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 (West Pennines (England)):Not significant OK
Based on:
Overshading: Very little
Windows facing North East: 5.83 m², No overhang
Windows facing South West: 7.13 m², No overhang
Air change rate: 0.00 ach
Blinds/curtains: None

10 Key features

Party wall U-value 0.00 W/m²K
Roof U-value 0.09 W/m²K

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (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	43.6700 (1b)	x 2.4200 (2b)	= 105.6814 (1b) - (3b)
First floor	43.6700 (1c)	x 2.6700 (2c)	= 116.5989 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	87.3400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 222.2803 (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) = 0.1350 (8)
Pressure test					Yes
Measured/design AP50					4.4000
Infiltration rate					0.3550 (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) =	0.3017 (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	0.3847	0.3772	0.3696	0.3319	0.3243	0.2866	0.2866	0.2791	0.3017	0.3243	0.3394	0.3545 (22b)
Effective ac	0.5740	0.5711	0.5683	0.5551	0.5526	0.5411	0.5411	0.5389	0.5455	0.5526	0.5576	0.5628 (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
Front			2.1500	1.4000	3.0100		(26)
front (Uw = 1.30)			12.9600	1.2357	16.0152		(27)
gf			43.6700	0.1500	6.5505	75.0000	3275.2499 (28a)
external	95.3900	15.1100	80.2800	0.2000	16.0560	60.0000	4816.8000 (29a)
cold	43.6700		43.6700	0.0900	3.9303	9.0000	393.0300 (30)
Total net area of external elements Aum(A, m ²)			182.7300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	45.5620		(33)
party			43.6300	0.0000	0.0000	70.0000	3054.1001 (32)
gf			82.0000			9.0000	738.0000 (32c)
1f			105.0000			9.0000	945.0000 (32c)
1f			43.6700			18.0000	786.0600 (32d)
gf			43.6700			9.0000	393.0300 (32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss
(28)...(30) + (32) + (32a)...(32e) = 14401.2698 (34)
164.8874 (35)
12.8760 (36)
(33) + (36) = 58.4380 (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	42.1039	41.8932	41.6866	40.7162	40.5347	39.6895	39.6895	39.5330	40.0151	40.5347	40.9019	41.2859 (38)
Heat transfer coeff	100.5419	100.3312	100.1246	99.1543	98.9727	98.1276	98.1276	97.9711	98.4531	98.9727	99.3400	99.7239 (39)
Average = Sum(39)m / 12 =												99.1534 (39)
HLP	1.1512	1.1487	1.1464	1.1353	1.1332	1.1235	1.1235	1.1217	1.1272	1.1332	1.1374	1.1418 (40)
HLP (average)												1.1353 (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												2.5875 (42)
Average daily hot water use (litres/day)												95.6539 (43)
Daily hot water use	105.2193	101.3931	97.5670	93.7408	89.9147	86.0885	86.0885	89.9147	93.7408	97.5670	101.3931	105.2193 (44)
Energy conte	156.0372	136.4711	140.8260	122.7755	117.8060	101.6576	94.2007	108.0967	109.3877	127.4809	139.1553	151.1137 (45)
Energy content (annual)										Total = Sum(45)m =		1505.0083 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	23.4056	20.4707	21.1239	18.4163	17.6709	15.2486	14.1301	16.2145	16.4082	19.1221	20.8733	22.6670 (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	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	18.7639	16.9030	18.5757	17.7959	18.2578	17.5174	18.0070	18.1696	17.6692	18.4442	18.0390	18.7142 (61)
Total heat required for water heating calculated for each month	174.8011	153.3741	159.4016	140.5714	136.0638	119.1750	112.2077	126.2663	127.0569	145.9250	157.1943	169.8279 (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	174.8011	153.3741	159.4016	140.5714	136.0638	119.1750	112.2077	126.2663	127.0569	145.9250	157.1943	169.8279 (64)
Heat gains from water heating, kWh/month	56.5733	49.6024	51.4686	45.2718	43.7349	38.1805	35.8235	40.4846	40.7887	46.9984	50.7789	54.9238 (65)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)												
Total per year (kWh/year) = Sum(64)m = 1721.8651 (64)												

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	129.3766	129.3766	129.3766	129.3766	129.3766	129.3766	129.3766	129.3766	129.3766	129.3766	129.3766	129.3766 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	22.1119	19.6396	15.9720	12.0918	9.0388	7.6309	8.2455	10.7178	14.3854	18.2655	21.3186	22.7264 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	234.0980	236.5272	230.4057	217.3737	200.9232	185.4620	175.1330	172.7038	178.8253	191.8573	208.3078	223.7690 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.9377	35.9377	35.9377	35.9377	35.9377	35.9377	35.9377	35.9377	35.9377	35.9377	35.9377	35.9377 (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)	-103.5013	-103.5013	-103.5013	-103.5013	-103.5013	-103.5013	-103.5013	-103.5013	-103.5013	-103.5013	-103.5013	-103.5013 (71)
Water heating gains (Table 5)	76.0394	73.8131	69.1782	62.8775	58.7835	53.0285	48.1499	54.4147	56.6510	63.1699	70.5262	73.8224 (72)
Total internal gains	397.0623	394.7929	380.3688	357.1561	333.5585	310.9344	296.3413	302.6493	314.6746	338.1057	364.9656	385.1308 (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
Northeast												5.8300	11.2829	0.4600	0.0000	0.7700	23.2991
Southwest												7.1300	36.7938	0.4600	0.0000	0.7700	92.9208 (75)
Solar gains	116.2200	205.7046	302.0103	408.6607	489.1834	499.4793	475.7945	413.6061	338.6107	232.8899	140.6141	98.5481	(83)				
Total gains	513.2823	600.4975	682.3791	765.8168	822.7418	810.4137	772.1358	716.2554	653.2853	570.9956	505.5797	483.6789	(84)				

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (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	39.7879	39.8715	39.9537	40.3447	40.4187	40.7669	40.7669	40.8320	40.6321	40.4187	40.2693	40.1143
alpha	3.6525	3.6581	3.6636	3.6896	3.6946	3.7178	3.7178	3.7221	3.7088	3.6946	3.6846	3.6743
util living area	0.9908	0.9830	0.9656	0.9214	0.8288	0.6783	0.5288	0.5824	0.8027	0.9461	0.9842	0.9926 (86)
MIT	19.2784	19.4914	19.8324	20.2703	20.6475	20.8841	20.9653	20.9503	20.7708	20.2774	19.6964	19.2378 (87)
Th 2	19.9593	19.9612	19.9631	19.9721	19.9738	19.9817	19.9817	19.9831	19.9786	19.9738	19.9704	19.9669 (88)
util rest of house	0.9887	0.9791	0.9575	0.9018	0.7851	0.5984	0.4190	0.4719	0.7376	0.9287	0.9799	0.9909 (89)
MIT 2	18.3900	18.6026	18.9402	19.3708	19.7183	19.9178	19.9693	19.9638	19.8352	19.3866	18.8146	18.3553 (90)
Living area fraction	18.5260	18.7387	19.0768	19.5085	19.8606	20.0657	20.1218	20.1148	19.9784	19.5230	18.9496	18.4904 (92)
MIT	18.5260	18.7387	19.0768	19.5085	19.8606	20.0657	20.1218	20.1148	19.9784	19.5230	18.9496	18.4904 (93)
Temperature adjustment												0.0000
adjusted MIT	18.5260	18.7387	19.0768	19.5085	19.8606	20.0657	20.1218	20.1148	19.9784	19.5230	18.9496	18.4904 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9847	0.9730	0.9485	0.8911	0.7797	0.6055	0.4348	0.4872	0.7376	0.9190	0.9742	0.9875 (94)
Ext temp.	505.4232	584.2903	647.2351	682.4212	641.4554	490.7360	335.7503	348.9275	481.8312	524.7306	492.5175	477.6117 (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	1430.3079	1388.4483	1259.2452	1051.8738	807.6742	536.3343	345.5836	363.9449	578.7509	883.1285	1177.1393	1425.0987 (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	688.1143	540.3942	455.3355	266.0059	123.6668	0.0000	0.0000	0.0000	0.0000	266.6481	492.9277	704.9303 (98)
Space heating per m2												3538.0228 (98)
(98) / (4) = 40.5086 (99)												

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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 %)													93.0000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3804.3256 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	688.1143	540.3942	455.3355	266.0059	123.6668	0.0000	0.0000	0.0000	0.0000	266.6481	492.9277	704.9303	(98)
Space heating efficiency (main heating system 1)	93.0000	93.0000	93.0000	93.0000	93.0000	0.0000	0.0000	0.0000	0.0000	93.0000	93.0000	93.0000	(210)
Space heating fuel (main heating system)	739.9078	581.0690	489.6081	286.0279	132.9751	0.0000	0.0000	0.0000	0.0000	286.7184	530.0298	757.9896	(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	174.8011	153.3741	159.4016	140.5714	136.0638	119.1750	112.2077	126.2663	127.0569	145.9250	157.1943	169.8279	(64)
Efficiency of water heater (217)m	89.3757	89.3191	89.2024	88.9396	88.4031	87.0000	87.0000	87.0000	87.0000	88.9156	89.2558	89.4015	(217)
Fuel for water heating, kWh/month	195.5801	171.7147	178.6966	158.0526	153.9130	136.9828	128.9744	145.1337	146.0424	164.1164	176.1166	189.9609	(219)
Water heating fuel used													(219)
Annual totals kWh/year													
Space heating fuel - main system													3804.3256 (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)													390.5028 (232)
Total delivered energy for all uses													6215.1126 (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	3804.3256	0.2160	821.7343 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1945.2842	0.2160	420.1814 (264)
Space and water heating			1241.9157 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	390.5028	0.5190	202.6710 (268)
Total CO2, kg/year			1483.5117 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			16.9900 (273)

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

DER		16.9900 ZC1
Total Floor Area	TFA	87.3400
Assumed number of occupants	N	2.5875
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190
CO2 emissions from appliances, equation (L14)		15.8829 ZC2
CO2 emissions from cooking, equation (L16)		2.0735 ZC3
Total CO2 emissions		34.9465 ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000 ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000 ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000 ZC7
Net CO2 emissions		34.9465 ZC8

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (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	43.6700 (1b)	x 2.4200 (2b)	= 105.6814 (1b) - (3b)
First floor	43.6700 (1c)	x 2.6700 (2c)	= 116.5989 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	87.3400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 222.2803 (5)

2. Ventilation rate

										main heating	secondary heating	other	total	m3 per hour			
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																3 * 10 =	30.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =										30.0000 / (5) =							0.1350 (8)
Pressure test										Yes							
Measured/design AP50																	5.0000
Infiltration rate																	0.3850 (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) =							0.3272 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
Wind factor	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)				
Adj infilt rate	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)				
	0.4172	0.4090	0.4008	0.3599	0.3518	0.3109	0.3109	0.3027	0.3272	0.3518	0.3681	0.3845	(22b)				
Effective ac	0.5870	0.5837	0.5803	0.5648	0.5619	0.5483	0.5483	0.5458	0.5535	0.5619	0.5678	0.5739	(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 Opaque door			2.1500	1.0000	2.1500		(26)					
TER Opening Type (Uw = 1.40)			12.9600	1.3258	17.1818		(27)					
gf			43.6700	0.1300	5.6771		(28a)					
external	95.3900	15.1100	80.2800	0.1800	14.4504		(29a)					
cold	43.6700		43.6700	0.1300	5.6771		(30)					
Total net area of external elements Aum(A, m2)			182.7300				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		45.1364		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.4142 (36)					
Total fabric heat loss						(33) + (36) =	54.5506 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 43.0601	Feb 42.8122	Mar 42.5693	Apr 41.4280	May 41.2144	Jun 40.2204	Jul 40.2204	Aug 40.0363	Sep 40.6033	Oct 41.2144	Nov 41.6464	Dec 42.0980 (38)
Heat transfer coeff	97.6108	97.3629	97.1199	95.9786	95.7650	94.7710	94.7710	94.5869	95.1539	95.7650	96.1970	96.6486 (39)
Average = Sum(39)m / 12 =												95.9776 (39)
HLP	Jan 1.1176	Feb 1.1148	Mar 1.1120	Apr 1.0989	May 1.0965	Jun 1.0851	Jul 1.0851	Aug 1.0830	Sep 1.0895	Oct 1.0965	Nov 1.1014	Dec 1.1066 (40)
HLP (average)												1.0989 (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												2.5875 (42)
Average daily hot water use (litres/day)												95.6539 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												
Energy conte	105.2193	101.3931	97.5670	93.7408	89.9147	86.0885	86.0885	89.9147	93.7408	97.5670	101.3931	105.2193 (44)
Energy content (annual)	156.0372	136.4711	140.8260	122.7755	117.8060	101.6576	94.2007	108.0967	109.3877	127.4809	139.1553	151.1137 (45)
Distribution loss	Total = Sum(45)m = 1505.0083 (45)											
	(46)m = 0.15 x (45)m											
	23.4056	20.4707	21.1239	18.4163	17.6709	15.2486	14.1301	16.2145	16.4082	19.1221	20.8733	22.6670 (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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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	49.7191	46.2284	45.8195	42.4546	43.8698	45.8195	46.2284	49.7191	49.3151	50.9589 (61)
Solar input	206.9961	182.4985	190.5450	169.0038	163.6255	144.1122	138.0705	153.9162	155.6161	177.1999	188.4704	202.0726 (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	206.9961	182.4985	190.5450	169.0038	163.6255	144.1122	138.0705	153.9162	155.6161	177.1999	188.4704	202.0726 (64)
	64.6221	56.8835	59.2544	52.3799	50.6254	44.4148	42.2892	47.3970	47.9285	54.8171	58.5979	62.9850 (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	129.3766	129.3766	129.3766	129.3766	129.3766	129.3766	129.3766	129.3766	129.3766	129.3766	129.3766	129.3766	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	22.1119	19.6396	15.9720	12.0918	9.0388	7.6309	8.2455	10.7178	14.3854	18.2655	21.3186	22.7264	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	234.0980	236.5272	230.4057	217.3737	200.9232	185.4620	175.1330	172.7038	178.8253	191.8573	208.3078	223.7690	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.9377	35.9377	35.9377	35.9377	35.9377	35.9377	35.9377	35.9377	35.9377	35.9377	35.9377	35.9377	(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)	-103.5013	-103.5013	-103.5013	-103.5013	-103.5013	-103.5013	-103.5013	-103.5013	-103.5013	-103.5013	-103.5013	-103.5013	(71)
Water heating gains (Table 5)	86.8576	84.6481	79.6430	72.7499	68.0449	61.6872	56.8403	63.7057	66.5674	73.6790	81.3860	84.6573	(72)
Total internal gains	407.8805	405.6279	390.8337	367.0284	342.8198	319.5931	305.0317	311.9402	324.5910	348.6148	375.8254	395.9657	(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	
Northeast					5.8300	11.2829	0.6300	0.7000	0.7700		20.1031 (75)	
Southwest					7.1300	36.7938	0.6300	0.7000	0.7700		80.1745 (79)	
Solar gains	100.2776	177.4873	260.5823	352.6031	422.0802	430.9638	410.5279	356.8701	292.1621	200.9435	121.3255	85.0299 (83)
Total gains	508.1581	583.1151	651.4160	719.6316	764.9000	750.5569	715.5596	668.8104	616.7531	549.5582	497.1509	480.9956 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (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	62.1374	62.2956	62.4515	63.1941	63.3350	63.9993	63.9993	64.1238	63.7418	63.3350	63.0506	62.7560	
alpha	5.1425	5.1530	5.1634	5.2129	5.2223	5.2666	5.2666	5.2749	5.2495	5.2223	5.2034	5.1837	
util living area	0.9983	0.9961	0.9899	0.9669	0.8958	0.7396	0.5681	0.6253	0.8651	0.9794	0.9963	0.9987	(86)
MIT	19.7855	19.9322	20.1734	20.4947	20.7770	20.9440	20.9886	20.9816	20.8662	20.5030	20.0867	19.7608	(87)
Th 2	19.9865	19.9888	19.9911	20.0017	20.0037	20.0130	20.0130	20.0148	20.0094	20.0037	19.9997	19.9955	(88)
util rest of house	0.9977	0.9948	0.9862	0.9540	0.8551	0.6514	0.4482	0.5039	0.7988	0.9690	0.9948	0.9983	(89)
MIT 2	18.3639	18.5797	18.9319	19.3993	19.7793	19.9746	20.0087	20.0069	19.8985	19.4184	18.8138	18.3343	(90)
Living area fraction	18.5815	18.7867	19.1220	19.5670	19.9320	20.1230	20.1587	20.1561	20.0467	19.5844	19.0086	18.5526	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5815	18.7867	19.1220	19.5670	19.9320	20.1230	20.1587	20.1561	20.0467	19.5844	19.0086	18.5526	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9965	0.9925	0.9817	0.9468	0.8517	0.6621	0.4665	0.5222	0.8017	0.9630	0.9926	0.9973	(94)
Ext temp.	506.3544	578.7396	639.5088	681.3125	651.4509	496.9194	333.8368	349.2454	494.4701	529.2023	493.4749	479.6972	(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	1394.0300	1352.0493	1225.8457	1023.7991	788.3395	523.4221	337.2611	355.2798	565.8484	860.3950	1145.5766	1387.1624	(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 per m2	660.4306	519.6641	436.2346	246.5903	101.8451	0.0000	0.0000	0.0000	0.0000	246.4074	469.5132	675.1541	(98)
												3355.8394	(98)
												38.4227	(99)

8c. Space cooling requirement

Not applicable

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

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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													3592.9758 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	660.4306	519.6641	436.2346	246.5903	101.8451	0.0000	0.0000	0.0000	0.0000	246.4074	469.5132	675.1541	(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)	707.0991	556.3855	467.0606	264.0153	109.0419	0.0000	0.0000	0.0000	0.0000	263.8195	502.6908	722.8631	(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	206.9961	182.4985	190.5450	169.0038	163.6255	144.1122	138.0705	153.9162	155.6161	177.1999	188.4704	202.0726	(64)
Efficiency of water heater	87.7657	87.5383	87.0706	86.0012	83.8960	80.3000	80.3000	80.3000	80.3000	85.8814	87.2564	87.8545	(217)
Fuel for water heating, kWh/month	235.8507	208.4785	218.8396	196.5134	195.0338	179.4673	171.9433	191.6765	193.7934	206.3310	215.9961	230.0081	(219)
Water heating fuel used												2443.9316	(219)
Annual totals kWh/year													
Space heating fuel - main system												3592.9758	(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)												390.5028	(232)
Total delivered energy for all uses												6502.4102	(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	3592.9758	0.2160	776.0828 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2443.9316	0.2160	527.8892 (264)
Space and water heating			1303.9720 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	390.5028	0.5190	202.6710 (268)
Total CO2, kg/m2/year			1545.5680 (272)
Emissions per m2 for space and water heating			14.9298 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.3205 (272b)
Emissions per m2 for pumps and fans			0.4457 (272c)
Target Carbon Dioxide Emission Rate (TER) = (14.9298 * 1.00) + 2.3205 + 0.4457, rounded to 2 d.p.			17.7000 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (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	43.6700 (1b)	x 2.4200 (2b)	= 105.6814 (1b) - (3b)
First floor	43.6700 (1c)	x 2.6700 (2c)	= 116.5989 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	87.3400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 222.2803 (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) = 0.1350 (8)
Pressure test					Yes
Measured/design AP50					4.4000
Infiltration rate					0.3550 (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) =	0.3017 (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	0.3847	0.3772	0.3696	0.3319	0.3243	0.2866	0.2866	0.2791	0.3017	0.3243	0.3394	0.3545 (22b)
Effective ac	0.5740	0.5711	0.5683	0.5551	0.5526	0.5411	0.5411	0.5389	0.5455	0.5526	0.5576	0.5628 (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
Front			2.1500	1.4000	3.0100		(26)
front (Uw = 1.30)			12.9600	1.2357	16.0152		(27)
gf			43.6700	0.1500	6.5505	75.0000	3275.2499 (28a)
external	95.3900	15.1100	80.2800	0.2000	16.0560	60.0000	4816.8000 (29a)
cold	43.6700		43.6700	0.0900	3.9303	9.0000	393.0300 (30)
Total net area of external elements Aum(A, m ²)			182.7300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	45.5620		(33)
party			43.6300	0.0000	0.0000	70.0000	3054.1001 (32)
gf			82.0000			9.0000	738.0000 (32c)
lf			105.0000			9.0000	945.0000 (32c)
lf			43.6700			18.0000	786.0600 (32d)
gf			43.6700			9.0000	393.0300 (32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss
(28)...(30) + (32) + (32a)...(32e) = 14401.2698 (34)
164.8874 (35)
12.8760 (36)
(33) + (36) = 58.4380 (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	42.1039	41.8932	41.6866	40.7162	40.5347	39.6895	39.6895	39.5330	40.0151	40.5347	40.9019	41.2859 (38)
Heat transfer coeff	100.5419	100.3312	100.1246	99.1543	98.9727	98.1276	98.1276	97.9711	98.4531	98.9727	99.3400	99.7239 (39)
Average = Sum(39)m / 12 =												99.1534 (39)
HLP	1.1512	1.1487	1.1464	1.1353	1.1332	1.1235	1.1235	1.1217	1.1272	1.1332	1.1374	1.1418 (40)
HLP (average)												1.1353 (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												2.5875 (42)
Average daily hot water use (litres/day)												95.6539 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	105.2193	101.3931	97.5670	93.7408	89.9147	86.0885	86.0885	89.9147	93.7408	97.5670	101.3931	105.2193 (44)
Energy conte	156.0372	136.4711	140.8260	122.7755	117.8060	101.6576	94.2007	108.0967	109.3877	127.4809	139.1553	151.1137 (45)
Energy content (annual)										Total = Sum(45)m =		1505.0083 (45)

FULL SAP CALCULATION PRINTOUT

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CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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	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	33.1579	29.0001	29.9255	26.0898	25.0338	21.6022	20.0177	22.9706	23.2449	27.0897	29.5705	32.1117 (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	129.3766	129.3766	129.3766	129.3766	129.3766	129.3766	129.3766	129.3766	129.3766	129.3766	129.3766	129.3766 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	22.1119	19.6396	15.9720	12.0918	9.0388	7.6309	8.2455	10.7178	14.3854	18.2655	21.3186	22.7264 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	234.0980	236.5272	230.4057	217.3737	200.9232	185.4620	175.1330	172.7038	178.8253	191.8573	208.3078	223.7690 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.9377	35.9377	35.9377	35.9377	35.9377	35.9377	35.9377	35.9377	35.9377	35.9377	35.9377	35.9377 (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)	-103.5013	-103.5013	-103.5013	-103.5013	-103.5013	-103.5013	-103.5013	-103.5013	-103.5013	-103.5013	-103.5013	-103.5013 (71)
Water heating gains (Table 5)	44.5671	43.1549	40.2225	36.2358	33.6475	30.0031	26.9054	30.8744	32.2846	36.4109	41.0701	43.1608 (72)
Total internal gains	362.5900	361.1347	348.4131	327.5143	305.4225	284.9090	272.0969	276.1089	287.3082	308.3467	332.5095	351.4693 (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
Northeast					5.8300	11.2829	0.4600	0.0000			0.7700	23.2991 (75)
Southwest					7.1300	36.7938	0.4600	0.0000			0.7700	92.9208 (79)
Solar gains	116.2200	205.7046	302.0103	408.6607	489.1834	499.4793	475.7945	413.6061	338.6107	232.8899	140.6141	98.5481 (83)
Total gains	478.8099	566.8393	650.4234	736.1751	794.6059	784.3883	747.8914	689.7150	625.9189	541.2366	473.1236	450.0174 (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	39.7879	39.8715	39.9537	40.3447	40.4187	40.7669	40.7669	40.8320	40.6321	40.4187	40.2693	40.1143
alpha	3.6525	3.6581	3.6636	3.6896	3.6946	3.7178	3.7178	3.7221	3.7088	3.6946	3.6846	3.6743
util living area	0.9927	0.9858	0.9702	0.9291	0.8407	0.6932	0.5431	0.5998	0.8186	0.9536	0.9872	0.9941 (86)
MIT	19.2295	19.4451	19.7913	20.2383	20.6270	20.8751	20.9621	20.9452	20.7530	20.2418	19.6514	19.1896 (87)
Th 2	19.9593	19.9612	19.9631	19.9721	19.9738	19.9817	19.9817	19.9831	19.9786	19.9738	19.9704	19.9669 (88)
util rest of house	0.9910	0.9825	0.9629	0.9109	0.7987	0.6135	0.4314	0.4879	0.7558	0.9382	0.9837	0.9928 (89)
MIT 2	18.3414	18.5569	18.9004	19.3412	19.7016	19.9122	19.9681	19.9616	19.8222	19.3533	18.7703	18.3074 (90)
Living area fraction									fLA = Living area / (4) =			0.1531 (91)
MIT	18.4774	18.6929	19.0368	19.4785	19.8433	20.0596	20.1202	20.1121	19.9647	19.4893	18.9052	18.4425 (92)
Temperature adjustment												0.0000
adjusted MIT	18.4774	18.6929	19.0368	19.4785	19.8433	20.0596	20.1202	20.1121	19.9647	19.4893	18.9052	18.4425 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9876	0.9771	0.9545	0.9003	0.7925	0.6201	0.4474	0.5031	0.7548	0.9288	0.9787	0.9899 (94)
Useful gains	472.8585	553.8539	620.8599	662.7798	629.7534	486.4216	334.6288	346.9928	472.4218	502.6961	463.0242	445.4912 (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	1425.4219	1383.8566	1255.2386	1048.9082	805.9601	535.7402	345.4311	363.6820	577.3975	879.8016	1172.7252	1420.3172 (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	708.7072	557.7618	471.9777	278.0124	131.0978	0.0000	0.0000	0.0000	0.0000	280.5665	510.9847	725.2705 (98)
Space heating												3664.3787 (98)
Space heating per m2										(98) / (4) =		41.9553 (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	922.3991	726.1440	744.5800	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8238	0.8850	0.8571	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	759.9130	642.6036	638.2040	0.0000	0.0000	0.0000	0.0000 (102)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1014.5597	969.8984	903.7348	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	183.3456	243.5073	197.5549	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												624.4078 (104)
Cooled fraction									fC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	45.8364	60.8768	49.3887	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												156.1020 (107)
Space cooling per m2												1.7873 (108)
Energy for space heating												41.9553 (99)
Energy for space cooling												1.7873 (108)
Total												43.7426 (109)
Dwelling Fabric Energy Efficiency (DFEE)												43.7 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (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	43.6700 (1b)	x 2.4200 (2b)	= 105.6814 (1b) - (3b)
First floor	43.6700 (1c)	x 2.6700 (2c)	= 116.5989 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	87.3400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 222.2803 (5)

2. Ventilation rate

	main heating	+	secondary heating	+	other	=	total	m3 per hour				
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000 (6a)				
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000 (6b)				
Number of intermittent fans							3 * 10 =	30.0000 (7a)				
Number of passive vents							0 * 10 =	0.0000 (7b)				
Number of flueless gas fires							0 * 40 =	0.0000 (7c)				
								Air changes per hour				
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =						30.0000 / (5) =	0.1350 (8)				
Pressure test							Yes					
Measured/design AP50							5.0000					
Infiltration rate							0.3850	(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) =	0.3272 (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	0.4172	0.4090	0.4008	0.3599	0.3518	0.3109	0.3109	0.3027	0.3272	0.3518	0.3681	0.3845 (22b)
Effective ac	0.5870	0.5837	0.5803	0.5648	0.5619	0.5483	0.5483	0.5458	0.5535	0.5619	0.5678	0.5739 (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 Opaque door			2.1500	1.0000	2.1500		(26)					
TER Opening Type (Uw = 1.40)			12.9600	1.3258	17.1818		(27)					
gf			43.6700	0.1300	5.6771		(28a)					
external	95.3900	15.1100	80.2800	0.1800	14.4504		(29a)					
cold	43.6700		43.6700	0.1300	5.6771		(30)					
Total net area of external elements Aum(A, m2)			182.7300				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26) ... (30) + (32) =		45.1364		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.4142 (36)					
Total fabric heat loss						(33) + (36) =	54.5506 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 43.0601	Feb 42.8122	Mar 42.5693	Apr 41.4280	May 41.2144	Jun 40.2204	Jul 40.2204	Aug 40.0363	Sep 40.6033	Oct 41.2144	Nov 41.6464	Dec 42.0980 (38)
Heat transfer coeff	97.6108	97.3629	97.1199	95.9786	95.7650	94.7710	94.7710	94.5869	95.1539	95.7650	96.1970	96.6486 (39)
Average = Sum(39)m / 12 =												95.9776 (39)
HLP	Jan 1.1176	Feb 1.1148	Mar 1.1120	Apr 1.0989	May 1.0965	Jun 1.0851	Jul 1.0851	Aug 1.0830	Sep 1.0895	Oct 1.0965	Nov 1.1014	Dec 1.1066 (40)
HLP (average)												1.0989 (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												2.5875 (42)
Average daily hot water use (litres/day)												95.6539 (43)
Daily hot water use	Jan 105.2193	Feb 101.3931	Mar 97.5670	Apr 93.7408	May 89.9147	Jun 86.0885	Jul 86.0885	Aug 89.9147	Sep 93.7408	Oct 97.5670	Nov 101.3931	Dec 105.2193 (44)
Energy conte	156.0372	136.4711	140.8260	122.7755	117.8060	101.6576	94.2007	108.0967	109.3877	127.4809	139.1553	151.1137 (45)
Energy content (annual)												Total = Sum(45)m = 1505.0083 (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												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Heat gains from water heating, kWh/month	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
	33.1579	29.0001	29.9255	26.0898	25.0338	21.6022	20.0177	22.9706	23.2449	27.0897	29.5705	32.1117 (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	129.3766	129.3766	129.3766	129.3766	129.3766	129.3766	129.3766	129.3766	129.3766	129.3766	129.3766	129.3766 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	22.1119	19.6396	15.9720	12.0918	9.0388	7.6309	8.2455	10.7178	14.3854	18.2655	21.3186	22.7264 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	234.0980	236.5272	230.4057	217.3737	200.9232	185.4620	175.1330	172.7038	178.8253	191.8573	208.3078	223.7690 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.9377	35.9377	35.9377	35.9377	35.9377	35.9377	35.9377	35.9377	35.9377	35.9377	35.9377	35.9377 (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)	-103.5013	-103.5013	-103.5013	-103.5013	-103.5013	-103.5013	-103.5013	-103.5013	-103.5013	-103.5013	-103.5013	-103.5013 (71)
Water heating gains (Table 5)	44.5671	43.1549	40.2225	36.2358	33.6475	30.0031	26.9054	30.8744	32.2846	36.4109	41.0701	43.1608 (72)
Total internal gains	362.5900	361.1347	348.4131	327.5143	305.4225	284.9090	272.0969	276.1089	287.3082	308.3467	332.5095	351.4693 (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	
Northeast					5.8300	11.2829	0.6300	0.7000			0.7700	20.1031 (75)	
Southwest					7.1300	36.7938	0.6300	0.7000			0.7700	80.1745 (79)	

Solar gains	100.2776	177.4873	260.5823	352.6031	422.0802	430.9638	410.5279	356.8701	292.1621	200.9435	121.3255	85.0299	(83)
Total gains	462.8676	538.6220	608.9955	680.1175	727.5026	715.8728	682.6248	632.9791	579.4703	509.2901	453.8350	436.4991	(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	62.1374	62.2956	62.4515	63.1941	63.3350	63.9993	63.9993	64.1238	63.7418	63.3350	63.0506	62.7560
alpha	5.1425	5.1530	5.1634	5.2129	5.2223	5.2666	5.2666	5.2749	5.2495	5.2223	5.2034	5.1837
util living area	0.9989	0.9973	0.9925	0.9736	0.9111	0.7636	0.5923	0.6545	0.8875	0.9851	0.9976	0.9992 (86)
MIT	19.7369	19.8849	20.1296	20.4582	20.7526	20.9348	20.9862	20.9773	20.8453	20.4633	20.0405	19.7129 (87)
Th 2	19.9865	19.9888	19.9911	20.0017	20.0037	20.0130	20.0130	20.0148	20.0094	20.0037	19.9997	19.9955 (88)
util rest of house	0.9985	0.9964	0.9897	0.9629	0.8742	0.6765	0.4689	0.5303	0.8271	0.9772	0.9966	0.9989 (89)
MIT 2	18.8302	18.9797	19.2249	19.5560	19.8308	19.9818	20.0094	20.0080	19.9192	19.5663	19.1441	18.8134 (90)
Living area fraction									fLA = Living area / (4) =			0.1531 (91)
MIT	18.9690	19.1183	19.3634	19.6941	19.9719	20.1277	20.1589	20.1564	20.0609	19.7036	19.2813	18.9511 (92)
Temperature adjustment												0.0000
adjusted MIT	18.9690	19.1183	19.3634	19.6941	19.9719	20.1277	20.1589	20.1564	20.0609	19.7036	19.2813	18.9511 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9980	0.9953	0.9873	0.9587	0.8728	0.6877	0.4879	0.5493	0.8309	0.9740	0.9956	0.9985 (94)
Useful gains	461.9252	536.0749	601.2635	652.0158	634.9504	492.2703	333.0669	347.6895	481.4633	496.0378	451.8315	435.8431 (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	1431.8506	1384.3321	1249.2944	1036.0037	792.1609	523.8657	337.2814	355.3032	567.2069	871.8038	1171.8089	1425.6740 (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	721.6245	570.0289	482.1350	276.4713	116.9646	0.0000	0.0000	0.0000	0.0000	279.5699	518.3837	736.4342 (98)
Space heating												3701.6121 (98)
Space heating per m2											(98) / (4) =	42.3816 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b												
Ext. temp.	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	890.8475	701.3055	718.8607	0.0000	0.0000	0.0000	0.0000 (100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.8598	0.9231	0.8973	0.0000	0.0000	0.0000	0.0000 (101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	765.9634	647.3738	645.0501	0.0000	0.0000	0.0000	0.0000 (102)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	934.4766	893.6128	837.4200	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	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	0.0000	0.0000	0.0000	0.0000	0.0000	121.3295	183.2019	143.1232	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction												447.6545 (104)
												fC = cooled area / (4) = 1.0000 (105)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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	30.3324	45.8005	35.7808	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling											111.9136 (107)
Space cooling per m2											1.2814 (108)
Energy for space heating											42.3816 (99)
Energy for space cooling											1.2814 (108)
Total											43.6630 (109)
Target Fabric Energy Efficiency (TFEE)											50.2 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (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	43.6700 (1b)	x 2.4200 (2b)	= 105.6814 (1b) - (3b)
First floor	43.6700 (1c)	x 2.6700 (2c)	= 116.5989 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	87.3400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 222.2803 (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) = 0.1350 (8)
Pressure test					Yes
Measured/design AP50					4.4000
Infiltration rate					0.3550 (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) =	0.3017 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.6000	4.5000	4.5000	4.1000	4.2000	3.7000	3.5000	3.5000	3.7000	4.1000	4.1000	4.2000 (22)
Wind factor	1.1500	1.1250	1.1250	1.0250	1.0500	0.9250	0.8750	0.8750	0.9250	1.0250	1.0250	1.0500 (22a)
Adj infilt rate	0.3470	0.3394	0.3394	0.3093	0.3168	0.2791	0.2640	0.2640	0.2791	0.3093	0.3093	0.3168 (22b)
Effective ac	0.5602	0.5576	0.5576	0.5478	0.5502	0.5389	0.5348	0.5348	0.5389	0.5478	0.5478	0.5502 (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
Front			2.1500	1.4000	3.0100		(26)
front (Uw = 1.30)			12.9600	1.2357	16.0152		(27)
gf			43.6700	0.1500	6.5505	75.0000	3275.2499 (28a)
external	95.3900	15.1100	80.2800	0.2000	16.0560	60.0000	4816.8000 (29a)
cold	43.6700		43.6700	0.0900	3.9303	9.0000	393.0300 (30)
Total net area of external elements Aum(A, m ²)			182.7300				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		45.5620		(33)
party			43.6300	0.0000	0.0000	70.0000	3054.1001 (32)
gf			82.0000			9.0000	738.0000 (32c)
lf			105.0000			9.0000	945.0000 (32c)
lf			43.6700			18.0000	786.0600 (32d)
gf			43.6700			9.0000	393.0300 (32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss
(28)...(30) + (32) + (32a)...(32e) = 14401.2698 (34)
164.8874 (35)
12.8760 (36)
(33) + (36) = 58.4380 (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	41.0918	40.9019	40.9019	40.1841	40.3573	39.5330	39.2325	39.2325	39.5330	40.1841	40.1841	40.3573 (38)
Heat transfer coeff	99.5299	99.3400	99.3400	98.6221	98.7953	97.9711	97.6706	97.6706	97.9711	98.6221	98.6221	98.7953 (39)
Average = Sum(39)m / 12 =												98.5792 (39)
HLP	1.1396	1.1374	1.1374	1.1292	1.1312	1.1217	1.1183	1.1183	1.1217	1.1292	1.1292	1.1312 (40)
HLP (average)												1.1287 (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												2.5875 (42)
Average daily hot water use (litres/day)												95.6539 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	105.2193	101.3931	97.5670	93.7408	89.9147	86.0885	86.0885	89.9147	93.7408	97.5670	101.3931	105.2193 (44)
Energy conte	156.0372	136.4711	140.8260	122.7755	117.8060	101.6576	94.2007	108.0967	109.3877	127.4809	139.1553	151.1137 (45)
Energy content (annual)										Total = Sum(45)m =		1505.0083 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	23.4056	20.4707	21.1239	18.4163	17.6709	15.2486	14.1301	16.2145	16.4082	19.1221	20.8733	22.6670 (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	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	18.7639	16.9030	18.5757	17.7959	18.2578	17.5174	18.0070	18.1696	17.6692	18.4442	18.0390	18.7142 (61)
Total heat required for water heating calculated for each month	174.8011	153.3741	159.4016	140.5714	136.0638	119.1750	112.2077	126.2663	127.0569	145.9250	157.1943	169.8279 (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	174.8011	153.3741	159.4016	140.5714	136.0638	119.1750	112.2077	126.2663	127.0569	145.9250	157.1943	169.8279 (64)
RHI water heating demand												
Heat gains from water heating, kWh/month	56.5733	49.6024	51.4686	45.2718	43.7349	38.1805	35.8235	40.4846	40.7887	46.9984	50.7789	54.9238 (65)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)												
Total per year (kWh/year) = Sum(64)m = 1721.8651 (64)												
1722 (64)												

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	155.2520	155.2520	155.2520	155.2520	155.2520	155.2520	155.2520	155.2520	155.2520	155.2520	155.2520	155.2520 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	53.3478	47.3830	38.5345	29.1731	21.8072	18.4106	19.8933	25.8580	34.7066	44.0680	51.4338	54.8305 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	349.4000	353.0257	343.8891	324.4384	299.8853	276.8089	261.3925	257.7668	266.9034	286.3541	310.9072	333.9836 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.1127	53.1127	53.1127	53.1127	53.1127	53.1127	53.1127	53.1127	53.1127	53.1127	53.1127	53.1127 (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)	-103.5013	-103.5013	-103.5013	-103.5013	-103.5013	-103.5013	-103.5013	-103.5013	-103.5013	-103.5013	-103.5013	-103.5013 (71)
Water heating gains (Table 5)	76.0394	73.8131	69.1782	62.8775	58.7835	53.0285	48.1499	54.4147	56.6510	63.1699	70.5262	73.8224 (72)
Total internal gains	586.6506	582.0852	559.4651	524.3524	488.3395	456.1114	437.2990	445.9029	466.1243	501.4554	540.7306	570.4998 (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
Northeast												5.8300	9.5471		0.4600		0.0000	1.0000	25.6034 (75)
Southwest												7.1300	31.1332		0.4600		0.0000	1.0000	102.1108 (79)
Solar gains	127.7142	237.4656	367.7073	505.9609	592.2878	616.2407	575.4129	492.6734	416.8104	279.5412	160.4804	115.7955 (83)							
Total gains	714.3649	819.5508	927.1724	1030.3133	1080.6272	1072.3521	1012.7119	938.5763	882.9348	780.9966	701.2111	686.2954 (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	40.1925	40.2693	40.2693	40.5624	40.4913	40.8320	40.9576	40.9576	40.8320	40.5624	40.5624	40.4913
alpha	3.6795	3.6846	3.6846	3.7042	3.6994	3.7221	3.7305	3.7305	3.7221	3.7042	3.7042	3.6994
util living area	0.9720	0.9534	0.9166	0.8296	0.6895	0.5201	0.4142	0.4532	0.6730	0.8742	0.9537	0.9755 (86)
MIT	19.6312	19.8513	20.1577	20.5576	20.8309	20.9554	20.9847	20.9790	20.8788	20.5220	20.0200	19.5946 (87)
Th 2	19.9686	19.9704	19.9704	19.9771	19.9755	19.9831	19.9859	19.9859	19.9831	19.9771	19.9771	19.9755 (88)
util rest of house	0.9661	0.9437	0.8996	0.7959	0.6321	0.4417	0.3232	0.3575	0.5993	0.8413	0.9423	0.9703 (89)
MIT 2	18.7449	18.9610	19.2557	19.6325	19.8642	19.9615	19.9808	19.9785	19.9132	19.6103	19.1345	18.7144 (90)
Living area fraction	18.8806	19.0973	19.3938	19.7741	20.0122	20.1137	20.1345	20.1317	20.0610	19.7498	19.2700	18.8491 (92)
MIT	18.8806	19.0973	19.3938	19.7741	20.0122	20.1137	20.1345	20.1317	20.0610	19.7498	19.2700	18.8491 (93)
Temperature adjustment												0.0000
adjusted MIT	18.8806	19.0973	19.3938	19.7741	20.0122	20.1137	20.1345	20.1317	20.0610	19.7498	19.2700	18.8491 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9579	0.9336	0.8883	0.7884	0.6343	0.4521	0.3368	0.3716	0.6054	0.8327	0.9325	0.9628 (94)
Ext temp.	684.3237	765.1202	823.6062	812.3401	685.4379	484.8372	341.0858	348.7995	534.5271	650.3674	653.8769	660.7668 (95)
Heat loss rate W	4.7000	5.3000	6.7000	9.3000	12.3000	15.0000	16.6000	16.5000	14.1000	10.8000	7.5000	4.6000 (96)
Month fracti	1411.3940	1370.6224	1261.0028	1032.9828	761.9303	500.9929	345.2175	354.7096	584.0043	882.6504	1160.7846	1407.7470 (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	540.9403	406.8975	325.4231	158.8628	56.9103	0.0000	0.0000	0.0000	0.0000	172.8186	364.9735	555.7533 (98)
RHI space heating demand												2582.5793 (98)
												2583 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (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	43.6700 (1b)	x 2.4200 (2b)	= 105.6814 (1b) - (3b)
First floor	43.6700 (1c)	x 2.6700 (2c)	= 116.5989 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	87.3400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 222.2803 (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) = 0.1350 (8)
Pressure test					Yes
Measured/design AP50					4.4000
Infiltration rate					0.3550 (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) =	0.3017 (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	0.3847	0.3772	0.3696	0.3319	0.3243	0.2866	0.2866	0.2791	0.3017	0.3243	0.3394	0.3545 (22b)
Effective ac	0.5740	0.5711	0.5683	0.5551	0.5526	0.5411	0.5411	0.5389	0.5455	0.5526	0.5576	0.5628 (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
Front			2.1500	1.4000	3.0100		(26)
front (Uw = 1.30)			12.9600	1.2357	16.0152		(27)
gf			43.6700	0.1500	6.5505	75.0000	3275.2499 (28a)
external	95.3900	15.1100	80.2800	0.2000	16.0560	60.0000	4816.8000 (29a)
cold	43.6700		43.6700	0.0900	3.9303	9.0000	393.0300 (30)
Total net area of external elements Aum(A, m ²)			182.7300				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		45.5620		(33)
party			43.6300	0.0000	0.0000	70.0000	3054.1001 (32)
gf			82.0000			9.0000	738.0000 (32c)
1f			105.0000			9.0000	945.0000 (32c)
1f			43.6700			18.0000	786.0600 (32d)
gf			43.6700			9.0000	393.0300 (32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss
(28)...(30) + (32) + (32a)...(32e) = 14401.2698 (34)
164.8874 (35)
12.8760 (36)
(33) + (36) = 58.4380 (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	42.1039	41.8932	41.6866	40.7162	40.5347	39.6895	39.6895	39.5330	40.0151	40.5347	40.9019	41.2859 (38)
Heat transfer coeff	100.5419	100.3312	100.1246	99.1543	98.9727	98.1276	98.1276	97.9711	98.4531	98.9727	99.3400	99.7239 (39)
Average = Sum(39)m / 12 =												99.1534 (39)
HLP	1.1512	1.1487	1.1464	1.1353	1.1332	1.1235	1.1235	1.1217	1.1272	1.1332	1.1374	1.1418 (40)
HLP (average)												1.1353 (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												2.5875 (42)
Average daily hot water use (litres/day)												95.6539 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	105.2193	101.3931	97.5670	93.7408	89.9147	86.0885	86.0885	89.9147	93.7408	97.5670	101.3931	105.2193 (44)
Energy conte	156.0372	136.4711	140.8260	122.7755	117.8060	101.6576	94.2007	108.0967	109.3877	127.4809	139.1553	151.1137 (45)
Energy content (annual)										Total = Sum(45)m =		1505.0083 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	23.4056	20.4707	21.1239	18.4163	17.6709	15.2486	14.1301	16.2145	16.4082	19.1221	20.8733	22.6670 (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	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	18.7639	16.9030	18.5757	17.7959	18.2578	17.5174	18.0070	18.1696	17.6692	18.4442	18.0390	18.7142 (61)
Total heat required for water heating calculated for each month	174.8011	153.3741	159.4016	140.5714	136.0638	119.1750	112.2077	126.2663	127.0569	145.9250	157.1943	169.8279 (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	174.8011	153.3741	159.4016	140.5714	136.0638	119.1750	112.2077	126.2663	127.0569	145.9250	157.1943	169.8279 (64)
Heat gains from water heating, kWh/month	56.5733	49.6024	51.4686	45.2718	43.7349	38.1805	35.8235	40.4846	40.7887	46.9984	50.7789	54.9238 (65)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)												
Total per year (kWh/year) = Sum(64)m = 1721.8651 (64)												

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	155.2520	155.2520	155.2520	155.2520	155.2520	155.2520	155.2520	155.2520	155.2520	155.2520	155.2520	155.2520	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	53.3478	47.3830	38.5345	29.1731	21.8072	18.4106	19.8933	25.8580	34.7066	44.0680	51.4338	54.8305	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	349.4000	353.0257	343.8891	324.4384	299.8853	276.8089	261.3925	257.7668	266.9034	286.3541	310.9072	333.9836	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.1127	53.1127	53.1127	53.1127	53.1127	53.1127	53.1127	53.1127	53.1127	53.1127	53.1127	53.1127	(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)	-103.5013	-103.5013	-103.5013	-103.5013	-103.5013	-103.5013	-103.5013	-103.5013	-103.5013	-103.5013	-103.5013	-103.5013	(71)
Water heating gains (Table 5)	76.0394	73.8131	69.1782	62.8775	58.7835	53.0285	48.1499	54.4147	56.6510	63.1699	70.5262	73.8224	(72)
Total internal gains	586.6506	582.0852	559.4651	524.3524	488.3395	456.1114	437.2990	445.9029	466.1243	501.4554	540.7306	570.4998	(73)

6. Solar gains

[Jan]												Area	Solar flux	g	FF	Access	Gains
												m2	Table 6a	Specific data	Specific data	factor	W
													W/m2	or Table 6b	or Table 6c	Table 6d	
Northeast												5.8300	11.2829	0.4600	0.0000	1.0000	30.2586 (75)
Southwest												7.1300	36.7938	0.4600	0.0000	1.0000	120.6764 (79)
Solar gains	150.9350	267.1488	392.2211	530.7282	635.3031	648.6745	617.9149	537.1508	439.7541	302.4544	182.6157	127.9846	(83)				
Total gains	737.5856	849.2340	951.6862	1055.0806	1123.6425	1104.7858	1055.2139	983.0537	905.8784	803.9098	723.3463	698.4844	(84)				

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (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	39.7879	39.8715	39.9537	40.3447	40.4187	40.7669	40.7669	40.8320	40.6321	40.4187	40.2693	40.1143	
alpha	3.6525	3.6581	3.6636	3.6896	3.6946	3.7178	3.7178	3.7221	3.7088	3.6946	3.6846	3.6743	
util living area	0.9716	0.9525	0.9148	0.8342	0.7026	0.5362	0.4003	0.4445	0.6630	0.8720	0.9538	0.9762	(86)
MIT	19.5844	19.8131	20.1441	20.5280	20.8064	20.9472	20.9862	20.9797	20.8835	20.5150	19.9803	19.5353	(87)
Th 2	19.9593	19.9612	19.9631	19.9721	19.9738	19.9817	19.9817	19.9831	19.9786	19.9738	19.9704	19.9669	(88)
util rest of house	0.9657	0.9429	0.8977	0.8021	0.6494	0.4615	0.3115	0.3521	0.5891	0.8394	0.9428	0.9712	(89)
MIT 2	18.6912	18.9157	19.2362	19.6007	19.8420	19.9546	19.9771	19.9758	19.9118	19.6001	19.0899	18.6489	(90)
Living area fraction	0.9657	0.9429	0.8977	0.8021	0.6494	0.4615	0.3115	0.3521	0.5891	0.8394	0.9428	0.9712	(91)
MIT	18.8279	19.0531	19.3752	19.7426	19.9897	20.1065	20.1316	20.1295	20.0606	19.7402	19.2262	18.7845	(92)
Temperature adjustment	18.8279	19.0531	19.3752	19.7426	19.9897	20.1065	20.1316	20.1295	20.0606	19.7402	19.2262	18.7845	(93)
adjusted MIT	18.8279	19.0531	19.3752	19.7426	19.9897	20.1065	20.1316	20.1295	20.0606	19.7402	19.2262	18.7845	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9574	0.9325	0.8863	0.7941	0.6503	0.4710	0.3249	0.3658	0.5954	0.8308	0.9328	0.9637	(94)
Ext temp.	706.1755	791.9515	843.4561	837.8316	730.6657	520.3276	342.8171	359.5606	539.3911	667.8834	674.7615	673.1398	(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	1460.6659	1419.9992	1289.1216	1075.0915	820.4495	540.3431	346.5434	365.3833	586.8377	904.6277	1204.6174	1454.4281	(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	(98)
Space heating per m2	561.3409	422.0480	331.5751	170.8271	66.7992	0.0000	0.0000	0.0000	0.0000	176.1378	381.4963	581.2785	(98)
												2691.5030	(98)
												30.8164	(99)

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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 %)													93.0000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													2894.0892 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	561.3409	422.0480	331.5751	170.8271	66.7992	0.0000	0.0000	0.0000	0.0000	176.1378	381.4963	581.2785	(98)
Space heating efficiency (main heating system 1)	93.0000	93.0000	93.0000	93.0000	93.0000	0.0000	0.0000	0.0000	0.0000	93.0000	93.0000	93.0000	(210)
Space heating fuel (main heating system)	603.5924	453.8151	356.5324	183.6851	71.8271	0.0000	0.0000	0.0000	0.0000	189.3954	410.2111	625.0307	(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	174.8011	153.3741	159.4016	140.5714	136.0638	119.1750	112.2077	126.2663	127.0569	145.9250	157.1943	169.8279	(64)
Efficiency of water heater (217)m	89.2691	89.1803	89.0036	88.6205	87.9655	87.0000	87.0000	87.0000	87.0000	88.6155	89.1034	89.3037	(216)
Fuel for water heating, kWh/month	195.8138	171.9819	179.0958	158.6217	154.6786	136.9828	128.9744	145.1337	146.0424	164.6722	176.4178	190.1688	(219)
Water heating fuel used												1948.5839	(219)
Annual totals kWh/year													
Space heating fuel - main system													2894.0892 (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)													376.8554 (232)
Total delivered energy for all uses													5294.5285 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2894.0892	3.4800	100.7143 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1948.5839	3.4800	67.8107 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	376.8554	13.1900	49.7072 (250)
Additional standing charges			120.0000 (251)
Total energy cost			348.1247 (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] =	1.1048 (257)
SAP value		84.5877
SAP rating (Section 12)		85 (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	2894.0892	0.2160	625.1233 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1948.5839	0.2160	420.8941 (264)
Space and water heating			1046.0174 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	376.8554	0.5190	195.5879 (268)
Total kg/year			1280.5303 (272)
CO2 emissions per m2			14.6600 (273)
EI value			87.0341
EI rating			87 (274)
EI band			B

Calculation of stars for heating and DHW

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9000 = 3.867$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9000 = 0.2400$, stars = 4
Water heating energy efficiency	$3.48 / 0.8826 = 3.943$, stars = 4
Water heating environmental impact	$0.216 / 0.8826 = 0.2447$, stars = 4

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

SAP 2012 WORKSHEET FOR New Build (As Built) (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	43.6700 (1b)	x 2.4200 (2b)	= 105.6814 (1b) - (3b)
First floor	43.6700 (1c)	x 2.6700 (2c)	= 116.5989 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	87.3400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 222.2803 (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) = 0.1350 (8)
Pressure test					Yes
Measured/design AP50					4.4000
Infiltration rate					0.3550 (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) =	0.3017 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.6000	4.5000	4.5000	4.1000	4.2000	3.7000	3.5000	3.5000	3.7000	4.1000	4.1000	4.2000 (22)
Wind factor	1.1500	1.1250	1.1250	1.0250	1.0500	0.9250	0.8750	0.8750	0.9250	1.0250	1.0250	1.0500 (22a)
Adj infilt rate												
Effective ac	0.3470	0.3394	0.3394	0.3093	0.3168	0.2791	0.2640	0.2640	0.2791	0.3093	0.3093	0.3168 (22b)
	0.5602	0.5576	0.5576	0.5478	0.5502	0.5389	0.5348	0.5348	0.5389	0.5478	0.5478	0.5502 (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
Front			2.1500	1.4000	3.0100		(26)
front (Uw = 1.30)			12.9600	1.2357	16.0152		(27)
gf			43.6700	0.1500	6.5505	75.0000	3275.2499 (28a)
external	95.3900	15.1100	80.2800	0.2000	16.0560	60.0000	4816.8000 (29a)
cold	43.6700		43.6700	0.0900	3.9303	9.0000	393.0300 (30)
Total net area of external elements Aum(A, m ²)			182.7300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	45.5620		(33)
party			43.6300	0.0000	0.0000	70.0000	3054.1001 (32)
gf			82.0000			9.0000	738.0000 (32c)
lf			105.0000			9.0000	945.0000 (32c)
lf			43.6700			18.0000	786.0600 (32d)
gf			43.6700			9.0000	393.0300 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 14401.2698 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 164.8874 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 12.8760 (36)
Total fabric heat loss (33) + (36) = 58.4380 (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	41.0918	40.9019	40.9019	40.1841	40.3573	39.5330	39.2325	39.2325	39.5330	40.1841	40.1841	40.3573 (38)
Heat transfer coeff	99.5299	99.3400	99.3400	98.6221	98.7953	97.9711	97.6706	97.6706	97.9711	98.6221	98.6221	98.7953 (39)
Average = Sum(39)m / 12 =												98.5792 (39)
HLP	1.1396	1.1374	1.1374	1.1292	1.1312	1.1217	1.1183	1.1183	1.1217	1.1292	1.1292	1.1312 (40)
HLP (average)												1.1287 (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 2.5875 (42)
Average daily hot water use (litres/day) 95.6539 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	105.2193	101.3931	97.5670	93.7408	89.9147	86.0885	86.0885	89.9147	93.7408	97.5670	101.3931	105.2193 (44)
Energy conte	156.0372	136.4711	140.8260	122.7755	117.8060	101.6576	94.2007	108.0967	109.3877	127.4809	139.1553	151.1137 (45)
Energy content (annual)										Total = Sum(45)m =		1505.0083 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Distribution loss (46)m = 0.15 x (45)m	23.4056	20.4707	21.1239	18.4163	17.6709	15.2486	14.1301	16.2145	16.4082	19.1221	20.8733	22.6670 (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	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	18.7639	16.9030	18.5757	17.7959	18.2578	17.5174	18.0070	18.1696	17.6692	18.4442	18.0390	18.7142 (61)
Total heat required for water heating calculated for each month	174.8011	153.3741	159.4016	140.5714	136.0638	119.1750	112.2077	126.2663	127.0569	145.9250	157.1943	169.8279 (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	174.8011	153.3741	159.4016	140.5714	136.0638	119.1750	112.2077	126.2663	127.0569	145.9250	157.1943	169.8279 (64)
Heat gains from water heating, kWh/month	56.5733	49.6024	51.4686	45.2718	43.7349	38.1805	35.8235	40.4846	40.7887	46.9984	50.7789	54.9238 (65)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)												
Total per year (kWh/year) = Sum(64)m = 1721.8651 (64)												

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	155.2520	155.2520	155.2520	155.2520	155.2520	155.2520	155.2520	155.2520	155.2520	155.2520	155.2520	155.2520	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	53.3478	47.3830	38.5345	29.1731	21.8072	18.4106	19.8933	25.8580	34.7066	44.0680	51.4338	54.8305	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	349.4000	353.0257	343.8891	324.4384	299.8853	276.8089	261.3925	257.7668	266.9034	286.3541	310.9072	333.9836	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.1127	53.1127	53.1127	53.1127	53.1127	53.1127	53.1127	53.1127	53.1127	53.1127	53.1127	53.1127	(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)	-103.5013	-103.5013	-103.5013	-103.5013	-103.5013	-103.5013	-103.5013	-103.5013	-103.5013	-103.5013	-103.5013	-103.5013	(71)
Water heating gains (Table 5)	76.0394	73.8131	69.1782	62.8775	58.7835	53.0285	48.1499	54.4147	56.6510	63.1699	70.5262	73.8224	(72)
Total internal gains	586.6506	582.0852	559.4651	524.3524	488.3395	456.1114	437.2990	445.9029	466.1243	501.4554	540.7306	570.4998	(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	
Northeast					5.8300	9.5471	0.4600	0.0000	1.0000		25.6034 (75)	
Southwest					7.1300	31.1332	0.4600	0.0000	1.0000		102.1108 (79)	
Solar gains	127.7142	237.4656	367.7073	505.9609	592.2878	616.2407	575.4129	492.6734	416.8104	279.5412	160.4804	115.7955 (83)
Total gains	714.3649	819.5508	927.1724	1030.3133	1080.6272	1072.3521	1012.7119	938.5763	882.9348	780.9966	701.2111	686.2954 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (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	40.1925	40.2693	40.2693	40.5624	40.4913	40.8320	40.9576	40.9576	40.8320	40.5624	40.5624	40.4913	
alpha	3.6795	3.6846	3.6846	3.7042	3.6994	3.7221	3.7305	3.7305	3.7221	3.7042	3.7042	3.6994	
util living area	0.9720	0.9534	0.9166	0.8296	0.6895	0.5201	0.4142	0.4532	0.6730	0.8742	0.9537	0.9755	(86)
MIT	19.6312	19.8513	20.1577	20.5576	20.8309	20.9554	20.9847	20.9790	20.8788	20.5220	20.0200	19.5946	(87)
Th 2	19.9686	19.9704	19.9704	19.9771	19.9755	19.9831	19.9859	19.9859	19.9831	19.9771	19.9771	19.9755	(88)
util rest of house	0.9661	0.9437	0.8996	0.7959	0.6321	0.4417	0.3232	0.3575	0.5993	0.8413	0.9423	0.9703	(89)
MIT 2	18.7449	18.9610	19.2557	19.6325	19.8642	19.9615	19.9808	19.9785	19.9132	19.6103	19.1345	18.7144	(90)
Living area fraction	18.8806	19.0973	19.3938	19.7741	20.0122	20.1137	20.1345	20.1317	20.0610	19.7498	19.2700	18.8491	(91)
MIT	18.8806	19.0973	19.3938	19.7741	20.0122	20.1137	20.1345	20.1317	20.0610	19.7498	19.2700	18.8491	(92)
Temperature adjustment	18.8806	19.0973	19.3938	19.7741	20.0122	20.1137	20.1345	20.1317	20.0610	19.7498	19.2700	18.8491	(93)
adjusted MIT	18.8806	19.0973	19.3938	19.7741	20.0122	20.1137	20.1345	20.1317	20.0610	19.7498	19.2700	18.8491	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9579	0.9336	0.8883	0.7884	0.6343	0.4521	0.3368	0.3716	0.6054	0.8327	0.9325	0.9628	(94)
Useful gains	684.3237	765.1202	823.6062	812.3401	685.4379	484.8372	341.0858	348.7995	534.5271	650.3674	653.8769	660.7668	(95)
Ext temp.	4.7000	5.3000	6.7000	9.3000	12.3000	15.0000	16.6000	16.5000	14.1000	10.8000	7.5000	4.6000	(96)
Heat loss rate W	1411.3940	1370.6224	1261.0028	1032.9828	761.9303	500.9929	345.2175	354.7096	584.0043	882.6504	1160.7846	1407.7470	(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	540.9403	406.8975	325.4231	158.8628	56.9103	0.0000	0.0000	0.0000	0.0000	172.8186	364.9735	555.7533	(98)
Space heating												2582.5793	(98)
Space heating per m2												29.5693	(99)
										(98) / (4) =			

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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 %)													93.0000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													2776.9670 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	540.9403	406.8975	325.4231	158.8628	56.9103	0.0000	0.0000	0.0000	0.0000	172.8186	364.9735	555.7533	(98)
Space heating efficiency (main heating system 1)	93.0000	93.0000	93.0000	93.0000	93.0000	0.0000	0.0000	0.0000	0.0000	93.0000	93.0000	93.0000	(210)
Space heating fuel (main heating system)	581.6562	437.5242	349.9174	170.8202	61.1939	0.0000	0.0000	0.0000	0.0000	185.8264	392.4446	597.5842	(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	174.8011	153.3741	159.4016	140.5714	136.0638	119.1750	112.2077	126.2663	127.0569	145.9250	157.1943	169.8279	(64)
Efficiency of water heater (217)m	89.2484	89.1584	88.9911	88.5663	87.8637	87.0000	87.0000	87.0000	87.0000	88.6013	89.0753	89.2794	(216)
Fuel for water heating, kWh/month	195.8591	172.0243	179.1209	158.7189	154.8577	136.9828	128.9744	145.1337	146.0424	164.6986	176.4734	190.2206	(219)
Water heating fuel used												1949.1068	(219)
Annual totals kWh/year													
Space heating fuel - main system												2776.9670	(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)												376.8554	(232)
Total delivered energy for all uses												5177.9291	(238)

10a. Fuel costs - using BEDF prices (536)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2776.9670	7.6100	211.3272 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1949.1068	7.6100	148.3270 (247)
Pumps and fans for heating	75.0000	31.0800	23.3100 (249)
Energy for lighting	376.8554	31.0800	117.1266 (250)
Additional standing charges			105.0000 (251)
Total energy cost			605.0909 (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	2776.9670	0.2160	599.8249 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1949.1068	0.2160	421.0071 (264)
Space and water heating			1020.8319 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	376.8554	0.5190	195.5879 (268)
Total kg/year			1255.3449 (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	2776.9670	1.2200	3387.8997 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1949.1068	1.2200	2377.9103 (264)
Space and water heating			5765.8100 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	376.8554	3.0700	1156.9459 (268)
Primary energy kWh/year			7153.0059 (272)
Primary energy kWh/m2/year			81.8984 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 85
Current environmental impact rating: B 87

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

(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	Recommended
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	+ 1.2	-£ 57	-179 kg (14.3%)
U Solar photovoltaic panels	+ 10.1	-£ 499	-833 kg (77.4%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£57	2.05 kg/m²	B 86 B 89
Solar photovoltaic panels	£499	9.54 kg/m²	A 96 A 98
Total Savings	£556	11.59 kg/m²	

Potential energy efficiency rating: A 96
Potential environmental impact rating: A 98

Fuel prices for cost data on this page from database revision number 536 TEST (31 Jan 2024)
Recommendation texts revision number 4.9c (22 Feb 2014)

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

	Current	Potential	Saving
Electricity	£140	£156	-£16
Mains gas	£465	£392	£72
Space heating	£340	£340	£0
Water heating	£148	£92	£57
Lighting	£117	£117	£0
Generated (PV)	-£0	-£499	£499
Total cost of fuels	£605	£49	£555
Total cost of uses	£605	£50	£556
Delivered energy	59 kWh/m²	31 kWh/m²	29 kWh/m²
Carbon dioxide emissions	1.3 tonnes	0.2 tonnes	1.0 tonnes
CO2 emissions per m²	14 kg/m²	3 kg/m²	12 kg/m²
Primary energy	82 kWh/m²	14 kWh/m²	68 kWh/m²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (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	43.6700 (1b)	x 2.4200 (2b)	= 105.6814 (1b) - (3b)
First floor	43.6700 (1c)	x 2.6700 (2c)	= 116.5989 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	87.3400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 222.2803 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					30.0000 / (5) = 0.1350 (8)
Pressure test					Yes
Measured/design AP50					4.4000
Infiltration rate					0.3550 (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) =	0.3017 (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	0.3847	0.3772	0.3696	0.3319	0.3243	0.2866	0.2866	0.2791	0.3017	0.3243	0.3394	0.3545 (22b)
Effective ac	0.5740	0.5711	0.5683	0.5551	0.5526	0.5411	0.5411	0.5389	0.5455	0.5526	0.5576	0.5628 (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
Front			2.1500	1.4000	3.0100		(26)
front (Uw = 1.30)			12.9600	1.2357	16.0152		(27)
gf			43.6700	0.1500	6.5505	75.0000	3275.2499 (28a)
external	95.3900	15.1100	80.2800	0.2000	16.0560	60.0000	4816.8000 (29a)
cold	43.6700		43.6700	0.0900	3.9303	9.0000	393.0300 (30)
Total net area of external elements Aum(A, m ²)			182.7300				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		45.5620		(33)
party			43.6300	0.0000	0.0000	70.0000	3054.1001 (32)
gf			82.0000			9.0000	738.0000 (32c)
1f			105.0000			9.0000	945.0000 (32c)
1f			43.6700			18.0000	786.0600 (32d)
gf			43.6700			9.0000	393.0300 (32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss

(28)...(30) + (32) + (32a)...(32e) =	14401.2698 (34)
	164.8874 (35)
	12.8760 (36)
(33) + (36) =	58.4380 (37)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1512	1.1487	1.1464	1.1353	1.1332	1.1235	1.1235	1.1217	1.1272	1.1332	1.1374	1.1418 (40)
HLP (average)												1.1353 (40)
Days in month												
	31	28	31	30	31	30	31	31	30	31	30	31 (41)

HLP	Jan 1.1512	Feb 1.1487	Mar 1.1464	Apr 1.1353	May 1.1332	Jun 1.1235	Jul 1.1235	Aug 1.1217	Sep 1.1272	Oct 1.1332	Nov 1.1374	Dec 1.1418 (40)
HLP (average)												1.1353 (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												2.5875 (42)
Average daily hot water use (litres/day)												95.6539 (43)
Daily hot water use	Jan 105.2193	Feb 101.3931	Mar 97.5670	Apr 93.7408	May 89.9147	Jun 86.0885	Jul 86.0885	Aug 89.9147	Sep 93.7408	Oct 97.5670	Nov 101.3931	Dec 105.2193 (44)
Energy conte	156.0372	136.4711	140.8260	122.7755	117.8060	101.6576	94.2007	108.0967	109.3877	127.4809	139.1553	151.1137 (45)
Energy content (annual)										Total = Sum(45)m =		1505.0083 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	23.4056	20.4707	21.1239	18.4163	17.6709	15.2486	14.1301	16.2145	16.4082	19.1221	20.8733	22.6670 (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	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	18.7639	16.9030	18.5757	17.7959	18.2578	17.5174	18.0070	18.1696	17.6692	18.4442	18.0390	18.7142 (61)
Total heat required for water heating calculated for each month	174.8011	153.3741	159.4016	140.5714	136.0638	119.1750	112.2077	126.2663	127.0569	145.9250	157.1943	169.8279 (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												1.2050 (H8)
Utilisation factor												0.5639 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												95.6539 (H14)
Volume ratio Veff/V												0.7841 (H15)
Solar storage volume factor												0.9514 (H16)
Solar input	-24.8070	-41.3957	-70.5016	-94.4860	-116.7295	-114.7637	-113.2470	-98.9445	-77.4934	-52.9189	-29.4246	-855.4710 (H17)
Solar input (sum of months) = Sum (63)m =												-855.4710 (63)
Output from w/h	149.9941	111.9784	88.9001	46.0854	19.3343	4.4113	0.0000	27.3218	49.5635	93.0062	127.7697	149.0687 (64)
Total per year (kWh/year) = Sum (64)m =												867.4334 (64)
Heat gains from water heating, kWh/month	56.5733	49.6024	51.4686	45.2718	43.7349	38.1805	35.8235	40.4846	40.7887	46.9984	50.7789	54.9238 (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	155.2520	155.2520	155.2520	155.2520	155.2520	155.2520	155.2520	155.2520	155.2520	155.2520	155.2520	155.2520	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	53.3478	47.3830	38.5345	29.1731	21.8072	18.4106	19.8933	25.8580	34.7066	44.0680	51.4338	54.8305	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	349.4000	353.0257	343.8891	324.4384	299.8853	276.8089	261.3925	257.7668	266.9034	286.3541	310.9072	333.9836	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.1127	53.1127	53.1127	53.1127	53.1127	53.1127	53.1127	53.1127	53.1127	53.1127	53.1127	53.1127	(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)	-103.5013	-103.5013	-103.5013	-103.5013	-103.5013	-103.5013	-103.5013	-103.5013	-103.5013	-103.5013	-103.5013	-103.5013	(71)
Water heating gains (Table 5)	76.0394	73.8131	69.1782	62.8775	58.7835	53.0285	48.1499	54.4147	56.6510	63.1699	70.5262	73.8224	(72)
Total internal gains	586.6506	582.0852	559.4651	524.3524	488.3395	456.1114	437.2990	445.9029	466.1243	501.4554	540.7306	570.4998	(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
Northeast					5.8300	11.2829	0.4600	0.0000			1.0000			30.2586 (75)
Southwest					7.1300	36.7938	0.4600	0.0000			1.0000			120.6764 (79)

Solar gains	150.9350	267.1488	392.2211	530.7282	635.3031	648.6745	617.9149	537.1508	439.7541	302.4544	182.6157	127.9846	(83)	
Total gains	737.5856	849.2340	951.6862	1055.0806	1123.6425	1104.7858	1055.2139	983.0537	905.8784	803.9098	723.3463	698.4844	(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	39.7879	39.8715	39.9537	40.3447	40.4187	40.7669	40.7669	40.8320	40.6321	40.4187	40.2693	40.1143	
alpha	3.6525	3.6581	3.6636	3.6896	3.6946	3.7178	3.7178	3.7221	3.7088	3.6946	3.6846	3.6743	
util living area	0.9716	0.9525	0.9148	0.8342	0.7026	0.5362	0.4003	0.4445	0.6630	0.8720	0.9538	0.9762	(86)
MIT	19.5844	19.8131	20.1441	20.5280	20.8064	20.9472	20.9862	20.9797	20.8835	20.5150	19.9803	19.5353	(87)
Th 2	19.9593	19.9612	19.9631	19.9721	19.9738	19.9817	19.9817	19.9831	19.9786	19.9738	19.9704	19.9669	(88)
util rest of house	0.9657	0.9429	0.8977	0.8021	0.6494	0.4615	0.3115	0.3521	0.5891	0.8394	0.9428	0.9712	(89)
MIT 2	18.6912	18.9157	19.2362	19.6007	19.8420	19.9546	19.9771	19.9758	19.9118	19.6001	19.0899	18.6489	(90)
Living area fraction									fLA = Living area / (4) =			0.1531	(91)
MIT	18.8279	19.0531	19.3752	19.7426	19.9897	20.1065	20.1316	20.1295	20.0606	19.7402	19.2262	18.7845	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8279	19.0531	19.3752	19.7426	19.9897	20.1065	20.1316	20.1295	20.0606	19.7402	19.2262	18.7845	(93)

8. Space heating requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9574	0.9325	0.8863	0.7941	0.6503	0.4710	0.3249	0.3658	0.5954	0.8308	0.9328	0.9637	(94)
Useful gains	706.1755	791.9515	843.4561	837.8316	730.6657	520.3276	342.8171	359.5606	539.3911	667.8834	674.7615	673.1398	(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													
	1460.6659	1419.9992	1289.1216	1075.0915	820.4495	540.3431	346.5434	365.3833	586.8377	904.6277	1204.6174	1454.4281	(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													
	561.3409	422.0480	331.5751	170.8271	66.7992	0.0000	0.0000	0.0000	0.0000	176.1378	381.4963	581.2785	(98)
Space heating													2691.5030 (98)
Space heating per m2											(98) / (4) =	30.8164	(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 %)													93.0000	(206)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement													2894.0892	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	561.3409	422.0480	331.5751	170.8271	66.7992	0.0000	0.0000	0.0000	0.0000	176.1378	381.4963	581.2785	(98)	
Space heating efficiency (main heating system 1)	93.0000	93.0000	93.0000	93.0000	93.0000	0.0000	0.0000	0.0000	0.0000	93.0000	93.0000	93.0000	(210)	
Space heating fuel (main heating system)	603.5924	453.8151	356.5324	183.6851	71.8271	0.0000	0.0000	0.0000	0.0000	189.3954	410.2111	625.0307	(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	149.9941	111.9784	88.9001	46.0854	19.3343	4.4113	0.0000	27.3218	49.5635	93.0062	127.7697	149.0687	(64)	
Efficiency of water heater	89.3503	89.3539	89.3486	89.3454	89.3087	87.0000	87.0000	87.0000	87.0000	88.9402	89.2281	89.3710	(216)	
Fuel for water heating, kWh/month	167.8720	125.3201	99.4980	51.5811	21.6488	5.0705	0.0000	31.4044	56.9695	104.5716	143.1945	166.7976	(219)	
Water heating fuel used												973.9281	(219)	
Annual totals kWh/year														
Space heating fuel - main system													2894.0892	(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)													376.8554	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 2.50 * 1080 * 0.80) =									-1727.2394				-1727.2394	(233)
Total delivered energy for all uses													2642.6333	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2894.0892	3.4800	100.7143	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	973.9281	3.4800	33.8927	(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	376.8554	13.1900	49.7072	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-1727.2394	13.1900	-227.8229	(252)
Total energy cost			92.9788	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)		0.2951	(257)
SAP value	[(255) x (256)] / [(4) + 45.0] =	95.8836	
SAP rating (Section 12)		96	(258)
SAP band		A	

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
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FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Space heating - main system 1	2894.0892	0.2160	625.1233 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	973.9281	0.2160	210.3685 (264)
Space and water heating			835.4917 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	376.8554	0.5190	195.5879 (268)
Energy saving/generation technologies			
PV Unit			
Total kg/year	-1727.2394	0.5190	-896.4372 (269)
CO2 emissions per m2			199.5174 (272)
EI value			2.2800 (273)
EI rating			97.9798
EI band			98 (274)
			A

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

SAP 2012 WORKSHEET FOR New Build (As Built) (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	43.6700 (1b)	x 2.4200 (2b)	= 105.6814 (1b) - (3b)
First floor	43.6700 (1c)	x 2.6700 (2c)	= 116.5989 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	87.3400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 222.2803 (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) = 0.1350 (8)
Pressure test					Yes
Measured/design AP50					4.4000
Infiltration rate					0.3550 (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) =		0.3017 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.6000	4.5000	4.5000	4.1000	4.2000	3.7000	3.5000	3.5000	3.7000	4.1000	4.1000	4.2000 (22)
Wind factor	1.1500	1.1250	1.1250	1.0250	1.0500	0.9250	0.8750	0.8750	0.9250	1.0250	1.0250	1.0500 (22a)
Adj infilt rate												
Effective ac	0.3470	0.3394	0.3394	0.3093	0.3168	0.2791	0.2640	0.2640	0.2791	0.3093	0.3093	0.3168 (22b)
	0.5602	0.5576	0.5576	0.5478	0.5502	0.5389	0.5348	0.5348	0.5389	0.5478	0.5478	0.5502 (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
Front			2.1500	1.4000	3.0100		(26)
front (Uw = 1.30)			12.9600	1.2357	16.0152		(27)
gf			43.6700	0.1500	6.5505	75.0000	3275.2499 (28a)
external	95.3900	15.1100	80.2800	0.2000	16.0560	60.0000	4816.8000 (29a)
cold	43.6700		43.6700	0.0900	3.9303	9.0000	393.0300 (30)
Total net area of external elements Aum(A, m ²)			182.7300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	45.5620		(33)
party			43.6300	0.0000	0.0000	70.0000	3054.1001 (32)
gf			82.0000			9.0000	738.0000 (32c)
lf			105.0000			9.0000	945.0000 (32c)
lf			43.6700			18.0000	786.0600 (32d)
gf			43.6700			9.0000	393.0300 (32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 41.0918	Feb 40.9019	Mar 40.9019	Apr 40.1841	May 40.3573	Jun 39.5330	Jul 39.2325	Aug 39.2325	Sep 39.5330	Oct 40.1841	Nov 40.1841	Dec 40.3573 (38)
Heat transfer coeff	99.5299	99.3400	99.3400	98.6221	98.7953	97.9711	97.6706	97.6706	97.9711	98.6221	98.6221	98.7953 (39)
Average = Sum(39)m / 12 =												98.5792 (39)

HLP	Jan 1.1396	Feb 1.1374	Mar 1.1374	Apr 1.1292	May 1.1312	Jun 1.1217	Jul 1.1183	Aug 1.1183	Sep 1.1217	Oct 1.1292	Nov 1.1292	Dec 1.1312 (40)
HLP (average)												1.1287 (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												2.5875 (42)
Average daily hot water use (litres/day)												95.6539 (43)
Daily hot water use	Jan 105.2193	Feb 101.3931	Mar 97.5670	Apr 93.7408	May 89.9147	Jun 86.0885	Jul 86.0885	Aug 89.9147	Sep 93.7408	Oct 97.5670	Nov 101.3931	Dec 105.2193 (44)
Energy conte	156.0372	136.4711	140.8260	122.7755	117.8060	101.6576	94.2007	108.0967	109.3877	127.4809	139.1553	151.1137 (45)
Energy content (annual)										Total = Sum(45)m =		1505.0083 (45)

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Distribution loss (46)m = 0.15 x (45)m	23.4056	20.4707	21.1239	18.4163	17.6709	15.2486	14.1301	16.2145	16.4082	19.1221	20.8733	22.6670 (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	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	18.7639	16.9030	18.5757	17.7959	18.2578	17.5174	18.0070	18.1696	17.6692	18.4442	18.0390	18.7142 (61)
Total heat required for water heating calculated for each month	174.8011	153.3741	159.4016	140.5714	136.0638	119.1750	112.2077	126.2663	127.0569	145.9250	157.1943	169.8279 (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												1003.2404 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												1685.4438 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.1199 (H8)
Utilisation factor												0.5906 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												95.6539 (H14)
Volume ratio Veff/V												0.7841 (H15)
Solar storage volume factor												0.9514 (H16)
Solar input												-832.6195 (H17)
Solar input	-21.9832	-38.5364	-69.2212	-94.3368	-113.9728	-114.1818	-110.4451	-95.0437	-76.9241	-51.2230	-27.0809	-19.6704 (63)
Solar input (sum of months) = Sum (63)m =												-832.6195 (63)
Output from w/h	152.8179	114.8376	90.1805	46.2346	22.0910	4.9932	1.7626	31.2226	50.1328	94.7020	130.1133	150.1575 (64)
Total per year (kWh/year) = Sum (64)m =												889.2457 (64)
Heat gains from water heating, kWh/month	56.5733	49.6024	51.4686	45.2718	43.7349	38.1805	35.8235	40.4846	40.7887	46.9984	50.7789	54.9238 (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	155.2520	155.2520	155.2520	155.2520	155.2520	155.2520	155.2520	155.2520	155.2520	155.2520	155.2520	155.2520 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	53.3478	47.3830	38.5345	29.1731	21.8072	18.4106	19.8933	25.8580	34.7066	44.0680	51.4338	54.8305 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	349.4000	353.0257	343.8891	324.4384	299.8853	276.8089	261.3925	257.7668	266.9034	286.3541	310.9072	333.9836 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.1127	53.1127	53.1127	53.1127	53.1127	53.1127	53.1127	53.1127	53.1127	53.1127	53.1127	53.1127 (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)	-103.5013	-103.5013	-103.5013	-103.5013	-103.5013	-103.5013	-103.5013	-103.5013	-103.5013	-103.5013	-103.5013	-103.5013 (71)
Water heating gains (Table 5)	76.0394	73.8131	69.1782	62.8775	58.7835	53.0285	48.1499	54.4147	56.6510	63.1699	70.5262	73.8224 (72)
Total internal gains	586.6506	582.0852	559.4651	524.3524	488.3395	456.1114	437.2990	445.9029	466.1243	501.4554	540.7306	570.4998 (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	
Northeast					5.8300	9.5471	0.4600		0.0000			1.0000			25.6034 (75)
Southwest					7.1300	31.1332	0.4600		0.0000			1.0000			102.1108 (79)
Solar gains	127.7142	237.4656	367.7073	505.9609	592.2878	616.2407	575.4129	492.6734	416.8104	279.5412	160.4804	115.7955	(83)		
Total gains	714.3649	819.5508	927.1724	1030.3133	1080.6272	1072.3521	1012.7119	938.5763	882.9348	780.9966	701.2111	686.2954	(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	40.1925	40.2693	40.2693	40.5624	40.4913	40.8320	40.9576	40.9576	40.8320	40.5624	40.5624	40.4913
alpha	3.6795	3.6846	3.6846	3.7042	3.6994	3.7221	3.7305	3.7305	3.7221	3.7042	3.7042	3.6994
util living area	0.9720	0.9534	0.9166	0.8296	0.6895	0.5201	0.4142	0.4532	0.6730	0.8742	0.9537	0.9755 (86)
MIT	19.6312	19.8513	20.1577	20.5576	20.8309	20.9554	20.9847	20.9790	20.8788	20.5220	20.0200	19.5946 (87)
Th 2	19.9686	19.9704	19.9704	19.9771	19.9755	19.9831	19.9859	19.9859	19.9831	19.9771	19.9771	19.9755 (88)
util rest of house	0.9661	0.9437	0.8996	0.7959	0.6321	0.4417	0.3232	0.3575	0.5993	0.8413	0.9423	0.9703 (89)
MIT 2	18.7449	18.9610	19.2557	19.6325	19.8642	19.9615	19.9808	19.9785	19.9132	19.6103	19.1345	18.7144 (90)
Living area fraction									fLA = Living area / (4) =			0.1531 (91)
MIT	18.8806	19.0973	19.3938	19.7741	20.0122	20.1137	20.1345	20.1317	20.0610	19.7498	19.2700	18.8491 (92)
Temperature adjustment												0.0000
adjusted MIT	18.8806	19.0973	19.3938	19.7741	20.0122	20.1137	20.1345	20.1317	20.0610	19.7498	19.2700	18.8491 (93)

8. Space heating requirement

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9579	0.9336	0.8883	0.7884	0.6343	0.4521	0.3368	0.3716	0.6054	0.8327	0.9325	0.9628	(94)
Useful gains	684.3237	765.1202	823.6062	812.3401	685.4379	484.8372	341.0858	348.7995	534.5271	650.3674	653.8769	660.7668	(95)
Ext temp.	4.7000	5.3000	6.7000	9.3000	12.3000	15.0000	16.6000	16.5000	14.1000	10.8000	7.5000	4.6000	(96)
Heat loss rate W													
	1411.3940	1370.6224	1261.0028	1032.9828	761.9303	500.9929	345.2175	354.7096	584.0043	882.6504	1160.7846	1407.7470	(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													
	540.9403	406.8975	325.4231	158.8628	56.9103	0.0000	0.0000	0.0000	0.0000	172.8186	364.9735	555.7533	(98)
Space heating													2582.5793 (98)
Space heating per m2											(98) / (4) =	29.5693	(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 %)													93.0000	(206)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement													2776.9670	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	540.9403	406.8975	325.4231	158.8628	56.9103	0.0000	0.0000	0.0000	0.0000	172.8186	364.9735	555.7533	(98)	
Space heating efficiency (main heating system 1)	93.0000	93.0000	93.0000	93.0000	93.0000	0.0000	0.0000	0.0000	0.0000	93.0000	93.0000	93.0000	(210)	
Space heating fuel (main heating system)	581.6562	437.5242	349.9174	170.8202	61.1939	0.0000	0.0000	0.0000	0.0000	185.8264	392.4446	597.5842	(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	152.8179	114.8376	90.1805	46.2346	22.0910	4.9932	1.7626	31.2226	50.1328	94.7020	130.1133	150.1575	(64)	
Efficiency of water heater	89.3215	89.3221	89.3316	89.3058	89.1405	87.0000	87.0000	87.0000	87.0000	88.9146	89.1917	89.3447	(217)	
Fuel for water heating, kWh/month	171.0874	128.5658	100.9503	51.7711	24.7822	5.7393	2.0260	35.8881	57.6240	106.5089	145.8805	168.0654	(219)	
Water heating fuel used												998.8890	(219)	
Annual totals kWh/year														
Space heating fuel - main system													2776.9670	(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)													376.8554	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 2.50 * 1003 * 0.80) =									-1605.1846				-1605.1846	(233)
Total delivered energy for all uses													2672.5267	(238)

10a. Fuel costs - using BEDF prices (536)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2776.9670	7.6100	211.3272 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	998.8890	7.6100	76.0155 (247)
Pumps and fans for heating	75.0000	31.0800	23.3100 (249)
Pump for solar water heating	50.0000	31.0800	15.5400 (249)
Energy for lighting	376.8554	31.0800	117.1266 (250)
Additional standing charges			105.0000 (251)
Energy saving/generation technologies			
PV Unit	-1605.1846	31.0800	-498.8914 (252)
Total energy cost			49.4279 (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	2776.9670	0.2160	599.8249 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	998.8890	0.2160	215.7600 (264)
Space and water heating			815.5849 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	376.8554	0.5190	195.5879 (268)
Energy saving/generation technologies			
PV Unit	-1605.1846	0.5190	-833.0908 (269)
Total kg/year			242.9570 (272)

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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	2776.9670	1.2200	3387.8997 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	998.8890	1.2200	1218.6445 (264)
Space and water heating			4606.5442 (265)
Pumps and fans	125.0000	3.0700	383.7500 (267)
Energy for lighting	376.8554	3.0700	1156.9459 (268)
Energy saving/generation technologies			
PV Unit	-1605.1846	3.0700	-4927.9167 (269)
Primary energy kWh/year			1219.3235 (272)
Primary energy kWh/m2/year			13.9607 (273)

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

Overheating Calculation Input Data

Dwelling type	EndTerrace House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	West Pennines
Front of dwelling faces	North East
Overshading	Very little
Thermal mass parameter	164.9 (calculated from construction elements)
Night ventilation	No
Ventilation rate during hot weather (ach)	4.00 (Windows half open)

Overheating Calculation

Summer ventilation heat loss coefficient	293.41 (P1)
Transmission heat loss coefficient	58.44 (37)
Summer heat loss coefficient	351.85 (P2)

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

Solar shading Orientation	Z blinds	Solar access	Z overhangs	Z summer
North East	1.000	1.00	1.000	1.000 (P8)
South West	1.000	1.00	1.000	1.000 (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 East	5.8300	89.6552	0.4600	0.0000	1.0000	240.4372
South West	7.1300	112.1012	0.4600	0.0000	1.0000	367.6696
total:						608.1068

Solar gains	Jun 658	Jul 608	Aug 520	(P4)
Internal gains	453	434	443	
Total summer gains	1112	1042	963	(P5)
Summer gain/loss ratio	3.16	2.96	2.74	(P6)
Summer external temperature	14.70	16.40	16.30	
Thermal mass temperature increment (TMP = 164.9)	0.85	0.85	0.85	
Threshold temperature	18.70	20.21	19.88	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	
Assessment of likelihood of high internal temperature:	Not significant			

BASIC COMPLIANCE REPORT

Calculation Type: New Build (As Built)

Property Reference	Plot 001	Issued on Date	26/02/2024
Assessment Reference	plot 1 chain	Prop Type Ref	22186
Property	68 Victoria Avenue, Blackley, MANCHESTER, M9 0RE		
SAP Rating	85 B	DER	16.99
Environmental	87 B	TER	17.70
CO ₂ Emissions (t/year)	1.26	% DER<TER	3.99
General Requirements Compliance	Pass	DFEE	43.74
		TFEE	50.21
		% DFEE<TFEE	12.88
Assessor Details	Mr. Patrick McGuigan, JSP Sustainability Ltd, Tel: 01904 435 325, technical@jspsustainability.co.uk		Assessor ID
			Y128-0001
Client			

SUMMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	17.70	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	16.99	kgCO ₂ /m ²	Pass
	-0.71 (-4.0%)	kgCO ₂ /m ²	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	50.21	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DFEE)	43.74	kWh/m ² /yr	
	-6.5 (-12.9%)	kWh/m ² /yr	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.20 (max. 0.30)	0.20 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.15 (max. 0.25)	0.15 (max. 0.70)	Pass
Roof	0.09 (max. 0.20)	0.09 (max. 0.35)	Pass
Openings	1.31 (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	4.40 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

BASIC COMPLIANCE REPORT

Calculation Type: New Build (As Built)

Main heating system

Boiler system with radiators or underfloor - Mains gas
Data from database
Vaillant ecoTEC sustain 28 VUW 286/7-2 (H-GB)
Combi boiler
Efficiency: 89.1% SEDBUK2009
Minimum: 88.0%

Pass

Secondary heating system

None

5 Cylinder insulation

Hot water storage

No cylinder

6 Controls

Space heating controls

Programmer, room thermostat and TRVs

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 (West Pennines (England))

Not significant

Pass

Based on:

Overshading

Very little

Windows facing North East

5.83 m², No overhang

Windows facing South West

7.13 m², No overhang

Air change rate

0.00 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

4.40 (measured in this dwelling)

Maximum

10.0

Pass

10 Key features

Party wall U-value

0.00

W/m²K

Roof U-value

0.09

W/m²K

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

Property Reference	Plot 001	Issued on Date	26/02/2024
Assessment Reference	plot 1 chain	Prop Type Ref	22186
Property	68 Victoria Avenue, Blackley, MANCHESTER, M9 0RE		
SAP Rating	85 B	DER	16.99
Environmental	87 B	TER	17.70
CO ₂ Emissions (t/year)	1.26	% DER<TER	3.99
General Requirements Compliance	Pass	DFEE	43.74
		TFEE	50.21
		% DFEE<TFEE	12.88
Assessor Details	Mr. Patrick McGuigan, JSP Sustainability Ltd, Tel: 01904 435 325, technical@jpsustainability.co.uk		Assessor ID
			Y128-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Built)

Orientation	North East
Property Tenure	Unknown
Transaction Type	None of the above
Terrain Type	Suburban
1.0 Property Type	House, End-Terrace
2.0 Number of Storeys	2
3.0 Date Built	2022
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Very little

6.0 Measurements		Heat Loss Perimeter	Internal Floor Area	Average Storey Height
	Ground Floor:	1.00 m	43.67 m ²	2.42 m
	1st Storey:	1.00 m	43.67 m ²	2.67 m

7.0 Living Area	13.37	m ²
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8.0 Thermal Mass Parameter	Precise calculation	
Thermal Mass	164.89	kJ/m ² K

9.0 External Walls						
Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area (m ²)	Nett Area (m ²)
external	Cavity Wall	Cavity wall : plasterboard on dabs, AAC block, filled cavity, any outside structure	0.20	60.00	95.39	80.28

9.1 Party Walls					
Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Area (m ²)
party	Filled Cavity with Edge Sealing	Single plasterboard on dabs on both sides, dense blocks, cavity or cavity fill	0.00	70.00	43.63

9.2 Internal Walls					
Description	Construction		Kappa (kJ/m ² K)	Area (m ²)	
gf	Plasterboard on timber frame		9.00	82.00	
1f	Plasterboard on timber frame		9.00	105.00	

10.0 External Roofs						
Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area (m ²)	Nett Area (m ²)
cold	External Slope Roof	Plasterboard, insulated at ceiling level	0.09	9.00	43.67	43.67

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

10.2 Internal Ceilings

Description	Construction	Kappa (kJ/m²K)	Area (m²)
gf	Other	9.00	43.67

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Area (m²)
gf	Ground Floor - Solid	Suspended concrete floor, carpeted	0.15	75.00	43.67

11.2 Internal Floors

Description	Construction	Kappa (kJ/m²K)	Area (m²)
1f	Plasterboard ceiling, carpeted chipboard floor	18.00	43.67

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Front	BFRC data	Solid Door							1.40
front	BFRC data	Window	Double Low-E Soft 0.05			0.46			1.30

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
Front	Solid Door	[1] external	North East							2.15	
front	Window	[1] external	North East	None	0.00					5.83	
rear	Window	[1] external	South West	None	0.00					7.13	

14.0 Conservatory

None

15.0 Draught Proofing

100 %

16.0 Draught Lobby

No

17.0 Thermal Bridging

Calculate Bridges

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E1 Steel lintel with perforated steel base plate	10.11	0.358	No
Independently assessed	E3 Sill	7.50	0.020	No
Independently assessed	E4 Jamb	23.30	0.016	No
Independently assessed	E5 Ground floor (normal)	18.76	0.108	No
Independently assessed	E6 Intermediate floor within a dwelling	18.76	0.000	No
Independently assessed	E10 Eaves (insulation at ceiling level)	8.58	0.122	No
Independently assessed	E12 Gable (insulation at ceiling level)	10.18	0.108	No
Independently assessed	E16 Corner (normal)	10.17	0.068	No
Independently assessed	E18 Party wall between dwellings	10.17	0.092	No
Table K1 - Default	P1 Party wall - Ground floor	8.58	0.160	No
Table K1 - Default	P2 Party wall - Intermediate floor within a dwelling	8.58	0.000	No
Independently assessed	P4 Party wall - Roof (insulation at ceiling level)	8.58	0.182	No

Y-value	0.070	W/m²K
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18.0 Pressure Testing

Designed AP ₅₀	Yes	
Property Tested ?	5.00	m³/(h.m²) @ 50 Pa
As Built AP ₅₀	Yes	
	4.40	m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather Windows half open

Cross ventilation possible Yes

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

Night Ventilation

Air change rate

Mechanical Ventilation

Mechanical Ventilation System Present

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				3
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System

22.0 Lighting

Internal

Total number of light fittings

Total number of L.E.L. fittings

Percentage of L.E.L. fittings %

External

External lights fitted

23.0 Electricity Tariff

24.0 Main Heating 1

Percentage of Heat %

Database Ref. No.

Fuel Type

Main Heating

SAP Code

In Winter

In Summer

Controls

PCDF Controls

Delayed Start Stat

Sap Code

Flue Type

Fan Assisted Flue

Is MHS Pumped

Heat Emitter

Flow Temperature

Combi boiler type

Combi keep hot type

25.0 Main Heating 2

Community Heating

28.0 Water Heating

Water Heating

Flue Gas Heat Recovery System

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

Waste Water Heat Recovery Instantaneous System 1	No
Waste Water Heat Recovery Instantaneous System 2	No
Waste Water Heat Recovery Storage System	No
Solar Panel	No
Water use <= 125 litres/person/day	Yes
SAP Code	901

29.0 Hot Water Cylinder	None
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Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£57	B 86	
	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar photovoltaic panels, 2.5 kWp	£3,500 - £5,500	£499	A 96	

Energy performance certificate (EPC)

68 Victoria Avenue
Blackley
MANCHESTER
M9 0RE

Energy rating

B

Valid until: **25 February 2034**

Certificate number: **6334-1232-4300-0936-5222**

Property type

End-terrace house

Total floor area

87 square metres

Rules on letting this property

Properties can be let if they have an energy rating from A to E.

You can read [guidance for landlords on the regulations and exemptions](https://www.gov.uk/guidance/domestic-private-rented-property-minimum-energy-efficiency-standard-landlord-guidance) (<https://www.gov.uk/guidance/domestic-private-rented-property-minimum-energy-efficiency-standard-landlord-guidance>).

Energy rating and score

This property's energy rating is B. It has the potential to be A.

[See how to improve this property's energy efficiency.](#)

The graph shows this property's current and potential energy rating.

Properties get a rating from A (best) to G (worst) and a score. The better the rating and score, the lower your energy bills are likely to be.

For properties in England and Wales:

the average energy rating is D
the average energy score is 60

Score	Energy rating	Current	Potential
92+	A		96 A
81-91	B	85 B	
69-80	C		
55-68	D		
39-54	E		
21-38	F		
1-20	G		

Breakdown of property's energy performance

Features in this property

Features get a rating from very good to very poor, based on how energy efficient they are. Ratings are not based on how well features work or their condition.

Assumed ratings are based on the property's age and type. They are used for features the assessor could not inspect.

Feature	Description	Rating
Walls	Average thermal transmittance 0.20 W/m ² K	Very good
Roof	Average thermal transmittance 0.09 W/m ² K	Very good
Floor	Average thermal transmittance 0.15 W/m ² K	Very good
Windows	High performance glazing	Very good
Main heating	Boiler and radiators, mains gas	Good
Main heating control	Programmer, room thermostat and TRVs	Good
Hot water	From main system	Good
Lighting	Low energy lighting in all fixed outlets	Very good
Air tightness	Air permeability 4.4 m ³ /h.m ² (as tested)	Good
Secondary heating	None	N/A

Primary energy use

The primary energy use for this property per year is 82 kilowatt hours per square metre (kWh/m²).

How this affects your energy bills

An average household would need to spend **£605 per year on heating, hot water and lighting** in this property. These costs usually make up the majority of your energy bills.

You could **save £56 per year** if you complete the suggested steps for improving this property's energy rating.

This is **based on average costs in 2024** when this EPC was created. People living at the property may use different amounts of energy for heating, hot water and lighting.

Heating this property

Estimated energy needed in this property is:

- 2,583 kWh per year for heating
 - 1,722 kWh per year for hot water
-

Impact on the environment

This property's environmental impact rating is B. It has the potential to be A.

Properties get a rating from A (best) to G (worst) on how much carbon dioxide (CO2) they produce each year.

Carbon emissions

An average household produces 6 tonnes of CO2

This property produces 1.3 tonnes of CO2

This property's potential production 0.2 tonnes of CO2

You could improve this property's CO2 emissions by making the suggested changes. This will help to protect the environment.

These ratings are based on assumptions about average occupancy and energy use. People living at the property may use different amounts of energy.

Changes you could make

Step	Typical installation cost	Typical yearly saving
1. Solar water heating	£4,000 - £6,000	£57
2. Solar photovoltaic panels	£3,500 - £5,500	£499

Help paying for energy improvements

You might be able to get a grant from the [Boiler Upgrade Scheme \(https://www.gov.uk/apply-boiler-upgrade-scheme\)](https://www.gov.uk/apply-boiler-upgrade-scheme). This will help you buy a more efficient, low carbon heating system for this property.

More ways to save energy

Find ways to save energy in your home by visiting www.gov.uk/improve-energy-efficiency.

Who to contact about this certificate

Contacting the assessor

If you're unhappy about your property's energy assessment or certificate, you can complain to the assessor who created it.

Assessor's name	Patrick McGuigan
Telephone	01904 432 325
Email	technical@jspsustainability.co.uk

Contacting the accreditation scheme

If you're still unhappy after contacting the assessor, you should contact the assessor's accreditation scheme.

Accreditation scheme	Elmhurst Energy Systems Ltd
Assessor's ID	EES/027210
Telephone	01455 883 250
Email	enquiries@elmhurstenergy.co.uk

About this assessment

Assessor's declaration	No related party
Date of assessment	26 February 2024
Date of certificate	26 February 2024
Type of assessment	SAP
