

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.51
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Project Information:

Assessed By: Ben Tunningley (STRO027495) **Building Type:** Semi-detached House

Dwelling Details:

NEW DWELLING DESIGN STAGE

Total Floor Area: 105.98m²

Site Reference : Chain Road

Plot Reference: Plot 009

Address : Plot 009, 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) 16.78 kg/m²

Dwelling Carbon Dioxide Emission Rate (DER) 16.23 kg/m²

OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 50.2 kWh/m²

Dwelling Fabric Energy Efficiency (DFEE) 43.7 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 7.27m²
 Windows facing: South West 7.2m²
 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 009
Chain Road
Manchester
M9

Assessor Number: STRO027495

Buiding regulation assessment

	kg/m ² /year
TER	16.78
DER	16.23

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		16.23	(ZC1)
TER		16.78	
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		16.23	
% improvement DER/TER	3.3		

Total Energy Type CO2 Emissions for Codes Levels 6

	kg/m ² /year	
DER accounting for SAP Section 16 allowances	16.23	(ZC1)
CO2 emissions from appliances, equation (L14)	14.8	(ZC2)
CO2 emissions from cooking, equation (L16)	1.75	(ZC3)
Net CO2 emissions	33.6	(ZC8)

Result:

Credits awarded for ENE 1 = 0.5

Code Level = 3

ENE 2 - Fabric energy Efficiency

Fabric energy Efficiency: 43.74

Credits awarded for ENE 2 = 7.6

ENE 7 - Low or Zero Carbon (LZC) Technologies

Reduction in CO2 Emissions

	%	kg/m ² /year	
Standard Case CO2 emissions		33.63	
Standard DER		17.08	
Actual Case CO2 emissions		33.63	
Actual DER		17.08	
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 009

Address : Plot 009, Chain Road, Manchester, M9

1. Overall dwelling dimensions:

	Area(m ²)		Av. Height(m)		Volume(m ³)
Ground floor	52.99	(1a) x	2.43	(2a) =	128.77
First floor	52.99	(1b) x	2.65	(2b) =	140.42
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	105.98	(4)			
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	269.19
					(5)

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							4	x 10 =	40
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) =	40	÷ (5) =	0.15	(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)			0.4	(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) =		0.34	(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

	0.43	0.42	0.42	0.37	0.36	0.32	0.32	0.31	0.34	0.36	0.38	0.4
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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 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 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 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 0.59 0.59 0.57 0.57 0.55 0.55 0.55 0.56 0.57 0.57 0.58 (24d)

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

(25)m= 0.59 0.59 0.59 0.57 0.57 0.55 0.55 0.55 0.56 0.57 0.57 0.58 (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			7.27	x1/[1/(1.3)+0.04]	= 8.98		(27)
Windows Type 2			7.2	x1/[1/(1.3)+0.04]	= 8.9		(27)
Floor			52.99	x 0.15	= 7.948501	75	3974.25 (28)
Walls	104.7	16.62	88.08	x 0.2	= 17.62	60	5284.8 (29)
Roof	52.99	0	52.99	x 0.09	= 4.77	9	476.91 (30)
Total area of elements, m²			210.68				(31)
Party wall			52.32	x 0	= 0	70	3662.4 (32)
Internal wall **			97.69			9	879.174 (32c)
Internal wall **			123			9	1107 (32c)
Internal floor			52.99			18	953.82 (32d)
Internal ceiling			52.99			9	476.91 (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) = 51.22 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 16815.26 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 158.66 (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

14

(36)

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

Total fabric heat loss

(33) + (36) =

65.23

(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
52.7	52.38	52.07	50.59	50.31	49.02	49.02	48.78	49.51	50.31	50.87	51.46

(38)

Heat transfer coefficient, W/K

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

(39)m=

117.93	117.61	117.29	115.81	115.54	114.24	114.24	114.01	114.74	115.54	116.1	116.68
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Average = Sum(39)_{1...12} /12=

115.81

(39)

Heat loss parameter (HLP), W/m²K

(40)m = (39)m ÷ (4)

(40)m=

1.11	1.11	1.11	1.09	1.09	1.08	1.08	1.08	1.08	1.09	1.1	1.1
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Average = Sum(40)_{1...12} /12=

1.09

(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

2.79

(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

100.42

(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=

110.47	106.45	102.43	98.42	94.4	90.38	90.38	94.4	98.42	102.43	106.45	110.47
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Total = Sum(44)_{1...12} =

1205.1

(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=

163.82	143.28	147.85	128.9	123.68	106.73	98.9	113.49	114.84	133.84	146.1	158.65
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Total = Sum(45)_{1...12} =

1580.08

(45)

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

(46)m=

24.57	21.49	22.18	19.33	18.55	16.01	14.83	17.02	17.23	20.08	21.91	23.8
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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=	18.84	16.97	18.68	17.91	18.37	17.61	18.09	18.27	17.78	18.54	18.11	18.79
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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=	182.66	160.25	166.53	146.81	142.05	124.34	116.99	131.76	132.62	152.38	164.21	177.44
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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=	182.66	160.25	166.53	146.81	142.05	124.34	116.99	131.76	132.62	152.38	164.21	177.44
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Output from water heater (annual)_{1...12}

1798.04

(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=	59.18	51.88	53.83	47.34	45.72	39.89	37.41	42.3	42.63	49.14	53.1	57.45
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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=	167.31	167.31	167.31	167.31	167.31	167.31	167.31	167.31	167.31	167.31	167.31	167.31

(66)

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

(67)m=	61.44	54.57	44.38	33.6	25.11	21.2	22.91	29.78	39.97	50.75	59.23	63.15
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(67)

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

(68)m=	396.49	400.6	390.24	368.16	340.3	314.12	296.62	292.51	302.88	324.95	352.81	379
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(68)

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

(69)m=	54.52	54.52	54.52	54.52	54.52	54.52	54.52	54.52	54.52	54.52	54.52	54.52
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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=	-111.54	-111.54	-111.54	-111.54	-111.54	-111.54	-111.54	-111.54	-111.54	-111.54	-111.54	-111.54
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(71)

Water heating gains (Table 5)

(72)m=	79.54	77.21	72.35	65.75	61.45	55.4	50.28	56.86	59.21	66.04	73.76	77.22
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(72)

Total internal gains =

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

(73)m=	650.76	645.67	620.26	580.8	540.15	504.01	483.1	492.43	515.34	555.03	599.09	632.65
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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	7.27	x	11.28	x	0.46	x	1.11	=	37.73	(75)
Northeast 0.9x	1	x	7.27	x	22.97	x	0.46	x	1.11	=	76.81	(75)
Northeast 0.9x	1	x	7.27	x	41.38	x	0.46	x	1.11	=	138.38	(75)
Northeast 0.9x	1	x	7.27	x	67.96	x	0.46	x	1.11	=	227.26	(75)
Northeast 0.9x	1	x	7.27	x	91.35	x	0.46	x	1.11	=	305.48	(75)
Northeast 0.9x	1	x	7.27	x	97.38	x	0.46	x	1.11	=	325.67	(75)
Northeast 0.9x	1	x	7.27	x	91.1	x	0.46	x	1.11	=	304.66	(75)
Northeast 0.9x	1	x	7.27	x	72.63	x	0.46	x	1.11	=	242.88	(75)
Northeast 0.9x	1	x	7.27	x	50.42	x	0.46	x	1.11	=	168.62	(75)
Northeast 0.9x	1	x	7.27	x	28.07	x	0.46	x	1.11	=	93.86	(75)
Northeast 0.9x	1	x	7.27	x	14.2	x	0.46	x	1.11	=	47.48	(75)
Northeast 0.9x	1	x	7.27	x	9.21	x	0.46	x	1.11	=	30.81	(75)
Southwest 0.9x	1	x	7.2	x	36.79		0.46	x	1.11	=	121.86	(79)
Southwest 0.9x	1	x	7.2	x	62.67		0.46	x	1.11	=	207.57	(79)
Southwest 0.9x	1	x	7.2	x	85.75		0.46	x	1.11	=	284.01	(79)
Southwest 0.9x	1	x	7.2	x	106.25		0.46	x	1.11	=	351.91	(79)
Southwest 0.9x	1	x	7.2	x	119.01		0.46	x	1.11	=	394.16	(79)
Southwest 0.9x	1	x	7.2	x	118.15		0.46	x	1.11	=	391.31	(79)
Southwest 0.9x	1	x	7.2	x	113.91		0.46	x	1.11	=	377.27	(79)
Southwest 0.9x	1	x	7.2	x	104.39		0.46	x	1.11	=	345.74	(79)
Southwest 0.9x	1	x	7.2	x	92.85		0.46	x	1.11	=	307.53	(79)
Southwest 0.9x	1	x	7.2	x	69.27		0.46	x	1.11	=	229.41	(79)
Southwest 0.9x	1	x	7.2	x	44.07		0.46	x	1.11	=	145.96	(79)
Southwest 0.9x	1	x	7.2	x	31.49		0.46	x	1.11	=	104.29	(79)

Solar gains in watts, calculated for each month

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

(83)m=

159.59	284.38	422.39	579.16	699.64	716.99	681.93	588.62	476.14	323.28	193.44	135.1
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------

 (83)

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

(84)m=

810.35	930.05	1042.65	1159.96	1239.79	1220.99	1165.03	1081.05	991.48	878.31	792.53	767.75
--------	--------	---------	---------	---------	---------	---------	---------	--------	--------	--------	--------

 (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
0.98	0.96	0.93	0.85	0.73	0.56	0.42	0.47	0.69	0.89	0.96	0.98

 (86)

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

(87)m=

19.52	19.74	20.08	20.48	20.78	20.94	20.98	20.98	20.87	20.47	19.92	19.48
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (87)

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

(88)m=

19.99	19.99	20	20.01	20.01	20.02	20.02	20.02	20.02	20.01	20	20
-------	-------	----	-------	-------	-------	-------	-------	-------	-------	----	----

 (88)

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

(89)m=

0.97	0.95	0.91	0.83	0.68	0.49	0.33	0.38	0.62	0.86	0.95	0.98
------	------	------	------	------	------	------	------	------	------	------	------

 (89)

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

(90)m=	18.65	18.87	19.2	19.59	19.86	19.99	20.01	20.01	19.94	19.59	19.07	18.62	(90)
--------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =

0.17 (91)

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

(92)m=	18.8	19.02	19.35	19.74	20.01	20.14	20.17	20.17	20.09	19.74	19.21	18.76	(92)
--------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(93)m=	18.8	19.02	19.35	19.74	20.01	20.14	20.17	20.17	20.09	19.74	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	0.94	0.9	0.82	0.68	0.5	0.35	0.39	0.63	0.85	0.94	0.97	(94)
--------	------	------	-----	------	------	-----	------	------	------	------	------	------	------

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

(95)m=	781.3	877.07	940.66	947.25	839.61	605.78	402.96	421.58	621.51	749	747.54	744.35	(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=	1709.59	1660.34	1506.76	1255.23	960.09	633.46	408.34	429.99	687.26	1055.63	1405.65	1699.07	(97)
--------	---------	---------	---------	---------	--------	--------	--------	--------	--------	---------	---------	---------	------

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

(98)m=	690.65	526.36	421.18	221.75	89.64	0	0	0	0	228.14	473.84	710.31	
Total per year (kWh/year) = Sum(98) _{1...5,9...12} =												3361.86	(98)

Space heating requirement in kWh/m²/year

31.72 (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)

690.65	526.36	421.18	221.75	89.64	0	0	0	0	228.14	473.84	710.31
--------	--------	--------	--------	-------	---	---	---	---	--------	--------	--------

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

742.63	565.98	452.88	238.44	96.38	0	0	0	0	245.31	509.5	763.77
--------	--------	--------	--------	-------	---	---	---	---	--------	-------	--------

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

3614.9 (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)

182.66	160.25	166.53	146.81	142.05	124.34	116.99	131.76	132.62	152.38	164.21	177.44
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

Efficiency of water heater

87 (216)

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(217)m=	89.36	89.28	89.13	88.78	88.14	87	87	87	87	88.77	89.21	89.38	(217)
---------	-------	-------	-------	-------	-------	----	----	----	----	-------	-------	-------	-------

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	204.42	179.49	186.84	165.37	161.17	142.91	134.47	151.45	152.44	171.65	184.07	198.52	
Total = Sum(219a) _{1...12} =												2032.79	(219)

Annual totals

	kWh/year	kWh/year
Space heating fuel used, main system 1		3614.9
Water heating fuel used		2032.79
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
Electricity for lighting		434.01
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		6156.7

10a. Fuel costs - individual heating systems:

	Fuel kWh/year	Fuel Price (Table 12)	Fuel Cost £/year
Space heating - main system 1	(211) x	3.48	x 0.01 = 125.8
Space heating - main system 2	(213) x	0	x 0.01 = 0
Space heating - secondary	(215) x	13.19	x 0.01 = 0
Water heating cost (other fuel)	(219)	3.48	x 0.01 = 70.74
Pumps, fans and electric keep-hot	(231)	13.19	x 0.01 = 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)	13.19	x 0.01 = 57.25
Additional standing charges (Table 12)			120
Appendix Q items: repeat lines (253) and (254) as needed			
Total energy cost	(245)...(247) + (250)...(254) =		383.68

11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.07
SAP rating (Section 12)		85.11

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	= 780.82
Space heating (secondary)	(215) x	0.519	= 0
Water heating	(219) x	0.216	= 439.08

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Space and water heating	(261) + (262) + (263) + (264) =			1219.9	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	225.25	(268)
Total CO ₂ , kg/year	sum of (265)...(271) =			1484.08	(272)
CO₂ emissions per m²	(272) ÷ (4) =			14	(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	=	4410.18	(261)
Space heating (secondary)	(215) x	3.07	=	0	(263)
Energy for water heating	(219) x	1.22	=	2480.01	(264)
Space and water heating	(261) + (262) + (263) + (264) =			6890.19	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	3.07	=	230.25	(267)
Electricity for lighting	(232) x	0	=	1332.4	(268)
'Total Primary Energy	sum of (265)...(271) =			8452.84	(272)
Primary energy kWh/m²/year	(272) ÷ (4) =			79.76	(273)

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User Details:

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

Property Address: Plot 009

Address : Plot 009, Chain Road, Manchester, M9

1. Overall dwelling dimensions:

	Area(m ²)		Av. Height(m)		Volume(m ³)
Ground floor	52.99	(1a) x	2.43	(2a) =	128.77
First floor	52.99	(1b) x	2.65	(2b) =	140.42
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	105.98	(4)			
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =			269.19
					(5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	+	0
Number of open flues	0	+	0	+	0
Number of intermittent fans				4	40
Number of passive vents				0	0
Number of flueless gas fires				0	0

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40	÷ (5) =	0.15	(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)			0.4	(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) =		0.34	(21)

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

	0.43	0.42	0.42	0.37	0.36	0.32	0.32	0.31	0.34	0.36	0.38	0.4
--	------	------	------	------	------	------	------	------	------	------	------	-----

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
---------	---	---	---	---	---	---	---	---	---	---	---	---

(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	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.57	0.58
---------	------	------	------	------	------	------	------	------	------	------	------	------

(24d)

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

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

(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			7.27	x 1/[1/(1.3)+0.04]	= 8.98		(27)
Windows Type 2			7.2	x 1/[1/(1.3)+0.04]	= 8.9		(27)
Floor			52.99	x 0.15	= 7.948501	75	3974.25 (28)
Walls	104.7	16.62	88.08	x 0.2	= 17.62	60	5284.8 (29)
Roof	52.99	0	52.99	x 0.09	= 4.77	9	476.91 (30)
Total area of elements, m²			210.68				(31)
Party wall			52.32	x 0	= 0	70	3662.4 (32)
Internal wall **			97.69			9	879.174 (32c)
Internal wall **			123			9	1107 (32c)
Internal floor			52.99			18	953.82 (32d)
Internal ceiling			52.99			9	476.91 (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) = 51.22 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 16815.26 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 158.66 (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

14 (36)

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

Total fabric heat loss

(33) + (36) =

65.23 (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
52.7	52.38	52.07	50.59	50.31	49.02	49.02	48.78	49.51	50.31	50.87	51.46

(38)

Heat transfer coefficient, W/K

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

(39)m=

117.93	117.61	117.29	115.81	115.54	114.24	114.24	114.01	114.74	115.54	116.1	116.68
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	--------

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

115.81 (39)

Heat loss parameter (HLP), W/m²K

(40)m = (39)m ÷ (4)

(40)m=

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

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

1.09 (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

2.79

(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

100.42

(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=

110.47	106.45	102.43	98.42	94.4	90.38	90.38	94.4	98.42	102.43	106.45	110.47
--------	--------	--------	-------	------	-------	-------	------	-------	--------	--------	--------

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

1205.1 (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=

163.82	143.28	147.85	128.9	123.68	106.73	98.9	113.49	114.84	133.84	146.1	158.65
--------	--------	--------	-------	--------	--------	------	--------	--------	--------	-------	--------

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

1580.08 (45)

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

(46)m=

24.57	21.49	22.18	19.33	18.55	16.01	14.83	17.02	17.23	20.08	21.91	23.8
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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
--------	---	---	---	---	---	---	---	---	---	---	---

(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
--------	---	---	---	---	---	---	---	---	---	---	---

(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
--------	---	---	---	---	---	---	---	---	---	---	---

(59)

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

(61)m=	18.84	16.97	18.68	17.91	18.37	17.61	18.09	18.27	17.78	18.54	18.11	18.79
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(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=	182.66	160.25	166.53	146.81	142.05	124.34	116.99	131.76	132.62	152.38	164.21	177.44
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

(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
--------	---	---	---	---	---	---	---	---	---	---	---

(63)

Output from water heater

(64)m=	182.66	160.25	166.53	146.81	142.05	124.34	116.99	131.76	132.62	152.38	164.21	177.44
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

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

1798.04

(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=	59.18	51.88	53.83	47.34	45.72	39.89	37.41	42.3	42.63	49.14	53.1	57.45
--------	-------	-------	-------	-------	-------	-------	-------	------	-------	-------	------	-------

(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=	139.42	139.42	139.42	139.42	139.42	139.42	139.42	139.42	139.42	139.42	139.42	139.42

(66)

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

(67)m=	25.55	22.69	18.45	13.97	10.44	8.82	9.53	12.38	16.62	21.1	24.63	26.26
--------	-------	-------	-------	-------	-------	------	------	-------	-------	------	-------	-------

(67)

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

(68)m=	265.65	268.41	261.46	246.67	228	210.46	198.74	195.98	202.93	217.71	236.38	253.93
--------	--------	--------	--------	--------	-----	--------	--------	--------	--------	--------	--------	--------

(68)

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

(69)m=	36.94	36.94	36.94	36.94	36.94	36.94	36.94	36.94	36.94	36.94	36.94	36.94
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(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=	-111.54	-111.54	-111.54	-111.54	-111.54	-111.54	-111.54	-111.54	-111.54	-111.54	-111.54	-111.54
--------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------

(71)

Water heating gains (Table 5)

(72)m=	79.54	77.21	72.35	65.75	61.45	55.4	50.28	56.86	59.21	66.04	73.76	77.22
--------	-------	-------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------

(72)

Total internal gains =

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

(73)m=	438.57	436.13	420.09	394.21	367.72	342.5	326.37	333.05	346.58	372.69	402.6	425.23
--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------	-------	--------

(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	7.27	x	11.28	x	0.46	x	1.11	=	29.05	(75)
Northeast 0.9x	0.77	x	7.27	x	22.97	x	0.46	x	1.11	=	59.14	(75)
Northeast 0.9x	0.77	x	7.27	x	41.38	x	0.46	x	1.11	=	106.55	(75)
Northeast 0.9x	0.77	x	7.27	x	67.96	x	0.46	x	1.11	=	174.99	(75)
Northeast 0.9x	0.77	x	7.27	x	91.35	x	0.46	x	1.11	=	235.22	(75)
Northeast 0.9x	0.77	x	7.27	x	97.38	x	0.46	x	1.11	=	250.77	(75)
Northeast 0.9x	0.77	x	7.27	x	91.1	x	0.46	x	1.11	=	234.59	(75)
Northeast 0.9x	0.77	x	7.27	x	72.63	x	0.46	x	1.11	=	187.02	(75)
Northeast 0.9x	0.77	x	7.27	x	50.42	x	0.46	x	1.11	=	129.83	(75)
Northeast 0.9x	0.77	x	7.27	x	28.07	x	0.46	x	1.11	=	72.27	(75)
Northeast 0.9x	0.77	x	7.27	x	14.2	x	0.46	x	1.11	=	36.56	(75)
Northeast 0.9x	0.77	x	7.27	x	9.21	x	0.46	x	1.11	=	23.73	(75)
Southwest 0.9x	0.77	x	7.2	x	36.79		0.46	x	1.11	=	93.83	(79)
Southwest 0.9x	0.77	x	7.2	x	62.67		0.46	x	1.11	=	159.83	(79)
Southwest 0.9x	0.77	x	7.2	x	85.75		0.46	x	1.11	=	218.69	(79)
Southwest 0.9x	0.77	x	7.2	x	106.25		0.46	x	1.11	=	270.97	(79)
Southwest 0.9x	0.77	x	7.2	x	119.01		0.46	x	1.11	=	303.51	(79)
Southwest 0.9x	0.77	x	7.2	x	118.15		0.46	x	1.11	=	301.31	(79)
Southwest 0.9x	0.77	x	7.2	x	113.91		0.46	x	1.11	=	290.5	(79)
Southwest 0.9x	0.77	x	7.2	x	104.39		0.46	x	1.11	=	266.22	(79)
Southwest 0.9x	0.77	x	7.2	x	92.85		0.46	x	1.11	=	236.79	(79)
Southwest 0.9x	0.77	x	7.2	x	69.27		0.46	x	1.11	=	176.65	(79)
Southwest 0.9x	0.77	x	7.2	x	44.07		0.46	x	1.11	=	112.39	(79)
Southwest 0.9x	0.77	x	7.2	x	31.49		0.46	x	1.11	=	80.3	(79)

Solar gains in watts, calculated for each month

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

(83)m= 122.89 218.97 325.24 445.96 538.72 552.08 525.08 453.24 366.63 248.92 148.95 104.03 (83)

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

(84)m= 561.45 655.1 745.33 840.17 906.44 894.58 851.45 786.28 713.21 621.61 551.54 529.26 (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=	0.99	0.99	0.97	0.93	0.85	0.7	0.55	0.61	0.83	0.96	0.99	0.99

(86)

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

(87)m= 19.22 19.43 19.77 20.22 20.61 20.87 20.96 20.94 20.74 20.23 19.65 19.19 (87)

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

(88)m= 19.99 19.99 20 20.01 20.01 20.02 20.02 20.02 20.02 20.01 20 20 (88)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(89)m=	0.99	0.98	0.97	0.92	0.81	0.63	0.44	0.5	0.77	0.94	0.98	0.99

(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	18.57	18.91	19.35	19.72	19.94	20	20	19.85	19.37	18.8	18.34	(90)
--------	-------	-------	-------	-------	-------	-------	----	----	-------	-------	------	-------	------

fLA = Living area ÷ (4) =	0.17	(91)
---------------------------	------	------

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

(92)m=	18.51	18.71	19.05	19.5	19.87	20.1	20.16	20.15	20	19.52	18.94	18.48	(92)
--------	-------	-------	-------	------	-------	------	-------	-------	----	-------	-------	-------	------

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

(93)m=	18.51	18.71	19.05	19.5	19.87	20.1	20.16	20.15	20	19.52	18.94	18.48	(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=	0.99	0.98	0.96	0.91	0.8	0.63	0.46	0.52	0.77	0.93	0.98	0.99	(94)
--------	------	------	------	------	-----	------	------	------	------	------	------	------	------

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

(95)m=	554.43	640.65	713.4	761.35	727.56	566.4	392.98	406.61	546.8	579.56	539.93	523.85	(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=	1675.25	1624.39	1472.09	1227.33	943.91	628.11	406.98	427.97	676.67	1030.12	1374.39	1666.02	(97)
--------	---------	---------	---------	---------	--------	--------	--------	--------	--------	---------	---------	---------	------

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

(98)m=	833.89	661.08	564.46	335.5	160.96	0	0	0	0	335.22	600.81	849.77		
Total per year (kWh/year) = Sum(98) _{1...5,9...12} =													4341.69	(98)

Space heating requirement in kWh/m²/year

40.97	(99)
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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)

833.89	661.08	564.46	335.5	160.96	0	0	0	0	335.22	600.81	849.77
--------	--------	--------	-------	--------	---	---	---	---	--------	--------	--------

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

896.66	710.83	606.95	360.76	173.08	0	0	0	0	360.45	646.03	913.73
--------	--------	--------	--------	--------	---	---	---	---	--------	--------	--------

$$\text{Total (kWh/year) = Sum(211)}_{1...5,10...12} = 4668.48 \quad (211)$$

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)

182.66	160.25	166.53	146.81	142.05	124.34	116.99	131.76	132.62	152.38	164.21	177.44
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

Efficiency of water heater

87	(216)
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(217)m=

89.45	89.4	89.3	89.07	88.57	87	87	87	87	89.04	89.34	89.47
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 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=

204.22	179.25	186.49	164.84	160.38	142.91	134.47	151.45	152.44	171.13	183.8	198.33
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	--------

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

2029.71

 (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

451.16

(232)

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

7224.36

(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	<table><tr><td>0.216</td></tr></table>	0.216	=	<table><tr><td>1008.39</td></tr></table>	1008.39	(261)
0.216							
1008.39							
Space heating (secondary)	(215) x	<table><tr><td>0.519</td></tr></table>	0.519	=	<table><tr><td>0</td></tr></table>	0	(263)
0.519							
0							
Water heating	(219) x	<table><tr><td>0.216</td></tr></table>	0.216	=	<table><tr><td>438.42</td></tr></table>	438.42	(264)
0.216							
438.42							
Space and water heating	(261) + (262) + (263) + (264) =			<table><tr><td>1446.81</td></tr></table>	1446.81	(265)	
1446.81							
Electricity for pumps, fans and electric keep-hot	(231) x	<table><tr><td>0.519</td></tr></table>	0.519	=	<table><tr><td>38.93</td></tr></table>	38.93	(267)
0.519							
38.93							
Electricity for lighting	(232) x	<table><tr><td>0.519</td></tr></table>	0.519	=	<table><tr><td>234.15</td></tr></table>	234.15	(268)
0.519							
234.15							
Total CO2, kg/year	sum of (265)...(271) =			<table><tr><td>1719.89</td></tr></table>	1719.89	(272)	
1719.89							
Dwelling CO2 Emission Rate	(272) ÷ (4) =			<table><tr><td>16.23</td></tr></table>	16.23	(273)	
16.23							
El rating (section 14)				<table><tr><td>85</td></tr></table>	85	(274)	
85							

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 009

Address : Plot 009, Chain Road, Manchester, M9

1. Overall dwelling dimensions:

	Area(m ²)		Av. Height(m)		Volume(m ³)
Ground floor	52.99	(1a) x	2.43	(2a) =	128.77
First floor	52.99	(1b) x	2.65	(2b) =	140.42
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	105.98	(4)			
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	269.19
					(5)

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							4	x 10 =	40
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) =	40	÷ (5) =	0.15	(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)			0.4	(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) =		0.34	(21)

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

	0.43	0.42	0.42	0.37	0.36	0.32	0.32	0.31	0.34	0.36	0.38	0.4
--	------	------	------	------	------	------	------	------	------	------	------	-----

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

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

(25)m= 0.59 0.59 0.59 0.57 0.57 0.55 0.55 0.55 0.56 0.57 0.57 0.58 (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			7.27	x 1/[1/(1.4)+0.04]	= 9.64		(27)
Windows Type 2			7.2	x 1/[1/(1.4)+0.04]	= 9.55		(27)
Floor			52.99	x 0.13	= 6.8887		(28)
Walls	104.7	16.62	88.08	x 0.18	= 15.85		(29)
Roof	52.99	0	52.99	x 0.13	= 6.89		(30)
Total area of elements, m²			210.68				(31)
Party wall			52.32	x 0	= 0		(32)
Internal wall **			97.69				(32c)
Internal wall **			123				(32c)
Internal floor			52.99				(32d)
Internal ceiling			52.99				(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) = 50.97 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 16815.26 (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

10.27 (36)

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

Total fabric heat loss

(33) + (36) =

61.24 (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
52.7	52.38	52.07	50.59	50.31	49.02	49.02	48.78	49.51	50.31	50.87	51.46

(38)

Heat transfer coefficient, W/K

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

(39)m=

113.94	113.62	113.3	111.82	111.54	110.25	110.25	110.02	110.75	111.54	112.11	112.69
--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------

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

111.82 (39)

Heat loss parameter (HLP), W/m²K

(40)m = (39)m ÷ (4)

(40)m=

1.08	1.07	1.07	1.06	1.05	1.04	1.04	1.04	1.05	1.05	1.06	1.06
------	------	------	------	------	------	------	------	------	------	------	------

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

1.06 (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

2.79

(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

100.42

(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=

110.47	106.45	102.43	98.42	94.4	90.38	90.38	94.4	98.42	102.43	106.45	110.47
--------	--------	--------	-------	------	-------	-------	------	-------	--------	--------	--------

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

1205.1 (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=

163.82	143.28	147.85	128.9	123.68	106.73	98.9	113.49	114.84	133.84	146.1	158.65
--------	--------	--------	-------	--------	--------	------	--------	--------	--------	-------	--------

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

1580.08 (45)

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

(46)m=

24.57	21.49	22.18	19.33	18.55	16.01	14.83	17.02	17.23	20.08	21.91	23.8
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

(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) × (51) × (52) × (53) =

0
0

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

Water storage loss calculated for each month ((56)m = (55) × (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	50.96	48.53	48.1	44.57	46.06	48.1	48.53	50.96	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=

214.78	189.31	198.81	177.43	171.79	151.3	144.96	161.59	163.38	184.8	195.41	209.61
--------	--------	--------	--------	--------	-------	--------	--------	--------	-------	--------	--------

(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=

214.78	189.31	198.81	177.43	171.79	151.3	144.96	161.59	163.38	184.8	195.41	209.61
--------	--------	--------	--------	--------	-------	--------	--------	--------	-------	--------	--------

(64)
Output from water heater (annual)_{1...12}

2163.16

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=

67.21	59.15	61.9	54.99	53.15	46.63	44.4	49.76	50.32	57.24	60.91	65.49
-------	-------	------	-------	-------	-------	------	-------	-------	-------	-------	-------

(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
139.42	139.42	139.42	139.42	139.42	139.42	139.42	139.42	139.42	139.42	139.42	139.42

(66)

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

(67)m=

25.55	22.69	18.45	13.97	10.44	8.82	9.53	12.38	16.62	21.1	24.63	26.26
-------	-------	-------	-------	-------	------	------	-------	-------	------	-------	-------

(67)

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

(68)m=

265.65	268.41	261.46	246.67	228	210.46	198.74	195.98	202.93	217.71	236.38	253.93
--------	--------	--------	--------	-----	--------	--------	--------	--------	--------	--------	--------

(68)

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

(69)m=

36.94	36.94	36.94	36.94	36.94	36.94	36.94	36.94	36.94	36.94	36.94	36.94
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(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=

-111.54	-111.54	-111.54	-111.54	-111.54	-111.54	-111.54	-111.54	-111.54	-111.54	-111.54	-111.54
---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------

(71)

Water heating gains (Table 5)

(72)m=

90.34	88.02	83.2	76.38	71.44	64.76	59.68	66.88	69.89	76.94	84.59	88.03
-------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=

449.36	446.94	430.94	404.85	377.71	351.86	335.76	343.07	357.26	383.58	413.43	436.04
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

(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	7.27	x	11.28	x	0.63	x	0.7	=	25.07	(75)
Northeast 0.9x	0.77	x	7.27	x	22.97	x	0.63	x	0.7	=	51.03	(75)
Northeast 0.9x	0.77	x	7.27	x	41.38	x	0.63	x	0.7	=	91.94	(75)
Northeast 0.9x	0.77	x	7.27	x	67.96	x	0.63	x	0.7	=	150.98	(75)
Northeast 0.9x	0.77	x	7.27	x	91.35	x	0.63	x	0.7	=	202.95	(75)
Northeast 0.9x	0.77	x	7.27	x	97.38	x	0.63	x	0.7	=	216.37	(75)
Northeast 0.9x	0.77	x	7.27	x	91.1	x	0.63	x	0.7	=	202.41	(75)
Northeast 0.9x	0.77	x	7.27	x	72.63	x	0.63	x	0.7	=	161.36	(75)
Northeast 0.9x	0.77	x	7.27	x	50.42	x	0.63	x	0.7	=	112.02	(75)
Northeast 0.9x	0.77	x	7.27	x	28.07	x	0.63	x	0.7	=	62.36	(75)
Northeast 0.9x	0.77	x	7.27	x	14.2	x	0.63	x	0.7	=	31.54	(75)
Northeast 0.9x	0.77	x	7.27	x	9.21	x	0.63	x	0.7	=	20.47	(75)
Southwest 0.9x	0.77	x	7.2	x	36.79		0.63	x	0.7	=	80.96	(79)
Southwest 0.9x	0.77	x	7.2	x	62.67		0.63	x	0.7	=	137.91	(79)
Southwest 0.9x	0.77	x	7.2	x	85.75		0.63	x	0.7	=	188.69	(79)
Southwest 0.9x	0.77	x	7.2	x	106.25		0.63	x	0.7	=	233.8	(79)
Southwest 0.9x	0.77	x	7.2	x	119.01		0.63	x	0.7	=	261.87	(79)
Southwest 0.9x	0.77	x	7.2	x	118.15		0.63	x	0.7	=	259.98	(79)
Southwest 0.9x	0.77	x	7.2	x	113.91		0.63	x	0.7	=	250.65	(79)
Southwest 0.9x	0.77	x	7.2	x	104.39		0.63	x	0.7	=	229.7	(79)
Southwest 0.9x	0.77	x	7.2	x	92.85		0.63	x	0.7	=	204.31	(79)
Southwest 0.9x	0.77	x	7.2	x	69.27		0.63	x	0.7	=	152.42	(79)
Southwest 0.9x	0.77	x	7.2	x	44.07		0.63	x	0.7	=	96.97	(79)
Southwest 0.9x	0.77	x	7.2	x	31.49		0.63	x	0.7	=	69.29	(79)

Solar gains in watts, calculated for each month

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

(83)m= 106.03 188.94 280.63 384.78 464.83 476.35 453.06 391.07 316.34 214.78 128.52 89.76 (83)

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

(84)m= 555.39 635.87 711.56 789.63 842.54 828.21 788.82 734.14 673.6 598.36 541.95 525.79 (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	0.98	0.92	0.77	0.6	0.66	0.89	0.99	1	1

(86)

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

(87)m= 19.79 19.93 20.16 20.48 20.76 20.94 20.99 20.98 20.85 20.49 20.08 19.77 (87)

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

(88)m= 20.02 20.02 20.03 20.04 20.04 20.05 20.05 20.05 20.05 20.04 20.04 20.03 (88)

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

	1	1	0.99	0.97	0.88	0.69	0.48	0.54	0.83	0.98	1	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=	18.39	18.6	18.94	19.4	19.79	20.01	20.04	20.04	19.92	19.42	18.83	18.37	(90)
--------	-------	------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =

0.17 (91)

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

(92)m=	18.63	18.82	19.14	19.58	19.95	20.16	20.2	20.2	20.07	19.6	19.04	18.6	(92)
--------	-------	-------	-------	-------	-------	-------	------	------	-------	------	-------	------	------

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

(93)m=	18.63	18.82	19.14	19.58	19.95	20.16	20.2	20.2	20.07	19.6	19.04	18.6	(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	1	0.99	0.96	0.88	0.7	0.5	0.56	0.84	0.97	1	1	(94)
--------	---	---	------	------	------	-----	-----	------	------	------	---	---	------

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

(95)m=	554.19	632.87	702.85	758.62	740.23	577.01	392.32	409.32	563.66	583	539.44	524.94	(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=	1632.24	1581.18	1432.03	1194.17	920.63	613.13	397.06	417.84	661.59	1003.78	1338.7	1623.08	(97)
--------	---------	---------	---------	---------	--------	--------	--------	--------	--------	---------	--------	---------	------

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

(98)m=	802.08	637.26	542.51	313.6	134.22	0	0	0	0	313.06	575.47	817.01	
Total per year (kWh/year) = Sum(98) _{1...5,9...12} =												4135.21	(98)

Space heating requirement in kWh/m²/year

39.02 (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)

802.08	637.26	542.51	313.6	134.22	0	0	0	0	313.06	575.47	817.01
--------	--------	--------	-------	--------	---	---	---	---	--------	--------	--------

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

858.75	682.29	580.84	335.76	143.71	0	0	0	0	335.18	616.13	874.74
--------	--------	--------	--------	--------	---	---	---	---	--------	--------	--------

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

4427.41 (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)

214.78	189.31	198.81	177.43	171.79	151.3	144.96	161.59	163.38	184.8	195.41	209.61
--------	--------	--------	--------	--------	-------	--------	--------	--------	-------	--------	--------

Efficiency of water heater

80.3 (216)

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(217)m=

88.06	87.87	87.45	86.47	84.44	80.3	80.3	80.3	80.3	86.37	87.61	88.14
-------	-------	-------	-------	-------	------	------	------	------	-------	-------	-------

 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=

243.9	215.44	227.34	205.2	203.45	188.42	180.52	201.24	203.46	213.97	223.05	237.82
-------	--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------

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

2543.8

 (219)

Annual totals

kWh/year

kWh/year

Space heating fuel used, main system 1

4427.41

Water heating fuel used

2543.8

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

451.16

 (232)

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

7497.38

 (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		<table><tr><td>0.216</td></tr></table>	0.216	=	<table><tr><td>956.32</td></tr></table> (261)	956.32
0.216							
956.32							
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>549.46</td></tr></table> (264)	549.46
0.216							
549.46							
Space and water heating	(261) + (262) + (263) + (264) =				<table><tr><td>1505.78</td></tr></table> (265)	1505.78	
1505.78							
Electricity for pumps, fans and electric keep-hot	(231) x		<table><tr><td>0.519</td></tr></table>	0.519	=	<table><tr><td>38.93</td></tr></table> (267)	38.93
0.519							
38.93							
Electricity for lighting	(232) x		<table><tr><td>0.519</td></tr></table>	0.519	=	<table><tr><td>234.15</td></tr></table> (268)	234.15
0.519							
234.15							
Total CO2, kg/year	sum of (265)...(271) =				<table><tr><td>1778.86</td></tr></table> (272)	1778.86	
1778.86							

TER =

16.78

 (273)

SAP 2012 Overheating Assessment

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

Property Details: Plot 009

Dwelling type:	Semi-detached 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 158.66
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:	355.33	(P1)
Transmission heat loss coefficient:	65.2	
Summer heat loss coefficient:	420.56	(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	7.27	89.66	0.46	0	1	299.82	
South West (rear)	1 x	7.2	112.1	0.46	0	1	371.28	
Total							671.1	(P3/P4)

Internal gains:

	June	July	August	
Internal gains	501.01	480.1	489.43	
Total summer gains	1228.75	1151.2	1059.31	(P5)
Summer gain/loss ratio	2.92	2.74	2.52	(P6)
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	0.89	0.89	0.89	
Threshold temperature	18.51	20.03	19.71	(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 009			Issued on Date	10/11/2023
Assessment Reference	9 Chain	Prop Type Ref	22186		
Property	1f Chain Road, MANCHESTER, M9 6AJ				
SAP Rating	85 B	DER	16.03	TER	16.78
Environmental	87 B	% DER<TER	4.50		
CO ₂ Emissions (t/year)	1.43	DFEE	42.88	TFEE	50.23
General Requirements Compliance	Pass	% DFEE<TFEE	14.63		
Assessor Details	Mr. Ryan Gallacher, Ryan Gallacher, Tel: 01904217325, ryan.gallacher@jspsustainability.co.uk			Assessor ID	AU40-0001
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

Semi-Detached House, total floor area 106 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) 16.78 kgCO₂/m²

Dwelling Carbon Dioxide Emission Rate (DER) 16.03 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 50.2 kWh/m²/yr

Dwelling Fabric Energy Efficiency (DFEE) 42.9 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: 3.98 (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: 7.27 m², No overhang
Windows facing South West: 7.20 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
Air permeability 4.0 m³/m²h

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	52.9900 (1b)	x 2.4300 (2b)	= 128.7657 (1b) - (3b)
First floor	52.9900 (1c)	x 2.6500 (2c)	= 140.4235 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	105.9800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 269.1892 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.1486 (8)
Pressure test					Yes
Measured/design AP50					3.9800
Infiltration rate					0.3476 (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) =	0.2955 (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	0.3767	0.3693	0.3619	0.3250	0.3176	0.2807	0.2807	0.2733	0.2955	0.3176	0.3324	0.3472 (22b)
Effective ac	0.5710	0.5682	0.5655	0.5528	0.5504	0.5394	0.5394	0.5373	0.5436	0.5504	0.5552	0.5603 (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)			14.4700	1.2357	17.8812		(27)
gf			52.9900	0.1500	7.9485	75.0000	3974.2501 (28a)
external	104.7000	16.6200	88.0800	0.2000	17.6160	60.0000	5284.7998 (29a)
cold	52.9900		52.9900	0.0900	4.7691	9.0000	476.9100 (30)
Total net area of external elements Aum(A, m ²)			210.6800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	51.2248		(33)
party			52.3200	0.0000	0.0000	70.0000	3662.4000 (32)
gf			97.6860			9.0000	879.1740 (32c)
1f			123.0000			9.0000	1107.0000 (32c)
1f			52.9900			18.0000	953.8200 (32d)
gf			52.9900			9.0000	476.9100 (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) = 16815.2640 (34)
158.6645 (35)
14.0026 (36)
(33) + (36) = 65.2273 (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	50.7192	50.4744	50.2345	49.1077	48.8969	47.9154	47.9154	47.7337	48.2935	48.8969	49.3234	49.7693 (38)
Heat transfer coeff	115.9465	115.7018	115.4619	114.3350	114.1242	113.1428	113.1428	112.9610	113.5208	114.1242	114.5507	114.9966 (39)
Average = Sum(39)m / 12 =												114.3340 (39)
HLP	1.0940	1.0917	1.0895	1.0788	1.0768	1.0676	1.0676	1.0659	1.0712	1.0768	1.0809	1.0851 (40)
HLP (average)												1.0788 (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												2.7884 (42)
Average daily hot water use (litres/day)												100.4249 (43)
Daily hot water use	110.4674	106.4504	102.4334	98.4164	94.3994	90.3824	90.3824	94.3994	98.4164	102.4334	106.4504	110.4674 (44)
Energy conte	163.8200	143.2780	147.8501	128.8993	123.6819	106.7281	98.8993	113.4884	114.8438	133.8394	146.0961	158.6509 (45)
Energy content (annual)										Total = Sum(45)m =		1580.0753 (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	24.5730	21.4917	22.1775	19.3349	18.5523	16.0092	14.8349	17.0233	17.2266	20.0759	21.9144	23.7976 (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	18.8425	16.9717	18.6812	17.9148	18.3672	17.6078	18.0908	18.2700	17.7751	18.5397	18.1091	18.7903 (61)
Total heat required for water heating calculated for each month	182.6625	160.2497	166.5313	146.8141	142.0491	124.3359	116.9900	131.7584	132.6188	152.3791	164.2052	177.4413 (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	182.6625	160.2497	166.5313	146.8141	142.0491	124.3359	116.9900	131.7584	132.6188	152.3791	164.2052	177.4413 (64)
Heat gains from water heating, kWh/month	59.1808	51.8829	53.8305	47.3377	45.7160	39.8890	37.4067	42.3024	42.6293	49.1365	53.1042	57.4490 (65)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)												
Total per year (kWh/year) = Sum(64)m = 1798.0354 (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	139.4209	139.4209	139.4209	139.4209	139.4209	139.4209	139.4209	139.4209	139.4209	139.4209	139.4209	139.4209 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.5468	22.6904	18.4531	13.9702	10.4429	8.8163	9.5263	12.3827	16.6200	21.1029	24.6302	26.2568 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	265.6487	268.4053	261.4588	246.6704	228.0027	210.4577	198.7366	195.9800	202.9266	217.7150	236.3826	253.9276 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.9421	36.9421	36.9421	36.9421	36.9421	36.9421	36.9421	36.9421	36.9421	36.9421	36.9421	36.9421 (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)	-111.5367	-111.5367	-111.5367	-111.5367	-111.5367	-111.5367	-111.5367	-111.5367	-111.5367	-111.5367	-111.5367	-111.5367 (71)
Water heating gains (Table 5)	79.5441	77.2067	72.3528	65.7468	61.4463	55.4014	50.2778	56.8580	59.2074	66.0437	73.7559	77.2164 (72)
Total internal gains	438.5658	436.1287	420.0909	394.2137	367.7182	342.5018	326.3671	333.0470	346.5802	372.6879	402.5950	425.2271 (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					7.2700	11.2829	0.4600	0.0000			0.7700	29.0540 (75)
Southwest					7.2000	36.7938	0.4600	0.0000			0.7700	93.8331 (79)
Solar gains	122.8871	218.9727	325.2416	445.9559	538.7249	552.0795	525.0848	453.2376	366.6298	248.9229	148.9478	104.0285 (83)
Total gains	561.4529	655.1013	745.3325	840.1695	906.4431	894.5813	851.4518	786.2846	713.2100	621.6108	551.5428	529.2556 (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	40.2850	40.3702	40.4541	40.8528	40.9283	41.2833	41.2833	41.3497	41.1458	40.9283	40.7759	40.6178
alpha	3.6857	3.6913	3.6969	3.7235	3.7286	3.7522	3.7522	3.7566	3.7431	3.7286	3.7184	3.7079
util living area	0.9926	0.9862	0.9715	0.9323	0.8458	0.6994	0.5495	0.6059	0.8245	0.9552	0.9872	0.9940 (86)
MIT	19.2567	19.4609	19.7975	20.2382	20.6258	20.8746	20.9619	20.9450	20.7517	20.2468	19.6709	19.2186 (87)
Th 2	20.0057	20.0076	20.0094	20.0182	20.0198	20.0274	20.0274	20.0288	20.0245	20.0198	20.0165	20.0130 (88)
util rest of house	0.9909	0.9831	0.9649	0.9155	0.8064	0.6234	0.4422	0.4987	0.7654	0.9409	0.9839	0.9927 (89)
MIT 2	18.4070	18.6112	18.9454	19.3810	19.7423	19.9557	20.0130	20.0062	19.8634	19.3973	18.8280	18.3746 (90)
Living area fraction	18.5479	18.7522	19.0868	19.5232	19.8889	20.1081	20.1704	20.1619	20.0107	19.5382	18.9678	18.5146 (92)
Temperature adjustment	18.5479	18.7522	19.0868	19.5232	19.8889	20.1081	20.1704	20.1619	20.0107	19.5382	18.9678	0.0000
adjusted MIT	18.5479	18.7522	19.0868	19.5232	19.8889	20.1081	20.1704	20.1619	20.0107	19.5382	18.9678	18.5146 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	554.4663	640.6338	713.1832	760.5491	725.5049	563.8523	390.6396	404.4997	545.2107	579.2358	539.9295	523.8845 (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	1651.9953	1602.7199	1453.2903	1214.6044	934.5476	623.2015	403.9649	424.9466	670.9920	1020.0706	1359.4633	1646.1290 (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	816.5616	646.5218	550.6397	326.9198	155.5277	0.0000	0.0000	0.0000	0.0000	327.9811	590.0643	834.9499 (98)
Space heating												4249.1660 (98)
Space heating per m2												(98) / (4) = 40.0940 (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													4568.9957 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	816.5616	646.5218	550.6397	326.9198	155.5277	0.0000	0.0000	0.0000	0.0000	327.9811	590.0643	834.9499	(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)	878.0232	695.1848	592.0857	351.5267	167.2341	0.0000	0.0000	0.0000	0.0000	352.6678	634.4778	897.7956	(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	182.6625	160.2497	166.5313	146.8141	142.0491	124.3359	116.9900	131.7584	132.6188	152.3791	164.2052	177.4413	(64)
Efficiency of water heater (217)m	89.4362	89.3878	89.2851	89.0484	88.5426	87.0000	87.0000	87.0000	87.0000	89.0262	89.3294	89.4593	(216)
Fuel for water heating, kWh/month	204.2377	179.2748	186.5164	164.8700	160.4303	142.9148	134.4713	151.4464	152.4354	171.1621	183.8199	198.3485	(219)
Water heating fuel used												2029.9277	(219)
Annual totals kWh/year													
Space heating fuel - main system												4568.9957	(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)												451.1638	(232)
Total delivered energy for all uses												7125.0873	(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	4568.9957	0.2160	986.9031 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2029.9277	0.2160	438.4644 (264)
Space and water heating			1425.3675 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	451.1638	0.5190	234.1540 (268)
Total CO2, kg/year			1698.4465 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			16.0300 (273)

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

DER		16.0300	ZC1
Total Floor Area	TFA	105.9800	
Assumed number of occupants	N	2.7884	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		14.8535	ZC2
CO2 emissions from cooking, equation (L16)		1.7543	ZC3
Total CO2 emissions		32.6379	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		32.6379	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	52.9900 (1b)	x 2.4300 (2b)	= 128.7657 (1b) - (3b)
First floor	52.9900 (1c)	x 2.6500 (2c)	= 140.4235 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	105.9800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 269.1892 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
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																4 * 10 =	40.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) =	0.1486 (8)	
Pressure test										Yes							
Measured/design AP50										5.0000							
Infiltration rate										0.3986 (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) =					0.3388 (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	0.4320	0.4235	0.4150	0.3727	0.3642	0.3219	0.3219	0.3134	0.3388	0.3642	0.3812	0.3981	(22b)				
Effective ac	0.5933	0.5897	0.5861	0.5694	0.5663	0.5518	0.5518	0.5491	0.5574	0.5663	0.5726	0.5792	(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)			14.4700	1.3258	19.1837		(27)					
gf			52.9900	0.1300	6.8887		(28a)					
external	104.7000	16.6200	88.0800	0.1800	15.8544		(29a)					
cold	52.9900		52.9900	0.1300	6.8887		(30)					
Total net area of external elements Aum(A, m2)			210.6800				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		50.9655		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.2713 (36)					
Total fabric heat loss						(33) + (36) =	61.2368 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 52.7045	Feb 52.3826	Mar 52.0671	Apr 50.5854	May 50.3082	Jun 49.0176	Jul 49.0176	Aug 48.7786	Sep 49.5147	Oct 50.3082	Nov 50.8690	Dec 51.4553 (38)
Heat transfer coeff	113.9413	113.6194	113.3040	111.8222	111.5450	110.2544	110.2544	110.0154	110.7515	111.5450	112.1058	112.6921 (39)
Average = Sum(39)m / 12 =												111.8209 (39)
HLP	Jan 1.0751	Feb 1.0721	Mar 1.0691	Apr 1.0551	May 1.0525	Jun 1.0403	Jul 1.0403	Aug 1.0381	Sep 1.0450	Oct 1.0525	Nov 1.0578	Dec 1.0633 (40)
HLP (average)												1.0551 (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												2.7884 (42)
Average daily hot water use (litres/day)												100.4249 (43)
Daily hot water use	Jan 110.4674	Feb 106.4504	Mar 102.4334	Apr 98.4164	May 94.3994	Jun 90.3824	Jul 90.3824	Aug 94.3994	Sep 98.4164	Oct 102.4334	Nov 106.4504	Dec 110.4674 (44)
Energy conte	163.8200	143.2780	147.8501	128.8993	123.6819	106.7281	98.8993	113.4884	114.8438	133.8394	146.0961	158.6509 (45)
Energy content (annual)										Total = Sum(45)m =		1580.0753 (45)
Distribution loss (46)m = 0.15 x (45)m												
	24.5730	21.4917	22.1775	19.3349	18.5523	16.0092	14.8349	17.0233	17.2266	20.0759	21.9144	23.7976 (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	50.9589	48.5341	48.1049	44.5722	46.0579	48.1049	48.5341	50.9589	49.3151	50.9589 (61)
Solar input	214.7789	189.3054	198.8090	177.4334	171.7869	151.3003	144.9572	161.5933	163.3779	184.7983	195.4112	209.6098 (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	214.7789	189.3054	198.8090	177.4334	171.7869	151.3003	144.9572	161.5933	163.3779	184.7983	195.4112	209.6098 (64)
	67.2099	59.1468	61.8999	54.9925	53.1505	46.6301	44.3985	49.7611	50.3191	57.2413	60.9057	65.4912 (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	139.4209	139.4209	139.4209	139.4209	139.4209	139.4209	139.4209	139.4209	139.4209	139.4209	139.4209	139.4209	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.5468	22.6904	18.4531	13.9702	10.4429	8.8163	9.5263	12.3827	16.6200	21.1029	24.6302	26.2568	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	265.6487	268.4053	261.4588	246.6704	228.0027	210.4577	198.7366	195.9800	202.9266	217.7150	236.3826	253.9276	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.9421	36.9421	36.9421	36.9421	36.9421	36.9421	36.9421	36.9421	36.9421	36.9421	36.9421	36.9421	(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)	-111.5367	-111.5367	-111.5367	-111.5367	-111.5367	-111.5367	-111.5367	-111.5367	-111.5367	-111.5367	-111.5367	-111.5367	(71)
Water heating gains (Table 5)	90.3359	88.0161	83.1988	76.3785	71.4388	64.7641	59.6754	66.8832	69.8876	76.9372	84.5913	88.0258	(72)
Total internal gains	449.3576	446.9381	430.9369	404.8454	377.7107	351.8644	335.7646	343.0722	357.2605	383.5814	413.4304	436.0364	(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	7.2700				11.2829		0.6300		0.7000		0.7700		25.0685 (75)	
Southwest	7.2000				36.7938		0.6300		0.7000		0.7700		80.9616 (79)	
Solar gains	106.0302	188.9353	280.6269	384.7824	464.8259	476.3486	453.0568	391.0652	316.3377	214.7772	128.5161	89.7585	(83)	
Total gains	555.3878	635.8734	711.5638	789.6277	842.5366	828.2130	788.8214	734.1374	673.5982	598.3586	541.9465	525.7949	(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	64.5922	64.7752	64.9556	65.8163	65.9799	66.7522	66.7522	66.8972	66.4526	65.9799	65.6498	65.3082	
alpha	5.3061	5.3183	5.3304	5.3878	5.3987	5.4501	5.4501	5.4598	5.4302	5.3987	5.3767	5.3539	
util living area	0.9990	0.9976	0.9934	0.9764	0.9170	0.7702	0.5975	0.6585	0.8925	0.9862	0.9978	0.9992	(86)
MIT	19.7889	19.9259	20.1581	20.4751	20.7611	20.9388	20.9875	20.9795	20.8527	20.4858	20.0829	19.7684	(87)
Th 2	20.0212	20.0237	20.0261	20.0376	20.0398	20.0499	20.0499	20.0517	20.0460	20.0398	20.0354	20.0309	(88)
util rest of house	0.9986	0.9968	0.9910	0.9668	0.8823	0.6859	0.4775	0.5378	0.8348	0.9790	0.9968	0.9990	(89)
MIT 2	18.3939	18.5958	18.9361	19.4010	19.7929	20.0064	20.0449	20.0426	19.9187	19.4225	18.8343	18.3709	(90)
Living area fraction	18.6253	18.8165	19.1388	19.5792	19.9535	20.1610	20.2013	20.1980	20.0736	19.5989	19.0414	18.6027	(91)
MIT	18.6253	18.8165	19.1388	19.5792	19.9535	20.1610	20.2013	20.1980	20.0736	19.5989	19.0414	18.6027	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6253	18.8165	19.1388	19.5792	19.9535	20.1610	20.2013	20.1980	20.0736	19.5989	19.0414	18.6027	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9978	0.9953	0.9878	0.9607	0.8786	0.6967	0.4974	0.5575	0.8368	0.9743	0.9954	0.9984	(94)
Ext temp.	554.1850	632.8719	702.8530	758.6160	740.2269	577.0133	392.3221	409.3167	563.6570	582.9974	539.4438	524.9432	(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	1632.2440	1581.1803	1432.0305	1194.1674	920.6338	613.1286	397.0567	417.8374	661.5853	1003.7802	1338.7013	1623.0753	(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	802.0759	637.2633	542.5080	313.5970	134.2227	0.0000	0.0000	0.0000	0.0000	313.0625	575.4654	817.0102	(98)
Space heating per m2												4135.2048	(98)
												39.0187	(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													4427.4142 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	802.0759	637.2633	542.5080	313.5970	134.2227	0.0000	0.0000	0.0000	0.0000	313.0625	575.4654	817.0102	(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)	858.7536	682.2947	580.8437	335.7569	143.7074	0.0000	0.0000	0.0000	0.0000	335.1846	616.1299	874.7433	(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	214.7789	189.3054	198.8090	177.4334	171.7869	151.3003	144.9572	161.5933	163.3779	184.7983	195.4112	209.6098	(64)
Efficiency of water heater	88.0605	87.8688	87.4502	86.4699	84.4379	80.3000	80.3000	80.3000	80.3000	86.3678	87.6068	88.1366	(217)
Fuel for water heating, kWh/month	243.8992	215.4410	227.3398	205.1966	203.4475	188.4188	180.5195	201.2370	203.4594	213.9667	223.0549	237.8239	(219)
Water heating fuel used												2543.8043	(219)
Annual totals kWh/year													
Space heating fuel - main system												4427.4142	(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)												451.1638	(232)
Total delivered energy for all uses												7497.3823	(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	4427.4142	0.2160	956.3215 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2543.8043	0.2160	549.4617 (264)
Space and water heating			1505.7832 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	451.1638	0.5190	234.1540 (268)
Total CO2, kg/m2/year			1778.6222 (272)
Emissions per m2 for space and water heating			14.2082 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.2094 (272b)
Emissions per m2 for pumps and fans			0.3673 (272c)
Target Carbon Dioxide Emission Rate (TER) = (14.2082 * 1.00) + 2.2094 + 0.3673, rounded to 2 d.p.			16.7800 (273)

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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	52.9900 (1b)	x 2.4300 (2b)	= 128.7657 (1b) - (3b)
First floor	52.9900 (1c)	x 2.6500 (2c)	= 140.4235 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	105.9800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 269.1892 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.1486 (8)
Pressure test					Yes
Measured/design AP50					3.9800
Infiltration rate					0.3476 (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) =	0.2955 (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	0.3767	0.3693	0.3619	0.3250	0.3176	0.2807	0.2807	0.2733	0.2955	0.3176	0.3324	0.3472 (22b)
Effective ac	0.5710	0.5682	0.5655	0.5528	0.5504	0.5394	0.5394	0.5373	0.5436	0.5504	0.5552	0.5603 (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)			14.4700	1.2357	17.8812		(27)
gf			52.9900	0.1500	7.9485	75.0000	3974.2501 (28a)
external	104.7000	16.6200	88.0800	0.2000	17.6160	60.0000	5284.7998 (29a)
cold	52.9900		52.9900	0.0900	4.7691	9.0000	476.9100 (30)
Total net area of external elements Aum(A, m ²)			210.6800				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		51.2248		(33)
party			52.3200	0.0000	0.0000	70.0000	3662.4000 (32)
gf			97.6860			9.0000	879.1740 (32c)
lf			123.0000			9.0000	1107.0000 (32c)
lf			52.9900			18.0000	953.8200 (32d)
gf			52.9900			9.0000	476.9100 (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) = 16815.2640 (34)
158.6645 (35)
14.0026 (36)
(33) + (36) = 65.2273 (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	50.7192	50.4744	50.2345	49.1077	48.8969	47.9154	47.9154	47.7337	48.2935	48.8969	49.3234	49.7693 (38)
Heat transfer coeff	115.9465	115.7018	115.4619	114.3350	114.1242	113.1428	113.1428	112.9610	113.5208	114.1242	114.5507	114.9966 (39)
Average = Sum(39)m / 12 =												114.3340 (39)
HLP	1.0940	1.0917	1.0895	1.0788	1.0768	1.0676	1.0676	1.0659	1.0712	1.0768	1.0809	1.0851 (40)
HLP (average)												1.0788 (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												2.7884 (42)
Average daily hot water use (litres/day)												100.4249 (43)
Daily hot water use	110.4674	106.4504	102.4334	98.4164	94.3994	90.3824	90.3824	94.3994	98.4164	102.4334	106.4504	110.4674 (44)
Energy conte	163.8200	143.2780	147.8501	128.8993	123.6819	106.7281	98.8993	113.4884	114.8438	133.8394	146.0961	158.6509 (45)
Energy content (annual)										Total = Sum(45)m =		1580.0753 (45)

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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	34.8118	30.4466	31.4181	27.3911	26.2824	22.6797	21.0161	24.1163	24.4043	28.4409	31.0454	33.7133 (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	139.4209	139.4209	139.4209	139.4209	139.4209	139.4209	139.4209	139.4209	139.4209	139.4209	139.4209	139.4209	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.5468	22.6904	18.4531	13.9702	10.4429	8.8163	9.5263	12.3827	16.6200	21.1029	24.6302	26.2568	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	265.6487	268.4053	261.4588	246.6704	228.0027	210.4577	198.7366	195.9800	202.9266	217.7150	236.3826	253.9276	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.9421	36.9421	36.9421	36.9421	36.9421	36.9421	36.9421	36.9421	36.9421	36.9421	36.9421	36.9421	(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)	-111.5367	-111.5367	-111.5367	-111.5367	-111.5367	-111.5367	-111.5367	-111.5367	-111.5367	-111.5367	-111.5367	-111.5367	(71)
Water heating gains (Table 5)	46.7900	45.3074	42.2287	38.0432	35.3258	31.4996	28.2474	32.4144	33.8949	38.2270	43.1186	45.3136	(72)
Total internal gains	402.8118	401.2294	386.9668	363.5100	338.5977	315.5999	301.3367	305.6033	318.2677	341.8711	368.9578	390.3243	(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				7.2700	11.2829	0.4600	0.0000			0.7700			29.0540 (75)
Southwest				7.2000	36.7938	0.4600	0.0000			0.7700			93.8331 (79)
Solar gains	122.8871	218.9727	325.2416	445.9559	538.7249	552.0795	525.0848	453.2376	366.6298	248.9229	148.9478	104.0285 (83)	
Total gains	525.6988	620.2021	712.2084	809.4659	877.3226	867.6795	826.4214	758.8409	684.8975	590.7940	517.9056	494.3528 (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	40.2850	40.3702	40.4541	40.8528	40.9283	41.2833	41.2833	41.3497	41.1458	40.9283	40.7759	40.6178	
alpha	3.6857	3.6913	3.6969	3.7235	3.7286	3.7522	3.7522	3.7566	3.7431	3.7286	3.7184	3.7079	
util living area	0.9940	0.9884	0.9752	0.9387	0.8564	0.7131	0.5631	0.6224	0.8386	0.9613	0.9896	0.9952	(86)
MIT	19.2128	19.4191	19.7601	20.2086	20.6063	20.8658	20.9587	20.9398	20.7343	20.2140	19.6303	19.1754	(87)
Th 2	20.0057	20.0076	20.0094	20.0182	20.0198	20.0274	20.0274	20.0288	20.0245	20.0198	20.0165	20.0130	(88)
util rest of house	0.9927	0.9858	0.9693	0.9232	0.8185	0.6376	0.4543	0.5142	0.7819	0.9486	0.9868	0.9942	(89)
MIT 2	18.3633	18.5699	18.9089	19.3533	19.7260	19.9500	20.0116	20.0037	19.8502	19.3664	18.7879	18.3316	(90)
Living area fraction									fLA = Living area / (4) =			0.1659	(91)
MIT	18.5042	18.7108	19.0501	19.4952	19.8720	20.1019	20.1687	20.1590	19.9969	19.5070	18.9276	18.4716	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5042	18.7108	19.0501	19.4952	19.8720	20.1019	20.1687	20.1590	19.9969	19.5070	18.9276	18.4716	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	520.3537	608.5310	685.0315	739.1340	712.3171	558.7477	389.2407	402.0778	534.2558	555.3576	508.8533	490.3007	(94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1646.9326	1597.9320	1449.0612	1211.3971	932.6219	622.5005	403.7763	424.6195	669.4180	1016.5007	1354.8655	1641.1832	(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	838.1747	664.8774	568.4381	340.0294	163.9068	0.0000	0.0000	0.0000	0.0000	343.0905	609.1288	856.2565	(98)
Space heating												4383.9024	(98)
Space heating per m2												(98) / (4) =	41.3654 (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	1063.5422	837.2566	858.5039	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8106	0.8748	0.8440	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	862.0755	732.4598	724.6197	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	1123.2315	1072.7078	995.9241	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	188.0323	253.1446	201.8505	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												643.0273 (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	47.0081	63.2861	50.4626	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												160.7568 (107)
Space cooling per m2												1.5169 (108)
Energy for space heating												41.3654 (99)
Energy for space cooling												1.5169 (108)
Total												42.8822 (109)
Dwelling Fabric Energy Efficiency (DFEE)												42.9 (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	52.9900 (1b)	x 2.4300 (2b)	= 128.7657 (1b) - (3b)
First floor	52.9900 (1c)	x 2.6500 (2c)	= 140.4235 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	105.9800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 269.1892 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
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																4 * 10 =	40.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) =	0.1486 (8)	
Pressure test										Yes							
Measured/design AP50										5.0000							
Infiltration rate										0.3986 (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) =					0.3388 (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	0.4320	0.4235	0.4150	0.3727	0.3642	0.3219	0.3219	0.3134	0.3388	0.3642	0.3812	0.3981	(22b)				
Effective ac	0.5933	0.5897	0.5861	0.5694	0.5663	0.5518	0.5518	0.5491	0.5574	0.5663	0.5726	0.5792	(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)			14.4700	1.3258	19.1837		(27)					
gf			52.9900	0.1300	6.8887		(28a)					
external	104.7000	16.6200	88.0800	0.1800	15.8544		(29a)					
cold	52.9900		52.9900	0.1300	6.8887		(30)					
Total net area of external elements Aum(A, m2)			210.6800				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	50.9655		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.2713 (36)					
Total fabric heat loss						(33) + (36) =	61.2368 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 52.7045	Feb 52.3826	Mar 52.0671	Apr 50.5854	May 50.3082	Jun 49.0176	Jul 49.0176	Aug 48.7786	Sep 49.5147	Oct 50.3082	Nov 50.8690	Dec 51.4553 (38)
Heat transfer coeff	113.9413	113.6194	113.3040	111.8222	111.5450	110.2544	110.2544	110.0154	110.7515	111.5450	112.1058	112.6921 (39)
Average = Sum(39)m / 12 =												111.8209 (39)
HLP	Jan 1.0751	Feb 1.0721	Mar 1.0691	Apr 1.0551	May 1.0525	Jun 1.0403	Jul 1.0403	Aug 1.0381	Sep 1.0450	Oct 1.0525	Nov 1.0578	Dec 1.0633 (40)
HLP (average)												1.0551 (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												2.7884 (42)
Average daily hot water use (litres/day)												100.4249 (43)
Daily hot water use	Jan 110.4674	Feb 106.4504	Mar 102.4334	Apr 98.4164	May 94.3994	Jun 90.3824	Jul 90.3824	Aug 94.3994	Sep 98.4164	Oct 102.4334	Nov 106.4504	Dec 110.4674 (44)
Energy conte	163.8200	143.2780	147.8501	128.8993	123.6819	106.7281	98.8993	113.4884	114.8438	133.8394	146.0961	158.6509 (45)
Energy content (annual)										Total = Sum(45)m =		1580.0753 (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	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)
	34.8118	30.4466	31.4181	27.3911	26.2824	22.6797	21.0161	24.1163	24.4043	28.4409	31.0454	33.7133 (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	139.4209	139.4209	139.4209	139.4209	139.4209	139.4209	139.4209	139.4209	139.4209	139.4209	139.4209	139.4209 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.5468	22.6904	18.4531	13.9702	10.4429	8.8163	9.5263	12.3827	16.6200	21.1029	24.6302	26.2568 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	265.6487	268.4053	261.4588	246.6704	228.0027	210.4577	198.7366	195.9800	202.9266	217.7150	236.3826	253.9276 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.9421	36.9421	36.9421	36.9421	36.9421	36.9421	36.9421	36.9421	36.9421	36.9421	36.9421	36.9421 (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)	-111.5367	-111.5367	-111.5367	-111.5367	-111.5367	-111.5367	-111.5367	-111.5367	-111.5367	-111.5367	-111.5367	-111.5367 (71)
Water heating gains (Table 5)	46.7900	45.3074	42.2287	38.0432	35.3258	31.4996	28.2474	32.4144	33.8949	38.2270	43.1186	45.3136 (72)
Total internal gains	402.8118	401.2294	386.9668	363.5100	338.5977	315.5999	301.3367	305.6033	318.2677	341.8711	368.9578	390.3243 (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				7.2700	11.2829		0.6300		0.7000	0.7700	25.0685 (75)	
Southwest				7.2000	36.7938		0.6300		0.7000	0.7700	80.9616 (79)	

Solar gains	106.0302	188.9353	280.6269	384.7824	464.8259	476.3486	453.0568	391.0652	316.3377	214.7772	128.5161	89.7585 (83)
Total gains	508.8419	590.1648	667.5937	748.2924	803.4236	791.9485	754.3935	696.6685	634.6055	556.6483	497.4738	480.0828 (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	64.5922	64.7752	64.9556	65.8163	65.9799	66.7522	66.7522	66.8972	66.4526	65.9799	65.6498	65.3082	
alpha	5.3061	5.3183	5.3304	5.3878	5.3987	5.4501	5.4501	5.4598	5.4302	5.3987	5.3767	5.3539	
util living area	0.9993	0.9983	0.9951	0.9812	0.9295	0.7924	0.6211	0.6867	0.9113	0.9900	0.9985	0.9995 (86)	
MIT	19.7473	19.8853	20.1198	20.4420	20.7378	20.9294	20.9850	20.9750	20.8321	20.4506	20.0432	19.7274 (87)	
Th 2	20.0212	20.0237	20.0261	20.0376	20.0398	20.0499	20.0499	20.0517	20.0460	20.0398	20.0354	20.0309 (88)	
util rest of house	0.9991	0.9978	0.9932	0.9733	0.8985	0.7098	0.4981	0.5642	0.8597	0.9846	0.9979	0.9994 (89)	
MIT 2	18.8686	19.0084	19.2441	19.5713	19.8518	20.0149	20.0457	20.0439	19.9439	19.5843	19.1759	18.8566 (90)	
Living area fraction									fLA = Living area / (4) =				0.1659 (91)
MIT	19.0144	19.1538	19.3894	19.7158	19.9988	20.1666	20.2015	20.1983	20.0912	19.7280	19.3197	19.0010 (92)	
Temperature adjustment												0.0000	
adjusted MIT	19.0144	19.1538	19.3894	19.7158	19.9988	20.1666	20.2015	20.1983	20.0912	19.7280	19.3197	19.0010 (93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9988	0.9970	0.9916	0.9699	0.8969	0.7211	0.5187	0.5845	0.8627	0.9822	0.9972	0.9991 (94)
Ext temp.	508.2080	588.4138	661.9684	725.7699	720.5539	571.0779	391.3007	407.2180	547.4573	546.7537	496.1055	479.6480 (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	1676.5740	1619.5110	1460.4173	1209.4426	925.6840	613.7372	397.0853	417.8747	663.5399	1018.1851	1369.9048	1667.9597 (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	869.2643	692.8973	594.0460	348.2444	152.6168	0.0000	0.0000	0.0000	0.0000	350.7449	629.1355	884.1039 (98)
Space heating per m2												4521.0529 (98)
										(98) / (4) =		42.6595 (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	1036.3915	815.8827	836.1172	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8443	0.9136	0.8838	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	875.0045	745.3841	739.0005	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1034.7148	988.5193	923.2551	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	114.9914	180.8926	137.0854	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												432.9694 (104)
Cooled fraction												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	28.7479	45.2231	34.2714	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling											108.2424 (107)
Space cooling per m2											1.0213 (108)
Energy for space heating											42.6595 (99)
Energy for space cooling											1.0213 (108)
Total											43.6808 (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	52.9900 (1b)	x 2.4300 (2b)	= 128.7657 (1b) - (3b)
First floor	52.9900 (1c)	x 2.6500 (2c)	= 140.4235 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	105.9800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 269.1892 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					40.0000 / (5) = 0.1486 (8)
Pressure test					Yes
Measured/design AP50					3.9800
Infiltration rate					0.3476 (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)	=	0.2955 (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	0.3398	0.3324	0.3324	0.3028	0.3102	0.2733	0.2585	0.2585	0.2733	0.3028	0.3028	0.3102 (22b)
	0.5577	0.5552	0.5552	0.5459	0.5481	0.5373	0.5334	0.5334	0.5373	0.5459	0.5459	0.5481 (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)			14.4700	1.2357	17.8812		(27)
gf			52.9900	0.1500	7.9485	75.0000	3974.2501 (28a)
external	104.7000	16.6200	88.0800	0.2000	17.6160	60.0000	5284.7998 (29a)
cold	52.9900		52.9900	0.0900	4.7691	9.0000	476.9100 (30)
Total net area of external elements Aum(A, m ²)			210.6800				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		51.2248		(33)
party			52.3200	0.0000	0.0000	70.0000	3662.4000 (32)
gf			97.6860			9.0000	879.1740 (32c)
lf			123.0000			9.0000	1107.0000 (32c)
lf			52.9900			18.0000	953.8200 (32d)
gf			52.9900			9.0000	476.9100 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 16815.2640 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 158.6645 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 14.0026 (36)
Total fabric heat loss (33) + (36) = 65.2273 (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	49.5439	49.3234	49.3234	48.4898	48.6909	47.7337	47.3847	47.3847	47.7337	48.4898	48.4898	48.6909 (38)
Heat transfer coeff	114.7712	114.5507	114.5507	113.7171	113.9182	112.9610	112.6121	112.6121	112.9610	113.7171	113.7171	113.9182 (39)
Average = Sum(39)m / 12 =												113.6672 (39)
HLP	1.0830	1.0809	1.0809	1.0730	1.0749	1.0659	1.0626	1.0626	1.0659	1.0730	1.0730	1.0749 (40)
HLP (average)												1.0725 (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												2.7884 (42)
Average daily hot water use (litres/day)												100.4249 (43)
Daily hot water use	110.4674	106.4504	102.4334	98.4164	94.3994	90.3824	90.3824	94.3994	98.4164	102.4334	106.4504	110.4674 (44)
Energy conte	163.8200	143.2780	147.8501	128.8993	123.6819	106.7281	98.8993	113.4884	114.8438	133.8394	146.0961	158.6509 (45)
Energy content (annual)										Total = Sum(45)m =		1580.0753 (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	24.5730	21.4917	22.1775	19.3349	18.5523	16.0092	14.8349	17.0233	17.2266	20.0759	21.9144	23.7976 (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	18.8425	16.9717	18.6812	17.9148	18.3672	17.6078	18.0908	18.2700	17.7751	18.5397	18.1091	18.7903 (61)
Total heat required for water heating calculated for each month	182.6625	160.2497	166.5313	146.8141	142.0491	124.3359	116.9900	131.7584	132.6188	152.3791	164.2052	177.4413 (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	182.6625	160.2497	166.5313	146.8141	142.0491	124.3359	116.9900	131.7584	132.6188	152.3791	164.2052	177.4413 (64)
RHI water heating demand												
Heat gains from water heating, kWh/month	59.1808	51.8829	53.8305	47.3377	45.7160	39.8890	37.4067	42.3024	42.6293	49.1365	53.1042	57.4490 (65)
												1798 (64)
												1798 (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	167.3051	167.3051	167.3051	167.3051	167.3051	167.3051	167.3051	167.3051	167.3051	167.3051	167.3051	167.3051	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	61.4380	54.5687	44.3783	33.5972	25.1143	21.2026	22.9101	29.7794	39.9699	50.7509	59.2338	63.1456	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	396.4907	400.6050	390.2370	368.1648	340.3026	314.1160	296.6218	292.5075	302.8755	324.9477	352.8099	378.9964	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.5189	54.5189	54.5189	54.5189	54.5189	54.5189	54.5189	54.5189	54.5189	54.5189	54.5189	54.5189	(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)	-111.5367	-111.5367	-111.5367	-111.5367	-111.5367	-111.5367	-111.5367	-111.5367	-111.5367	-111.5367	-111.5367	-111.5367	(71)
Water heating gains (Table 5)	79.5441	77.2067	72.3528	65.7468	61.4463	55.4014	50.2778	56.8580	59.2074	66.0437	73.7559	77.2164	(72)
Total internal gains	650.7601	645.6677	620.2553	580.7961	540.1505	504.0073	483.0971	492.4322	515.3400	555.0296	599.0869	632.6457	(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					7.2700	9.5471	0.4600	0.0000			1.0000			31.9274 (75)
Southwest					7.2000	31.1332	0.4600	0.0000			1.0000			103.1133 (79)
Solar gains	135.0407	252.7823	395.9922	552.1358	652.2711	681.1371	635.0231	539.8810	451.3004	298.7859	169.9916			122.2351 (83)
Total gains	785.8008	898.4500	1016.2475	1132.9319	1192.4216	1185.1444	1118.1202	1032.3132	966.6404	853.8155	769.0785			754.8808 (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	40.6975	40.7759	40.7759	41.0748	41.0023	41.3497	41.4778	41.4778	41.3497	41.0748	41.0748	41.0023	
alpha	3.7132	3.7184	3.7184	3.7383	3.7335	3.7566	3.7652	3.7652	3.7566	3.7383	3.7383	3.7335	
util living area	0.9765	0.9606	0.9281	0.8473	0.7105	0.5396	0.4314	0.4731	0.6978	0.8904	0.9609	0.9795	(86)
MIT	19.6010	19.8135	20.1185	20.5289	20.8173	20.9513	20.9832	20.9766	20.8664	20.4919	19.9879	19.5658	(87)
Th 2	20.0148	20.0165	20.0165	20.0229	20.0214	20.0288	20.0315	20.0315	20.0288	20.0229	20.0229	20.0214	(88)
util rest of house	0.9715	0.9526	0.9136	0.8169	0.6562	0.4631	0.3414	0.3786	0.6279	0.8616	0.9514	0.9752	(89)
MIT 2	18.7542	18.9637	19.2592	19.6494	19.8980	20.0043	20.0256	20.0228	19.9488	19.6249	19.1429	18.7247	(90)
Living area fraction									fLA = Living area / (4) =			0.1659	(91)
MIT	18.8947	19.1047	19.4017	19.7953	20.0505	20.1614	20.1844	20.1811	20.1010	19.7687	19.2830	18.8642	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8947	19.1047	19.4017	19.7953	20.0505	20.1614	20.1844	20.1811	20.1010	19.7687	19.2830	18.8642	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9643	0.9433	0.9027	0.8090	0.6580	0.4739	0.3560	0.3937	0.6335	0.8528	0.9424	0.9686	(94)
Useful gains	757.7594	847.5065	917.3796	916.5353	784.5822	561.6845	398.0414	406.4350	612.3781	728.1353	724.7662	731.1582	(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	1629.1428	1581.3337	1454.9920	1193.4983	882.9243	583.0343	403.6501	414.5308	677.8839	1019.8965	1339.9338	1624.9552	(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	648.3093	493.1319	399.9836	199.4134	73.1665	0.0000	0.0000	0.0000	0.0000	217.0703	442.9207	664.9850	(98)
Space heating												3138.9806	(98)
RHI space heating demand												3139	(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	52.9900 (1b)	x 2.4300 (2b)	= 128.7657 (1b) - (3b)
First floor	52.9900 (1c)	x 2.6500 (2c)	= 140.4235 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	105.9800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 269.1892 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.1486 (8)
Pressure test					Yes
Measured/design AP50					3.9800
Infiltration rate					0.3476 (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) =	0.2955 (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	0.3767	0.3693	0.3619	0.3250	0.3176	0.2807	0.2807	0.2733	0.2955	0.3176	0.3324	0.3472 (22b)
Effective ac	0.5710	0.5682	0.5655	0.5528	0.5504	0.5394	0.5394	0.5373	0.5436	0.5504	0.5552	0.5603 (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)			14.4700	1.2357	17.8812		(27)
gf			52.9900	0.1500	7.9485	75.0000	3974.2501 (28a)
external	104.7000	16.6200	88.0800	0.2000	17.6160	60.0000	5284.7998 (29a)
cold	52.9900		52.9900	0.0900	4.7691	9.0000	476.9100 (30)
Total net area of external elements Aum(A, m ²)			210.6800				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		51.2248		(33)
party			52.3200	0.0000	0.0000	70.0000	3662.4000 (32)
gf			97.6860			9.0000	879.1740 (32c)
lf			123.0000			9.0000	1107.0000 (32c)
lf			52.9900			18.0000	953.8200 (32d)
gf			52.9900			9.0000	476.9100 (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) = 16815.2640 (34)
158.6645 (35)
14.0026 (36)
(33) + (36) = 65.2273 (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	50.7192	50.4744	50.2345	49.1077	48.8969	47.9154	47.9154	47.7337	48.2935	48.8969	49.3234	49.7693 (38)
Heat transfer coeff	115.9465	115.7018	115.4619	114.3350	114.1242	113.1428	113.1428	112.9610	113.5208	114.1242	114.5507	114.9966 (39)
Average = Sum(39)m / 12 =												114.3340 (39)
HLP	1.0940	1.0917	1.0895	1.0788	1.0768	1.0676	1.0676	1.0659	1.0712	1.0768	1.0809	1.0851 (40)
HLP (average)												1.0788 (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												2.7884 (42)
Average daily hot water use (litres/day)												100.4249 (43)
Daily hot water use	110.4674	106.4504	102.4334	98.4164	94.3994	90.3824	90.3824	94.3994	98.4164	102.4334	106.4504	110.4674 (44)
Energy conte	163.8200	143.2780	147.8501	128.8993	123.6819	106.7281	98.8993	113.4884	114.8438	133.8394	146.0961	158.6509 (45)
Energy content (annual)										Total = Sum(45)m =		1580.0753 (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	24.5730	21.4917	22.1775	19.3349	18.5523	16.0092	14.8349	17.0233	17.2266	20.0759	21.9144	23.7976 (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	18.8425	16.9717	18.6812	17.9148	18.3672	17.6078	18.0908	18.2700	17.7751	18.5397	18.1091	18.7903 (61)
Total heat required for water heating calculated for each month	182.6625	160.2497	166.5313	146.8141	142.0491	124.3359	116.9900	131.7584	132.6188	152.3791	164.2052	177.4413 (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	182.6625	160.2497	166.5313	146.8141	142.0491	124.3359	116.9900	131.7584	132.6188	152.3791	164.2052	177.4413 (64)
Heat gains from water heating, kWh/month	59.1808	51.8829	53.8305	47.3377	45.7160	39.8890	37.4067	42.3024	42.6293	49.1365	53.1042	57.4490 (65)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)												
Total per year (kWh/year) = Sum(64)m = 1798.0354 (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	167.3051	167.3051	167.3051	167.3051	167.3051	167.3051	167.3051	167.3051	167.3051	167.3051	167.3051	167.3051 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	61.4380	54.5687	44.3783	33.5972	25.1143	21.2026	22.9101	29.7794	39.9699	50.7509	59.2338	63.1456 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	396.4907	400.6050	390.2370	368.1648	340.3026	314.1160	296.6218	292.5075	302.8755	324.9477	352.8099	378.9964 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.5189	54.5189	54.5189	54.5189	54.5189	54.5189	54.5189	54.5189	54.5189	54.5189	54.5189	54.5189 (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)	-111.5367	-111.5367	-111.5367	-111.5367	-111.5367	-111.5367	-111.5367	-111.5367	-111.5367	-111.5367	-111.5367	-111.5367 (71)
Water heating gains (Table 5)	79.5441	77.2067	72.3528	65.7468	61.4463	55.4014	50.2778	56.8580	59.2074	66.0437	73.7559	77.2164 (72)
Total internal gains	650.7601	645.6677	620.2553	580.7961	540.1505	504.0073	483.0971	492.4322	515.3400	555.0296	599.0869	632.6457 (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				7.2700	11.2829	0.4600	0.0000	1.0000	37.7324 (75)			
Southwest				7.2000	36.7938	0.4600	0.0000	1.0000	121.8612 (79)			
Solar gains	159.5936	284.3801	422.3916	579.1635	699.6428	716.9864	681.9283	588.6203	476.1426	323.2765	193.4387	135.1020 (83)
Total gains	810.3536	930.0477	1042.6470	1159.9596	1239.7933	1220.9937	1165.0253	1081.0525	991.4826	878.3062	792.5256	767.7477 (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	40.2850	40.3702	40.4541	40.8528	40.9283	41.2833	41.2833	41.3497	41.1458	40.9283	40.7759	40.6178
alpha	3.6857	3.6913	3.6969	3.7235	3.7286	3.7522	3.7522	3.7566	3.7431	3.7286	3.7184	3.7079
util living area	0.9761	0.9599	0.9266	0.8516	0.7234	0.5560	0.4171	0.4642	0.6880	0.8886	0.9610	0.9801 (86)
MIT	19.5522	19.7730	20.1037	20.4979	20.7912	20.9424	20.9848	20.9774	20.8714	20.4839	19.9464	19.5054 (87)
Th 2	20.0057	20.0076	20.0094	20.0182	20.0198	20.0274	20.0274	20.0288	20.0245	20.0198	20.0165	20.0130 (88)
util rest of house	0.9713	0.9519	0.9119	0.8228	0.6733	0.4832	0.3293	0.3730	0.6177	0.8600	0.9519	0.9760 (89)
MIT 2	18.6986	18.9164	19.2387	19.6161	19.8741	19.9968	20.0221	20.0202	19.9480	19.6139	19.0966	18.6583 (90)
Living area fraction	18.8402	19.0585	19.3822	19.7624	20.0262	20.1536	20.1818	20.1790	20.1011	19.7582	19.2375	18.7988 (92)
MIT	18.8402	19.0585	19.3822	19.7624	20.0262	20.1536	20.1818	20.1790	20.1011	19.7582	19.2375	18.7988 (93)
Temperature adjustment												0.0000
adjusted MIT	18.8402	19.0585	19.3822	19.7624	20.0262	20.1536	20.1818	20.1790	20.1011	19.7582	19.2375	18.7988 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9639	0.9425	0.9009	0.8143	0.6737	0.4931	0.3435	0.3875	0.6236	0.8511	0.9428	0.9694 (94)
Ext temp.	781.1276	876.5474	939.3381	944.6033	835.2109	602.0114	400.1898	418.9107	618.3188	747.5506	747.1836	744.2539 (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	1685.8878	1638.1662	1487.3977	1241.9503	950.2252	628.3510	405.2497	426.8805	681.2545	1045.1730	1390.3643	1678.8152 (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	673.1415	511.8079	407.7563	214.0898	85.5706	0.0000	0.0000	0.0000	0.0000	221.4311	463.0901	695.3136 (98)
												3272.2010 (98)
												(98) / (4) = 30.8756 (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													3518.4958 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	673.1415	511.8079	407.7563	214.0898	85.5706	0.0000	0.0000	0.0000	0.0000	221.4311	463.0901	695.3136	(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)	723.8081	550.3311	438.4477	230.2041	92.0114	0.0000	0.0000	0.0000	0.0000	238.0979	497.9464	747.6490	(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	182.6625	160.2497	166.5313	146.8141	142.0491	124.3359	116.9900	131.7584	132.6188	152.3791	164.2052	177.4413	(64)
Efficiency of water heater (217)m	89.3424	89.2660	89.1090	88.7550	88.1041	87.0000	87.0000	87.0000	87.0000	88.7525	89.1949	89.3734	(216)
Fuel for water heating, kWh/month	204.4521	179.5193	186.8850	165.4150	161.2288	142.9148	134.4713	151.4464	152.4354	171.6900	184.0971	198.5392	(219)
Water heating fuel used												2033.0944	(219)
Annual totals kWh/year													
Space heating fuel - main system													3518.4958 (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)													434.0060 (232)
Total delivered energy for all uses													6060.5962 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3518.4958	3.4800	122.4437 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2033.0944	3.4800	70.7517 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	434.0060	13.1900	57.2454 (250)
Additional standing charges			120.0000 (251)
Total energy cost			380.3332 (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] =	1.0580 (257)
SAP value		85.2406
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	3518.4958	0.2160	759.9951 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2033.0944	0.2160	439.1484 (264)
Space and water heating			1199.1435 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	434.0060	0.5190	225.2491 (268)
Total kg/year			1463.3176 (272)
CO2 emissions per m2			13.8100 (273)
EI value			87.0125
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	$3.48 / 0.8832 = 3.940$, stars = 4
Water heating environmental impact	$0.216 / 0.8832 = 0.2446$, 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	52.9900 (1b)	x 2.4300 (2b)	= 128.7657 (1b) - (3b)
First floor	52.9900 (1c)	x 2.6500 (2c)	= 140.4235 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	105.9800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 269.1892 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					40.0000 / (5) = 0.1486 (8)
Pressure test					Yes
Measured/design AP50					3.9800
Infiltration rate					0.3476 (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)	=	0.2955 (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	0.3398	0.3324	0.3324	0.3028	0.3102	0.2733	0.2585	0.2585	0.2733	0.3028	0.3028	0.3102 (22b)
Effective ac	0.5577	0.5552	0.5552	0.5459	0.5481	0.5373	0.5334	0.5334	0.5373	0.5459	0.5459	0.5481 (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)			14.4700	1.2357	17.8812		(27)
gf			52.9900	0.1500	7.9485	75.0000	3974.2501 (28a)
external	104.7000	16.6200	88.0800	0.2000	17.6160	60.0000	5284.7998 (29a)
cold	52.9900		52.9900	0.0900	4.7691	9.0000	476.9100 (30)
Total net area of external elements Aum(A, m ²)			210.6800				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		51.2248		(33)
party			52.3200	0.0000	0.0000	70.0000	3662.4000 (32)
gf			97.6860			9.0000	879.1740 (32c)
1f			123.0000			9.0000	1107.0000 (32c)
1f			52.9900			18.0000	953.8200 (32d)
gf			52.9900			9.0000	476.9100 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 16815.2640 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 158.6645 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 14.0026 (36)
Total fabric heat loss (33) + (36) = 65.2273 (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	49.5439	49.3234	49.3234	48.4898	48.6909	47.7337	47.3847	47.3847	47.7337	48.4898	48.4898	48.6909 (38)
Heat transfer coeff	114.7712	114.5507	114.5507	113.7171	113.9182	112.9610	112.6121	112.6121	112.9610	113.7171	113.7171	113.9182 (39)
Average = Sum(39)m / 12 =												113.6672 (39)
HLP	1.0830	1.0809	1.0809	1.0730	1.0749	1.0659	1.0626	1.0626	1.0659	1.0730	1.0730	1.0749 (40)
HLP (average)												1.0725 (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												2.7884 (42)
Average daily hot water use (litres/day)												100.4249 (43)
Daily hot water use	110.4674	106.4504	102.4334	98.4164	94.3994	90.3824	90.3824	94.3994	98.4164	102.4334	106.4504	110.4674 (44)
Energy conte	163.8200	143.2780	147.8501	128.8993	123.6819	106.7281	98.8993	113.4884	114.8438	133.8394	146.0961	158.6509 (45)
Energy content (annual)										Total = Sum(45)m =		1580.0753 (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	24.5730	21.4917	22.1775	19.3349	18.5523	16.0092	14.8349	17.0233	17.2266	20.0759	21.9144	23.7976 (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	18.8425	16.9717	18.6812	17.9148	18.3672	17.6078	18.0908	18.2700	17.7751	18.5397	18.1091	18.7903 (61)
Total heat required for water heating calculated for each month	182.6625	160.2497	166.5313	146.8141	142.0491	124.3359	116.9900	131.7584	132.6188	152.3791	164.2052	177.4413 (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	182.6625	160.2497	166.5313	146.8141	142.0491	124.3359	116.9900	131.7584	132.6188	152.3791	164.2052	177.4413 (64)
Heat gains from water heating, kWh/month	59.1808	51.8829	53.8305	47.3377	45.7160	39.8890	37.4067	42.3024	42.6293	49.1365	53.1042	57.4490 (65)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)												
Total per year (kWh/year) = Sum(64)m = 1798.0354 (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	167.3051	167.3051	167.3051	167.3051	167.3051	167.3051	167.3051	167.3051	167.3051	167.3051	167.3051	167.3051 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	61.4380	54.5687	44.3783	33.5972	25.1143	21.2026	22.9101	29.7794	39.9699	50.7509	59.2338	63.1456 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	396.4907	400.6050	390.2370	368.1648	340.3026	314.1160	296.6218	292.5075	302.8755	324.9477	352.8099	378.9964 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.5189	54.5189	54.5189	54.5189	54.5189	54.5189	54.5189	54.5189	54.5189	54.5189	54.5189	54.5189 (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)	-111.5367	-111.5367	-111.5367	-111.5367	-111.5367	-111.5367	-111.5367	-111.5367	-111.5367	-111.5367	-111.5367	-111.5367 (71)
Water heating gains (Table 5)	79.5441	77.2067	72.3528	65.7468	61.4463	55.4014	50.2778	56.8580	59.2074	66.0437	73.7559	77.2164 (72)
Total internal gains	650.7601	645.6677	620.2553	580.7961	540.1505	504.0073	483.0971	492.4322	515.3400	555.0296	599.0869	632.6457 (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					7.2700	9.5471	0.4600	0.0000	1.0000		31.9274 (75)	
Southwest					7.2000	31.1332	0.4600	0.0000	1.0000		103.1133 (79)	
Solar gains	135.0407	252.7823	395.9922	552.1358	652.2711	681.1371	635.0231	539.8810	451.3004	298.7859	169.9916	122.2351 (83)
Total gains	785.8008	898.4500	1016.2475	1132.9319	1192.4216	1185.1444	1118.1202	1032.3132	966.6404	853.8155	769.0785	754.8808 (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	40.6975	40.7759	40.7759	41.0748	41.0023	41.3497	41.4778	41.4778	41.3497	41.0748	41.0748	41.0023
alpha	3.7132	3.7184	3.7184	3.7383	3.7335	3.7566	3.7652	3.7652	3.7566	3.7383	3.7383	3.7335
util living area	0.9765	0.9606	0.9281	0.8473	0.7105	0.5396	0.4314	0.4731	0.6978	0.8904	0.9609	0.9795 (86)
MIT	19.6010	19.8135	20.1185	20.5289	20.8173	20.9513	20.9832	20.9766	20.8664	20.4919	19.9879	19.5658 (87)
Th 2	20.0148	20.0165	20.0165	20.0229	20.0214	20.0288	20.0315	20.0315	20.0288	20.0229	20.0229	20.0214 (88)
util rest of house	0.9715	0.9526	0.9136	0.8169	0.6562	0.4631	0.3414	0.3786	0.6279	0.8616	0.9514	0.9752 (89)
MIT 2	18.7542	18.9637	19.2592	19.6494	19.8980	20.0043	20.0256	20.0228	19.9488	19.6249	19.1429	18.7247 (90)
Living area fraction	18.8947	19.1047	19.4017	19.7953	20.0505	20.1614	20.1844	20.1811	20.1010	19.7687	19.2830	18.8642 (92)
Temperature adjustment	18.8947	19.1047	19.4017	19.7953	20.0505	20.1614	20.1844	20.1811	20.1010	19.7687	19.2830	0.0000
adjusted MIT	18.8947	19.1047	19.4017	19.7953	20.0505	20.1614	20.1844	20.1811	20.1010	19.7687	19.2830	18.8642 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9643	0.9433	0.9027	0.8090	0.6580	0.4739	0.3560	0.3937	0.6335	0.8528	0.9424	0.9686 (94)
Ext temp.	757.7594	847.5065	917.3796	916.5353	784.5822	561.6845	398.0414	406.4350	612.3781	728.1353	724.7662	731.1582 (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	1629.1428	1581.3337	1454.9920	1193.4983	882.9243	583.0343	403.6501	414.5308	677.8839	1019.8965	1339.9338	1624.9552 (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	648.3093	493.1319	399.9836	199.4134	73.1665	0.0000	0.0000	0.0000	0.0000	217.0703	442.9207	664.9850 (98)
Space heating												3138.9806 (98)
Space heating per m2										(98) / (4) =		29.6186 (99)

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													3375.2480 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	648.3093	493.1319	399.9836	199.4134	73.1665	0.0000	0.0000	0.0000	0.0000	217.0703	442.9207	664.9850	(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)	697.1068	530.2494	430.0899	214.4230	78.6736	0.0000	0.0000	0.0000	0.0000	233.4090	476.2588	715.0376	(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	182.6625	160.2497	166.5313	146.8141	142.0491	124.3359	116.9900	131.7584	132.6188	152.3791	164.2052	177.4413	(64)
Efficiency of water heater (217)m	89.3229	89.2452	89.0969	88.7030	87.9972	87.0000	87.0000	87.0000	87.0000	88.7379	89.1684	89.3510	(216)
Fuel for water heating, kWh/month	204.4968	179.5611	186.9104	165.5120	161.4246	142.9148	134.4713	151.4464	152.4354	171.7181	184.1518	198.5889	(219)
Water heating fuel used												2033.6316	(219)
Annual totals kWh/year													
Space heating fuel - main system												3375.2480	(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)												434.0060	(232)
Total delivered energy for all uses												5917.8856	(238)

10a. Fuel costs - using BEDF prices (531)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3375.2480	10.2300	345.2879 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2033.6316	10.2300	208.0405 (247)
Pumps and fans for heating	75.0000	36.7200	27.5400 (249)
Energy for lighting	434.0060	36.7200	159.3670 (250)
Additional standing charges			103.0000 (251)
Total energy cost			843.2354 (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	3375.2480	0.2160	729.0536 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2033.6316	0.2160	439.2644 (264)
Space and water heating			1168.3180 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	434.0060	0.5190	225.2491 (268)
Total kg/year			1432.4921 (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	3375.2480	1.2200	4117.8026 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2033.6316	1.2200	2481.0306 (264)
Space and water heating			6598.8332 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	434.0060	3.0700	1332.3985 (268)
Primary energy kWh/year			8161.4816 (272)
Primary energy kWh/m2/year			77.0096 (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	+ 1.1	-£ 81	-183 kg (12.8%)
U Solar photovoltaic panels	+ 8.8	-£ 589	-833 kg (66.7%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£81	1.73 kg/m²	B 86 B 89
Solar photovoltaic panels	£589	7.86 kg/m²	A 95 A 97
Total Savings	£670	9.59 kg/m²	

Potential energy efficiency rating: A 95
Potential environmental impact rating: A 97

Fuel prices for cost data on this page from database revision number 531 TEST (31 Oct 2023)
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	£187	£205	-£18
Mains gas	£656	£557	£99
Space heating	£476	£476	£0
Water heating	£208	£127	£81
Lighting	£159	£159	£0
Generated (PV)	-£0	-£589	£589
Total cost of fuels	£843	£173	£670
Total cost of uses	£843	£173	£670
Delivered energy	56 kWh/m²	32 kWh/m²	24 kWh/m²
Carbon dioxide emissions	1.4 tonnes	0.4 tonnes	1.0 tonnes
CO2 emissions per m²	14 kg/m²	4 kg/m²	10 kg/m²
Primary energy	77 kWh/m²	21 kWh/m²	56 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	52.9900 (1b)	x 2.4300 (2b)	= 128.7657 (1b) - (3b)
First floor	52.9900 (1c)	x 2.6500 (2c)	= 140.4235 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	105.9800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 269.1892 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.1486 (8)
Pressure test					Yes
Measured/design AP50					3.9800
Infiltration rate					0.3476 (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) =	0.2955 (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	0.3767	0.3693	0.3619	0.3250	0.3176	0.2807	0.2807	0.2733	0.2955	0.3176	0.3324	0.3472 (22b)
Effective ac	0.5710	0.5682	0.5655	0.5528	0.5504	0.5394	0.5394	0.5373	0.5436	0.5504	0.5552	0.5603 (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)			14.4700	1.2357	17.8812		(27)
gf			52.9900	0.1500	7.9485	75.0000	3974.2501 (28a)
external	104.7000	16.6200	88.0800	0.2000	17.6160	60.0000	5284.7998 (29a)
cold	52.9900		52.9900	0.0900	4.7691	9.0000	476.9100 (30)
Total net area of external elements Aum(A, m ²)			210.6800				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		51.2248		(33)
party			52.3200	0.0000	0.0000	70.0000	3662.4000 (32)
gf			97.6860			9.0000	879.1740 (32c)
1f			123.0000			9.0000	1107.0000 (32c)
1f			52.9900			18.0000	953.8200 (32d)
gf			52.9900			9.0000	476.9100 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 16815.2640 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 158.6645 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 14.0026 (36)
Total fabric heat loss (33) + (36) = 65.2273 (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	50.7192	50.4744	50.2345	49.1077	48.8969	47.9154	47.9154	47.7337	48.2935	48.8969	49.3234	49.7693 (38)
Heat transfer coeff	115.9465	115.7018	115.4619	114.3350	114.1242	113.1428	113.1428	112.9610	113.5208	114.1242	114.5507	114.9966 (39)
Average = Sum(39)m / 12 =												114.3340 (39)
HLP	1.0940	1.0917	1.0895	1.0788	1.0768	1.0676	1.0676	1.0659	1.0712	1.0768	1.0809	1.0851 (40)
HLP (average)												1.0788 (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												2.7884 (42)
Average daily hot water use (litres/day)												100.4249 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	110.4674	106.4504	102.4334	98.4164	94.3994	90.3824	90.3824	94.3994	98.4164	102.4334	106.4504	110.4674 (44)
Energy content (annual)	163.8200	143.2780	147.8501	128.8993	123.6819	106.7281	98.8993	113.4884	114.8438	133.8394	146.0961	158.6509 (45)
	Total = Sum(45)m =											1580.0753 (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	24.5730	21.4917	22.1775	19.3349	18.5523	16.0092	14.8349	17.0233	17.2266	20.0759	21.9144	23.7976 (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	18.8425	16.9717	18.6812	17.9148	18.3672	17.6078	18.0908	18.2700	17.7751	18.5397	18.1091	18.7903 (61)
Total heat required for water heating calculated for each month	182.6625	160.2497	166.5313	146.8141	142.0491	124.3359	116.9900	131.7584	132.6188	152.3791	164.2052	177.4413 (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												1.1478 (H8)
Utilisation factor												0.5816 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												100.4249 (H14)
Volume ratio Veff/V												0.7468 (H15)
Solar storage volume factor												0.9416 (H16)
Solar input	-25.3231	-42.2569	-71.9684	-96.4518	-119.1581	-117.1514	-115.6032	-101.0031	-79.1057	-54.0199	-30.0368	-873.2696 (H17)
Solar input (sum of months) = Sum (63)m =												-873.2696 (63)
Output from w/h	157.3395	117.9928	94.5629	50.3622	22.8910	7.1845	1.3868	30.7553	53.5131	98.3592	134.1684	156.2502 (64)
Total per year (kWh/year) = Sum (64)m =												924.7658 (64)
Heat gains from water heating, kWh/month	59.1808	51.8829	53.8305	47.3377	45.7160	39.8890	37.4067	42.3024	42.6293	49.1365	53.1042	57.4490 (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	167.3051	167.3051	167.3051	167.3051	167.3051	167.3051	167.3051	167.3051	167.3051	167.3051	167.3051	167.3051	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	61.4380	54.5687	44.3783	33.5972	25.1143	21.2026	22.9101	29.7794	39.9699	50.7509	59.2338	63.1456	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	396.4907	400.6050	390.2370	368.1648	340.3026	314.1160	296.6218	292.5075	302.8755	324.9477	352.8099	378.9964	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.5189	54.5189	54.5189	54.5189	54.5189	54.5189	54.5189	54.5189	54.5189	54.5189	54.5189	54.5189	(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)	-111.5367	-111.5367	-111.5367	-111.5367	-111.5367	-111.5367	-111.5367	-111.5367	-111.5367	-111.5367	-111.5367	-111.5367	(71)
Water heating gains (Table 5)	79.5441	77.2067	72.3528	65.7468	61.4463	55.4014	50.2778	56.8580	59.2074	66.0437	73.7559	77.2164	(72)
Total internal gains	650.7601	645.6677	620.2553	580.7961	540.1505	504.0073	483.0971	492.4322	515.3400	555.0296	599.0869	632.6457	(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					7.2700	11.2829	0.4600	0.0000			1.0000			37.7324 (75)
Southwest					7.2000	36.7938	0.4600	0.0000			1.0000			121.8612 (79)

Solar gains	159.5936	284.3801	422.3916	579.1635	699.6428	716.9864	681.9283	588.6203	476.1426	323.2765	193.4387	135.1020 (83)		
Total gains	810.3536	930.0477	1042.6470	1159.9596	1239.7933	1220.9937	1165.0253	1081.0525	991.4826	878.3062	792.5256	767.7477 (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	40.2850	40.3702	40.4541	40.8528	40.9283	41.2833	41.2833	41.3497	41.1458	40.9283	40.7759	40.6178	
alpha	3.6857	3.6913	3.6969	3.7235	3.7286	3.7522	3.7522	3.7566	3.7431	3.7286	3.7184	3.7079	
util living area	0.9761	0.9599	0.9266	0.8516	0.7234	0.5560	0.4171	0.4642	0.6880	0.8886	0.9610	0.9801	(86)
MIT	19.5522	19.7730	20.1037	20.4979	20.7912	20.9424	20.9848	20.9774	20.8714	20.4839	19.9464	19.5054	(87)
Th 2	20.0057	20.0076	20.0094	20.0182	20.0198	20.0274	20.0274	20.0288	20.0245	20.0198	20.0165	20.0130	(88)
util rest of house	0.9713	0.9519	0.9119	0.8228	0.6733	0.4832	0.3293	0.3730	0.6177	0.8600	0.9519	0.9760	(89)
MIT 2	18.6986	18.9164	19.2387	19.6161	19.8741	19.9968	20.0221	20.0202	19.9480	19.6139	19.0966	18.6583	(90)
Living area fraction									fLA = Living area / (4) =			0.1659	(91)
MIT	18.8402	19.0585	19.3822	19.7624	20.0262	20.1536	20.1818	20.1790	20.1011	19.7582	19.2375	18.7988	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8402	19.0585	19.3822	19.7624	20.0262	20.1536	20.1818	20.1790	20.1011	19.7582	19.2375	18.7988	(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	0.9639	0.9425	0.9009	0.8143	0.6737	0.4931	0.3435	0.3875	0.6236	0.8511	0.9428	0.9694	(94)
Useful gains	781.1276	876.5474	939.3381	944.6033	835.2109	602.0114	400.1898	418.9107	618.3188	747.5506	747.1836	744.2539	(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													
	1685.8878	1638.1662	1487.3977	1241.9503	950.2252	628.3510	405.2497	426.8805	681.2545	1045.1730	1390.3643	1678.8152	(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													
	673.1415	511.8079	407.7563	214.0898	85.5706	0.0000	0.0000	0.0000	0.0000	221.4311	463.0901	695.3136	(98)
Space heating													
Space heating per m2													
											(98) / (4) =	30.8756	(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													3518.4958	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	673.1415	511.8079	407.7563	214.0898	85.5706	0.0000	0.0000	0.0000	0.0000	221.4311	463.0901	695.3136	(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)	723.8081	550.3311	438.4477	230.2041	92.0114	0.0000	0.0000	0.0000	0.0000	238.0979	497.9464	747.6490	(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	157.3395	117.9928	94.5629	50.3622	22.8910	7.1845	1.3868	30.7553	53.5131	98.3592	134.1684	156.2502	(64)	
Efficiency of water heater	89.4158	89.4223	89.4195	89.4128	89.3497	87.0000	87.0000	87.0000	87.0000	89.0555	89.3082	89.4341	(217)	
Fuel for water heating, kWh/month	175.9637	131.9501	105.7520	56.3255	25.6195	8.2580	1.5941	35.3509	61.5094	110.4471	150.2307	174.7097	(219)	
Water heating fuel used												1037.7107	(219)	
Annual totals kWh/year														
Space heating fuel - main system													3518.4958	(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)													434.0060	(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													3387.9731	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3518.4958	3.4800	122.4437	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1037.7107	3.4800	36.1123	(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	434.0060	13.1900	57.2454	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-1727.2394	13.1900	-227.8229	(252)
Total energy cost			124.4660	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.3462	(257)
SAP value		95.1699	
SAP rating (Section 12)		95	(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	3518.4958	0.2160	759.9951 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1037.7107	0.2160	224.1455 (264)
Space and water heating			984.1406 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	434.0060	0.5190	225.2491 (268)
Energy saving/generation technologies			
PV Unit			
Total kg/year	-1727.2394	0.5190	-896.4372 (269)
CO2 emissions per m2			377.8275 (272)
EI value			3.5700 (273)
EI rating			96.6466
EI band			97 (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	52.9900 (1b)	x 2.4300 (2b)	= 128.7657 (1b) - (3b)
First floor	52.9900 (1c)	x 2.6500 (2c)	= 140.4235 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	105.9800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 269.1892 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.1486 (8)
Pressure test					Yes
Measured/design AP50					3.9800
Infiltration rate					0.3476 (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) =		0.2955 (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	0.3398	0.3324	0.3324	0.3028	0.3102	0.2733	0.2585	0.2585	0.2733	0.3028	0.3028	0.3102 (22b)
Effective ac	0.5577	0.5552	0.5552	0.5459	0.5481	0.5373	0.5334	0.5334	0.5373	0.5459	0.5459	0.5481 (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)			14.4700	1.2357	17.8812		(27)
gf			52.9900	0.1500	7.9485	75.0000	3974.2501 (28a)
external	104.7000	16.6200	88.0800	0.2000	17.6160	60.0000	5284.7998 (29a)
cold	52.9900		52.9900	0.0900	4.7691	9.0000	476.9100 (30)
Total net area of external elements Aum(A, m ²)			210.6800				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		51.2248		(33)
party			52.3200	0.0000	0.0000	70.0000	3662.4000 (32)
gf			97.6860			9.0000	879.1740 (32c)
lf			123.0000			9.0000	1107.0000 (32c)
lf			52.9900			18.0000	953.8200 (32d)
gf			52.9900			9.0000	476.9100 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 16815.2640 (34)
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 158.6645 (35)
 Thermal bridges (Sum(L x Psi) calculated using Appendix K) 14.0026 (36)
 Total fabric heat loss (33) + (36) = 65.2273 (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	49.5439	49.3234	49.3234	48.4898	48.6909	47.7337	47.3847	47.3847	47.7337	48.4898	48.4898	48.6909 (38)
Heat transfer coeff	114.7712	114.5507	114.5507	113.7171	113.9182	112.9610	112.6121	112.6121	112.9610	113.7171	113.7171	113.9182 (39)
Average = Sum(39)m / 12 =												113.6672 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0830	1.0809	1.0809	1.0730	1.0749	1.0659	1.0626	1.0626	1.0659	1.0730	1.0730	1.0749 (40)
HLP (average)												1.0725 (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												2.7884 (42)
Average daily hot water use (litres/day)												100.4249 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	110.4674	106.4504	102.4334	98.4164	94.3994	90.3824	90.3824	94.3994	98.4164	102.4334	106.4504	110.4674 (44)
Energy conte	163.8200	143.2780	147.8501	128.8993	123.6819	106.7281	98.8993	113.4884	114.8438	133.8394	146.0961	158.6509 (45)
Energy content (annual)										Total = Sum(45)m =		1580.0753 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Distribution loss (46)m = 0.15 x (45)m	24.5730	21.4917	22.1775	19.3349	18.5523	16.0092	14.8349	17.0233	17.2266	20.0759	21.9144	23.7976 (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	18.8425	16.9717	18.6812	17.9148	18.3672	17.6078	18.0908	18.2700	17.7751	18.5397	18.1091	18.7903 (61)
Total heat required for water heating calculated for each month	182.6625	160.2497	166.5313	146.8141	142.0491	124.3359	116.9900	131.7584	132.6188	152.3791	164.2052	177.4413 (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												1.0667 (H8)
Utilisation factor												0.6084 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												100.4249 (H14)
Volume ratio Veff/V												0.7468 (H15)
Solar storage volume factor												0.9416 (H16)
Solar input												-848.9893 (H17)
Solar input	-22.4154	-39.2941	-70.5821	-96.1915	-116.2136	-116.4267	-112.6165	-96.9123	-78.4364	-52.2301	-27.6134	-20.0571 (63)
Solar input (sum of months) = Sum (63)m =												-848.9893 (63)
Output from w/h	160.2471	120.9557	95.9492	50.6225	25.8355	7.9092	4.3735	34.8460	54.1824	100.1490	136.5918	157.3841 (64)
Total per year (kWh/year) = Sum (64)m =												949.0461 (64)
Heat gains from water heating, kWh/month	59.1808	51.8829	53.8305	47.3377	45.7160	39.8890	37.4067	42.3024	42.6293	49.1365	53.1042	57.4490 (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	167.3051	167.3051	167.3051	167.3051	167.3051	167.3051	167.3051	167.3051	167.3051	167.3051	167.3051	167.3051	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	61.4380	54.5687	44.3783	33.5972	25.1143	21.2026	22.9101	29.7794	39.9699	50.7509	59.2338	63.1456	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	396.4907	400.6050	390.2370	368.1648	340.3026	314.1160	296.6218	292.5075	302.8755	324.9477	352.8099	378.9964	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.5189	54.5189	54.5189	54.5189	54.5189	54.5189	54.5189	54.5189	54.5189	54.5189	54.5189	54.5189	(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)	-111.5367	-111.5367	-111.5367	-111.5367	-111.5367	-111.5367	-111.5367	-111.5367	-111.5367	-111.5367	-111.5367	-111.5367	(71)
Water heating gains (Table 5)	79.5441	77.2067	72.3528	65.7468	61.4463	55.4014	50.2778	56.8580	59.2074	66.0437	73.7559	77.2164	(72)
Total internal gains	650.7601	645.6677	620.2553	580.7961	540.1505	504.0073	483.0971	492.4322	515.3400	555.0296	599.0869	632.6457	(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					7.2700	9.5471	0.4600	0.0000			1.0000			31.9274 (75)
Southwest					7.2000	31.1332	0.4600	0.0000			1.0000			103.1133 (79)
Solar gains	135.0407	252.7823	395.9922	552.1358	652.2711	681.1371	635.0231	539.8810	451.3004	298.7859	169.9916	122.2351 (83)		
Total gains	785.8008	898.4500	1016.2475	1132.9319	1192.4216	1185.1444	1118.1202	1032.3132	966.6404	853.8155	769.0785	754.8808 (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	40.6975	40.7759	40.7759	41.0748	41.0023	41.3497	41.4778	41.4778	41.3497	41.0748	41.0748	41.0023	
alpha	3.7132	3.7184	3.7184	3.7383	3.7335	3.7566	3.7652	3.7652	3.7566	3.7383	3.7383	3.7335	
util living area	0.9765	0.9606	0.9281	0.8473	0.7105	0.5396	0.4314	0.4731	0.6978	0.8904	0.9609	0.9795	(86)
MIT	19.6010	19.8135	20.1185	20.5289	20.8173	20.9513	20.9832	20.9766	20.8664	20.4919	19.9879	19.5658	(87)
Th 2	20.0148	20.0165	20.0165	20.0229	20.0214	20.0288	20.0315	20.0315	20.0288	20.0229	20.0229	20.0214	(88)
util rest of house	0.9715	0.9526	0.9136	0.8169	0.6562	0.4631	0.3414	0.3786	0.6279	0.8616	0.9514	0.9752	(89)
MIT 2	18.7542	18.9637	19.2592	19.6494	19.8980	20.0043	20.0256	20.0228	19.9488	19.6249	19.1429	18.7247	(90)
Living area fraction									fLA = Living area / (4) =			0.1659	(91)
MIT	18.8947	19.1047	19.4017	19.7953	20.0505	20.1614	20.1844	20.1811	20.1010	19.7687	19.2830	18.8642	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8947	19.1047	19.4017	19.7953	20.0505	20.1614	20.1844	20.1811	20.1010	19.7687	19.2830	18.8642	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9643	0.9433	0.9027	0.8090	0.6580	0.4739	0.3560	0.3937	0.6335	0.8528	0.9424	0.9686 (94)
Useful gains	757.7594	847.5065	917.3796	916.5353	784.5822	561.6845	398.0414	406.4350	612.3781	728.1353	724.7662	731.1582 (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	1629.1428	1581.3337	1454.9920	1193.4983	882.9243	583.0343	403.6501	414.5308	677.8839	1019.8965	1339.9338	1624.9552 (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	648.3093	493.1319	399.9836	199.4134	73.1665	0.0000	0.0000	0.0000	0.0000	217.0703	442.9207	664.9850 (98)
Space heating												3138.9806 (98)
Space heating per m2												29.6186 (99)
										(98) / (4) =		

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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	3375.2480	1.2200	4117.8026 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1065.4682	1.2200	1299.8712 (264)
Space and water heating			5417.6738 (265)
Pumps and fans	125.0000	3.0700	383.7500 (267)
Energy for lighting	434.0060	3.0700	1332.3985 (268)
Energy saving/generation technologies			
PV Unit	-1605.1846	3.0700	-4927.9167 (269)
Primary energy kWh/year			2205.9055 (272)
Primary energy kWh/m2/year			20.8144 (273)

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

Overheating Calculation Input Data

Dwelling type	SemiDetached 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	158.7 (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	355.33 (P1)
Transmission heat loss coefficient	65.23 (37)
Summer heat loss coefficient	420.56 (P2)

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

Solar shading	Z blinds	Solar access	Z overhangs	Z summer
Orientation				
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	7.2700	89.6552	0.4600	0.0000	1.0000	299.8248
South West	7.2000	112.1012	0.4600	0.0000	1.0000	371.2792
total:						671.1040

Solar gains	Jun 728	Jul 671	Aug 570	(P4)
Internal gains	501	480	489	
Total summer gains	1229	1151	1059	(P5)
Summer gain/loss ratio	2.92	2.74	2.52	(P6)
Summer external temperature	14.70	16.40	16.30	
Thermal mass temperature increment (TMP = 158.7)	0.89	0.89	0.89	
Threshold temperature	18.51	20.03	19.71	(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 009	Issued on Date	10/11/2023
Assessment Reference	9 Chain	Prop Type Ref	22186
Property	1f Chain Road, MANCHESTER, M9 6AJ		
SAP Rating	85 B	DER	16.03
Environmental	87 B	TER	16.78
CO ₂ Emissions (t/year)	1.43	% DER<TER	4.50
General Requirements Compliance	Pass	DFEE	42.88
		TFEE	50.23
		% DFEE<TFEE	14.63
Assessor Details	Mr. Ryan Gallacher, Ryan Gallacher, Tel: 01904217325, ryan.gallacher@jspsustainability.co.uk		Assessor ID
			AU40-0001
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)	16.78	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	16.03	kgCO ₂ /m ²	Pass
	-0.75 (-4.5%)	kgCO ₂ /m ²	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	50.23	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DFEE)	42.88	kWh/m ² /yr	
	-7.3 (-14.5%)	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	3.98 (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

7.27 m², No overhang

Windows facing South West

7.20 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

3.98 (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

Air permeability

4.0

m³/m²h

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 009	Issued on Date	10/11/2023
Assessment Reference	9 Chain	Prop Type Ref	22186
Property	1f Chain Road, MANCHESTER, M9 6AJ		
SAP Rating	85 B	DER	16.03
Environmental	87 B	TER	16.78
CO ₂ Emissions (t/year)	1.43	% DER<TER	4.50
General Requirements Compliance	Pass	DFEE	42.88
		TFEE	50.23
		% DFEE<TFEE	14.63
Assessor Details	Mr. Ryan Gallacher, Ryan Gallacher, Tel: 01904217325, ryan.gallacher@jspsustainability.co.uk		Assessor ID
			AU40-0001
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, Semi-Detached						
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	52.99 m ²	2.43 m		
	1st Storey:		1.00 m	52.99 m ²	2.65 m		
7.0 Living Area	17.58			m ²			
8.0 Thermal Mass Parameter	Precise calculation						
Thermal Mass	158.66			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	104.70	88.08
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	52.32	
9.2 Internal Walls							
Description	Construction				Kappa (kJ/m ² K)	Area (m ²)	
gf	Plasterboard on timber frame					9.00	97.69
1f	Plasterboard on timber frame					9.00	123.00
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	52.99	52.99

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

10.2 Internal Ceilings

Description	Construction	Kappa (kJ/m ² K)	Area (m ²)
gf	Other	9.00	52.99

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Area (m ²)
gf	Ground Floor - Solid	Suspended concrete floor, carpeted	0.15	75.00	52.99

11.2 Internal Floors

Description	Construction	Kappa (kJ/m ² K)	Area (m ²)
1f	Plasterboard ceiling, carpeted chipboard floor	18.00	52.99

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m ² K)
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 (m ²)	Curtain Closed
Front	Solid Door	[1] external	North East							2.15	
front	Window	[1] external	North East	None	0.00					7.27	
rear	Window	[1] external	South West	None	0.00					7.20	

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	10.36	0.358	No
Independently assessed	E3 Sill	7.75	0.020	No
Independently assessed	E4 Jamb	25.05	0.016	No
Independently assessed	E5 Ground floor (normal)	20.59	0.108	No
Independently assessed	E6 Intermediate floor within a dwelling	20.59	0.000	No
Independently assessed	E10 Eaves (insulation at ceiling level)	10.29	0.122	No
Independently assessed	E12 Gable (insulation at ceiling level)	10.30	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	10.29	0.160	No
Table K1 - Default	P2 Party wall - Intermediate floor within a dwelling	10.29	0.000	No
Independently assessed	P4 Party wall - Roof (insulation at ceiling level)	10.29	0.182	No

Y-value	0.066	W/m ² K
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18.0 Pressure Testing

Designed AP ₅₀	Yes	
Property Tested ?	5.00	m ³ /(h.m ²) @ 50 Pa
As Built AP ₅₀	Yes	
	3.98	m ³ /(h.m ²) @ 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				4
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	£81	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	£589	A 95	

Energy performance certificate (EPC)

1f Chain Road
MANCHESTER
M9 6AJ

Energy rating

B

Valid until: **9 November 2033**

Certificate number: **2837-6139-7309-0080-2292**

Property type Semi-detached house

Total floor area 106 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 current 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		95 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 4.0 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 77 kilowatt hours per square metre (kWh/m²).

How this affects your energy bills

An average household would need to spend **£843 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 £81 per year** if you complete the suggested steps for improving this property's energy rating.

This is **based on average costs in 2023** 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:

- 3,139 kWh per year for heating
 - 1,798 kWh per year for hot water
-

Impact on the environment

This property's current 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. CO₂ harms the environment.

Carbon emissions

An average household produces 6 tonnes of CO₂

This property produces 1.4 tonnes of CO₂

This property's potential production 0.4 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	£81
2. Solar photovoltaic panels	£3,500 - £5,500	£589

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	Ryan Gallacher
Telephone	01904 435 325
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/027185
Telephone	01455 883 250
Email	enquiries@elmhurstenergy.co.uk

About this assessment

Assessor's declaration	No related party
Date of assessment	10 November 2023
Date of certificate	10 November 2023
Type of assessment	SAP
