

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: 86.9m²

Site Reference : Chain Road

Plot Reference: Plot 008

Address : Plot 008, Chain Road, Manchester, M9

Client Details:

Name: Great Places

Address :

This report covers items included within the SAP calculations.

It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Mains gas

Fuel factor: 1.00 (mains gas)

Target Carbon Dioxide Emission Rate (TER) 17.76 kg/m²

Dwelling Carbon Dioxide Emission Rate (DER) 17.16 kg/m²

OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 50.4 kWh/m²

Dwelling Fabric Energy Efficiency (DFEE) 44.4 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	

Regulations Compliance Report

5 Cylinder insulation

Hot water Storage: No cylinder

6 Controls

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

No cylinder
 Boiler interlock: Yes **OK**

7 Low energy lights

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

8 Mechanical ventilation

Not applicable

9 Summertime temperature

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

Based on:

Overshading: Very Little
 Windows facing: North East 5.85m²
 Windows facing: South West 7.1m²
 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 008
Chain Road
Manchester
M9

Assessor Number: STRO027495

Buiding regulation assessment

	kg/m ² /year
TER	17.76
DER	17.16

ENE 1 Assessment - Dwelling Emission Rate

Total Energy Type CO₂ Emissions for Codes Levels 1 - 5

	%	kg/m ² /year	
DER from SAP 2012 DER Worksheet		17.16	(ZC1)
TER		17.76	
Residual CO2 emissions offset from biofuel CHP		0	(ZC5)
CO2 emissions offset from additional allowable electricity generation		0	(ZC7)
Total CO2 emissions offset from SAP Section 16 allowances		0	
DER accounting for SAP Section 16 allowances		17.16	
% improvement DER/TER	3.4		

Total Energy Type CO2 Emissions for Codes Levels 6

	kg/m ² /year	
DER accounting for SAP Section 16 allowances	17.16	(ZC1)
CO2 emissions from appliances, equation (L14)	15.84	(ZC2)
CO2 emissions from cooking, equation (L16)	2.08	(ZC3)
Net CO2 emissions	36.2	(ZC8)

Result:

Credits awarded for ENE 1 = 0.5

Code Level = 3

ENE 2 - Fabric energy Efficiency

Fabric energy Efficiency: 44.42

Credits awarded for ENE 2 = 7.4

ENE 7 - Low or Zero Carbon (LZC) Technologies

Reduction in CO2 Emissions

	%	kg/m ² /year	
Standard Case CO2 emissions		36.19	
Standard DER		18.26	
Actual Case CO2 emissions		36.19	
Actual DER		18.26	
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 008

Address : Plot 008, Chain Road, Manchester, M9

1. Overall dwelling dimensions:

	Area(m ²)		Av. Height(m)		Volume(m ³)
Ground floor	43.45 (1a)	x	2.42 (2a)	=	105.15 (3a)
First floor	43.45 (1b)	x	2.69 (2b)	=	116.88 (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	86.9 (4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	222.03 (5)

2. Ventilation rate:

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

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.14 (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)			0.39 (18)
<i>Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used</i>			
Number of sides sheltered			2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.85 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.33 (21)

Infiltration rate modified for monthly wind speed

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

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

Wind Factor (22a)m = (22)m ÷ 4

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

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

If mechanical ventilation:

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

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

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

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			2.15	x 1.4	= 3.01		(26)
Windows Type 1			5.85	x 1/[1/(1.3)+0.04]	= 7.23		(27)
Windows Type 2			7.1	x 1/[1/(1.3)+0.04]	= 8.77		(27)
Floor			43.45	x 0.15	= 6.5175	75	3258.75 (28)
Walls	95.57	15.1	80.47	x 0.2	= 16.09	60	4828.2 (29)
Roof	43.45	0	43.45	x 0.09	= 3.91	9	391.05 (30)
Total area of elements, m²			182.47				(31)
Party wall			43.76	x 0	= 0	70	3063.2 (32)
Internal wall **			80.7			9	726.3 (32c)
Internal wall **			102.81			9	925.3062 (32c)
Internal floor			43.45			18	782.1 (32d)
Internal ceiling			43.45			9	391.05 (32e)

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

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

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 45.53 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 14365.96 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 165.32 (35)

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

SAP WorkSheet: New dwelling design stage

can be used instead of a detailed calculation.

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

12.8 (36)

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

Total fabric heat loss

(33) + (36) =

58.34 (37)

Ventilation heat loss calculated monthly

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

(38)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
43.02	42.77	42.53	41.38	41.17	40.18	40.18	39.99	40.56	41.17	41.6	42.05

(38)

Heat transfer coefficient, W/K

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

(39)m=

101.35	101.11	100.86	99.72	99.51	98.51	98.51	98.33	98.9	99.51	99.94	100.39
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Average = Sum(39)_{1...12} / 12 =

99.72 (39)

Heat loss parameter (HLP), W/m²K

(40)m = (39)m ÷ (4)

(40)m=

1.17	1.16	1.16	1.15	1.15	1.13	1.13	1.13	1.14	1.15	1.15	1.16
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Average = Sum(40)_{1...12} / 12 =

1.15 (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

2.58 (42)

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

if TFA ≤ 13.9, N = 1

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

95.5 (43)

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

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

(44)m=

105.05	101.23	97.41	93.59	89.77	85.95	85.95	89.77	93.59	97.41	101.23	105.05
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Total = Sum(44)_{1...12} =

1145.95 (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=

155.78	136.25	140.59	122.57	117.61	101.49	94.04	107.92	109.21	127.27	138.93	150.86
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Total = Sum(45)_{1...12} =

1502.52 (45)

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

(46)m=

23.37	20.44	21.09	18.39	17.64	15.22	14.11	16.19	16.38	19.09	20.84	22.63
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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)

SAP WorkSheet: New dwelling design stage

Energy lost from water storage, kWh/year

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

0
0

(54)

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

(55)

Water storage loss calculated for each month

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

(56)m=

0	0	0	0	0	0	0	0	0	0	0	0
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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	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	0
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(59)

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

(61)m=

18.76	16.9	18.57	17.79	18.25	17.51	18	18.17	17.67	18.44	18.04	18.71
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(61)

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

(62)m=

174.54	153.15	159.16	140.36	135.87	119	112.05	126.08	126.87	145.71	156.96	169.58
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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	0
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(63)

Output from water heater

(64)m=

174.54	153.15	159.16	140.36	135.87	119	112.05	126.08	126.87	145.71	156.96	169.58
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Output from water heater (annual)_{1...12}

1719.34 (64)

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

(65)m=

56.49	49.53	51.39	45.2	43.67	38.12	35.77	40.42	40.73	46.93	50.7	54.84
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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

(66)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
154.85	154.85	154.85	154.85	154.85	154.85	154.85	154.85	154.85	154.85	154.85	154.85

(66)

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

(67)m=

53.12	47.18	38.37	29.05	21.71	18.33	19.81	25.75	34.56	43.88	51.21	54.6
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(67)

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

(68)m=

348.15	351.76	342.65	323.27	298.81	275.82	260.45	256.84	265.95	285.33	309.79	332.78
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(68)

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

(69)m=

53.07	53.07	53.07	53.07	53.07	53.07	53.07	53.07	53.07	53.07	53.07	53.07
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(69)

Pumps and fans gains (Table 5a)

(70)m=

3	3	3	3	3	3	3	3	3	3	3	3
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(70)

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

(71)m=

-103.23	-103.23	-103.23	-103.23	-103.23	-103.23	-103.23	-103.23	-103.23	-103.23	-103.23	-103.23
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(71)

Water heating gains (Table 5)

(72)m=

75.92	73.7	69.07	62.78	58.7	52.95	48.08	54.33	56.57	63.07	70.42	73.71
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(72)

Total internal gains =

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

(73)m=

584.87	580.32	557.78	522.79	486.9	454.78	436.02	444.61	464.75	499.96	539.11	568.77
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(73)

6. Solar gains:

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

SAP WorkSheet: New dwelling design stage

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast 0.9x	1	x	5.85	x	11.28	x	0.46	x	1.11	=	30.36	(75)
Northeast 0.9x	1	x	5.85	x	22.97	x	0.46	x	1.11	=	61.8	(75)
Northeast 0.9x	1	x	5.85	x	41.38	x	0.46	x	1.11	=	111.35	(75)
Northeast 0.9x	1	x	5.85	x	67.96	x	0.46	x	1.11	=	182.87	(75)
Northeast 0.9x	1	x	5.85	x	91.35	x	0.46	x	1.11	=	245.81	(75)
Northeast 0.9x	1	x	5.85	x	97.38	x	0.46	x	1.11	=	262.06	(75)
Northeast 0.9x	1	x	5.85	x	91.1	x	0.46	x	1.11	=	245.15	(75)
Northeast 0.9x	1	x	5.85	x	72.63	x	0.46	x	1.11	=	195.44	(75)
Northeast 0.9x	1	x	5.85	x	50.42	x	0.46	x	1.11	=	135.68	(75)
Northeast 0.9x	1	x	5.85	x	28.07	x	0.46	x	1.11	=	75.53	(75)
Northeast 0.9x	1	x	5.85	x	14.2	x	0.46	x	1.11	=	38.2	(75)
Northeast 0.9x	1	x	5.85	x	9.21	x	0.46	x	1.11	=	24.8	(75)
Southwest 0.9x	1	x	7.1	x	36.79		0.46	x	1.11	=	120.17	(79)
Southwest 0.9x	1	x	7.1	x	62.67		0.46	x	1.11	=	204.69	(79)
Southwest 0.9x	1	x	7.1	x	85.75		0.46	x	1.11	=	280.07	(79)
Southwest 0.9x	1	x	7.1	x	106.25		0.46	x	1.11	=	347.02	(79)
Southwest 0.9x	1	x	7.1	x	119.01		0.46	x	1.11	=	388.69	(79)
Southwest 0.9x	1	x	7.1	x	118.15		0.46	x	1.11	=	385.88	(79)
Southwest 0.9x	1	x	7.1	x	113.91		0.46	x	1.11	=	372.03	(79)
Southwest 0.9x	1	x	7.1	x	104.39		0.46	x	1.11	=	340.94	(79)
Southwest 0.9x	1	x	7.1	x	92.85		0.46	x	1.11	=	303.25	(79)
Southwest 0.9x	1	x	7.1	x	69.27		0.46	x	1.11	=	226.23	(79)
Southwest 0.9x	1	x	7.1	x	44.07		0.46	x	1.11	=	143.93	(79)
Southwest 0.9x	1	x	7.1	x	31.49		0.46	x	1.11	=	102.84	(79)

Solar gains in watts, calculated for each month

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

(83)m= 150.53 266.5 391.42 529.89 634.5 647.94 617.18 536.38 438.94 301.76 182.14 127.63 (83)

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

(84)m= 735.4 846.82 949.2 1052.67 1121.4 1102.72 1053.21 980.98 903.69 801.72 721.25 696.41 (84)

7. Mean internal temperature (heating season)

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

21 (85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(86)m=	0.97	0.95	0.92	0.84	0.71	0.54	0.4	0.45	0.67	0.87	0.95	0.98

(86)

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

(87)m= 19.56 19.79 20.13 20.52 20.8 20.95 20.99 20.98 20.88 20.51 19.97 19.52 (87)

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

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

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

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

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

(90)m=	18.66	18.89	19.21	19.58	19.83	19.95	19.97	19.97	19.9	19.58	19.07	18.62	(90)
--------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------	-------	-------	------

fLA = Living area ÷ (4) =

0.15 (91)

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

(92)m=	18.8	19.03	19.35	19.73	19.98	20.1	20.13	20.12	20.05	19.73	19.21	18.76	(92)
--------	------	-------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------	------

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

(93)m=	18.8	19.03	19.35	19.73	19.98	20.1	20.13	20.12	20.05	19.73	19.21	18.76	(93)
--------	------	-------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------	------

8. Space heating requirement

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

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

Utilisation factor for gains, hm:

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

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

(95)m=	704.26	790.13	842.17	837.53	731.59	521.25	343.51	360.18	539.97	667.09	673.12	671.25	(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=	1469.59	1428.28	1296.29	1079.72	823.84	541.86	347.37	366.2	588.71	908.12	1209.91	1461.7	(97)
--------	---------	---------	---------	---------	--------	--------	--------	-------	--------	--------	---------	--------	------

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

(98)m=	569.41	428.84	337.87	174.38	68.64	0	0	0	0	179.32	386.49	588.09	
Total per year (kWh/year) = Sum(98) _{1...5,9...12} =												2733.03	(98)

Space heating requirement in kWh/m²/year

31.45 (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)

569.41	428.84	337.87	174.38	68.64	0	0	0	0	179.32	386.49	588.09
--------	--------	--------	--------	-------	---	---	---	---	--------	--------	--------

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

612.26	461.12	363.3	187.5	73.81	0	0	0	0	192.82	415.58	632.36
--------	--------	-------	-------	-------	---	---	---	---	--------	--------	--------

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

2938.74 (211)

Space heating fuel (secondary), kWh/month

= {[[(98)m x (201)] } x 100 ÷ (208)

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

Water heating

Output from water heater (calculated above)

174.54	153.15	159.16	140.36	135.87	119	112.05	126.08	126.87	145.71	156.96	169.58
--------	--------	--------	--------	--------	-----	--------	--------	--------	--------	--------	--------

Efficiency of water heater

87 (216)

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(217)m=

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

 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=

195.5	171.71	178.8	158.36	154.42	136.79	128.79	144.92	145.83	164.4	176.14	189.87
-------	--------	-------	--------	--------	--------	--------	--------	--------	-------	--------	--------

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

1945.53

 (219)

Annual totals

	kWh/year	kWh/year
Space heating fuel used, main system 1		2938.74
Water heating fuel used		1945.53

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 375.24 (232)

Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) = 5334.52 (338)

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 =	102.27 (240)
Space heating - main system 2	(213) x	0 x 0.01 =	0 (241)
Space heating - secondary	(215) x	13.19 x 0.01 =	0 (242)
Water heating cost (other fuel)	(219)	3.48 x 0.01 =	67.7 (247)
Pumps, fans and electric keep-hot	(231)	13.19 x 0.01 =	9.89 (249)
(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 =	49.49 (250)
Additional standing charges (Table 12)			120 (251)
Appendix Q items: repeat lines (253) and (254) as needed			
Total energy cost	(245)...(247) + (250)...(254) =		349.36 (255)

11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.11	(257)
SAP rating (Section 12)		84.48	(258)

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 =	634.77 (261)
Space heating (secondary)	(215) x	0.519 =	0 (263)
Water heating	(219) x	0.216 =	420.24 (264)

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Space and water heating	(261) + (262) + (263) + (264) =			1055	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	194.75	(268)
Total CO ₂ , kg/year	sum of (265)...(271) =			1288.68	(272)
CO₂ emissions per m²	(272) ÷ (4) =			14.83	(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	=	3585.27	(261)
Space heating (secondary)	(215) x	3.07	=	0	(263)
Energy for water heating	(219) x	1.22	=	2373.55	(264)
Space and water heating	(261) + (262) + (263) + (264) =			5958.82	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	3.07	=	230.25	(267)
Electricity for lighting	(232) x	0	=	1152	(268)
'Total Primary Energy	sum of (265)...(271) =			7341.07	(272)
Primary energy kWh/m²/year	(272) ÷ (4) =			84.48	(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 008

Address : Plot 008, Chain Road, Manchester, M9

1. Overall dwelling dimensions:

	Area(m ²)		Av. Height(m)		Volume(m ³)
Ground floor	43.45 (1a)	x	2.42 (2a)	=	105.15 (3a)
First floor	43.45 (1b)	x	2.69 (2b)	=	116.88 (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	86.9 (4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	222.03 (5)

2. Ventilation rate:

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

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.14 (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)			0.39 (18)
<i>Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used</i>			
Number of sides sheltered			2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.85 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.33 (21)

Infiltration rate modified for monthly wind speed

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

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
--------	-----	---	-----	-----	-----	-----	-----	-----	---	-----	-----	-----

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Wind Factor (22a)m = (22)m ÷ 4

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

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

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

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0 (23a)

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

0 (23b)

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

0 (23c)

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

(24a)m= 0 0 0 0 0 0 0 0 0 0 0 0 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 0.58 0.58 0.56 0.56 0.55 0.55 0.55 0.55 0.56 0.57 0.57 (24d)

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

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

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			2.15	x 1.4	= 3.01		(26)
Windows Type 1			5.85	x 1/[1/(1.3)+0.04]	= 7.23		(27)
Windows Type 2			7.1	x 1/[1/(1.3)+0.04]	= 8.77		(27)
Floor			43.45	x 0.15	= 6.5175	75	3258.75 (28)
Walls	95.57	15.1	80.47	x 0.2	= 16.09	60	4828.2 (29)
Roof	43.45	0	43.45	x 0.09	= 3.91	9	391.05 (30)
Total area of elements, m²			182.47				(31)
Party wall			43.76	x 0	= 0	70	3063.2 (32)
Internal wall **			80.7			9	726.3 (32c)
Internal wall **			102.81			9	925.3062 (32c)
Internal floor			43.45			18	782.1 (32d)
Internal ceiling			43.45			9	391.05 (32e)

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

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

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 45.53 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 14365.96 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 165.32 (35)

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

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can be used instead of a detailed calculation.

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

12.8 (36)

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

Total fabric heat loss

(33) + (36) =

58.34 (37)

Ventilation heat loss calculated monthly

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

(38)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
43.02	42.77	42.53	41.38	41.17	40.18	40.18	39.99	40.56	41.17	41.6	42.05

(38)

Heat transfer coefficient, W/K

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

(39)m=

101.35	101.11	100.86	99.72	99.51	98.51	98.51	98.33	98.9	99.51	99.94	100.39
--------	--------	--------	-------	-------	-------	-------	-------	------	-------	-------	--------

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

99.72 (39)

Heat loss parameter (HLP), W/m²K

(40)m = (39)m ÷ (4)

(40)m=

1.17	1.16	1.16	1.15	1.15	1.13	1.13	1.13	1.14	1.15	1.15	1.16
------	------	------	------	------	------	------	------	------	------	------	------

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

1.15 (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

2.58

(42)

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

if TFA ≤ 13.9, N = 1

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

95.5

(43)

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

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

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

(44)m=

105.05	101.23	97.41	93.59	89.77	85.95	85.95	89.77	93.59	97.41	101.23	105.05
--------	--------	-------	-------	-------	-------	-------	-------	-------	-------	--------	--------

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

1145.95 (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=

155.78	136.25	140.59	122.57	117.61	101.49	94.04	107.92	109.21	127.27	138.93	150.86
--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------	--------

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

1502.52 (45)

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

(46)m=

23.37	20.44	21.09	18.39	17.64	15.22	14.11	16.19	16.38	19.09	20.84	22.63
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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	0
---	---	---	---	---	---	---	---	---	---	---	---

(56)

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

(57)m=

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

(57)

Primary circuit loss (annual) from Table 3

0

(58)

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

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

(59)m=

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

(59)

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

(61)m=

18.76	16.9	18.57	17.79	18.25	17.51	18	18.17	17.67	18.44	18.04	18.71
-------	------	-------	-------	-------	-------	----	-------	-------	-------	-------	-------

(61)

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

(62)m=

174.54	153.15	159.16	140.36	135.87	119	112.05	126.08	126.87	145.71	156.96	169.58
--------	--------	--------	--------	--------	-----	--------	--------	--------	--------	--------	--------

(62)

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

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

(63)m=

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

(63)

Output from water heater

(64)m=

174.54	153.15	159.16	140.36	135.87	119	112.05	126.08	126.87	145.71	156.96	169.58
--------	--------	--------	--------	--------	-----	--------	--------	--------	--------	--------	--------

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

1719.34

(64)

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

(65)m=

56.49	49.53	51.39	45.2	43.67	38.12	35.77	40.42	40.73	46.93	50.7	54.84
-------	-------	-------	------	-------	-------	-------	-------	-------	-------	------	-------

(65)

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

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

Metabolic gains (Table 5), Watts

(66)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
129.04	129.04	129.04	129.04	129.04	129.04	129.04	129.04	129.04	129.04	129.04	129.04

(66)

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

(67)m=

22.01	19.55	15.9	12.04	9	7.6	8.21	10.67	14.32	18.18	21.22	22.62
-------	-------	------	-------	---	-----	------	-------	-------	-------	-------	-------

(67)

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

(68)m=

233.26	235.68	229.58	216.59	200.2	184.8	174.5	172.08	178.18	191.17	207.56	222.97
--------	--------	--------	--------	-------	-------	-------	--------	--------	--------	--------	--------

(68)

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

(69)m=

35.9	35.9	35.9	35.9	35.9	35.9	35.9	35.9	35.9	35.9	35.9	35.9
------	------	------	------	------	------	------	------	------	------	------	------

(69)

Pumps and fans gains (Table 5a)

(70)m=

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

(70)

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

(71)m=

-103.23	-103.23	-103.23	-103.23	-103.23	-103.23	-103.23	-103.23	-103.23	-103.23	-103.23	-103.23
---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------

(71)

Water heating gains (Table 5)

(72)m=

75.92	73.7	69.07	62.78	58.7	52.95	48.08	54.33	56.57	63.07	70.42	73.71
-------	------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------

(72)

Total internal gains =

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

(73)m=

395.91	393.64	379.26	356.13	332.61	310.06	295.5	301.8	313.78	337.14	363.91	384.01
--------	--------	--------	--------	--------	--------	-------	-------	--------	--------	--------	--------

(73)

6. Solar gains:

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

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Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast 0.9x	0.77	x	5.85	x	11.28	x	0.46	x	1.11	=	23.38	(75)
Northeast 0.9x	0.77	x	5.85	x	22.97	x	0.46	x	1.11	=	47.59	(75)
Northeast 0.9x	0.77	x	5.85	x	41.38	x	0.46	x	1.11	=	85.74	(75)
Northeast 0.9x	0.77	x	5.85	x	67.96	x	0.46	x	1.11	=	140.81	(75)
Northeast 0.9x	0.77	x	5.85	x	91.35	x	0.46	x	1.11	=	189.28	(75)
Northeast 0.9x	0.77	x	5.85	x	97.38	x	0.46	x	1.11	=	201.79	(75)
Northeast 0.9x	0.77	x	5.85	x	91.1	x	0.46	x	1.11	=	188.77	(75)
Northeast 0.9x	0.77	x	5.85	x	72.63	x	0.46	x	1.11	=	150.49	(75)
Northeast 0.9x	0.77	x	5.85	x	50.42	x	0.46	x	1.11	=	104.48	(75)
Northeast 0.9x	0.77	x	5.85	x	28.07	x	0.46	x	1.11	=	58.16	(75)
Northeast 0.9x	0.77	x	5.85	x	14.2	x	0.46	x	1.11	=	29.42	(75)
Northeast 0.9x	0.77	x	5.85	x	9.21	x	0.46	x	1.11	=	19.09	(75)
Southwest 0.9x	0.77	x	7.1	x	36.79		0.46	x	1.11	=	92.53	(79)
Southwest 0.9x	0.77	x	7.1	x	62.67		0.46	x	1.11	=	157.61	(79)
Southwest 0.9x	0.77	x	7.1	x	85.75		0.46	x	1.11	=	215.65	(79)
Southwest 0.9x	0.77	x	7.1	x	106.25		0.46	x	1.11	=	267.2	(79)
Southwest 0.9x	0.77	x	7.1	x	119.01		0.46	x	1.11	=	299.29	(79)
Southwest 0.9x	0.77	x	7.1	x	118.15		0.46	x	1.11	=	297.13	(79)
Southwest 0.9x	0.77	x	7.1	x	113.91		0.46	x	1.11	=	286.46	(79)
Southwest 0.9x	0.77	x	7.1	x	104.39		0.46	x	1.11	=	262.52	(79)
Southwest 0.9x	0.77	x	7.1	x	92.85		0.46	x	1.11	=	233.51	(79)
Southwest 0.9x	0.77	x	7.1	x	69.27		0.46	x	1.11	=	174.2	(79)
Southwest 0.9x	0.77	x	7.1	x	44.07		0.46	x	1.11	=	110.83	(79)
Southwest 0.9x	0.77	x	7.1	x	31.49		0.46	x	1.11	=	79.19	(79)

Solar gains in watts, calculated for each month

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

(83)m=

115.91	205.2	301.39	408.01	488.57	498.91	475.23	413.01	337.98	232.35	140.25	98.28
--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------

 (83)

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

(84)m=

511.82	598.84	680.66	764.14	821.17	808.97	770.73	714.81	651.76	569.49	504.16	482.29
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (84)

7. Mean internal temperature (heating season)

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

21 (85)

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

(86)m=

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

 (86)

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

(87)m=

19.26	19.47	19.81	20.26	20.64	20.88	20.96	20.95	20.77	20.27	19.68	19.22
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (87)

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

(88)m=

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

 (88)

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

(89)m=

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

 (89)

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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	19.7	19.91	19.96	19.96	19.82	19.37	18.79	18.33	(90)
--------	-------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =

0.15 (91)

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

(92)m=	18.5	18.71	19.05	19.49	19.85	20.06	20.12	20.11	19.97	19.51	18.93	18.47	(92)
--------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(93)m=	18.5	18.71	19.05	19.49	19.85	20.06	20.12	20.11	19.97	19.51	18.93	18.47	(93)
--------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

8. Space heating requirement

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

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

Utilisation factor for gains, hm:

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

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

(95)m=	503.97	582.72	645.78	681.43	641.35	491.14	336.26	349.31	481.69	523.61	491.16	476.23	(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=	1439.08	1396.53	1266.17	1056.24	810.84	537.76	346.38	364.72	580.47	886.44	1182.31	1432.25	(97)
--------	---------	---------	---------	---------	--------	--------	--------	--------	--------	--------	---------	---------	------

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

(98)m=	695.72	546.88	461.57	269.87	126.09	0	0	0	0	269.94	497.62	711.28	
Total per year (kWh/year) = Sum(98) _{1...5,9...12} =												3578.98	(98)

Space heating requirement in kWh/m²/year

41.19 (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)

695.72	546.88	461.57	269.87	126.09	0	0	0	0	269.94	497.62	711.28
--------	--------	--------	--------	--------	---	---	---	---	--------	--------	--------

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

748.08	588.04	496.31	290.18	135.59	0	0	0	0	290.26	535.08	764.82
--------	--------	--------	--------	--------	---	---	---	---	--------	--------	--------

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

3848.37 (211)

Space heating fuel (secondary), kWh/month

= {[[(98)m x (201)] } x 100 ÷ (208)

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

Water heating

Output from water heater (calculated above)

174.54	153.15	159.16	140.36	135.87	119	112.05	126.08	126.87	145.71	156.96	169.58
--------	--------	--------	--------	--------	-----	--------	--------	--------	--------	--------	--------

Efficiency of water heater

87 (216)

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(217)m=	89.38	89.33	89.21	88.95	88.42	87	87	87	87	88.93	89.26	89.41	(217)
---------	-------	-------	-------	-------	-------	----	----	----	----	-------	-------	-------	-------

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	195.27	171.45	178.41	157.8	153.66	136.79	128.79	144.92	145.83	163.86	175.84	189.67	
Total = Sum(219a) _{1...12} =												1942.3	(219)

Annual totals

Space heating fuel used, main system 1

Water heating fuel used

Electricity for pumps, fans and electric keep-hot

central heating pump:

boiler with a fan-assisted flue

Total electricity for the above, kWh/year

Electricity for lighting

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

kWh/year

kWh/year

30

(230c)

45

(230e)

75

(231)

388.75

(232)

6254.41

(238)

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

	Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	831.25	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	419.54	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1250.78	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	201.76	(268)
Total CO2, kg/year		sum of (265)...(271) =		1491.47	(272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =		17.16	(273)
El rating (section 14)				85	(274)

TER WorkSheet: New dwelling design stage

User Details:

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

Property Address: Plot 008

Address : Plot 008, Chain Road, Manchester, M9

1. Overall dwelling dimensions:

	Area(m ²)		Av. Height(m)		Volume(m ³)
Ground floor	43.45 (1a)	x	2.42 (2a)	=	105.15 (3a)
First floor	43.45 (1b)	x	2.69 (2b)	=	116.88 (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	86.9 (4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	222.03 (5)

2. Ventilation rate:

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

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.14 (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)			0.39 (18)
<i>Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used</i>			
Number of sides sheltered			2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.85 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.33 (21)

Infiltration rate modified for monthly wind speed

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

Monthly average wind speed from Table 7

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

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

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

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

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0 (23a)

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

0 (23b)

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

0 (23c)

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

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

(24a)

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

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

(24b)

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

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

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

(24c)

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

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

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

(24d)

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

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

(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			2.15	x 1	= 2.15		(26)
Windows Type 1			5.85	x 1/[1/(1.4)+0.04]	= 7.76		(27)
Windows Type 2			7.1	x 1/[1/(1.4)+0.04]	= 9.41		(27)
Floor			43.45	x 0.13	= 5.6485		(28)
Walls	95.57	15.1	80.47	x 0.18	= 14.48		(29)
Roof	43.45	0	43.45	x 0.13	= 5.65		(30)
Total area of elements, m²			182.47				(31)
Party wall			43.76	x 0	= 0		(32)
Internal wall **			80.7				(32c)
Internal wall **			102.81				(32c)
Internal floor			43.45				(32d)
Internal ceiling			43.45				(32e)

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

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

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 45.1 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 14365.96 (34)

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

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

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can be used instead of a detailed calculation.

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

9.4 (36)

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

Total fabric heat loss

(33) + (36) =

54.5 (37)

Ventilation heat loss calculated monthly

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

(38)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
43.02	42.77	42.53	41.38	41.17	40.18	40.18	39.99	40.56	41.17	41.6	42.05

(38)

Heat transfer coefficient, W/K

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

(39)m=

97.52	97.27	97.02	95.88	95.67	94.68	94.68	94.49	95.06	95.67	96.1	96.55
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------

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

95.88 (39)

Heat loss parameter (HLP), W/m²K

(40)m = (39)m ÷ (4)

(40)m=

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

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

1.1 (40)

Number of days in month (Table 1a)

(41)m=

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

(41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

2.58 (42)

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

if TFA ≤ 13.9, N = 1

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

95.5 (43)

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

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

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

(44)m=

105.05	101.23	97.41	93.59	89.77	85.95	85.95	89.77	93.59	97.41	101.23	105.05
--------	--------	-------	-------	-------	-------	-------	-------	-------	-------	--------	--------

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

1145.95 (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=

155.78	136.25	140.59	122.57	117.61	101.49	94.04	107.92	109.21	127.27	138.93	150.86
--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------	--------

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

1502.52 (45)

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

(46)m=

23.37	20.44	21.09	18.39	17.64	15.22	14.11	16.19	16.38	19.09	20.84	22.63
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(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)

TER WorkSheet: New dwelling design stage

Energy lost from water storage, kWh/year

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

0
0

(54)

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

(55)

Water storage loss calculated for each month

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

(56)m=

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

(56)

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

(57)m=

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

(57)

Primary circuit loss (annual) from Table 3

0

(58)

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

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

(59)m=

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

(59)

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

(61)m=

50.96	46.03	49.64	46.15	45.74	42.38	43.8	45.74	46.15	49.64	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=

206.74	182.27	190.23	168.72	163.35	143.87	137.84	153.66	155.36	176.91	188.24	201.82
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

(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=

206.74	182.27	190.23	168.72	163.35	143.87	137.84	153.66	155.36	176.91	188.24	201.82
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

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

2069.02

(64)

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

(65)m=

64.54	56.81	59.16	52.29	50.54	44.34	42.22	47.32	47.85	54.73	58.52	62.9
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

(65)

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

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

Metabolic gains (Table 5), Watts

(66)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
129.04	129.04	129.04	129.04	129.04	129.04	129.04	129.04	129.04	129.04	129.04	129.04

(66)

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

(67)m=

22.01	19.55	15.9	12.04	9	7.6	8.21	10.67	14.32	18.18	21.22	22.62
-------	-------	------	-------	---	-----	------	-------	-------	-------	-------	-------

(67)

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

(68)m=

233.26	235.68	229.58	216.59	200.2	184.8	174.5	172.08	178.18	191.17	207.56	222.97
--------	--------	--------	--------	-------	-------	-------	--------	--------	--------	--------	--------

(68)

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

(69)m=

35.9	35.9	35.9	35.9	35.9	35.9	35.9	35.9	35.9	35.9	35.9	35.9
------	------	------	------	------	------	------	------	------	------	------	------

(69)

Pumps and fans gains (Table 5a)

(70)m=

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

(70)

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

(71)m=

-103.23	-103.23	-103.23	-103.23	-103.23	-103.23	-103.23	-103.23	-103.23	-103.23	-103.23	-103.23
---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------

(71)

Water heating gains (Table 5)

(72)m=

86.74	84.54	79.51	72.63	67.93	61.59	56.75	63.6	66.46	73.56	81.28	84.55
-------	-------	-------	-------	-------	-------	-------	------	-------	-------	-------	-------

(72)

Total internal gains =

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

(73)m=

406.73	404.48	389.7	365.97	341.85	318.69	304.17	311.07	323.67	347.62	374.78	394.85
--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------

(73)

6. Solar gains:

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

TER WorkSheet: New dwelling design stage

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast 0.9x	0.77	x	5.85	x	11.28	x	0.63	x	0.7	=	20.17	(75)
Northeast 0.9x	0.77	x	5.85	x	22.97	x	0.63	x	0.7	=	41.06	(75)
Northeast 0.9x	0.77	x	5.85	x	41.38	x	0.63	x	0.7	=	73.98	(75)
Northeast 0.9x	0.77	x	5.85	x	67.96	x	0.63	x	0.7	=	121.49	(75)
Northeast 0.9x	0.77	x	5.85	x	91.35	x	0.63	x	0.7	=	163.31	(75)
Northeast 0.9x	0.77	x	5.85	x	97.38	x	0.63	x	0.7	=	174.11	(75)
Northeast 0.9x	0.77	x	5.85	x	91.1	x	0.63	x	0.7	=	162.87	(75)
Northeast 0.9x	0.77	x	5.85	x	72.63	x	0.63	x	0.7	=	129.85	(75)
Northeast 0.9x	0.77	x	5.85	x	50.42	x	0.63	x	0.7	=	90.14	(75)
Northeast 0.9x	0.77	x	5.85	x	28.07	x	0.63	x	0.7	=	50.18	(75)
Northeast 0.9x	0.77	x	5.85	x	14.2	x	0.63	x	0.7	=	25.38	(75)
Northeast 0.9x	0.77	x	5.85	x	9.21	x	0.63	x	0.7	=	16.47	(75)
Southwest 0.9x	0.77	x	7.1	x	36.79		0.63	x	0.7	=	79.84	(79)
Southwest 0.9x	0.77	x	7.1	x	62.67		0.63	x	0.7	=	135.99	(79)
Southwest 0.9x	0.77	x	7.1	x	85.75		0.63	x	0.7	=	186.07	(79)
Southwest 0.9x	0.77	x	7.1	x	106.25		0.63	x	0.7	=	230.55	(79)
Southwest 0.9x	0.77	x	7.1	x	119.01		0.63	x	0.7	=	258.24	(79)
Southwest 0.9x	0.77	x	7.1	x	118.15		0.63	x	0.7	=	256.37	(79)
Southwest 0.9x	0.77	x	7.1	x	113.91		0.63	x	0.7	=	247.17	(79)
Southwest 0.9x	0.77	x	7.1	x	104.39		0.63	x	0.7	=	226.51	(79)
Southwest 0.9x	0.77	x	7.1	x	92.85		0.63	x	0.7	=	201.47	(79)
Southwest 0.9x	0.77	x	7.1	x	69.27		0.63	x	0.7	=	150.3	(79)
Southwest 0.9x	0.77	x	7.1	x	44.07		0.63	x	0.7	=	95.63	(79)
Southwest 0.9x	0.77	x	7.1	x	31.49		0.63	x	0.7	=	68.32	(79)

Solar gains in watts, calculated for each month

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

(83)m= 100.01 177.05 260.05 352.04 421.55 430.48 410.04 356.36 291.62 200.48 121.01 84.8 (83)

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

(84)m= 506.73 581.53 649.75 718.02 763.39 749.17 714.21 667.42 615.29 548.1 495.78 479.65 (84)

7. Mean internal temperature (heating season)

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

21 (85)

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

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

(86)

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

(87)m= 19.78 19.93 20.17 20.49 20.78 20.94 20.99 20.98 20.87 20.5 20.08 19.76 (87)

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

(88)m= 19.98 19.99 19.99 20 20 20.01 20.01 20.01 20.01 20 20 19.99 (88)

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

	1	0.99	0.99	0.95	0.85	0.65	0.45	0.5	0.8	0.97	0.99	1
(89)m=												

(89)

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

(90)m=	18.35	18.57	18.92	19.39	19.77	19.97	20.01	20	19.89	19.41	18.81	18.32	(90)
--------	-------	-------	-------	-------	-------	-------	-------	----	-------	-------	-------	-------	------

$fLA = \text{Living area} \div (4) =$	0.15	(91)
---------------------------------------	------	------

Mean internal temperature (for the whole dwelling) = $fLA \times T1 + (1 - fLA) \times T2$

(92)m=	18.57	18.78	19.12	19.56	19.93	20.12	20.16	20.15	20.04	19.58	19	18.55	(92)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	----	-------	------

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

(93)m=	18.57	18.78	19.12	19.56	19.93	20.12	20.16	20.15	20.04	19.58	19	18.55	(93)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	----	-------	------

8. Space heating requirement

Set T_i to the mean internal temperature obtained at step 11 of Table 9b, so that $T_{i,m}=(76)m$ 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, h_m :

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

Useful gains, $h_m G_m$, $W = (94)m \times (84)m$

(95)m=	504.92	577.13	637.8	679.64	650.02	496.02	333.31	348.67	493.32	527.73	492.09	478.34	(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, L_m , $W = [(39)m \times [(93)m - (96)m]]$

(97)m=	1392.01	1350.11	1224.11	1022.39	787.28	522.72	336.78	354.78	565.06	859.15	1143.91	1385.14	(97)
--------	---------	---------	---------	---------	--------	--------	--------	--------	--------	--------	---------	---------	------

Space heating requirement for each month, $kWh/month = 0.024 \times [(97)m - (95)m] \times (41)m$

(98)m=	660	519.44	436.21	246.77	102.12	0	0	0	0	246.58	469.31	674.67	
$\text{Total per year (kWh/year)} = \text{Sum}(98)_{1..5,9..12} =$												3355.11	(98)

Space heating requirement in $kWh/m^2/year$

38.61	(99)
-------	------

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

Space heating:

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

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

Fraction of total heating from main system 1 $(204) = (202) \times [1 - (203)] =$ 1 (204)

Efficiency of main space heating system 1 93.4 (206)

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

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

Space heating requirement (calculated above)

660	519.44	436.21	246.77	102.12	0	0	0	0	246.58	469.31	674.67
-----	--------	--------	--------	--------	---	---	---	---	--------	--------	--------

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

706.64	556.15	467.04	264.21	109.34	0	0	0	0	264	502.48	722.34		
Total (kWh/year) =Sum(211) _{1..5,10...12} =												3592.19	(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)

206.74	182.27	190.23	168.72	163.35	143.87	137.84	153.66	155.36	176.91	188.24	201.82
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

Efficiency of water heater 80.3 (216)

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(217)m=

87.77	87.54	87.07	86.01	83.91	80.3	80.3	80.3	80.3	85.89	87.26	87.86
-------	-------	-------	-------	-------	------	------	------	------	-------	-------	-------

 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=

235.55	208.22	218.47	196.17	194.69	179.17	171.66	191.36	193.47	205.98	215.73	229.72
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

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

2440.19

 (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

388.75

(232)

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

6496.13

(238)

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

	Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year
Space heating (main system 1)	(211) x	0.216	=	775.91 (261)
Space heating (secondary)	(215) x	0.519	=	0 (263)
Water heating	(219) x	0.216	=	527.08 (264)
Space and water heating	(261) + (262) + (263) + (264) =			1302.99 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93 (267)
Electricity for lighting	(232) x	0.519	=	201.76 (268)
Total CO2, kg/year	sum of (265)...(271) =			1543.68 (272)

TER =

17.76

(273)

SAP 2012 Overheating Assessment

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

Property Details: Plot 008

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 165.32
Night ventilation:	False
Blinds, curtains, shutters:	None
Ventilation rate during hot weather (ach):	4 (Windows open half the time)

Overheating Details:

Summer ventilation heat loss coefficient:	293.08	(P1)
Transmission heat loss coefficient:	58.3	
Summer heat loss coefficient:	351.42	(P2)

Overhangs:

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

Solar shading:

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

Solar gains:

Orientation		Area	Flux	g_	FF	Shading	Gains
North East (front)	1 x	5.85	89.66	0.46	0	1	241.26
South West (rear)	1 x	7.1	112.1	0.46	0	1	366.12
Total							607.38 (P3/P4)

Internal gains:

	June	July	August	
Internal gains	451.78	433.02	441.61	
Total summer gains	1109.44	1040.41	960.9	(P5)
Summer gain/loss ratio	3.16	2.96	2.73	(P6)
Mean summer external temperature (West Pennines)	14.7	16.4	16.3	
Thermal mass temperature increment	0.84	0.84	0.84	
Threshold temperature	18.7	20.2	19.88	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	

Assessment of likelihood of high internal temperature: Not significant

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

Property Reference	Plot 008			Issued on Date	16/11/2023
Assessment Reference	22187 plot 8	Prop Type Ref	22186		
Property	1e Chain Road, MANCHESTER, M9 6AJ				
SAP Rating	85 B	DER	16.99	TER	17.76
Environmental	87 B	% DER<TER	4.36		
CO ₂ Emissions (t/year)	1.25	DFEE	43.67	TFEE	50.45
General Requirements Compliance	Pass	% DFEE<TFEE	13.43		
Assessor Details	Mr. Ben Tunningley, Ben Tunningley, Tel: 01904217325, ben.tunningley@jspsustainability.co.uk			Assessor ID	AU36-0001
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 87 m²

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

1a TER and DER

Fuel for main heating:Mains gas

Fuel factor:1.00 (mains gas)

Target Carbon Dioxide Emission Rate (TER) 17.76 kgCO₂/m²

Dwelling Carbon Dioxide Emission Rate (DER) 16.99 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)50.5 kWh/m²/yr

Dwelling Fabric Energy Efficiency (DFEE)43.7 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.20 (max. 0.30)	0.20 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.15 (max. 0.25)	0.15 (max. 0.70)	OK
Roof	0.09 (max. 0.20)	0.09 (max. 0.35)	OK
Openings	1.31 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals: 4.08 (measured in this dwelling)
Maximum 10.0 OK

4 Heating efficiency

Main heating system: Boiler system with radiators or underfloor - Mains gas

Data from database

Vaillant ecoTEC sustain 28 VUW 286/7-2 (H-GB)

Combi boiler

Efficiency: 89.1% SEDBUK2009

Minimum: 88.0% OK

Secondary heating system:

None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls: Programmer, room thermostat and TRVs OK

Hot water controls:

No cylinder

Boiler interlock

Yes

OK

7 Low energy lights

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

8 Mechanical ventilation

Not applicable

9 Summertime temperature

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

Based on:

Overshading: Very little
Windows facing North East: 5.85 m², No overhang
Windows facing South West: 7.10 m², No overhang
Air change rate: 0.00 ach
Blinds/curtains: None

10 Key features

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	43.4500 (1b)	x 2.4200 (2b)	= 105.1490 (1b) - (3b)
First floor	43.4500 (1c)	x 2.6900 (2c)	= 116.8805 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	86.9000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 222.0295 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					30.0000 / (5) = 0.1351 (8)
Pressure test					Yes
Measured/design AP50					4.0800
Infiltration rate					0.3391 (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)	=	0.2882 (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	0.3675	0.3603	0.3531	0.3171	0.3099	0.2738	0.2738	0.2666	0.2882	0.3099	0.3243	0.3387 (22b)
Effective ac	0.5675	0.5649	0.5623	0.5503	0.5480	0.5375	0.5375	0.5355	0.5415	0.5480	0.5526	0.5574 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front			2.1500	1.4000	3.0100		(26)
front (Uw = 1.30)			12.9500	1.2357	16.0029		(27)
gf			43.4500	0.1500	6.5175	75.0000	3258.7501 (28a)
external	95.5700	15.1000	80.4700	0.2000	16.0940	60.0000	4828.2000 (29a)
cold	43.4500		43.4500	0.0900	3.9105	9.0000	391.0500 (30)
Total net area of external elements Aum(A, m ²)			182.4700				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	45.5349		(33)
party			43.7600	0.0000	0.0000	70.0000	3063.1999 (32)
gf			80.7000			9.0000	726.3000 (32c)
1f			102.8118			9.0000	925.3062 (32c)
1f			43.4500			18.0000	782.1000 (32d)
gf			43.4500			9.0000	391.0500 (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) = 14365.9561 (34)
165.3160 (35)
12.8021 (36)
(33) + (36) = 58.3370 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	41.5831	41.3910	41.2026	40.3180	40.1525	39.3820	39.3820	39.2393	39.6788	40.1525	40.4873	40.8374 (38)
Heat transfer coeff	99.9201	99.7279	99.5396	98.6550	98.4894	97.7189	97.7189	97.5763	98.0157	98.4894	98.8243	99.1743 (39)
Average = Sum(39)m / 12 =												98.6542 (39)
HLP	1.1498	1.1476	1.1454	1.1353	1.1334	1.1245	1.1245	1.1229	1.1279	1.1334	1.1372	1.1412 (40)
HLP (average)												1.1353 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.5809 (42)
Average daily hot water use (litres/day)												95.4956 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	105.0452	101.2253	97.4055	93.5857	89.7659	85.9460	85.9460	89.7659	93.5857	97.4055	101.2253	105.0452 (44)
Energy conte	155.7789	136.2452	140.5929	122.5723	117.6110	101.4894	94.0448	107.9178	109.2067	127.2699	138.9250	150.8636 (45)
Energy content (annual)										Total = Sum(45)m =		1502.5175 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	23.3668	20.4368	21.0889	18.3858	17.6417	15.2234	14.1067	16.1877	16.3810	19.0905	20.8388	22.6295 (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	18.7613	16.9007	18.5711	17.7921	18.2543	17.5145	18.0043	18.1664	17.6657	18.4400	18.0366	18.7117 (61)
Total heat required for water heating calculated for each month	174.5402	153.1459	159.1640	140.3644	135.8653	119.0039	112.0491	126.0842	126.8724	145.7099	156.9617	169.5752 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	174.5402	153.1459	159.1640	140.3644	135.8653	119.0039	112.0491	126.0842	126.8724	145.7099	156.9617	169.5752 (64)
Heat gains from water heating, kWh/month	56.4868	49.5267	51.3899	45.2033	43.6692	38.1238	35.7710	40.4243	40.7277	46.9272	50.7017	54.8401 (65)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)												
Total per year (kWh/year) = Sum(64)m = 1719.3362 (64)												

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	129.0434	129.0434	129.0434	129.0434	129.0434	129.0434	129.0434	129.0434	129.0434	129.0434	129.0434	129.0434 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	22.0126	19.5514	15.9003	12.0375	8.9982	7.5967	8.2085	10.6697	14.3208	18.1836	21.2229	22.6244 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	233.2576	235.6780	229.5785	216.5933	200.2018	184.7961	174.5042	172.0837	178.1833	191.1684	207.5599	222.9656 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.9043	35.9043	35.9043	35.9043	35.9043	35.9043	35.9043	35.9043	35.9043	35.9043	35.9043	35.9043 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-103.2347	-103.2347	-103.2347	-103.2347	-103.2347	-103.2347	-103.2347	-103.2347	-103.2347	-103.2347	-103.2347	-103.2347 (71)
Water heating gains (Table 5)	75.9231	73.7005	69.0725	62.7824	58.6952	52.9498	48.0793	54.3337	56.5662	63.0742	70.4191	73.7098 (72)
Total internal gains	395.9063	393.6429	379.2643	356.1262	332.6082	310.0556	295.5049	301.8001	313.7833	337.1393	363.9149	384.0128 (73)

6. Solar gains

[Jan]														
	Area m2				Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W	
Northeast	5.8500				11.2829		0.4600		0.0000		0.7700		23.3790 (75)	
Southwest	7.1000				36.7938		0.4600		0.0000		0.7700		92.5299 (79)	
Solar gains	115.9089	205.2013	301.3922	408.0131	488.5658	498.9137	475.2295	413.0114	337.9812	232.3527	140.2463	98.2788 (83)		
Total gains	511.8153	598.8443	680.6564	764.1393	821.1741	808.9693	770.7344	714.8114	651.7644	569.4919	504.1612	482.2916 (84)		

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	39.9374	40.0143	40.0900	40.4495	40.5175	40.8369	40.8369	40.8967	40.7133	40.5175	40.3802	40.2377
alpha	3.6625	3.6676	3.6727	3.6966	3.7012	3.7225	3.7225	3.7264	3.7142	3.7012	3.6920	3.6825
util living area	0.9908	0.9830	0.9655	0.9211	0.8280	0.6774	0.5279	0.5815	0.8022	0.9460	0.9842	0.9926 (86)
MIT	19.2855	19.4981	19.8384	20.2743	20.6502	20.8850	20.9657	20.9507	20.7722	20.2804	19.7008	19.2436 (87)
Th 2	19.9603	19.9621	19.9639	19.9721	19.9737	19.9809	19.9809	19.9822	19.9781	19.9737	19.9706	19.9673 (88)
util rest of house	0.9887	0.9791	0.9573	0.9014	0.7842	0.5973	0.4180	0.4710	0.7368	0.9285	0.9799	0.9909 (89)
MIT 2	18.3976	18.6096	18.9464	19.3743	19.7204	19.9176	19.9687	19.9631	19.8358	19.3891	18.8188	18.3611 (90)
Living area fraction	18.5350	18.7472	19.0845	19.5136	19.8643	20.0673	20.1230	20.1160	19.9807	19.5271	18.9553	18.4977 (92)
MIT	18.5350	18.7472	19.0845	19.5136	19.8643	20.0673	20.1230	20.1160	19.9807	19.5271	18.9553	18.4977 (93)
Temperature adjustment												0.0000
adjusted MIT	18.5350	18.7472	19.0845	19.5136	19.8643	20.0673	20.1230	20.1160	19.9807	19.5271	18.9553	18.4977 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9847	0.9730	0.9484	0.8908	0.7789	0.6047	0.4341	0.4865	0.7370	0.9189	0.9742	0.9875 (94)
Ext temp.	503.9927	582.6844	645.5437	680.6947	639.6447	489.1835	334.5636	347.7475	480.3672	523.2879	491.1430	476.2544 (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	1422.3640	1380.9480	1252.6524	1047.0877	804.1011	534.2633	344.2625	362.5897	576.4020	879.2206	1171.5879	1417.9667 (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	683.2683	536.4331	451.6889	263.8030	122.3556	0.0000	0.0000	0.0000	0.0000	264.8139	489.9204	700.6340 (98)
Space heating per m2												3512.9171 (98)
(98) / (4) = 40.4248 (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													3777.3302 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	683.2683	536.4331	451.6889	263.8030	122.3556	0.0000	0.0000	0.0000	0.0000	264.8139	489.9204	700.6340	(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)	734.6971	576.8098	485.6870	283.6591	131.5652	0.0000	0.0000	0.0000	0.0000	284.7461	526.7961	753.3699	(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	174.5402	153.1459	159.1640	140.3644	135.8653	119.0039	112.0491	126.0842	126.8724	145.7099	156.9617	169.5752	(64)
Efficiency of water heater (217)m	89.3729	89.3160	89.1986	88.9349	88.3962	87.0000	87.0000	87.0000	87.0000	88.9118	89.2532	89.3993	(217)
Fuel for water heating, kWh/month	195.2943	171.4653	178.4378	157.8281	153.7004	136.7860	128.7921	144.9243	145.8304	163.8814	175.8611	189.6830	(219)
Water heating fuel used												1942.4843	(219)
Annual totals kWh/year													
Space heating fuel - main system												3777.3302	(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)												388.7500	(232)
Total delivered energy for all uses												6183.5645	(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	3777.3302	0.2160	815.9033 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1942.4843	0.2160	419.5766 (264)
Space and water heating			1235.4799 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	388.7500	0.5190	201.7612 (268)
Total CO2, kg/year			1476.1662 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			16.9900 (273)

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

DER		16.9900	ZC1
Total Floor Area		86.9000	
Assumed number of occupants		2.5809	
CO2 emission factor in Table 12 for electricity displaced from grid		0.5190	
CO2 emissions from appliances, equation (L14)		15.9060	ZC2
CO2 emissions from cooking, equation (L16)		2.0822	ZC3
Total CO2 emissions		34.9782	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		34.9782	ZC8

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	43.4500 (1b)	x 2.4200 (2b)	= 105.1490 (1b) - (3b)
First floor	43.4500 (1c)	x 2.6900 (2c)	= 116.8805 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	86.9000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 222.0295 (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																3 * 10 =	30.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =										30.0000 / (5) =							0.1351 (8)
Pressure test										Yes							
Measured/design AP50																	5.0000
Infiltration rate																	0.3851 (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) =							0.3273 (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	0.4174	0.4092	0.4010	0.3601	0.3519	0.3110	0.3110	0.3028	0.3273	0.3519	0.3683	0.3846	(22b)				
Effective ac	0.5871	0.5837	0.5804	0.5648	0.5619	0.5484	0.5484	0.5458	0.5536	0.5619	0.5678	0.5740	(25)				

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opaque door			2.1500	1.0000	2.1500		(26)					
TER Opening Type (Uw = 1.40)			12.9500	1.3258	17.1686		(27)					
gf			43.4500	0.1300	5.6485		(28a)					
external	95.5700	15.1000	80.4700	0.1800	14.4846		(29a)					
cold	43.4500		43.4500	0.1300	5.6485		(30)					
Total net area of external elements Aum(A, m2)			182.4700				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	45.1002		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.3983 (36)					
Total fabric heat loss						(33) + (36) =	54.4985 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 43.0166	Feb 42.7688	Mar 42.5259	Apr 41.3850	May 41.1715	Jun 40.1778	Jul 40.1778	Aug 39.9938	Sep 40.5606	Oct 41.1715	Nov 41.6033	Dec 42.0548 (38)
Heat transfer coeff	97.5151	97.2673	97.0243	95.8834	95.6700	94.6763	94.6763	94.4923	95.0590	95.6700	96.1018	96.5533 (39)
Average = Sum(39)m / 12 =												95.8824 (39)
HLP	Jan 1.1222	Feb 1.1193	Mar 1.1165	Apr 1.1034	May 1.1009	Jun 1.0895	Jul 1.0895	Aug 1.0874	Sep 1.0939	Oct 1.1009	Nov 1.1059	Dec 1.1111 (40)
HLP (average)												1.1034 (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												2.5809 (42)
Average daily hot water use (litres/day)												95.4956 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	105.0452	101.2253	97.4055	93.5857	89.7659	85.9460	85.9460	89.7659	93.5857	97.4055	101.2253	105.0452 (44)
Energy conte	155.7789	136.2452	140.5929	122.5723	117.6110	101.4894	94.0448	107.9178	109.2067	127.2699	138.9250	150.8636 (45)
Energy content (annual)												Total = Sum(45)m = 1502.5175 (45)
Distribution loss	(46)m = 0.15 x (45)m											
	23.3668	20.4368	21.0889	18.3858	17.6417	15.2234	14.1067	16.1877	16.3810	19.0905	20.8388	22.6295 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												

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Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Total heat required for water heating calculated for each month	50.9589	46.0274	49.6368	46.1518	45.7437	42.3843	43.7972	45.7437	46.1518	49.6368	49.3151	50.9589 (61)
Solar input	206.7378	182.2726	190.2297	168.7241	163.3547	143.8737	137.8420	153.6615	155.3585	176.9067	188.2401	201.8225 (62)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	206.7378	182.2726	190.2297	168.7241	163.3547	143.8737	137.8420	153.6615	155.3585	176.9067	188.2401	201.8225 (64)
Heat gains from water heating, kWh/month	64.5362	56.8084	59.1563	52.2932	50.5416	44.3413	42.2192	47.3186	47.8492	54.7264	58.5213	62.9019 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	129.0434	129.0434	129.0434	129.0434	129.0434	129.0434	129.0434	129.0434	129.0434	129.0434	129.0434	129.0434	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	22.0126	19.5514	15.9003	12.0375	8.9982	7.5967	8.2085	10.6697	14.3208	18.1836	21.2229	22.6244	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	233.2576	235.6780	229.5785	216.5933	200.2018	184.7961	174.5042	172.0837	178.1833	191.1684	207.5599	222.9656	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.9043	35.9043	35.9043	35.9043	35.9043	35.9043	35.9043	35.9043	35.9043	35.9043	35.9043	35.9043	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-103.2347	-103.2347	-103.2347	-103.2347	-103.2347	-103.2347	-103.2347	-103.2347	-103.2347	-103.2347	-103.2347	-103.2347	(71)
Water heating gains (Table 5)	86.7422	84.5363	79.5112	72.6295	67.9322	61.5851	56.7462	63.6003	66.4572	73.5570	81.2796	84.5455	(72)
Total internal gains	406.7254	404.4788	389.7030	365.9734	341.8453	318.6909	304.1719	311.0667	323.6743	347.6220	374.7755	394.8486	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d			Gains W
Northeast					5.8500	11.2829	0.6300	0.7000			0.7700			20.1720 (75)
Southwest					7.1000	36.7938	0.6300	0.7000			0.7700			79.8372 (79)
Solar gains	100.0092	177.0530	260.0490	352.0443	421.5473	430.4758	410.0404	356.3570	291.6190	200.4800	121.0082	84.7975 (83)		
Total gains	506.7347	581.5318	649.7520	718.0177	763.3926	749.1667	714.2123	667.4236	615.2932	548.1020	495.7837	479.6461 (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	61.8850	62.0427	62.1980	62.9381	63.0785	63.7406	63.7406	63.8647	63.4839	63.0785	62.7951	62.5015	
alpha	5.1257	5.1362	5.1465	5.1959	5.2052	5.2494	5.2494	5.2576	5.2323	5.2052	5.1863	5.1668	
util living area	0.9983	0.9961	0.9898	0.9668	0.8957	0.7397	0.5684	0.6257	0.8651	0.9793	0.9963	0.9987	(86)
MIT	19.7805	19.9276	20.1696	20.4921	20.7754	20.9434	20.9884	20.9813	20.8650	20.5003	20.0828	19.7558	(87)
Th 2	19.9828	19.9821	19.9874	19.9981	20.0001	20.0094	20.0094	20.0112	20.0058	20.0001	19.9960	19.9918	(88)
util rest of house	0.9977	0.9948	0.9861	0.9538	0.8549	0.6512	0.4481	0.5038	0.7987	0.9689	0.9948	0.9983	(89)
MIT 2	18.3540	18.5703	18.9237	19.3926	19.7742	19.9706	20.0050	20.0032	19.8940	19.4119	18.8054	18.3244	(90)
Living area fraction	18.5748	18.7804	19.1165	19.5628	19.9291	20.1212	20.1572	20.1546	20.0443	19.5804	19.0031	18.5459	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5748	18.7804	19.1165	19.5628	19.9291	20.1212	20.1572	20.1546	20.0443	19.5804	19.0031	18.5459	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	504.9164	577.1305	637.8016	679.6447	650.0177	496.0216	333.3129	348.6690	493.3234	527.7284	492.0865	478.3361	(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	1392.0095	1350.1083	1224.1100	1022.3859	787.2815	522.7244	336.7846	354.7797	565.0563	859.1525	1143.9121	1385.1448	(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	659.9972	519.4411	436.2135	246.7736	102.1243	0.0000	0.0000	0.0000	0.0000	246.5795	469.3144	674.6657	(98)
Space heating												3355.1093	(98)
Space heating per m2												38.6089	(99)

8c. Space cooling requirement

Not applicable

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

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Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.4000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3592.1941 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	659.9972	519.4411	436.2135	246.7736	102.1243	0.0000	0.0000	0.0000	0.0000	246.5795	469.3144	674.6657	(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)	706.6351	556.1468	467.0380	264.2116	109.3408	0.0000	0.0000	0.0000	0.0000	264.0038	502.4780	722.3402	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	206.7378	182.2726	190.2297	168.7241	163.3547	143.8737	137.8420	153.6615	155.3585	176.9067	188.2401	201.8225	(64)
Efficiency of water heater	87.7669	87.5399	87.0742	86.0071	83.9062	80.3000	80.3000	80.3000	80.3000	85.8873	87.2581	87.8555	(216)
Fuel for water heating, kWh/month	235.5533	208.2165	218.4684	196.1746	194.6874	179.1703	171.6588	191.3593	193.4726	205.9754	215.7279	229.7209	(219)
Water heating fuel used												2440.1854	(219)
Annual totals kWh/year													
Space heating fuel - main system												3592.1941	(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)												388.7500	(232)
Total delivered energy for all uses												6496.1295	(238)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	3592.1941	0.2160	775.9139 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2440.1854	0.2160	527.0800 (264)
Space and water heating			1302.9940 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	388.7500	0.5190	201.7612 (268)
Total CO2, kg/m2/year			1543.6802 (272)
Emissions per m2 for space and water heating			14.9942 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.3218 (272b)
Emissions per m2 for pumps and fans			0.4479 (272c)
Target Carbon Dioxide Emission Rate (TER) = (14.9942 * 1.00) + 2.3218 + 0.4479, rounded to 2 d.p.			17.7600 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	43.4500 (1b)	x 2.4200 (2b)	= 105.1490 (1b) - (3b)
First floor	43.4500 (1c)	x 2.6900 (2c)	= 116.8805 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	86.9000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 222.0295 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1351 (8)
Pressure test					Yes
Measured/design AP50					4.0800
Infiltration rate					0.3391 (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) =	0.2882 (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	0.3675	0.3603	0.3531	0.3171	0.3099	0.2738	0.2738	0.2666	0.2882	0.3099	0.3243	0.3387 (22b)
Effective ac	0.5675	0.5649	0.5623	0.5503	0.5480	0.5375	0.5375	0.5355	0.5415	0.5480	0.5526	0.5574 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front			2.1500	1.4000	3.0100		(26)
front (Uw = 1.30)			12.9500	1.2357	16.0029		(27)
gf			43.4500	0.1500	6.5175	75.0000	3258.7501 (28a)
external	95.5700	15.1000	80.4700	0.2000	16.0940	60.0000	4828.2000 (29a)
cold	43.4500		43.4500	0.0900	3.9105	9.0000	391.0500 (30)
Total net area of external elements Aum(A, m ²)			182.4700				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	45.5349		(33)
party			43.7600	0.0000	0.0000	70.0000	3063.1999 (32)
gf			80.7000			9.0000	726.3000 (32c)
1f			102.8118			9.0000	925.3062 (32c)
1f			43.4500			18.0000	782.1000 (32d)
gf			43.4500			9.0000	391.0500 (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) = 14365.9561 (34)
165.3160 (35)
12.8021 (36)
(33) + (36) = 58.3370 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	41.5831	41.3910	41.2026	40.3180	40.1525	39.3820	39.3820	39.2393	39.6788	40.1525	40.4873	40.8374 (38)
Heat transfer coeff	99.9201	99.7279	99.5396	98.6550	98.4894	97.7189	97.7189	97.5763	98.0157	98.4894	98.8243	99.1743 (39)
Average = Sum(39)m / 12 =												98.6542 (39)
HLP	1.1498	1.1476	1.1454	1.1353	1.1334	1.1245	1.1245	1.1229	1.1279	1.1334	1.1372	1.1412 (40)
HLP (average)												1.1353 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.5809 (42)
Average daily hot water use (litres/day)												95.4956 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	105.0452	101.2253	97.4055	93.5857	89.7659	85.9460	85.9460	89.7659	93.5857	97.4055	101.2253	105.0452 (44)
Energy conte	155.7789	136.2452	140.5929	122.5723	117.6110	101.4894	94.0448	107.9178	109.2067	127.2699	138.9250	150.8636 (45)
Energy content (annual)											Total = Sum(45)m =	1502.5175 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	33.1030	28.9521	29.8760	26.0466	24.9923	21.5665	19.9845	22.9325	23.2064	27.0448	29.5216	32.0585 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	129.0434	129.0434	129.0434	129.0434	129.0434	129.0434	129.0434	129.0434	129.0434	129.0434	129.0434	129.0434	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	22.0126	19.5514	15.9003	12.0375	8.9982	7.5967	8.2085	10.6697	14.3208	18.1836	21.2229	22.6244	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	233.2576	235.6780	229.5785	216.5933	200.2018	184.7961	174.5042	172.0837	178.1833	191.1684	207.5599	222.9656	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.9043	35.9043	35.9043	35.9043	35.9043	35.9043	35.9043	35.9043	35.9043	35.9043	35.9043	35.9043	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-103.2347	-103.2347	-103.2347	-103.2347	-103.2347	-103.2347	-103.2347	-103.2347	-103.2347	-103.2347	-103.2347	-103.2347	(71)
Water heating gains (Table 5)	44.4933	43.0835	40.1559	36.1758	33.5919	29.9535	26.8609	30.8233	32.2311	36.3506	41.0022	43.0894	(72)
Total internal gains	361.4765	360.0260	347.3477	326.5197	304.5049	284.0593	271.2866	275.2897	286.4482	307.4156	331.4980	350.3924	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d			Gains W
Northeast				5.8500	11.2829	0.4600	0.0000			0.7700			23.3790 (75)
Southwest				7.1000	36.7938	0.4600	0.0000			0.7700			92.5299 (79)
Solar gains	115.9089	205.2013	301.3922	408.0131	488.5658	498.9137	475.2295	413.0114	337.9812	232.3527	140.2463	98.2788	(83)
Total gains	477.3854	565.2273	648.7399	734.5328	793.0707	782.9730	746.5160	688.3010	624.4294	539.7683	471.7443	448.6712	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	39.9374	40.0143	40.0900	40.4495	40.5175	40.8369	40.8369	40.8967	40.7133	40.5175	40.3802	40.2377	
alpha	3.6625	3.6676	3.6727	3.6966	3.7012	3.7225	3.7225	3.7264	3.7142	3.7012	3.6920	3.6825	
util living area	0.9927	0.9858	0.9701	0.9288	0.8400	0.6923	0.5421	0.5990	0.8181	0.9535	0.9872	0.9942	(86)
MIT	19.2365	19.4516	19.7972	20.2423	20.6298	20.8761	20.9625	20.9456	20.7545	20.2447	19.6556	19.1953	(87)
Th 2	19.9603	19.9621	19.9639	19.9721	19.9737	19.9809	19.9809	19.9822	19.9781	19.9737	19.9706	19.9673	(88)
util rest of house	0.9910	0.9825	0.9628	0.9106	0.7978	0.6124	0.4304	0.4870	0.7551	0.9381	0.9837	0.9928	(89)
MIT 2	18.3489	18.5639	18.9065	19.3448	19.7037	19.9121	19.9674	19.9609	19.8228	19.3558	18.7743	18.3131	(90)
Living area fraction									fLA = Living area / (4) =			0.1548	(91)
MIT	18.4863	18.7013	19.0444	19.4837	19.8471	20.0613	20.1214	20.1133	19.9670	19.4934	18.9107	18.4497	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.4863	18.7013	19.0444	19.4837	19.8471	20.0613	20.1214	20.1133	19.9670	19.4934	18.9107	18.4497	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9876	0.9771	0.9545	0.9000	0.7919	0.6193	0.4467	0.5024	0.7543	0.9287	0.9787	0.9900	(94)
Ext temp.	471.4676	552.2891	619.2161	661.1088	628.0057	484.9028	333.4541	345.8293	471.0015	501.2949	461.6866	444.1718	(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	1417.4971	1376.3743	1248.6629	1044.1364	802.3999	533.6746	344.1118	362.3293	575.0572	875.9061	1167.1882	1413.2015	(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	703.8460	553.7852	468.3084	275.7799	129.7493	0.0000	0.0000	0.0000	0.0000	278.7107	507.9611	720.9580	(98)
Space heating per m2												3639.0987	(98)
										(98) / (4) =		41.8769	(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	918.5581	723.1202	741.5796	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8249	0.8858	0.8579	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	757.6776	640.5080	636.2111	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	1012.5896	967.9825	901.7628	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												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	183.5366	243.6411	197.5704	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												624.7481 (104)
Cooled fraction									fC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)												
Intermittency factor	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												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	45.8842	60.9103	49.3926	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												156.1870 (107)
Space cooling per m2												1.7973 (108)
Energy for space heating												41.8769 (99)
Energy for space cooling												1.7973 (108)
Total												43.6742 (109)
Dwelling Fabric Energy Efficiency (DFEE)												43.7 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	43.4500 (1b)	x 2.4200 (2b)	= 105.1490 (1b) - (3b)
First floor	43.4500 (1c)	x 2.6900 (2c)	= 116.8805 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	86.9000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 222.0295 (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																3 * 10 =	30.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =										30.0000 / (5) =							0.1351 (8)
Pressure test										Yes							
Measured/design AP50																	5.0000
Infiltration rate																	0.3851 (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) =							0.3273 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
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	0.4174	0.4092	0.4010	0.3601	0.3519	0.3110	0.3110	0.3028	0.3273	0.3519	0.3683	0.3846	(22b)				
Effective ac	0.5871	0.5837	0.5804	0.5648	0.5619	0.5484	0.5484	0.5458	0.5536	0.5619	0.5678	0.5740	(25)				

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opaque door			2.1500	1.0000	2.1500		(26)					
TER Opening Type (Uw = 1.40)			12.9500	1.3258	17.1686		(27)					
gf			43.4500	0.1300	5.6485		(28a)					
external	95.5700	15.1000	80.4700	0.1800	14.4846		(29a)					
cold	43.4500		43.4500	0.1300	5.6485		(30)					
Total net area of external elements Aum(A, m2)			182.4700				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26) ... (30) + (32) =	45.1002		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.3983 (36)					
Total fabric heat loss						(33) + (36) =	54.4985 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 43.0166	Feb 42.7688	Mar 42.5259	Apr 41.3850	May 41.1715	Jun 40.1778	Jul 40.1778	Aug 39.9938	Sep 40.5606	Oct 41.1715	Nov 41.6033	Dec 42.0548 (38)
Heat transfer coeff	97.5151	97.2673	97.0243	95.8834	95.6700	94.6763	94.6763	94.4923	95.0590	95.6700	96.1018	96.5533 (39)
Average = Sum(39)m / 12 =												95.8824 (39)
HLP	Jan 1.1222	Feb 1.1193	Mar 1.1165	Apr 1.1034	May 1.1009	Jun 1.0895	Jul 1.0895	Aug 1.0874	Sep 1.0939	Oct 1.1009	Nov 1.1059	Dec 1.1111 (40)
HLP (average)												1.1034 (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												2.5809 (42)
Average daily hot water use (litres/day)												95.4956 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												
	105.0452	101.2253	97.4055	93.5857	89.7659	85.9460	85.9460	89.7659	93.5857	97.4055	101.2253	105.0452 (44)
Energy conte	155.7789	136.2452	140.5929	122.5723	117.6110	101.4894	94.0448	107.9178	109.2067	127.2699	138.9250	150.8636 (45)
Energy content (annual)											Total = Sum(45)m =	1502.5175 (45)
Distribution loss	(46)m = 0.15 x (45)m											
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Heat gains from water heating, kWh/month	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
	33.1030	28.9521	29.8760	26.0466	24.9923	21.5665	19.9845	22.9325	23.2064	27.0448	29.5216	32.0585 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	129.0434	129.0434	129.0434	129.0434	129.0434	129.0434	129.0434	129.0434	129.0434	129.0434	129.0434	129.0434	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	22.0126	19.5514	15.9003	12.0375	8.9982	7.5967	8.2085	10.6697	14.3208	18.1836	21.2229	22.6244	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	233.2576	235.6780	229.5785	216.5933	200.2018	184.7961	174.5042	172.0837	178.1833	191.1684	207.5599	222.9656	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.9043	35.9043	35.9043	35.9043	35.9043	35.9043	35.9043	35.9043	35.9043	35.9043	35.9043	35.9043	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-103.2347	-103.2347	-103.2347	-103.2347	-103.2347	-103.2347	-103.2347	-103.2347	-103.2347	-103.2347	-103.2347	-103.2347	(71)
Water heating gains (Table 5)	44.4933	43.0835	40.1559	36.1758	33.5919	29.9535	26.8609	30.8233	32.2311	36.3506	41.0022	43.0894	(72)
Total internal gains	361.4765	360.0260	347.3477	326.5197	304.5049	284.0593	271.2866	275.2897	286.4482	307.4156	331.4980	350.3924	(73)

6. Solar gains

[Jan]			Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W				
Northeast			5.8500	11.2829	0.6300	0.7000	0.7700	20.1720 (75)				
Southwest			7.1000	36.7938	0.6300	0.7000	0.7700	79.8372 (79)				

Solar gains	100.0092	177.0530	260.0490	352.0443	421.5473	430.4758	410.0404	356.3570	291.6190	200.4800	121.0082	84.7975 (83)
Total gains	461.4857	537.0790	607.3967	678.5640	726.0522	714.5350	681.3270	631.6466	578.0672	507.8956	452.5062	435.1899 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	61.8850	62.0427	62.1980	62.9381	63.0785	63.7406	63.7406	63.8647	63.4839	63.0785	62.7951	62.5015	
alpha	5.1257	5.1362	5.1465	5.1959	5.2052	5.2494	5.2494	5.2576	5.2323	5.2052	5.1863	5.1668	
util living area	0.9989	0.9973	0.9924	0.9735	0.9109	0.7637	0.5926	0.6549	0.8876	0.9850	0.9976	0.9992	(86)
MIT	19.7318	19.8802	20.1257	20.4554	20.7510	20.9341	20.9860	20.9770	20.8440	20.4605	20.0365	19.7077	(87)
Th 2	19.9828	19.9851	19.9874	19.9981	20.0001	20.0094	20.0094	20.0112	20.0058	20.0001	19.9960	19.9918	(88)
util rest of house	0.9985	0.9964	0.9896	0.9627	0.8739	0.6764	0.4688	0.5303	0.8270	0.9771	0.9966	0.9989	(89)
MIT 2	18.8221	18.9720	19.2180	19.5503	19.8261	19.9779	20.0057	20.0043	19.9148	19.5606	19.1371	18.8053	(90)
Living area fraction	18.9629	19.1126	19.3585	19.6903	19.9692	20.1259	20.1574	20.1548	20.0587	19.6999	19.2763	18.9450	(92)
MIT	18.9629	19.1126	19.3585	19.6903	19.9692	20.1259	20.1574	20.1548	20.0587	19.6999	19.2763	18.9450	(93)
Temperature adjustment												0.0000	
adjusted MIT	18.9629	19.1126	19.3585	19.6903	19.9692	20.1259	20.1574	20.1548	20.0587	19.6999	19.2763	18.9450	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9979	0.9952	0.9872	0.9585	0.8726	0.6877	0.4881	0.5495	0.8309	0.9739	0.9955	0.9985	(94)
Ext temp.	460.5352	534.5156	599.6316	650.4091	633.5371	491.3580	332.5353	347.0996	480.3058	494.6250	450.4901	434.5277	(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	1429.8541	1382.4182	1247.5888	1034.6156	791.1188	523.1717	336.8050	354.8032	566.4239	870.5838	1170.1644	1423.6784	(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	721.1732	569.7906	482.0802	276.6287	117.2408	0.0000	0.0000	0.0000	0.0000	279.7134	518.1655	735.9281	(98)
Space heating per m2												3700.7204	(98)
												42.5860	(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	889.9570	700.6045	718.1412	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8590	0.9224	0.8965	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	764.4470	646.2467	643.8019	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	932.5972	891.7875	835.5434	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	121.0681	182.6823	142.6556	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												446.4061	(104)
Cooled fraction												1.0000	(105)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	30.2670	45.6706	35.6639	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling											111.6015 (107)
Space cooling per m2											1.2843 (108)
Energy for space heating											42.5860 (99)
Energy for space cooling											1.2843 (108)
Total											43.8702 (109)
Target Fabric Energy Efficiency (TFEE)											50.5 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	43.4500 (1b)	x 2.4200 (2b)	= 105.1490 (1b) - (3b)
First floor	43.4500 (1c)	x 2.6900 (2c)	= 116.8805 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	86.9000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 222.0295 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1351 (8)
Pressure test					Yes
Measured/design AP50					4.0800
Infiltration rate					0.3391 (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) =		0.2882 (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	0.3315	0.3243	0.3243	0.2955	0.3027	0.2666	0.2522	0.2522	0.2666	0.2955	0.2955	0.3027 (22b)
Effective ac	0.5549	0.5526	0.5526	0.5436	0.5458	0.5355	0.5318	0.5318	0.5355	0.5436	0.5436	0.5458 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front			2.1500	1.4000	3.0100		(26)
front (Uw = 1.30)			12.9500	1.2357	16.0029		(27)
gf			43.4500	0.1500	6.5175	75.0000	3258.7501 (28a)
external	95.5700	15.1000	80.4700	0.2000	16.0940	60.0000	4828.2000 (29a)
cold	43.4500		43.4500	0.0900	3.9105	9.0000	391.0500 (30)
Total net area of external elements Aum(A, m ²)			182.4700				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	45.5349		(33)
party			43.7600	0.0000	0.0000	70.0000	3063.1999 (32)
gf			80.7000			9.0000	726.3000 (32c)
1f			102.8118			9.0000	925.3062 (32c)
1f			43.4500			18.0000	782.1000 (32d)
gf			43.4500			9.0000	391.0500 (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) = 14365.9561 (34)
165.3160 (35)
12.8021 (36)
(33) + (36) = 58.3370 (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	40.6604	40.4873	40.4873	39.8329	39.9908	39.2393	38.9654	38.9654	39.2393	39.8329	39.8329	39.9908 (38)
Heat transfer coeff	98.9974	98.8243	98.8243	98.1698	98.3277	97.5763	97.3023	97.3023	97.5763	98.1698	98.1698	98.3277 (39)
Average = Sum(39)m / 12 =												98.1307 (39)
HLP	1.1392	1.1372	1.1372	1.1297	1.1315	1.1229	1.1197	1.1197	1.1229	1.1297	1.1297	1.1315 (40)
HLP (average)												1.1292 (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												2.5809 (42)
Average daily hot water use (litres/day)												95.4956 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	105.0452	101.2253	97.4055	93.5857	89.7659	85.9460	85.9460	89.7659	93.5857	97.4055	101.2253	105.0452 (44)
Energy conte	155.7789	136.2452	140.5929	122.5723	117.6110	101.4894	94.0448	107.9178	109.2067	127.2699	138.9250	150.8636 (45)
Energy content (annual)										Total = Sum(45)m =		1502.5175 (45)

FULL SAP CALCULATION PRINTOUT

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CALCULATION OF HEAT DEMAND 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	23.3668	20.4368	21.0889	18.3858	17.6417	15.2234	14.1067	16.1877	16.3810	19.0905	20.8388	22.6295 (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	18.7613	16.9007	18.5711	17.7921	18.2543	17.5145	18.0043	18.1664	17.6657	18.4400	18.0366	18.7117 (61)
Total heat required for water heating calculated for each month	174.5402	153.1459	159.1640	140.3644	135.8653	119.0039	112.0491	126.0842	126.8724	145.7099	156.9617	169.5752 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	174.5402	153.1459	159.1640	140.3644	135.8653	119.0039	112.0491	126.0842	126.8724	145.7099	156.9617	169.5752 (64)
RHI water heating demand												
Heat gains from water heating, kWh/month	56.4868	49.5267	51.3899	45.2033	43.6692	38.1238	35.7710	40.4243	40.7277	46.9272	50.7017	54.8401 (65)
Solar input (sum of months) = Sum(63)m =												0.0000 (63)
Total per year (kWh/year) = Sum(64)m =												1719 (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	154.8520	154.8520	154.8520	154.8520	154.8520	154.8520	154.8520	154.8520	154.8520	154.8520	154.8520	154.8520	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	53.1195	47.1803	38.3696	29.0482	21.7139	18.3318	19.8081	25.7474	34.5581	43.8794	51.2138	54.5959	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	348.1456	351.7583	342.6545	323.2736	298.8087	275.8151	260.4540	256.8414	265.9452	285.3260	309.7909	332.7845	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.0661	53.0661	53.0661	53.0661	53.0661	53.0661	53.0661	53.0661	53.0661	53.0661	53.0661	53.0661	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-103.2347	-103.2347	-103.2347	-103.2347	-103.2347	-103.2347	-103.2347	-103.2347	-103.2347	-103.2347	-103.2347	-103.2347	(71)
Water heating gains (Table 5)	75.9231	73.7005	69.0725	62.7824	58.6952	52.9498	48.0793	54.3337	56.5662	63.0742	70.4191	73.7098	(72)
Total internal gains	584.8717	580.3224	557.7799	522.7876	486.9012	454.7801	436.0249	444.6058	464.7528	499.9631	539.1072	568.7735	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
Northeast				5.8500	9.5471		0.4600	0.0000	1.0000		25.6913 (75)	
Southwest				7.1000	31.1332		0.4600	0.0000	1.0000		101.6812 (79)	

Solar gains	127.3724	236.8846	366.9547	505.1591	591.5401	615.5429	574.7295	491.9649	416.0356	278.8964	160.0608	115.4791 (83)
Total gains	712.2441	817.2071	924.7347	1027.9467	1078.4413	1070.3230	1010.7544	936.5707	880.7884	778.8595	699.1679	684.2526 (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	40.3096	40.3802	40.3802	40.6494	40.5841	40.8967	41.0118	41.0118	40.8967	40.6494	40.6494	40.5841	
alpha	3.6873	3.6920	3.6920	3.7100	3.7056	3.7264	3.7341	3.7341	3.7264	3.7100	3.7100	3.7056	
util living area	0.9720	0.9533	0.9164	0.8290	0.6885	0.5192	0.4135	0.4525	0.6724	0.8739	0.9537	0.9755	(86)
MIT	19.6365	19.8562	20.1622	20.5603	20.8325	20.9558	20.9849	20.9792	20.8796	20.5243	20.0231	19.5987	(87)
Th 2	19.9689	19.9706	19.9706	19.9767	19.9752	19.9822	19.9848	19.9848	19.9822	19.9767	19.9767	19.9752	(88)
util rest of house	0.9660	0.9436	0.8993	0.7953	0.6310	0.4408	0.3225	0.3568	0.5986	0.8409	0.9423	0.9703	(89)
MIT 2	18.7501	18.9656	19.2600	19.6345	19.8652	19.9609	19.9797	19.9775	19.9128	19.6118	19.1370	18.7179	(90)
Living area fraction									fLA = Living area / (4) =			0.1548	(91)
MIT	18.8873	19.1035	19.3997	19.7778	20.0149	20.1149	20.1353	20.1325	20.0624	19.7531	19.2741	18.8542	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8873	19.1035	19.3997	19.7778	20.0149	20.1149	20.1353	20.1325	20.0624	19.7531	19.2741	18.8542	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9579	0.9335	0.8881	0.7879	0.6334	0.4514	0.3363	0.3712	0.6049	0.8325	0.9325	0.9628	(94)
Useful gains	682.2937	762.8850	821.2324	809.9566	683.0748	483.1410	339.9142	347.6096	532.7752	648.3960	651.9564	658.8129	(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	1404.5071	1364.1192	1255.0345	1028.6061	758.5896	499.0899	343.9937	353.4515	581.7921	878.9208	1155.8639	1401.5879	(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	537.3268	404.0294	322.7488	157.4276	56.1830	0.0000	0.0000	0.0000	0.0000	171.5104	362.8134	552.6246	(98)
Space heating												2564.6639	(98)
RHI space heating demand												2565	(98)

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FULL SAP CALCULATION PRINTOUT

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CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	43.4500 (1b)	x 2.4200 (2b)	= 105.1490 (1b) - (3b)
First floor	43.4500 (1c)	x 2.6900 (2c)	= 116.8805 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	86.9000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 222.0295 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1351 (8)
Pressure test					Yes
Measured/design AP50					4.0800
Infiltration rate					0.3391 (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) =	0.2882 (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	0.3675	0.3603	0.3531	0.3171	0.3099	0.2738	0.2738	0.2666	0.2882	0.3099	0.3243	0.3387 (22b)
Effective ac	0.5675	0.5649	0.5623	0.5503	0.5480	0.5375	0.5375	0.5355	0.5415	0.5480	0.5526	0.5574 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front			2.1500	1.4000	3.0100		(26)
front (Uw = 1.30)			12.9500	1.2357	16.0029		(27)
gf			43.4500	0.1500	6.5175	75.0000	3258.7501 (28a)
external	95.5700	15.1000	80.4700	0.2000	16.0940	60.0000	4828.2000 (29a)
cold	43.4500		43.4500	0.0900	3.9105	9.0000	391.0500 (30)
Total net area of external elements Aum(A, m ²)			182.4700				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	45.5349		(33)
party			43.7600	0.0000	0.0000	70.0000	3063.1999 (32)
gf			80.7000			9.0000	726.3000 (32c)
1f			102.8118			9.0000	925.3062 (32c)
1f			43.4500			18.0000	782.1000 (32d)
gf			43.4500			9.0000	391.0500 (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) = 14365.9561 (34)
165.3160 (35)
12.8021 (36)
(33) + (36) = 58.3370 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	41.5831	41.3910	41.2026	40.3180	40.1525	39.3820	39.3820	39.2393	39.6788	40.1525	40.4873	40.8374 (38)
Heat transfer coeff	99.9201	99.7279	99.5396	98.6550	98.4894	97.7189	97.7189	97.5763	98.0157	98.4894	98.8243	99.1743 (39)
Average = Sum(39)m / 12 =												98.6542 (39)
HLP	1.1498	1.1476	1.1454	1.1353	1.1334	1.1245	1.1245	1.1229	1.1279	1.1334	1.1372	1.1412 (40)
HLP (average)												1.1353 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.5809 (42)
Average daily hot water use (litres/day)												95.4956 (43)
Daily hot water use	105.0452	101.2253	97.4055	93.5857	89.7659	85.9460	85.9460	89.7659	93.5857	97.4055	101.2253	105.0452 (44)
Energy conte	155.7789	136.2452	140.5929	122.5723	117.6110	101.4894	94.0448	107.9178	109.2067	127.2699	138.9250	150.8636 (45)
Energy content (annual)										Total = Sum(45)m =		1502.5175 (45)

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Distribution loss (46)m = 0.15 x (45)m	23.3668	20.4368	21.0889	18.3858	17.6417	15.2234	14.1067	16.1877	16.3810	19.0905	20.8388	22.6295 (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	18.7613	16.9007	18.5711	17.7921	18.2543	17.5145	18.0043	18.1664	17.6657	18.4400	18.0366	18.7117 (61)
Total heat required for water heating calculated for each month	174.5402	153.1459	159.1640	140.3644	135.8653	119.0039	112.0491	126.0842	126.8724	145.7099	156.9617	169.5752 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	174.5402	153.1459	159.1640	140.3644	135.8653	119.0039	112.0491	126.0842	126.8724	145.7099	156.9617	169.5752 (64)
Heat gains from water heating, kWh/month	56.4868	49.5267	51.3899	45.2033	43.6692	38.1238	35.7710	40.4243	40.7277	46.9272	50.7017	54.8401 (65)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)												
Total per year (kWh/year) = Sum(64)m = 1719.3362 (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	154.8520	154.8520	154.8520	154.8520	154.8520	154.8520	154.8520	154.8520	154.8520	154.8520	154.8520	154.8520 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	53.1195	47.1803	38.3696	29.0482	21.7139	18.3318	19.8081	25.7474	34.5581	43.8794	51.2138	54.5959 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	348.1456	351.7583	342.6545	323.2736	298.8087	275.8151	260.4540	256.8414	265.9452	285.3260	309.7909	332.7845 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.0661	53.0661	53.0661	53.0661	53.0661	53.0661	53.0661	53.0661	53.0661	53.0661	53.0661	53.0661 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-103.2347	-103.2347	-103.2347	-103.2347	-103.2347	-103.2347	-103.2347	-103.2347	-103.2347	-103.2347	-103.2347	-103.2347 (71)
Water heating gains (Table 5)	75.9231	73.7005	69.0725	62.7824	58.6952	52.9498	48.0793	54.3337	56.5662	63.0742	70.4191	73.7098 (72)
Total internal gains	584.8717	580.3224	557.7799	522.7876	486.9012	454.7801	436.0249	444.6058	464.7528	499.9631	539.1072	568.7735 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d			Gains W
Northeast					5.8500	11.2829	0.4600	0.0000			1.0000			30.3624 (75)
Southwest					7.1000	36.7938	0.4600	0.0000			1.0000			120.1687 (79)
Solar gains	150.5311	266.4952	391.4184	529.8871	634.5011	647.9399	617.1811	536.3784	438.9366	301.7567	182.1381			127.6348 (83)
Total gains	735.4027	846.8176	949.1983	1052.6747	1121.4023	1102.7200	1053.2060	980.9842	903.6894	801.7198	721.2453			696.4083 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	39.9374	40.0143	40.0900	40.4495	40.5175	40.8369	40.8369	40.8967	40.7133	40.5175	40.3802	40.2377
alpha	3.6625	3.6676	3.6727	3.6966	3.7012	3.7225	3.7225	3.7264	3.7142	3.7012	3.6920	3.6825
util living area	0.9716	0.9524	0.9145	0.8336	0.7015	0.5352	0.3995	0.4437	0.6622	0.8717	0.9537	0.9762 (86)
MIT	19.5916	19.8198	20.1499	20.5315	20.8084	20.9477	20.9863	20.9799	20.8845	20.5177	19.9846	19.5410 (87)
Th 2	19.9603	19.9621	19.9639	19.9721	19.9737	19.9809	19.9809	19.9822	19.9781	19.9737	19.9706	19.9673 (88)
util rest of house	0.9656	0.9427	0.8973	0.8014	0.6483	0.4605	0.3108	0.3514	0.5882	0.8390	0.9427	0.9711 (89)
MIT 2	18.6988	18.9227	19.2421	19.6037	19.8434	19.9541	19.9764	19.9750	19.9119	19.6023	19.0940	18.6546 (90)
Living area fraction									fLA = Living area / (4) =			0.1548 (91)
MIT	18.8370	19.0616	19.3826	19.7473	19.9927	20.1079	20.1327	20.1305	20.0625	19.7440	19.2318	18.7918 (92)
Temperature adjustment												0.0000
adjusted MIT	18.8370	19.0616	19.3826	19.7473	19.9927	20.1079	20.1327	20.1305	20.0625	19.7440	19.2318	18.7918 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	704.0751	789.6155	840.9699	835.3057	728.1437	518.4777	341.5405	358.2661	537.5000	665.8235	672.7663	671.1457 (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	1452.5386	1412.3059	1282.3319	1070.1372	816.7473	538.2267	345.2097	364.0117	584.4155	900.5862	1198.9172	1447.1354 (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	556.8568	418.4480	328.3734	169.0787	65.9211	0.0000	0.0000	0.0000	0.0000	174.6635	378.8287	577.3364 (98)
Space heating												2669.5065 (98)
Space heating per m ²										(98) / (4) =		30.7193 (99)

8c. Space cooling requirement

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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													2870.4371 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	556.8568	418.4480	328.3734	169.0787	65.9211	0.0000	0.0000	0.0000	0.0000	174.6635	378.8287	577.3364	(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)	598.7708	449.9440	353.0896	181.8051	70.8829	0.0000	0.0000	0.0000	0.0000	187.8102	407.3427	620.7918	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	174.5402	153.1459	159.1640	140.3644	135.8653	119.0039	112.0491	126.0842	126.8724	145.7099	156.9617	169.5752	(64)
Efficiency of water heater (217)m	89.2654	89.1761	88.9981	88.6139	87.9578	87.0000	87.0000	87.0000	87.0000	88.6103	89.0999	89.3009	(216)
Fuel for water heating, kWh/month	195.5295	171.7342	178.8397	158.3999	154.4664	136.7860	128.7921	144.9243	145.8304	164.4390	176.1636	189.8920	(219)
Water heating fuel used													(219)
Annual totals kWh/year													
Space heating fuel - main system													2870.4371 (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)													375.2428 (232)
Total delivered energy for all uses													5266.4771 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2870.4371	3.4800	99.8912 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1945.7972	3.4800	67.7137 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	375.2428	13.1900	49.4945 (250)
Additional standing charges			120.0000 (251)
Total energy cost			346.9920 (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] =	1.1049 (257)
SAP value		84.5866
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	2870.4371	0.2160	620.0144 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1945.7972	0.2160	420.2922 (264)
Space and water heating			1040.3066 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	375.2428	0.5190	194.7510 (268)
Total kg/year			1273.9826 (272)
CO2 emissions per m2			14.6600 (273)
EI value			87.0573
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	$3.48 / 0.8825 = 3.943$, stars = 4
Water heating environmental impact	$0.216 / 0.8825 = 0.2448$, stars = 4

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	43.4500 (1b)	x 2.4200 (2b)	= 105.1490 (1b) - (3b)
First floor	43.4500 (1c)	x 2.6900 (2c)	= 116.8805 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	86.9000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 222.0295 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					30.0000 / (5) = 0.1351 (8)
Pressure test					Yes
Measured/design AP50					4.0800
Infiltration rate					0.3391 (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) =	0.2882 (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	0.3315	0.3243	0.3243	0.2955	0.3027	0.2666	0.2522	0.2522	0.2666	0.2955	0.2955	0.3027 (22b)
Effective ac	0.5549	0.5526	0.5526	0.5436	0.5458	0.5355	0.5318	0.5318	0.5355	0.5436	0.5436	0.5458 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front			2.1500	1.4000	3.0100		(26)
front (Uw = 1.30)			12.9500	1.2357	16.0029		(27)
gf			43.4500	0.1500	6.5175	75.0000	3258.7501 (28a)
external	95.5700	15.1000	80.4700	0.2000	16.0940	60.0000	4828.2000 (29a)
cold	43.4500		43.4500	0.0900	3.9105	9.0000	391.0500 (30)
Total net area of external elements Aum(A, m ²)			182.4700				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	45.5349		(33)
party			43.7600	0.0000	0.0000	70.0000	3063.1999 (32)
gf			80.7000			9.0000	726.3000 (32c)
1f			102.8118			9.0000	925.3062 (32c)
1f			43.4500			18.0000	782.1000 (32d)
gf			43.4500			9.0000	391.0500 (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) = 14365.9561 (34)
165.3160 (35)
12.8021 (36)
(33) + (36) = 58.3370 (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	40.6604	40.4873	40.4873	39.8329	39.9908	39.2393	38.9654	38.9654	39.2393	39.8329	39.8329	39.9908 (38)
Heat transfer coeff	98.9974	98.8243	98.8243	98.1698	98.3277	97.5763	97.3023	97.3023	97.5763	98.1698	98.1698	98.3277 (39)
Average = Sum(39)m / 12 =												98.1307 (39)
HLP	1.1392	1.1372	1.1372	1.1297	1.1315	1.1229	1.1197	1.1197	1.1229	1.1297	1.1297	1.1315 (40)
HLP (average)												1.1292 (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												2.5809 (42)
Average daily hot water use (litres/day)												95.4956 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	105.0452	101.2253	97.4055	93.5857	89.7659	85.9460	85.9460	89.7659	93.5857	97.4055	101.2253	105.0452 (44)
Energy conte	155.7789	136.2452	140.5929	122.5723	117.6110	101.4894	94.0448	107.9178	109.2067	127.2699	138.9250	150.8636 (45)
Energy content (annual)										Total = Sum(45)m =		1502.5175 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Distribution loss (46)m = 0.15 x (45)m	23.3668	20.4368	21.0889	18.3858	17.6417	15.2234	14.1067	16.1877	16.3810	19.0905	20.8388	22.6295 (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	18.7613	16.9007	18.5711	17.7921	18.2543	17.5145	18.0043	18.1664	17.6657	18.4400	18.0366	18.7117 (61)
Total heat required for water heating calculated for each month	174.5402	153.1459	159.1640	140.3644	135.8653	119.0039	112.0491	126.0842	126.8724	145.7099	156.9617	169.5752 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	174.5402	153.1459	159.1640	140.3644	135.8653	119.0039	112.0491	126.0842	126.8724	145.7099	156.9617	169.5752 (64)
Heat gains from water heating, kWh/month	56.4868	49.5267	51.3899	45.2033	43.6692	38.1238	35.7710	40.4243	40.7277	46.9272	50.7017	54.8401 (65)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)												
Total per year (kWh/year) = Sum(64)m = 1719.3362 (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	154.8520	154.8520	154.8520	154.8520	154.8520	154.8520	154.8520	154.8520	154.8520	154.8520	154.8520	154.8520	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	53.1195	47.1803	38.3696	29.0482	21.7139	18.3318	19.8081	25.7474	34.5581	43.8794	51.2138	54.5959	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	348.1456	351.7583	342.6545	323.2736	298.8087	275.8151	260.4540	256.8414	265.9452	285.3260	309.7909	332.7845	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.0661	53.0661	53.0661	53.0661	53.0661	53.0661	53.0661	53.0661	53.0661	53.0661	53.0661	53.0661	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-103.2347	-103.2347	-103.2347	-103.2347	-103.2347	-103.2347	-103.2347	-103.2347	-103.2347	-103.2347	-103.2347	-103.2347	(71)
Water heating gains (Table 5)	75.9231	73.7005	69.0725	62.7824	58.6952	52.9498	48.0793	54.3337	56.5662	63.0742	70.4191	73.7098	(72)
Total internal gains	584.8717	580.3224	557.7799	522.7876	486.9012	454.7801	436.0249	444.6058	464.7528	499.9631	539.1072	568.7735	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g		Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast				5.8500	9.5471			0.4600	0.0000	1.0000	25.6913 (75)	
Southwest				7.1000	31.1332			0.4600	0.0000	1.0000	101.6812 (79)	
Solar gains	127.3724	236.8846	366.9547	505.1591	591.5401	615.5429	574.7295	491.9649	416.0356	278.8964	160.0608	115.4791 (83)
Total gains	712.2441	817.2071	924.7347	1027.9467	1078.4413	1070.3230	1010.7544	936.5707	880.7884	778.8595	699.1679	684.2526 (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	40.3096	40.3802	40.3802	40.6494	40.5841	40.8967	41.0118	41.0118	40.8967	40.6494	40.6494	40.5841	
alpha	3.6873	3.6920	3.6920	3.7100	3.7056	3.7264	3.7341	3.7341	3.7264	3.7100	3.7100	3.7056	
util living area	0.9720	0.9533	0.9164	0.8290	0.6885	0.5192	0.4135	0.4525	0.6724	0.8739	0.9537	0.9755	(86)
MIT	19.6365	19.8562	20.1622	20.5603	20.8325	20.9558	20.9849	20.9792	20.8796	20.5243	20.0231	19.5987	(87)
Th 2	19.9689	19.9706	19.9706	19.9767	19.9752	19.9822	19.9848	19.9848	19.9822	19.9767	19.9767	19.9752	(88)
util rest of house	0.9660	0.9436	0.8993	0.7953	0.6310	0.4408	0.3225	0.3568	0.5986	0.8409	0.9423	0.9703	(89)
MIT 2	18.7501	18.9656	19.2600	19.6345	19.8652	19.9609	19.9797	19.9775	19.9128	19.6118	19.1370	18.7179	(90)
Living area fraction	18.8873	19.1035	19.3997	19.7778	20.0149	20.1149	20.1353	20.1325	20.0624	19.7531	19.2741	18.8542	(91)
MIT	18.8873	19.1035	19.3997	19.7778	20.0149	20.1149	20.1353	20.1325	20.0624	19.7531	19.2741	18.8542	(92)
Temperature adjustment	18.8873	19.1035	19.3997	19.7778	20.0149	20.1149	20.1353	20.1325	20.0624	19.7531	19.2741	18.8542	(93)
adjusted MIT	18.8873	19.1035	19.3997	19.7778	20.0149	20.1149	20.1353	20.1325	20.0624	19.7531	19.2741	18.8542	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9579	0.9335	0.8881	0.7879	0.6334	0.4514	0.3363	0.3712	0.6049	0.8325	0.9325	0.9628	(94)
Useful gains	682.2937	762.8850	821.2324	809.9566	683.0748	483.1410	339.9142	347.6096	532.7752	648.3960	651.9564	658.8129	(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	1404.5071	1364.1192	1255.0345	1028.6061	758.5896	499.0899	343.9937	353.4515	581.7921	878.9208	1155.8639	1401.5879	(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	537.3268	404.0294	322.7488	157.4276	56.1830	0.0000	0.0000	0.0000	0.0000	171.5104	362.8134	552.6246	(98)
Space heating												2564.6639	(98)
Space heating per m2												29.5128	(99)
										(98) / (4) =			

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.0000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													2757.7031 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	537.3268	404.0294	322.7488	157.4276	56.1830	0.0000	0.0000	0.0000	0.0000	171.5104	362.8134	552.6246	(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)	577.7707	434.4402	347.0417	169.2770	60.4118	0.0000	0.0000	0.0000	0.0000	184.4198	390.1219	594.2200	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	174.5402	153.1459	159.1640	140.3644	135.8653	119.0039	112.0491	126.0842	126.8724	145.7099	156.9617	169.5752	(64)
Efficiency of water heater (217)m	89.2455	89.1550	88.9865	88.5606	87.8567	87.0000	87.0000	87.0000	87.0000	88.5967	89.0725	89.2772	(216)
Fuel for water heating, kWh/month	195.5733	171.7749	178.8630	158.4953	154.6441	136.7860	128.7921	144.9243	145.8304	164.4642	176.2179	189.9425	(219)
Water heating fuel used												1946.3081	(219)
Annual totals kWh/year													
Space heating fuel - main system												2757.7031	(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)													375.2428 (232)
Total delivered energy for all uses													5154.2541 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2757.7031	10.2300	282.1130 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1946.3081	10.2300	199.1073 (247)
Pumps and fans for heating	75.0000	36.7200	27.5400 (249)
Energy for lighting	375.2428	36.7200	137.7892 (250)
Additional standing charges			103.0000 (251)
Total energy cost			749.5495 (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	2757.7031	0.2160	595.6639 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1946.3081	0.2160	420.4025 (264)
Space and water heating			1016.0664 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	375.2428	0.5190	194.7510 (268)
Total kg/year			1249.7425 (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	2757.7031	1.2200	3364.3978 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1946.3081	1.2200	2374.4959 (264)
Space and water heating			5738.8937 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	375.2428	3.0700	1151.9955 (268)
Primary energy kWh/year			7121.1392 (272)
Primary energy kWh/m2/year			81.9464 (273)

SAP 2012 EPC IMPROVEMENTS

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

(For testing purposes):

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

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.2	-£ 79	-179 kg (14.3%)
U Solar photovoltaic panels	+ 10.1	-£ 589	-833 kg (77.8%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£79	2.06 kg/m²	B 86 B 89
Solar photovoltaic panels	£589	9.59 kg/m²	A 96 A 98
Total Savings	£668	11.65 kg/m²	

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

Fuel prices for cost data on this page from database revision number 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	£165	£184	-£18
Mains gas	£584	£487	£97
Space heating	£413	£413	£0
Water heating	£199	£120	£79
Lighting	£138	£138	£0
Generated (PV)	-£0	-£589	£589
Total cost of fuels	£749	£82	£668
Total cost of uses	£750	£82	£668
Delivered energy	59 kWh/m²	30 kWh/m²	29 kWh/m²
Carbon dioxide emissions	1.2 tonnes	0.2 tonnes	1.0 tonnes
CO2 emissions per m²	14 kg/m²	3 kg/m²	12 kg/m²
Primary energy	82 kWh/m²	14 kWh/m²	68 kWh/m²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	43.4500 (1b)	x 2.4200 (2b)	= 105.1490 (1b) - (3b)
First floor	43.4500 (1c)	x 2.6900 (2c)	= 116.8805 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	86.9000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 222.0295 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
					Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1351 (8)
Pressure test					Yes
Measured/design AP50					4.0800
Infiltration rate					0.3391 (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) = 0.2882 (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	0.3675	0.3603	0.3531	0.3171	0.3099	0.2738	0.2738	0.2666	0.2882	0.3099	0.3243	0.3387 (22b)
Effective ac	0.5675	0.5649	0.5623	0.5503	0.5480	0.5375	0.5375	0.5355	0.5415	0.5480	0.5526	0.5574 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front			2.1500	1.4000	3.0100		(26)
front (Uw = 1.30)			12.9500	1.2357	16.0029		(27)
gf			43.4500	0.1500	6.5175	75.0000	3258.7501 (28a)
external	95.5700	15.1000	80.4700	0.2000	16.0940	60.0000	4828.2000 (29a)
cold	43.4500		43.4500	0.0900	3.9105	9.0000	391.0500 (30)
Total net area of external elements Aum(A, m ²)			182.4700				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	45.5349		(33)
party			43.7600	0.0000	0.0000	70.0000	3063.1999 (32)
gf			80.7000			9.0000	726.3000 (32c)
lf			102.8118			9.0000	925.3062 (32c)
lf			43.4500			18.0000	782.1000 (32d)
gf			43.4500			9.0000	391.0500 (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) = 14365.9561 (34)
165.3160 (35)
12.8021 (36)
(33) + (36) = 58.3370 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	41.5831	41.3910	41.2026	40.3180	40.1525	39.3820	39.3820	39.2393	39.6788	40.1525	40.4873	40.8374 (38)
Heat transfer coeff	99.9201	99.7279	99.5396	98.6550	98.4894	97.7189	97.7189	97.5763	98.0157	98.4894	98.8243	99.1743 (39)
Average = Sum(39)m / 12 =												98.6542 (39)
HLP	1.1498	1.1476	1.1454	1.1353	1.1334	1.1245	1.1245	1.1229	1.1279	1.1334	1.1372	1.1412 (40)
HLP (average)												1.1353 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.5809 (42)
Average daily hot water use (litres/day)												95.4956 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	105.0452	101.2253	97.4055	93.5857	89.7659	85.9460	85.9460	89.7659	93.5857	97.4055	101.2253	105.0452 (44)
Energy conte	155.7789	136.2452	140.5929	122.5723	117.6110	101.4894	94.0448	107.9178	109.2067	127.2699	138.9250	150.8636 (45)
Energy content (annual)										Total = Sum(45)m =		1502.5175 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	23.3668	20.4368	21.0889	18.3858	17.6417	15.2234	14.1067	16.1877	16.3810	19.0905	20.8388	22.6295 (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	18.7613	16.9007	18.5711	17.7921	18.2543	17.5145	18.0043	18.1664	17.6657	18.4400	18.0366	18.7117 (61)
Total heat required for water heating calculated for each month	174.5402	153.1459	159.1640	140.3644	135.8653	119.0039	112.0491	126.0842	126.8724	145.7099	156.9617	169.5752 (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												1.2070 (H8)
Utilisation factor												0.5633 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												95.4956 (H14)
Volume ratio Veff/V												0.7854 (H15)
Solar storage volume factor												0.9517 (H16)
Solar input												-854.8593 (H17)
Solar input	-24.7892	-41.3661	-70.4512	-94.4184	-116.6460	-114.6816	-113.1661	-98.8738	-77.4380	-52.8810	-29.4036	-20.7443 (63)
Solar input (sum of months) = Sum (63)m =												-854.8593 (63)
Output from w/h	149.7510	111.7798	88.7128	45.9459	19.2193	4.3222	0.0000	27.2104	49.4345	92.8289	127.5581	148.8309 (64)
Total per year (kWh/year) = Sum (64)m =												865.5939 (64)
Heat gains from water heating, kWh/month	56.4868	49.5267	51.3899	45.2033	43.6692	38.1238	35.7710	40.4243	40.7277	46.9272	50.7017	54.8401 (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	154.8520	154.8520	154.8520	154.8520	154.8520	154.8520	154.8520	154.8520	154.8520	154.8520	154.8520	154.8520 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	53.1195	47.1803	38.3696	29.0482	21.7139	18.3318	19.8081	25.7474	34.5581	43.8794	51.2138	54.5959 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	348.1456	351.7583	342.6545	323.2736	298.8087	275.8151	260.4540	256.8414	265.9452	285.3260	309.7909	332.7845 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.0661	53.0661	53.0661	53.0661	53.0661	53.0661	53.0661	53.0661	53.0661	53.0661	53.0661	53.0661 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-103.2347	-103.2347	-103.2347	-103.2347	-103.2347	-103.2347	-103.2347	-103.2347	-103.2347	-103.2347	-103.2347	-103.2347 (71)
Water heating gains (Table 5)	75.9231	73.7005	69.0725	62.7824	58.6952	52.9498	48.0793	54.3337	56.5662	63.0742	70.4191	73.7098 (72)
Total internal gains	584.8717	580.3224	557.7799	522.7876	486.9012	454.7801	436.0249	444.6058	464.7528	499.9631	539.1072	568.7735 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b		FF Specific data or Table 6c	Access factor Table 6d		Gains W
Northeast					5.8500	11.2829	0.4600		0.0000	1.0000		30.3624 (75)
Southwest					7.1000	36.7938	0.4600		0.0000	1.0000		120.1687 (79)
Solar gains	150.5311	266.4952	391.4184	529.8871	634.5011	647.9399	617.1811	536.3784	438.9366	301.7567	182.1381	127.6348 (83)
Total gains	735.4027	846.8176	949.1983	1052.6747	1121.4023	1102.7200	1053.2060	980.9842	903.6894	801.7198	721.2453	696.4083 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	39.9374	40.0143	40.0900	40.4495	40.5175	40.8369	40.8369	40.8967	40.7133	40.5175	40.3802	40.2377
alpha	3.6625	3.6676	3.6727	3.6966	3.7012	3.7225	3.7225	3.7264	3.7142	3.7012	3.6920	3.6825
util living area	0.9716	0.9524	0.9145	0.8336	0.7015	0.5352	0.3995	0.4437	0.6622	0.8717	0.9537	0.9762 (86)
MIT	19.5916	19.8198	20.1499	20.5315	20.8084	20.9477	20.9863	20.9799	20.8845	20.5177	19.9846	19.5410 (87)
Th 2	19.9603	19.9621	19.9639	19.9721	19.9737	19.9809	19.9809	19.9822	19.9781	19.9737	19.9706	19.9673 (88)
util rest of house	0.9656	0.9427	0.8973	0.8014	0.6483	0.4605	0.3108	0.3514	0.5882	0.8390	0.9427	0.9711 (89)
MIT 2	18.6988	18.9227	19.2421	19.6037	19.8434	19.9541	19.9764	19.9750	19.9119	19.6023	19.0940	18.6546 (90)
Living area fraction									fLA = Living area / (4) =			0.1548 (91)
MIT	18.8370	19.0616	19.3826	19.7473	19.9927	20.1079	20.1327	20.1305	20.0625	19.7440	19.2318	18.7918 (92)
Temperature adjustment												0.0000
adjusted MIT	18.8370	19.0616	19.3826	19.7473	19.9927	20.1079	20.1327	20.1305	20.0625	19.7440	19.2318	18.7918 (93)

8. Space heating requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9574	0.9325	0.8860	0.7935	0.6493	0.4702	0.3243	0.3652	0.5948	0.8305	0.9328	0.9637	(94)
Useful gains	704.0751	789.6155	840.9699	835.3057	728.1437	518.4777	341.5405	358.2661	537.5000	665.8235	672.7663	671.1457	(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													
	1452.5386	1412.3059	1282.3319	1070.1372	816.7473	538.2267	345.2097	364.0117	584.4155	900.5862	1198.9172	1447.1354	(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													
	556.8568	418.4480	328.3734	169.0787	65.9211	0.0000	0.0000	0.0000	0.0000	174.6635	378.8287	577.3364	(98)
Space heating													2669.5065 (98)
Space heating per m2											(98) / (4) =	30.7193	(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	2870.4371	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	556.8568	418.4480	328.3734	169.0787	65.9211	0.0000	0.0000	0.0000	0.0000	174.6635	378.8287	577.3364	(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)	598.7708	449.9440	353.0896	181.8051	70.8829	0.0000	0.0000	0.0000	0.0000	187.8102	407.3427	620.7918	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)

Water heating													
Water heating requirement	149.7510	111.7798	88.7128	45.9459	19.2193	4.3222	0.0000	27.2104	49.4345	92.8289	127.5581	148.8309	(64)
Efficiency of water heater	89.3471	89.3505	89.3447	89.3417	89.3049	87.0000	87.0000	87.0000	87.0000	88.9357	89.2250	87.0000	(216)
Fuel for water heating, kWh/month	167.6060	125.1027	99.2928	51.4272	21.5210	4.9681	0.0000	31.2764	56.8212	104.3775	142.9623	166.5364	(219)
Water heating fuel used												971.8914	(219)
Annual totals kWh/year													
Space heating fuel - main system												2870.4371	(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)												375.2428	(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												2615.3319	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2870.4371	3.4800	99.8912	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	971.8914	3.4800	33.8218	(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	375.2428	13.1900	49.4945	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-1727.2394	13.1900	-227.8229	(252)
Total energy cost			91.8722	(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] =	0.2925	(257)
SAP value		95.9190	
SAP rating (Section 12)		96	(258)
SAP band		A	

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

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

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Space heating - main system 1	2870.4371	0.2160	620.0144 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	971.8914	0.2160	209.9285 (264)
Space and water heating			829.9430 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	375.2428	0.5190	194.7510 (268)
Energy saving/generation technologies			
PV Unit			
Total kg/year	-1727.2394	0.5190	-896.4372 (269)
CO2 emissions per m2			193.1317 (272)
EI value			2.2200 (273)
EI rating			98.0379
EI band			98 (274)
			A

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	43.4500 (1b)	x 2.4200 (2b)	= 105.1490 (1b) - (3b)
First floor	43.4500 (1c)	x 2.6900 (2c)	= 116.8805 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	86.9000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 222.0295 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1351 (8)
Pressure test					Yes
Measured/design AP50					4.0800
Infiltration rate					0.3391 (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) =	0.2882 (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	0.3315	0.3243	0.3243	0.2955	0.3027	0.2666	0.2522	0.2522	0.2666	0.2955	0.2955	0.3027 (22b)
Effective ac	0.5549	0.5526	0.5526	0.5436	0.5458	0.5355	0.5318	0.5318	0.5355	0.5436	0.5436	0.5458 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front			2.1500	1.4000	3.0100		(26)
front (Uw = 1.30)			12.9500	1.2357	16.0029		(27)
gf			43.4500	0.1500	6.5175	75.0000	3258.7501 (28a)
external	95.5700	15.1000	80.4700	0.2000	16.0940	60.0000	4828.2000 (29a)
cold	43.4500		43.4500	0.0900	3.9105	9.0000	391.0500 (30)
Total net area of external elements Aum(A, m ²)			182.4700				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	45.5349		(33)
party			43.7600	0.0000	0.0000	70.0000	3063.1999 (32)
gf			80.7000			9.0000	726.3000 (32c)
1f			102.8118			9.0000	925.3062 (32c)
1f			43.4500			18.0000	782.1000 (32d)
gf			43.4500			9.0000	391.0500 (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) = 14365.9561 (34)
165.3160 (35)
12.8021 (36)
(33) + (36) = 58.3370 (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	40.6604	40.4873	40.4873	39.8329	39.9908	39.2393	38.9654	38.9654	39.2393	39.8329	39.8329	39.9908 (38)
Heat transfer coeff	98.9974	98.8243	98.8243	98.1698	98.3277	97.5763	97.3023	97.3023	97.5763	98.1698	98.1698	98.3277 (39)
Average = Sum(39)m / 12 =												98.1307 (39)
HLP	1.1392	1.1372	1.1372	1.1297	1.1315	1.1229	1.1197	1.1197	1.1229	1.1297	1.1297	1.1315 (40)
HLP (average)												1.1292 (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												2.5809 (42)
Average daily hot water use (litres/day)												95.4956 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	105.0452	101.2253	97.4055	93.5857	89.7659	85.9460	85.9460	89.7659	93.5857	97.4055	101.2253	105.0452 (44)
Energy conte	155.7789	136.2452	140.5929	122.5723	117.6110	101.4894	94.0448	107.9178	109.2067	127.2699	138.9250	150.8636 (45)
Energy content (annual)										Total = Sum(45)m =		1502.5175 (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	23.3668	20.4368	21.0889	18.3858	17.6417	15.2234	14.1067	16.1877	16.3810	19.0905	20.8388	22.6295 (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	18.7613	16.9007	18.5711	17.7921	18.2543	17.5145	18.0043	18.1664	17.6657	18.4400	18.0366	18.7117 (61)
Total heat required for water heating calculated for each month	174.5402	153.1459	159.1640	140.3644	135.8653	119.0039	112.0491	126.0842	126.8724	145.7099	156.9617	169.5752 (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												1.1217 (H8)
Utilisation factor												0.5899 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												95.4956 (H14)
Volume ratio Veff/V												0.7854 (H15)
Solar storage volume factor												0.9517 (H16)
Solar input	-21.9683	-38.5103	-69.1743	-94.2729	-113.8956	-114.1044	-110.3703	-94.9793	-76.8719	-51.1883	-27.0626	-832.0554 (H17)
Solar input (sum of months) = Sum (63)m =												-832.0554 (63)
Output from w/h	152.5719	114.6356	89.9897	46.0915	21.9697	4.8994	1.6788	31.1049	50.0005	94.5216	129.8991	149.9182 (64)
Total per year (kWh/year) = Sum (64)m =												887.2808 (64)
Heat gains from water heating, kWh/month	56.4868	49.5267	51.3899	45.2033	43.6692	38.1238	35.7710	40.4243	40.7277	46.9272	50.7017	54.8401 (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	154.8520	154.8520	154.8520	154.8520	154.8520	154.8520	154.8520	154.8520	154.8520	154.8520	154.8520	154.8520	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	53.1195	47.1803	38.3696	29.0482	21.7139	18.3318	19.8081	25.7474	34.5581	43.8794	51.2138	54.5959	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	348.1456	351.7583	342.6545	323.2736	298.8087	275.8151	260.4540	256.8414	265.9452	285.3260	309.7909	332.7845	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.0661	53.0661	53.0661	53.0661	53.0661	53.0661	53.0661	53.0661	53.0661	53.0661	53.0661	53.0661	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-103.2347	-103.2347	-103.2347	-103.2347	-103.2347	-103.2347	-103.2347	-103.2347	-103.2347	-103.2347	-103.2347	-103.2347	(71)
Water heating gains (Table 5)	75.9231	73.7005	69.0725	62.7824	58.6952	52.9498	48.0793	54.3337	56.5662	63.0742	70.4191	73.7098	(72)
Total internal gains	584.8717	580.3224	557.7799	522.7876	486.9012	454.7801	436.0249	444.6058	464.7528	499.9631	539.1072	568.7735	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d	Gains W
Northeast					5.8500	9.5471	0.4600	0.0000			1.0000	25.6913 (75)
Southwest					7.1000	31.1332	0.4600	0.0000			1.0000	101.6812 (79)

Solar gains	127.3724	236.8846	366.9547	505.1591	591.5401	615.5429	574.7295	491.9649	416.0356	278.8964	160.0608	115.4791 (83)
Total gains	712.2441	817.2071	924.7347	1027.9467	1078.4413	1070.3230	1010.7544	936.5707	880.7884	778.8595	699.1679	684.2526 (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	40.3096	40.3802	40.3802	40.6494	40.5841	40.8967	41.0118	41.0118	40.8967	40.6494	40.6494	40.5841
alpha	3.6873	3.6920	3.6920	3.7100	3.7056	3.7264	3.7341	3.7341	3.7264	3.7100	3.7100	3.7056
util living area	0.9720	0.9533	0.9164	0.8290	0.6885	0.5192	0.4135	0.4525	0.6724	0.8739	0.9537	0.9755 (86)
MIT	19.6365	19.8562	20.1622	20.5603	20.8325	20.9558	20.9849	20.9792	20.8796	20.5243	20.0231	19.5987 (87)
Th 2	19.9689	19.9706	19.9706	19.9767	19.9752	19.9822	19.9848	19.9848	19.9822	19.9767	19.9767	19.9752 (88)
util rest of house	0.9660	0.9436	0.8993	0.7953	0.6310	0.4408	0.3225	0.3568	0.5986	0.8409	0.9423	0.9703 (89)
MIT 2	18.7501	18.9656	19.2600	19.6345	19.8652	19.9609	19.9797	19.9775	19.9128	19.6118	19.1370	18.7179 (90)
Living area fraction									fLA = Living area / (4) =			0.1548 (91)
MIT	18.8873	19.1035	19.3997	19.7778	20.0149	20.1149	20.1353	20.1325	20.0624	19.7531	19.2741	18.8542 (92)
Temperature adjustment												0.0000
adjusted MIT	18.8873	19.1035	19.3997	19.7778	20.0149	20.1149	20.1353	20.1325	20.0624	19.7531	19.2741	18.8542 (93)

8. Space heating requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9579	0.9335	0.8881	0.7879	0.6334	0.4514	0.3363	0.3712	0.6049	0.8325	0.9325	0.9628	(94)
Useful gains	682.2937	762.8850	821.2324	809.9566	683.0748	483.1410	339.9142	347.6096	532.7752	648.3960	651.9564	658.8129	(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													
Month fracti	1404.5071	1364.1192	1255.0345	1028.6061	758.5896	499.0899	343.9937	353.4515	581.7921	878.9208	1155.8639	1401.5879	(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	537.3268	404.0294	322.7488	157.4276	56.1830	0.0000	0.0000	0.0000	0.0000	171.5104	362.8134	552.6246	(98)
Space heating per m2												2564.6639	(98)
											(98) / (4) =	29.5128	(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													2757.7031	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	537.3268	404.0294	322.7488	157.4276	56.1830	0.0000	0.0000	0.0000	0.0000	171.5104	362.8134	552.6246	(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)	577.7707	434.4402	347.0417	169.2770	60.4118	0.0000	0.0000	0.0000	0.0000	184.4198	390.1219	594.2200	(211)	
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)	
Water heating														
Water heating requirement	152.5719	114.6356	89.9897	46.0915	21.9697	4.8994	1.6788	31.1049	50.0005	94.5216	129.8991	149.9182	(64)	
Efficiency of water heater	89.3189	89.3193	89.3284	89.3026	89.1360	87.0000	87.0000	87.0000	87.0000	88.9107	89.1892	89.3426	(216)	
Fuel for water heating, kWh/month	170.8171	128.3437	100.7403	51.6127	24.6474	5.6315	1.9297	35.7527	57.4718	106.3107	145.6444	167.8015	(219)	
Water heating fuel used												996.7036	(219)	
Annual totals kWh/year														
Space heating fuel - main system													2757.7031	(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)													375.2428	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 2.50 * 1003 * 0.80) =										-1605.1846			-1605.1846	(233)
Total delivered energy for all uses													2649.4650	(238)

10a. Fuel costs - using BEDF prices (£31)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2757.7031	10.2300	282.1130	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	996.7036	10.2300	101.9628	(247)
Pumps and fans for heating	75.0000	36.7200	27.5400	(249)
Pump for solar water heating	50.0000	36.7200	18.3600	(249)
Energy for lighting	375.2428	36.7200	137.7892	(250)
Additional standing charges			103.0000	(251)
Energy saving/generation technologies				
PV Unit	-1605.1846	36.7200	-589.4238	(252)
Total energy cost			81.3412	(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	2757.7031	0.2160	595.6639	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	996.7036	0.2160	215.2880	(264)
Space and water heating			810.9519	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	375.2428	0.5190	194.7510	(268)
Energy saving/generation technologies				
PV Unit	-1605.1846	0.5190	-833.0908	(269)
Total kg/year			237.4871	(272)

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	2757.7031	1.2200	3364.3978 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	996.7036	1.2200	1215.9784 (264)
Space and water heating			4580.3762 (265)
Pumps and fans	125.0000	3.0700	383.7500 (267)
Energy for lighting	375.2428	3.0700	1151.9955 (268)
Energy saving/generation technologies			
PV Unit	-1605.1846	3.0700	-4927.9167 (269)
Primary energy kWh/year			1188.2050 (272)
Primary energy kWh/m2/year			13.6732 (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	165.3 (calculated from construction elements)
Night ventilation	No
Ventilation rate during hot weather (ach)	4.00 (Windows half open)

Overheating Calculation

Summer ventilation heat loss coefficient	293.08 (P1)
Transmission heat loss coefficient	58.34 (37)
Summer heat loss coefficient	351.42 (P2)

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

Solar shading Orientation	Z blinds	Solar access	Z overhangs	Z summer
North East	1.000	1.00	1.000	1.000 (P8)
South West	1.000	1.00	1.000	1.000 (P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North East	5.8500	89.6552	0.4600	0.0000	1.0000	241.2620
South West	7.1000	112.1012	0.4600	0.0000	1.0000	366.1226
total:						607.3846

Solar gains	Jun 658	Jul 607	Aug 519	(P4)
Internal gains	452	433	442	
Total summer gains	1109	1040	961	(P5)
Summer gain/loss ratio	3.16	2.96	2.73	(P6)
Summer external temperature	14.70	16.40	16.30	
Thermal mass temperature increment (TMP = 165.3)	0.84	0.84	0.84	
Threshold temperature	18.70	20.20	19.88	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	
Assessment of likelihood of high internal temperature:	Not significant			

BASIC COMPLIANCE REPORT

Calculation Type: New Build (As Built)

Property Reference	Plot 008	Issued on Date	16/11/2023
Assessment Reference	22187 plot 8	Prop Type Ref	22186
Property	1e Chain Road, MANCHESTER, M9 6AJ		

SAP Rating	85 B	DER	16.99	TER	17.76
Environmental	87 B	% DER<TER	4.36		
CO ₂ Emissions (t/year)	1.25	DFEE	43.67	TFEE	50.45
General Requirements Compliance	Pass	% DFEE<TFEE	13.43		

Assessor Details	Mr. Ben Tunningley, Ben Tunningley, Tel: 01904217325, ben.tunningley@jpsustainability.co.uk	Assessor ID	AU36-0001
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Client	
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SUMMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	17.76	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	16.99	kgCO ₂ /m ²	Pass
	-0.77 (-4.3%)	kgCO ₂ /m ²	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	50.45	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DFEE)	43.67	kWh/m ² /yr	
	-6.8 (-13.5%)	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	4.08 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

BASIC COMPLIANCE REPORT

Calculation Type: New Build (As Built)

Main heating system

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

Pass

Secondary heating system

None

5 Cylinder insulation

Hot water storage

No cylinder

6 Controls

Space heating controls

Programmer, room thermostat and TRVs

Pass

Hot water controls

No cylinder

Boiler interlock

Yes

Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings

100

%

Minimum

75

%

Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (West Pennines (England))

Not significant

Pass

Based on:

Overshading

Very little

Windows facing North East

5.85 m², No overhang

Windows facing South West

7.10 m², No overhang

Air change rate

0.00 ach

Blinds/curtains

None

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type

U-value

Filled Cavity with Edge Sealing

0.00

W/m²K

Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals

4.08 (measured in this dwelling)

Maximum

10.0

Pass

10 Key features

Party wall U-value

0.00

W/m²K

Roof U-value

0.09

W/m²K

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

Energy performance certificate (EPC)

1e Chain Road
MANCHESTER
M9 6AJ

Energy rating

B

Valid until: **15 November 2033**

Certificate number: **9337-9239-9309-0936-2296**

Property type Semi-detached house

Total floor area 87 square metres

Rules on letting this property

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

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

Energy rating and score

This property's 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		96 A
81-91	B	85 B	
69-80	C		
55-68	D		
39-54	E		
21-38	F		
1-20	G		

Breakdown of property's energy performance

Features in this property

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

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

Feature	Description	Rating
Walls	Average thermal transmittance 0.20 W/m ² K	Very good
Roof	Average thermal transmittance 0.09 W/m ² K	Very good
Floor	Average thermal transmittance 0.15 W/m ² K	Very good
Windows	High performance glazing	Very good
Main heating	Boiler and radiators, mains gas	Good
Main heating control	Programmer, room thermostat and TRVs	Good
Hot water	From main system	Good
Lighting	Low energy lighting in all fixed outlets	Very good
Air tightness	Air permeability 4.1 m ³ /h.m ² (as tested)	Good
Secondary heating	None	N/A

Primary energy use

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

How this affects your energy bills

An average household would need to spend **£750 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 £79 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:

- 2,565 kWh per year for heating
 - 1,719 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 1.2 tonnes of CO₂

This property's potential production 0.2 tonnes of CO₂

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

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

Changes you could make

Step	Typical installation cost	Typical yearly saving
1. Solar water heating	£4,000 - £6,000	£79
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	Ben Tunningley
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/027167
Telephone	01455 883 250
Email	enquiries@elmhurstenergy.co.uk

About this assessment

Assessor's declaration	No related party
Date of assessment	16 November 2023
Date of certificate	16 November 2023
Type of assessment	SAP
