

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: Mid-terrace House

Dwelling Details:

NEW DWELLING DESIGN STAGE

Total Floor Area: 87.34m²

Site Reference : Chain Road

Plot Reference: Plot 003

Address : Plot 003, Chain Road, Manchester, M9

Client Details:

Name: Great Places

Address :

This report covers items included within the SAP calculations.

It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Mains gas

Fuel factor: 1.00 (mains gas)

Target Carbon Dioxide Emission Rate (TER) 16.51 kg/m²

Dwelling Carbon Dioxide Emission Rate (DER) 16.03 kg/m²

OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 44.0 kWh/m²

Dwelling Fabric Energy Efficiency (DFEE) 39.8 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 5.83m²
 Windows facing: South West 7.13m²
 Ventilation rate: 4.00
 Blinds/curtains: None

10 Key features

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

Code for Sustainable Homes Report

For use with Nov 2010 addendum 2014 England

Assessor and House Details

Assessor Name:	Ben Tunningley	Assessor Number:	STRO027495
Property Address:	Plot 003 Chain Road Manchester M9		

Buiding regulation assessment

	kg/m²/year
TER	16.51
DER	16.03

ENE 1 Assessment - Dwelling Emission Rate

Total Energy Type CO₂ Emissions for Codes Levels 1 - 5

	%	kg/m ² /year	
DER from SAP 2012 DER Worksheet		16.03	(ZC1)
TER		16.51	
Residual CO2 emissions offset from biofuel CHP		0	(ZC5)
CO2 emissions offset from additional allowable electricity generation		0	(ZC7)
Total CO2 emissions offset from SAP Section 16 allowances		0	
DER accounting for SAP Section 16 allowances		16.03	
% improvement DER/TER	2.9		

Total Energy Type CO2 Emissions for Codes Levels 6

	kg/m ² /year	
DER accounting for SAP Section 16 allowances	16.03	(ZC1)
CO2 emissions from appliances, equation (L14)	15.82	(ZC2)
CO2 emissions from cooking, equation (L16)	2.07	(ZC3)
Net CO2 emissions	35	(ZC8)

Result:

Credits awarded for ENE 1 = 0.4

Code Level = 3

ENE 2 - Fabric energy Efficiency

Fabric energy Efficiency: 39.76

Credits awarded for ENE 2 = 6.6

ENE 7 - Low or Zero Carbon (LZC) Technologies

Reduction in CO2 Emissions

	%	kg/m ² /year	
Standard Case CO2 emissions		35	
Standard DER		17.1	
Actual Case CO2 emissions		35	
Actual DER		17.1	
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 003

Address : Plot 003, Chain Road, Manchester, M9

1. Overall dwelling dimensions:

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

2. Ventilation rate:

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

Air changes per hour

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

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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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			5.83	x 1/[1/(1.3) + 0.04]	= 7.2		(27)
Windows Type 2			7.13	x 1/[1/(1.3) + 0.04]	= 8.81		(27)
Floor			43.67	x 0.15	= 6.5505	75	3275.25 (28)
Walls	51.77	15.11	36.66	x 0.2	= 7.33	60	2199.6 (29)
Roof	43.67	0	43.67	x 0.09	= 3.93	9	393.03 (30)
Total area of elements, m²			139.11				(31)
Party wall			87.26	x 0	= 0	70	6108.2 (32)
Internal wall **			82			9	738 (32c)
Internal wall **			105			9	945 (32c)
Internal floor			43.67			18	786.0599 (32d)
Internal ceiling			43.67			9	393.03 (32e)

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

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

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 36.84 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 14838.17 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 169.89 (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

14.08 (36)

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

Total fabric heat loss

(33) + (36) =

50.92 (37)

Ventilation heat loss calculated monthly

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

(38)m=

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

(38)

Heat transfer coefficient, W/K

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

(39)m=

93.98	93.73	93.49	92.35	92.13	91.14	91.14	90.96	91.52	92.13	92.57	93.02
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Average = Sum(39)_{1...12} /12=

92.35 (39)

Heat loss parameter (HLP), W/m²K

(40)m = (39)m ÷ (4)

(40)m=

1.08	1.07	1.07	1.06	1.05	1.04	1.04	1.04	1.05	1.05	1.06	1.06
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Average = Sum(40)_{1...12} /12=

1.06 (40)

Number of days in month (Table 1a)

(41)m=

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

(41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

2.59

(42)

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

if TFA ≤ 13.9, N = 1

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

95.65

(43)

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

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

(44)m=

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

1147.85 (44)

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

(45)m=

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

1505.01 (45)

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

(46)m=

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

Water storage loss:

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

0

(47)

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

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

Water storage loss:

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

0

(48)

Temperature factor from Table 2b

0

(49)

Energy lost from water storage, kWh/year

(48) x (49) =

0

(50)

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

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

0

(51)

If community heating see section 4.3

Volume factor from Table 2a

0

(52)

Temperature factor from Table 2b

0

(53)

SAP WorkSheet: New dwelling design stage

Energy lost from water storage, kWh/year

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

0

(54)

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

0

(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	18.58	17.8	18.26	17.52	18.01	18.17	17.67	18.44	18.04	18.71
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(61)

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

(62)m=

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

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

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

(63)m=

0	0	0	0	0	0	0	0	0	0	0	0
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(63)

Output from water heater

(64)m=

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

1721.87

(64)

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

(65)m=

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

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

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

Metabolic gains (Table 5), Watts

(66)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
155.25	155.25	155.25	155.25	155.25	155.25	155.25	155.25	155.25	155.25	155.25	155.25

(66)

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

(67)m=

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

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

(68)m=

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

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

(69)m=

53.11	53.11	53.11	53.11	53.11	53.11	53.11	53.11	53.11	53.11	53.11	53.11
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(69)

Pumps and fans gains (Table 5a)

(70)m=

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

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

(71)m=

-103.5	-103.5	-103.5	-103.5	-103.5	-103.5	-103.5	-103.5	-103.5	-103.5	-103.5	-103.5
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(71)

Water heating gains (Table 5)

(72)m=

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

Total internal gains =

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

(73)m=

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

6. Solar gains:

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

SAP WorkSheet: New dwelling design stage

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

Solar gains in watts, calculated for each month

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

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

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

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

7. Mean internal temperature (heating season)

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

21 (85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(86)m=	0.97	0.95	0.91	0.82	0.68	0.51	0.38	0.42	0.64	0.86	0.95	0.98

(86)

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

(87)m= 19.75 19.97 20.28 20.63 20.86 20.97 20.99 20.99 20.92 20.61 20.12 19.71 (87)

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

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

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

(89)m= 0.97 0.94 0.89 0.79 0.63 0.44 0.3 0.33 0.57 0.83 0.94 0.97 (89)

SAP WorkSheet: New dwelling design stage

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

(90)m=	18.9	19.12	19.42	19.75	19.95	20.03	20.04	20.04	20	19.74	19.27	18.86	(90)
--------	------	-------	-------	-------	-------	-------	-------	-------	----	-------	-------	-------	------

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

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

(92)m=	19.03	19.25	19.55	19.88	20.09	20.17	20.19	20.19	20.14	19.87	19.4	18.99	(92)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------	------

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

(93)m=	19.03	19.25	19.55	19.88	20.09	20.17	20.19	20.19	20.14	19.87	19.4	18.99	(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	0.88	0.78	0.63	0.45	0.31	0.35	0.57	0.82	0.93	0.97	(94)
--------	------	------	------	------	------	------	------	------	------	------	------	------	------

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

(95)m=	707.07	791.94	840.34	826.03	708.35	495.64	325.12	341.33	520.16	661.47	674.68	674.07	(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=	1384.22	1344.79	1219.89	1014.15	772.59	508.02	327.17	344.65	552.75	854.28	1138.87	1375.85	(97)
--------	---------	---------	---------	---------	--------	--------	--------	--------	--------	--------	---------	---------	------

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

(98)m=	503.8	371.51	282.39	135.44	47.8	0	0	0	0	143.45	334.22	522.12		
Total per year (kWh/year) = Sum(98) _{1...5,9...12} =													2340.74	(98)

Space heating requirement in kWh/m²/year

26.8	(99)
------	------

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

Space heating:

Fraction of space heat from secondary/supplementary system

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

Fraction of space heat from main system(s)

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

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

Fraction of total heating from main system 1

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

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

Efficiency of main space heating system 1

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

Efficiency of secondary/supplementary heating system, %

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

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

kWh/year

Space heating requirement (calculated above)

503.8	371.51	282.39	135.44	47.8	0	0	0	0	143.45	334.22	522.12
-------	--------	--------	--------	------	---	---	---	---	--------	--------	--------

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

541.72	399.48	303.65	145.64	51.39	0	0	0	0	154.25	359.38	561.42
--------	--------	--------	--------	-------	---	---	---	---	--------	--------	--------

$$\text{Total (kWh/year) = Sum(211)}_{1...5,10...12} = 2516.93 \quad (211)$$

Space heating fuel (secondary), kWh/month

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

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

Water heating

Output from water heater (calculated above)

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

Efficiency of water heater	87	(216)
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SAP WorkSheet: New dwelling design stage

(217)m=

89.21	89.1	88.89	88.45	87.76	87	87	87	87	88.46	89.02	89.24
-------	------	-------	-------	-------	----	----	----	----	-------	-------	-------

 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=

195.95	172.13	179.32	158.93	155.04	136.98	128.97	145.13	146.04	164.96	176.59	190.29
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

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

1950.34

 (219)

Annual totals

	kWh/year	kWh/year
Space heating fuel used, main system 1		2516.93
Water heating fuel used		1950.34

Electricity for pumps, fans and electric keep-hot

central heating pump: 30 (230c)

boiler with a fan-assisted flue 45 (230e)

Total electricity for the above, kWh/year sum of (230a)...(230g) =

75

 (231)

Electricity for lighting 376.86 (232)

Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) = 4919.13 (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 =	87.59
Space heating - main system 2	(213) x		0	x 0.01 =	0
Space heating - secondary	(215) x		13.19	x 0.01 =	0
Water heating cost (other fuel)	(219)		3.48	x 0.01 =	67.87
Pumps, fans and electric keep-hot	(231)		13.19	x 0.01 =	9.89
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a)					
Energy for lighting	(232)		13.19	x 0.01 =	49.71
Additional standing charges (Table 12)					120
Appendix Q items: repeat lines (253) and (254) as needed					
Total energy cost	(245)...(247) + (250)...(254) =				335.06

11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)	0.42
Energy cost factor (ECF) [(255) x (256)] ÷ [(4) + 45.0] =	1.06
SAP rating (Section 12)	85.17

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	=	543.66
Space heating (secondary)	(215) x		0.519	=	0
Water heating	(219) x		0.216	=	421.27

SAP WorkSheet: New dwelling design stage

Space and water heating	(261) + (262) + (263) + (264) =			964.93	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	195.59	(268)
Total CO ₂ , kg/year		sum of (265)...(271) =		1199.44	(272)
CO₂ emissions per m²		(272) ÷ (4) =		13.73	(273)
El rating (section 14)				88	(274)

13a. Primary Energy

	Energy kWh/year	Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x	1.22	=	3070.65	(261)
Space heating (secondary)	(215) x	3.07	=	0	(263)
Energy for water heating	(219) x	1.22	=	2379.42	(264)
Space and water heating	(261) + (262) + (263) + (264) =			5450.07	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	3.07	=	230.25	(267)
Electricity for lighting	(232) x	0	=	1156.95	(268)
'Total Primary Energy		sum of (265)...(271) =		6837.27	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =		78.28	(273)

DER WorkSheet: New dwelling design stage

User Details:

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

Property Address: Plot 003

Address : Plot 003, Chain Road, Manchester, M9

1. Overall dwelling dimensions:

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

2. Ventilation rate:

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

Air changes per hour

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

Infiltration rate modified for monthly wind speed

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

Monthly average wind speed from Table 7

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

Wind Factor (22a)m = (22)m ÷ 4

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

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

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

Calculate effective air change rate for the applicable case

If mechanical ventilation:

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			5.83	x 1/[1/(1.3)+0.04]	= 7.2		(27)
Windows Type 2			7.13	x 1/[1/(1.3)+0.04]	= 8.81		(27)
Floor			43.67	x 0.15	= 6.5505	75	3275.25 (28)
Walls	51.77	15.11	36.66	x 0.2	= 7.33	60	2199.6 (29)
Roof	43.67	0	43.67	x 0.09	= 3.93	9	393.03 (30)
Total area of elements, m²			139.11				(31)
Party wall			87.26	x 0	= 0	70	6108.2 (32)
Internal wall **			82			9	738 (32c)
Internal wall **			105			9	945 (32c)
Internal floor			43.67			18	786.0599 (32d)
Internal ceiling			43.67			9	393.03 (32e)

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

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

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 36.84 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 14838.17 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 169.89 (35)

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

DER WorkSheet: New dwelling design stage

can be used instead of a detailed calculation.

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

14.08

(36)

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

Total fabric heat loss

(33) + (36) =

50.92

(37)

Ventilation heat loss calculated monthly

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

(38)m=

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

(38)

Heat transfer coefficient, W/K

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

(39)m=

93.98	93.73	93.49	92.35	92.13	91.14	91.14	90.96	91.52	92.13	92.57	93.02
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

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

92.35

(39)

Heat loss parameter (HLP), W/m²K

(40)m = (39)m ÷ (4)

(40)m=

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

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

1.06

(40)

Number of days in month (Table 1a)

(41)m=

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

(41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

2.59

(42)

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

if TFA ≤ 13.9, N = 1

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

95.65

(43)

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

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

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

(44)m=

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

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

1147.85

(44)

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

(45)m=

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

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

1505.01

(45)

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

(46)m=

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

DER WorkSheet: New dwelling design stage

Energy lost from water storage, kWh/year

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

0
0

(54)

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

(55)

Water storage loss calculated for each month

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

(56)m=

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

(56)

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

(57)m=

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

(57)

Primary circuit loss (annual) from Table 3

0

(58)

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

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

(59)m=

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

(59)

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

(61)m=

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

(61)

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

(62)m=

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

(62)

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

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

(63)m=

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

(63)

Output from water heater

(64)m=

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

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

1721.87

(64)

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

(65)m=

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

(65)

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

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

Metabolic gains (Table 5), Watts

(66)m=

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

(66)

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

(67)m=

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

(67)

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

(68)m=

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

(68)

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

(69)m=

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

(69)

Pumps and fans gains (Table 5a)

(70)m=

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

(70)

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

(71)m=

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

(71)

Water heating gains (Table 5)

(72)m=

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

(72)

Total internal gains =

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

(73)m=

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

(73)

6. Solar gains:

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

DER WorkSheet: New dwelling design stage

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

Solar gains in watts, calculated for each month

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

(83)m=

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

 (83)

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

(84)m=

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

 (84)

7. Mean internal temperature (heating season)

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

21

 (85)

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

(86)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.99	0.98	0.97	0.92	0.82	0.65	0.5	0.55	0.79	0.94	0.98	0.99

 (86)

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

(87)m=

19.44	19.65	19.98	20.39	20.73	20.92	20.98	20.97	20.83	20.38	19.84	19.41
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (87)

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

(88)m=

20.02	20.02	20.03	20.04	20.04	20.05	20.05	20.05	20.04	20.04	20.03	20.03
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (88)

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

(89)m=

0.99	0.98	0.96	0.9	0.77	0.58	0.4	0.45	0.72	0.93	0.98	0.99
------	------	------	-----	------	------	-----	------	------	------	------	------

 (89)

DER WorkSheet: New dwelling design stage

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

(90)m=	18.6	18.81	19.13	19.53	19.84	20	20.04	20.04	19.94	19.54	19	18.57	(90)
--------	------	-------	-------	-------	-------	----	-------	-------	-------	-------	----	-------	------

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

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

(92)m=	18.73	18.94	19.26	19.66	19.98	20.14	20.18	20.18	20.07	19.67	19.13	18.7	(92)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------	------

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

(93)m=	18.73	18.94	19.26	19.66	19.98	20.14	20.18	20.18	20.07	19.67	19.13	18.7	(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=	0.99	0.97	0.95	0.89	0.77	0.58	0.42	0.47	0.72	0.92	0.98	0.99	(94)
--------	------	------	------	------	------	------	------	------	------	------	------	------	------

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

(95)m=	506.17	585.23	647.82	680.05	631.71	473.79	320.56	334.17	472.49	524.25	493.31	478.26	(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=	1355.95	1315.58	1192.69	994.02	762.49	505.28	326.59	343.75	546.59	835.24	1113.5	1348.56	(97)
--------	---------	---------	---------	--------	--------	--------	--------	--------	--------	--------	--------	---------	------

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

(98)m=	632.24	490.8	405.38	226.06	97.3	0	0	0	0	231.38	446.54	647.5	
Total per year ($kWh/year$) = $\text{Sum}(98)_{1..5,9..12} =$												3177.19	(98)

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

36.38	(99)
-------	------

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

Space heating:

Fraction of space heat from secondary/supplementary system

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

Fraction of space heat from main system(s)

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

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

Fraction of total heating from main system 1

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

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

Efficiency of main space heating system 1

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

Efficiency of secondary/supplementary heating system, %

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

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

Space heating requirement (calculated above)

632.24	490.8	405.38	226.06	97.3	0	0	0	0	231.38	446.54	647.5
--------	-------	--------	--------	------	---	---	---	---	--------	--------	-------

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

679.83	527.74	435.89	243.07	104.62	0	0	0	0	248.79	480.15	696.24
--------	--------	--------	--------	--------	---	---	---	---	--------	--------	--------

$$\text{Total } (kWh/year) = \text{Sum}(211)_{1..5,10..12} = \boxed{3416.33} \quad (211)$$

Space heating fuel (secondary), $kWh/month$

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

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

Water heating

Output from water heater (calculated above)

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

87	(216)
----	-------

DER WorkSheet: New dwelling design stage

(217)m=	89.33	89.27	89.13	88.83	88.23	87	87	87	87	88.82	89.2	89.36	(217)
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Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	195.67	171.81	178.84	158.26	154.22	136.98	128.97	145.13	146.04	164.3	176.23	190.05	
Total = Sum(219a) _{1...12} =												1946.52	(219)

Annual totals

Space heating fuel used, main system 1

kWh/year

kWh/year

Water heating fuel used

Electricity for pumps, fans and electric keep-hot

central heating pump:

30

(230c)

boiler with a fan-assisted flue

45

(230e)

Total electricity for the above, kWh/year

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

75

(231)

Electricity for lighting

390.5

(232)

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

5828.35

(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	=	737.93	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	420.45	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1158.38	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	202.67	(268)
Total CO2, kg/year		sum of (265)...(271) =		1399.97	(272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =		16.03	(273)
El rating (section 14)				86	(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 003

Address : Plot 003, Chain Road, Manchester, M9

1. Overall dwelling dimensions:

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

2. Ventilation rate:

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

Air changes per hour

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

Infiltration rate modified for monthly wind speed

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

Monthly average wind speed from Table 7

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

Wind Factor (22a)m = (22)m ÷ 4

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

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

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

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0 (23a)

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

0 (23b)

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

0 (23c)

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

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

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

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

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

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

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

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

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

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

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

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

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			2.15	x 1	= 2.15		(26)
Windows Type 1			5.83	x 1/[1/(1.4)+0.04]	= 7.73		(27)
Windows Type 2			7.13	x 1/[1/(1.4)+0.04]	= 9.45		(27)
Floor			43.67	x 0.13	= 5.6771		(28)
Walls	51.77	15.11	36.66	x 0.18	= 6.6		(29)
Roof	43.67	0	43.67	x 0.13	= 5.68		(30)
Total area of elements, m²			139.11				(31)
Party wall			87.26	x 0	= 0		(32)
Internal wall **			82				(32c)
Internal wall **			105				(32c)
Internal floor			43.67				(32d)
Internal ceiling			43.67				(32e)

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

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

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 37.28 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 14838.17 (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

TER WorkSheet: New dwelling design stage

can be used instead of a detailed calculation.

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

8.94 (36)

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

Total fabric heat loss

(33) + (36) =

46.22 (37)

Ventilation heat loss calculated monthly

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

(38)m=

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

(38)

Heat transfer coefficient, W/K

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

(39)m=

89.28	89.03	88.79	87.65	87.44	86.44	86.44	86.26	86.83	87.44	87.87	88.32
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

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

87.65 (39)

Heat loss parameter (HLP), W/m²K

(40)m = (39)m ÷ (4)

(40)m=

1.02	1.02	1.02	1	1	0.99	0.99	0.99	0.99	1	1.01	1.01
------	------	------	---	---	------	------	------	------	---	------	------

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

1 (40)

Number of days in month (Table 1a)

(41)m=

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

(41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

2.59

(42)

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

if TFA ≤ 13.9, N = 1

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

95.65

(43)

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

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

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

(44)m=

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

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

1147.85 (44)

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

(45)m=

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

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

1505.01 (45)

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

(46)m=

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

(46)

Water storage loss:

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

0

(47)

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

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

Water storage loss:

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

0

(48)

Temperature factor from Table 2b

0

(49)

Energy lost from water storage, kWh/year

(48) x (49) =

0

(50)

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

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

0

(51)

If community heating see section 4.3

Volume factor from Table 2a

0

(52)

Temperature factor from Table 2b

0

(53)

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

(61)

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

(62)m=

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

(62)

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

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

(63)m=

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

(63)

Output from water heater

(64)m=

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

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

2072.13

(64)

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

(65)m=

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

(65)

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

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

Metabolic gains (Table 5), Watts

(66)m=

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

(66)

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

(67)m=

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

(67)

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

(68)m=

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

(68)

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

(69)m=

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

(69)

Pumps and fans gains (Table 5a)

(70)m=

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

(70)

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

(71)m=

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

(71)

Water heating gains (Table 5)

(72)m=

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

(72)

Total internal gains =

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

(73)m=

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

(73)

6. Solar gains:

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

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	5.83	x	11.28	x	0.63	x	0.7	=	20.1 (75)
Northeast 0.9x	0.77	x	5.83	x	22.97	x	0.63	x	0.7	=	40.92 (75)
Northeast 0.9x	0.77	x	5.83	x	41.38	x	0.63	x	0.7	=	73.73 (75)
Northeast 0.9x	0.77	x	5.83	x	67.96	x	0.63	x	0.7	=	121.08 (75)
Northeast 0.9x	0.77	x	5.83	x	91.35	x	0.63	x	0.7	=	162.75 (75)
Northeast 0.9x	0.77	x	5.83	x	97.38	x	0.63	x	0.7	=	173.51 (75)
Northeast 0.9x	0.77	x	5.83	x	91.1	x	0.63	x	0.7	=	162.32 (75)
Northeast 0.9x	0.77	x	5.83	x	72.63	x	0.63	x	0.7	=	129.4 (75)
Northeast 0.9x	0.77	x	5.83	x	50.42	x	0.63	x	0.7	=	89.84 (75)
Northeast 0.9x	0.77	x	5.83	x	28.07	x	0.63	x	0.7	=	50.01 (75)
Northeast 0.9x	0.77	x	5.83	x	14.2	x	0.63	x	0.7	=	25.29 (75)
Northeast 0.9x	0.77	x	5.83	x	9.21	x	0.63	x	0.7	=	16.42 (75)
Southwest 0.9x	0.77	x	7.13	x	36.79		0.63	x	0.7	=	80.17 (79)
Southwest 0.9x	0.77	x	7.13	x	62.67		0.63	x	0.7	=	136.57 (79)
Southwest 0.9x	0.77	x	7.13	x	85.75		0.63	x	0.7	=	186.86 (79)
Southwest 0.9x	0.77	x	7.13	x	106.25		0.63	x	0.7	=	231.52 (79)
Southwest 0.9x	0.77	x	7.13	x	119.01		0.63	x	0.7	=	259.33 (79)
Southwest 0.9x	0.77	x	7.13	x	118.15		0.63	x	0.7	=	257.45 (79)
Southwest 0.9x	0.77	x	7.13	x	113.91		0.63	x	0.7	=	248.21 (79)
Southwest 0.9x	0.77	x	7.13	x	104.39		0.63	x	0.7	=	227.47 (79)
Southwest 0.9x	0.77	x	7.13	x	92.85		0.63	x	0.7	=	202.33 (79)
Southwest 0.9x	0.77	x	7.13	x	69.27		0.63	x	0.7	=	150.94 (79)
Southwest 0.9x	0.77	x	7.13	x	44.07		0.63	x	0.7	=	96.03 (79)
Southwest 0.9x	0.77	x	7.13	x	31.49		0.63	x	0.7	=	68.61 (79)

Solar gains in watts, calculated for each month

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

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

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

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

7. Mean internal temperature (heating season)

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

21 (85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(86)m=	1	1	0.99	0.96	0.87	0.7	0.52	0.58	0.84	0.98	1	1

(86)

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

(87)m= 19.92 20.06 20.29 20.59 20.84 20.97 20.99 20.99 20.91 20.59 20.2 19.89 (87)

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

(88)m= 20.06 20.07 20.07 20.08 20.08 20.09 20.09 20.09 20.09 20.08 20.08 20.07 (88)

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

	1	0.99	0.98	0.95	0.83	0.61	0.42	0.47	0.77	0.96	0.99	1
(89)m=												

(89)

TER WorkSheet: New dwelling design stage

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

(90)m=	18.61	18.82	19.16	19.6	19.92	20.07	20.09	20.09	20.01	19.6	19.03	18.58	(90)
--------	-------	-------	-------	------	-------	-------	-------	-------	-------	------	-------	-------	------

fLA = Living area ÷ (4) =

0.15 (91)

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

(92)m=	18.81	19.01	19.33	19.75	20.06	20.21	20.23	20.23	20.15	19.75	19.21	18.78	(92)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(93)m=	18.81	19.01	19.33	19.75	20.06	20.21	20.23	20.23	20.15	19.75	19.21	18.78	(93)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

8. Space heating requirement

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

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

Utilisation factor for gains, hm:

(94)m=	1	0.99	0.98	0.94	0.83	0.63	0.44	0.49	0.77	0.96	0.99	1	(94)
--------	---	------	------	------	------	------	------	------	------	------	------	---	------

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

(95)m=	506.41	578.65	638.59	676.12	634.38	469.55	312	327.12	477.49	526.86	493.4	479.76	(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=	1295.71	1256.59	1139.47	950.89	731.35	484.7	313.64	330.16	525.38	800.01	1064.26	1288.14	(97)
--------	---------	---------	---------	--------	--------	-------	--------	--------	--------	--------	---------	---------	------

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

(98)m=	587.24	455.58	372.66	197.84	72.14	0	0	0	0	203.23	411.02	601.44	
Total per year (kWh/year) = Sum(98) _{1...5,9...12} =												2901.14	(98)

Space heating requirement in kWh/m²/year

33.22 (99)

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

Space heating:

Fraction of space heat from secondary/supplementary system

0 (201)

Fraction of space heat from main system(s)

(202) = 1 – (201) =

1 (202)

Fraction of total heating from main system 1

(204) = (202) × [1 – (203)] =

1 (204)

Efficiency of main space heating system 1

93.4 (206)

Efficiency of secondary/supplementary heating system, %

0 (208)

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

kWh/year

Space heating requirement (calculated above)

587.24	455.58	372.66	197.84	72.14	0	0	0	0	203.23	411.02	601.44
--------	--------	--------	--------	-------	---	---	---	---	--------	--------	--------

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

(211)

628.73	487.77	398.99	211.82	77.24	0	0	0	0	217.59	440.06	643.94
--------	--------	--------	--------	-------	---	---	---	---	--------	--------	--------

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

3106.14 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

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

Water heating

Output from water heater (calculated above)

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

Efficiency of water heater

80.3 (216)

TER WorkSheet: New dwelling design stage

(217)m=

87.53	87.26	86.71	85.45	83.14	80.3	80.3	80.3	80.3	85.4	86.96	87.63
-------	-------	-------	-------	-------	------	------	------	------	------	-------	-------

 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=

236.48	209.14	219.75	197.78	196.8	179.47	171.94	191.68	193.79	207.5	216.73	230.6
--------	--------	--------	--------	-------	--------	--------	--------	--------	-------	--------	-------

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

2451.67

 (219)

Annual totals

Space heating fuel used, main system 1

kWh/year

kWh/year

Water heating fuel used

Electricity for pumps, fans and electric keep-hot

central heating pump:

30

 (230c)

boiler with a fan-assisted flue

45

 (230e)

Total electricity for the above, kWh/year

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

75

 (231)

Electricity for lighting

390.5

 (232)

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

6023.32

 (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 =	670.93 (261)
Space heating (secondary)	(215) x	0.519 =	0 (263)
Water heating	(219) x	0.216 =	529.56 (264)
Space and water heating	(261) + (262) + (263) + (264) =		1200.49 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519 =	38.93 (267)
Electricity for lighting	(232) x	0.519 =	202.67 (268)
Total CO2, kg/year	sum of (265)...(271) =		1442.08 (272)

TER =

16.51

 (273)

SAP 2012 Overheating Assessment

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

Property Details: Plot 003

Dwelling type:	Mid-terrace House
Located in:	England
Region:	West Pennines
Cross ventilation possible:	Yes
Number of storeys:	2
Front of dwelling faces:	North East
Overshading:	Very Little
Overhangs:	None
Thermal mass parameter:	Calculated 169.89
Night ventilation:	False
Blinds, curtains, shutters:	None
Ventilation rate during hot weather (ach):	4 (Windows open half the time)

Overheating Details:

Summer ventilation heat loss coefficient:	293.41	(P1)
Transmission heat loss coefficient:	50.9	
Summer heat loss coefficient:	344.33	(P2)

Overhangs:

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

Solar shading:

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

Solar gains:

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

Internal gains:

	June	July	August
Internal gains	453.11	434.3	442.9
Total summer gains	1111.52	1042.41	962.95 (P5)
Summer gain/loss ratio	3.23	3.03	2.8 (P6)
Mean summer external temperature (West Pennines)	14.7	16.4	16.3
Thermal mass temperature increment	0.81	0.81	0.81
Threshold temperature	18.74	20.24	19.91 (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 003			Issued on Date	26/02/2024
Assessment Reference	plot 3 chain	Prop Type Ref	22186		
Property	64 Victoria Avenue, Blackley, MANCHESTER, M9 0RE				
SAP Rating	85 B	DER	15.95	TER	16.51
Environmental	88 B	% DER<TER	3.40		
CO ₂ Emissions (t/year)	1.17	DFEE	39.42	TFEE	44.03
General Requirements Compliance	Pass	% DFEE<TFEE	10.47		
Assessor Details	Mr. Patrick McGuigan, JSP Sustainability Ltd, Tel: 01904 435 325, technical@jspsustainability.co.uk			Assessor ID	Y128-0001
Client					

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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

DWELLING AS BUILT

Mid-Terrace House, total floor area 87 m²

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

1a TER and DER

Fuel for main heating: Mains gas
Fuel factor: 1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 16.51 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 15.95 kgCO₂/m² OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 44.0 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE) 39.4 kWh/m²/yr 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: 4.60 (measured in this dwelling)
Maximum 10.0 OK

4 Heating efficiency

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

Secondary heating system: None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls: Programmer, room thermostat and TRVs OK

Hot water controls: No cylinder

Boiler interlock Yes OK

7 Low energy lights

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

8 Mechanical ventilation

Not applicable

9 Summertime temperature

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

Based on:

Overshading: Very little
Windows facing North East: 5.83 m², No overhang
Windows facing South West: 7.13 m², No overhang
Air change rate: 0.00 ach
Blinds/curtains: None

10 Key features

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	43.6700 (1b)	x 2.4200 (2b)	= 105.6814 (1b) - (3b)
First floor	43.6700 (1c)	x 2.6700 (2c)	= 116.5989 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	87.3400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 222.2803 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1350 (8)
Pressure test					Yes
Measured/design AP50					4.6000
Infiltration rate					0.3650 (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) =	0.3102 (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	0.3955	0.3878	0.3800	0.3412	0.3335	0.2947	0.2947	0.2870	0.3102	0.3335	0.3490	0.3645 (22b)
Effective ac	0.5782	0.5752	0.5722	0.5582	0.5556	0.5434	0.5434	0.5412	0.5481	0.5556	0.5609	0.5664 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front			2.1500	1.4000	3.0100		(26)
front (Uw = 1.30)			12.9600	1.2357	16.0152		(27)
gf			43.6700	0.1500	6.5505	75.0000	3275.2499 (28a)
external	51.7700	15.1100	36.6600	0.2000	7.3320	60.0000	2199.6000 (29a)
cold	43.6700		43.6700	0.0900	3.9303	9.0000	393.0300 (30)
Total net area of external elements Aum(A, m ²)			139.1100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	36.8380		(33)
party			87.2600	0.0000	0.0000	70.0000	6108.2001 (32)
gf			82.0000			9.0000	738.0000 (32c)
1f			105.0000			9.0000	945.0000 (32c)
1f			43.6700			18.0000	786.0600 (32d)
gf			43.6700			9.0000	393.0300 (32e)

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

(28)...(30) + (32) + (32a)...(32e) =	14838.1700 (34)
	169.8897 (35)
	14.0811 (36)
(33) + (36) =	50.9191 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	42.4140	42.1912	41.9728	40.9471	40.7551	39.8617	39.8617	39.6963	40.2058	40.7551	41.1434	41.5493 (38)
Heat transfer coeff	93.3331	93.1103	92.8919	91.8661	91.6742	90.7808	90.7808	90.6153	91.1249	91.6742	92.0625	92.4684 (39)
Average = Sum(39)m / 12 =												91.8652 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0686	1.0661	1.0636	1.0518	1.0496	1.0394	1.0394	1.0375	1.0433	1.0496	1.0541	1.0587 (40)
HLP (average)												1.0518 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.5875 (42)
Average daily hot water use (litres/day)												95.6539 (43)

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	23.4056	20.4707	21.1239	18.4163	17.6709	15.2486	14.1301	16.2145	16.4082	19.1221	20.8733	22.6670 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	18.7639	16.9030	18.5757	17.7959	18.2578	17.5174	18.0070	18.1696	17.6692	18.4442	18.0390	18.7142 (61)
Total heat required for water heating calculated for each month	174.8011	153.3741	159.4016	140.5714	136.0638	119.1750	112.2077	126.2663	127.0569	145.9250	157.1943	169.8279 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	174.8011	153.3741	159.4016	140.5714	136.0638	119.1750	112.2077	126.2663	127.0569	145.9250	157.1943	169.8279 (64)
Heat gains from water heating, kWh/month	56.5733	49.6024	51.4686	45.2718	43.7349	38.1805	35.8235	40.4846	40.7887	46.9984	50.7789	54.9238 (65)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)												
Total per year (kWh/year) = Sum(64)m = 1721.8651 (64)												

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	129.3766	129.3766	129.3766	129.3766	129.3766	129.3766	129.3766	129.3766	129.3766	129.3766	129.3766	129.3766 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	22.1119	19.6396	15.9720	12.0918	9.0388	7.6309	8.2455	10.7178	14.3854	18.2655	21.3186	22.7264 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	234.0980	236.5272	230.4057	217.3737	200.9232	185.4620	175.1330	172.7038	178.8253	191.8573	208.3078	223.7690 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.9377	35.9377	35.9377	35.9377	35.9377	35.9377	35.9377	35.9377	35.9377	35.9377	35.9377	35.9377 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-103.5013	-103.5013	-103.5013	-103.5013	-103.5013	-103.5013	-103.5013	-103.5013	-103.5013	-103.5013	-103.5013	-103.5013 (71)
Water heating gains (Table 5)	76.0394	73.8131	69.1782	62.8775	58.7835	53.0285	48.1499	54.4147	56.6510	63.1699	70.5262	73.8224 (72)
Total internal gains	397.0623	394.7929	380.3688	357.1561	333.5585	310.9344	296.3413	302.6493	314.6746	338.1057	364.9656	385.1308 (73)

6. Solar gains

[Jan]												Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W	
Northeast												5.8300	11.2829		0.4600		0.0000		0.7700		23.2991 (75)	
Southwest												7.1300	36.7938		0.4600		0.0000		0.7700		92.9208 (79)	
Solar gains	116.2200	205.7046	302.0103	408.6607	489.1834	499.4793	475.7945	413.6061	338.6107	232.8899	140.6141	98.5481	(83)									
Total gains	513.2823	600.4975	682.3791	765.8168	822.7418	810.4137	772.1358	716.2554	653.2853	570.9956	505.5797	483.6789	(84)									

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	44.1613	44.2670	44.3711	44.8665	44.9605	45.4029	45.4029	45.4858	45.2315	44.9605	44.7708	44.5743
alpha	3.9441	3.9511	3.9581	3.9911	3.9974	4.0269	4.0269	4.0324	4.0154	3.9974	3.9847	3.9716
util living area	0.9916	0.9837	0.9654	0.9167	0.8139	0.6515	0.4991	0.5526	0.7850	0.9440	0.9849	0.9933 (86)
MIT	19.4577	19.6645	19.9876	20.3958	20.7299	20.9215	20.9792	20.9689	20.8286	20.3883	19.8473	19.4195 (87)
Th 2	20.0265	20.0286	20.0307	20.0404	20.0422	20.0506	20.0506	20.0522	20.0474	20.0422	20.0385	20.0347 (88)
util rest of house	0.9896	0.9800	0.9572	0.8965	0.7697	0.5750	0.3993	0.4508	0.7198	0.9263	0.9808	0.9917 (89)
MIT 2	18.6163	18.8228	19.1425	19.5434	19.8480	20.0079	20.0433	20.0402	19.9413	19.5451	19.0133	18.5846 (90)
Living area fraction	18.7451	18.9517	19.2719	19.6739	19.9830	20.1478	20.1865	20.1824	20.0772	19.6742	19.1409	18.7124 (92)
MIT	18.7451	18.9517	19.2719	19.6739	19.9830	20.1478	20.1865	20.1824	20.0772	19.6742	19.1409	18.7124 (93)
Temperature adjustment												0.0000
adjusted MIT	18.7451	18.9517	19.2719	19.6739	19.9830	20.1478	20.1865	20.1824	20.0772	19.6742	19.1409	18.7124 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	506.1738	585.1976	647.6729	679.6096	630.7215	472.7306	319.6951	333.3625	471.7355	524.0474	493.2918	478.2708 (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	1348.2040	1308.3550	1186.4066	989.7539	759.3382	503.6335	325.5885	342.7427	544.6685	831.8687	1108.5176	1341.9378 (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	626.4705	485.9618	400.8179	223.3039	95.6908	0.0000	0.0000	0.0000	0.0000	229.0191	442.9626	642.5682 (98)
Space heating												3146.7948 (98)
Space heating per m2												36.0293 (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													3383.6503 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	626.4705	485.9618	400.8179	223.3039	95.6908	0.0000	0.0000	0.0000	0.0000	229.0191	442.9626	642.5682	(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)	673.6242	522.5395	430.9870	240.1117	102.8934	0.0000	0.0000	0.0000	0.0000	246.2571	476.3039	690.9336	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	174.8011	153.3741	159.4016	140.5714	136.0638	119.1750	112.2077	126.2663	127.0569	145.9250	157.1943	169.8279	(64)
Efficiency of water heater (217)m	89.3280	89.2616	89.1255	88.8168	88.2141	87.0000	87.0000	87.0000	87.0000	88.8082	89.1944	89.3559	(216)
Fuel for water heating, kWh/month	195.6845	171.8253	178.8507	158.2711	154.2427	136.9828	128.9744	145.1337	146.0424	164.3149	176.2378	190.0578	(219)
Water heating fuel used												1946.6181	(219)
Annual totals kWh/year													
Space heating fuel - main system												3383.6503	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												390.5028	(232)
Total delivered energy for all uses												5795.7713	(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	3383.6503	0.2160	730.8685 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1946.6181	0.2160	420.4695 (264)
Space and water heating			1151.3380 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	390.5028	0.5190	202.6710 (268)
Total CO2, kg/year			1392.9339 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			15.9500 (273)

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

DER		15.9500	ZC1
Total Floor Area	TFA	87.3400	
Assumed number of occupants	N	2.5875	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		15.8829	ZC2
CO2 emissions from cooking, equation (L16)		2.0735	ZC3
Total CO2 emissions		33.9065	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		33.9065	ZC8

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	43.6700 (1b)	x 2.4200 (2b)	= 105.6814 (1b) - (3b)
First floor	43.6700 (1c)	x 2.6700 (2c)	= 116.5989 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	87.3400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 222.2803 (5)

2. Ventilation rate

										main	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) =							0.1350 (8)
Pressure test										Yes							
Measured/design AP50																	5.0000
Infiltration rate																	0.3850 (18)
Number of sides sheltered																	2 (19)
Shelter factor										(20) = 1 - [0.075 x (19)] =							0.8500 (20)
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =							0.3272 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22)				
Adj infilt rate	0.4172	0.4090	0.4008	0.3599	0.3518	0.3109	0.3109	0.3027	0.3272	0.3518	0.3681	0.3845	(22a)				
Effective ac	0.5870	0.5837	0.5803	0.5648	0.5619	0.5483	0.5483	0.5458	0.5535	0.5619	0.5678	0.5739	(25)				

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opaque door			2.1500	1.0000	2.1500		(26)					
TER Opening Type (Uw = 1.40)			12.9600	1.3258	17.1818		(27)					
gf			43.6700	0.1300	5.6771		(28a)					
external	51.7700	15.1100	36.6600	0.1800	6.5988		(29a)					
cold	43.6700		43.6700	0.1300	5.6771		(30)					
Total net area of external elements Aum(A, m2)			139.1100				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26) ... (30) + (32) =	37.2848		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.9375 (36)					
Total fabric heat loss						(33) + (36) =	46.2223 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 43.0601	Feb 42.8122	Mar 42.5693	Apr 41.4280	May 41.2144	Jun 40.2204	Jul 40.2204	Aug 40.0363	Sep 40.6033	Oct 41.2144	Nov 41.6464	Dec 42.0980 (38)
Heat transfer coeff	89.2825	89.0346	88.7916	87.6503	87.4367	86.4427	86.4427	86.2586	86.8256	87.4367	87.8687	88.3203 (39)
Average = Sum(39)m / 12 =												87.6493 (39)
HLP	Jan 1.0222	Feb 1.0194	Mar 1.0166	Apr 1.0036	May 1.0011	Jun 0.9897	Jul 0.9897	Aug 0.9876	Sep 0.9941	Oct 1.0011	Nov 1.0061	Dec 1.0112 (40)
HLP (average)												1.0035 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.5875 (42)
Average daily hot water use (litres/day)												95.6539 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	105.2193	101.3931	97.5670	93.7408	89.9147	86.0885	86.0885	89.9147	93.7408	97.5670	101.3931	105.2193 (44)
Energy conte	156.0372	136.4711	140.8260	122.7755	117.8060	101.6576	94.2007	108.0967	109.3877	127.4809	139.1553	151.1137 (45)
Energy content (annual)												Total = Sum(45)m = 1505.0083 (45)
Distribution loss	(46)m = 0.15 x (45)m											
	23.4056	20.4707	21.1239	18.4163	17.6709	15.2486	14.1301	16.2145	16.4082	19.1221	20.8733	22.6670 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Total heat required for water heating calculated for each month	50.9589	46.0274	49.7191	46.2284	45.8195	42.4546	43.8698	45.8195	46.2284	49.7191	49.3151	50.9589 (61)
Solar input	206.9961	182.4985	190.5450	169.0038	163.6255	144.1122	138.0705	153.9162	155.6161	177.1999	188.4704	202.0726 (62)
Output from w/h	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Heat gains from water heating, kWh/month	206.9961	182.4985	190.5450	169.0038	163.6255	144.1122	138.0705	153.9162	155.6161	177.1999	188.4704	202.0726 (64)
	64.6221	56.8835	59.2544	52.3799	50.6254	44.4148	42.2892	47.3970	47.9285	54.8171	58.5979	62.9850 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	129.3766	129.3766	129.3766	129.3766	129.3766	129.3766	129.3766	129.3766	129.3766	129.3766	129.3766	129.3766	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	22.1119	19.6396	15.9720	12.0918	9.0388	7.6309	8.2455	10.7178	14.3854	18.2655	21.3186	22.7264	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	234.0980	236.5272	230.4057	217.3737	200.9232	185.4620	175.1330	172.7038	178.8253	191.8573	208.3078	223.7690	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.9377	35.9377	35.9377	35.9377	35.9377	35.9377	35.9377	35.9377	35.9377	35.9377	35.9377	35.9377	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-103.5013	-103.5013	-103.5013	-103.5013	-103.5013	-103.5013	-103.5013	-103.5013	-103.5013	-103.5013	-103.5013	-103.5013	(71)
Water heating gains (Table 5)	86.8576	84.6481	79.6430	72.7499	68.0449	61.6872	56.8403	63.7057	66.5674	73.6790	81.3860	84.6573	(72)
Total internal gains	407.8805	405.6279	390.8337	367.0284	342.8198	319.5931	305.0317	311.9402	324.5910	348.6148	375.8254	395.9657	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
Northeast					5.8300	11.2829	0.6300	0.7000	0.7700		20.1031 (75)	
Southwest					7.1300	36.7938	0.6300	0.7000	0.7700		80.1745 (79)	
Solar gains	100.2776	177.4873	260.5823	352.6031	422.0802	430.9638	410.5279	356.8701	292.1621	200.9435	121.3255	85.0299 (83)
Total gains	508.1581	583.1151	651.4160	719.6316	764.9000	750.5569	715.5596	668.8104	616.7531	549.5582	497.1509	480.9956 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	67.9336	68.1227	68.3092	69.1986	69.3676	70.1653	70.1653	70.3150	69.8559	69.3676	69.0266	68.6736	
alpha	5.5289	5.5415	5.5539	5.6132	5.6245	5.6777	5.6777	5.6877	5.6571	5.6245	5.6018	5.5782	
util living area	0.9983	0.9959	0.9886	0.9605	0.8738	0.6977	0.5246	0.5805	0.8372	0.9759	0.9961	0.9987	(86)
MIT	19.9170	20.0607	20.2909	20.5920	20.8399	20.9672	20.9945	20.9905	20.9084	20.5877	20.1982	19.8931	(87)
Th 2	20.0648	20.0672	20.0695	20.0804	20.0824	20.0919	20.0919	20.0937	20.0882	20.0824	20.0783	20.0740	(88)
util rest of house	0.9977	0.9946	0.9846	0.9461	0.8303	0.6144	0.4200	0.4727	0.7689	0.9643	0.9946	0.9983	(89)
MIT 2	18.6128	18.8242	19.1600	19.5963	19.9241	20.0699	20.0898	20.0896	20.0141	19.5981	19.0336	18.5846	(90)
Living area fraction	18.8124	19.0135	19.3331	19.7487	20.0643	20.2072	20.2283	20.2276	20.1510	19.7496	19.2119	18.7849	(92)
MIT	18.8124	19.0135	19.3331	19.7487	20.0643	20.2072	20.2283	20.2276	20.1510	19.7496	19.2119	18.7849	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8124	19.0135	19.3331	19.7487	20.0643	20.2072	20.2283	20.2276	20.1510	19.7496	19.2119	18.7849	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	506.4075	578.6484	638.5886	676.1172	634.3794	469.5483	312.0019	327.1163	477.4898	526.8558	493.3989	479.7559	(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	1295.7059	1256.5895	1139.4736	950.8944	731.3456	484.7041	313.6381	330.1596	525.3820	800.0095	1064.2560	1288.1405	(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	587.2380	455.5764	372.6584	197.8396	72.1428	0.0000	0.0000	0.0000	0.0000	203.2264	411.0171	601.4381	(98)
Space heating												2901.1369	(98)
Space heating per m2												33.2166	(99)

8c. Space cooling requirement

Not applicable

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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													3106.1423 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	587.2380	455.5764	372.6584	197.8396	72.1428	0.0000	0.0000	0.0000	0.0000	203.2264	411.0171	601.4381	(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)	628.7345	487.7692	398.9919	211.8197	77.2407	0.0000	0.0000	0.0000	0.0000	217.5871	440.0611	643.9381	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	206.9961	182.4985	190.5450	169.0038	163.6255	144.1122	138.0705	153.9162	155.6161	177.1999	188.4704	202.0726	(64)
Efficiency of water heater	87.5307	87.2608	86.7102	85.4486	83.1424	80.3000	80.3000	80.3000	80.3000	85.3969	86.9613	87.6282	(216)
Fuel for water heating, kWh/month	236.4840	209.1413	219.7494	197.7842	196.8016	179.4673	171.9433	191.6765	193.7934	207.5016	216.7290	230.6023	(219)
Water heating fuel used												2451.6739	(219)
Annual totals kWh/year													
Space heating fuel - main system												3106.1423	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												390.5028	(232)
Total delivered energy for all uses												6023.3190	(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	3106.1423	0.2160	670.9267 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2451.6739	0.2160	529.5616 (264)
Space and water heating			1200.4883 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	390.5028	0.5190	202.6710 (268)
Total CO2, kg/m2/year			1442.0843 (272)
Emissions per m2 for space and water heating			13.7450 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.3205 (272b)
Emissions per m2 for pumps and fans			0.4457 (272c)
Target Carbon Dioxide Emission Rate (TER) = (13.7450 * 1.00) + 2.3205 + 0.4457, rounded to 2 d.p.			16.5100 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	43.6700 (1b)	x 2.4200 (2b)	= 105.6814 (1b) - (3b)
First floor	43.6700 (1c)	x 2.6700 (2c)	= 116.5989 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	87.3400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 222.2803 (5)

2. Ventilation rate

										main	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) =	0.1350 (8)
Pressure test										Yes							
Measured/design AP50										4.6000							
Infiltration rate										0.3650 (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) =					0.3102 (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	(22)				
Adj infilt rate	0.3955	0.3878	0.3800	0.3412	0.3335	0.2947	0.2947	0.2870	0.3102	0.3335	0.3490	0.3645	(22a)				
Effective ac	0.5782	0.5752	0.5722	0.5582	0.5556	0.5434	0.5434	0.5412	0.5481	0.5556	0.5609	0.5664	(25)				

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front			2.1500	1.4000	3.0100		(26)
front (Uw = 1.30)			12.9600	1.2357	16.0152		(27)
gf			43.6700	0.1500	6.5505	75.0000	3275.2499 (28a)
external	51.7700	15.1100	36.6600	0.2000	7.3320	60.0000	2199.6000 (29a)
cold	43.6700		43.6700	0.0900	3.9303	9.0000	393.0300 (30)
Total net area of external elements Aum(A, m ²)			139.1100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	36.8380		(33)
party			87.2600	0.0000	0.0000	70.0000	6108.2001 (32)
gf			82.0000			9.0000	738.0000 (32c)
lf			105.0000			9.0000	945.0000 (32c)
lf			43.6700			18.0000	786.0600 (32d)
gf			43.6700			9.0000	393.0300 (32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss
(28)...(30) + (32) + (32a)...(32e) = 14838.1700 (34)
169.8897 (35)
14.0811 (36)
(33) + (36) = 50.9191 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	42.4140	42.1912	41.9728	40.9471	40.7551	39.8617	39.8617	39.6963	40.2058	40.7551	41.1434	41.5493 (38)
Heat transfer coeff	93.3331	93.1103	92.8919	91.8661	91.6742	90.7808	90.7808	90.6153	91.1249	91.6742	92.0625	92.4684 (39)
Average = Sum(39)m / 12 =												91.8652 (39)
HLP	1.0686	1.0661	1.0636	1.0518	1.0496	1.0394	1.0394	1.0375	1.0433	1.0496	1.0541	1.0587 (40)
HLP (average)												1.0518 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	33.1579	29.0001	29.9255	26.0898	25.0338	21.6022	20.0177	22.9706	23.2449	27.0897	29.5705	32.1117 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	129.3766	129.3766	129.3766	129.3766	129.3766	129.3766	129.3766	129.3766	129.3766	129.3766	129.3766	129.3766	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	22.1119	19.6396	15.9720	12.0918	9.0388	7.6309	8.2455	10.7178	14.3854	18.2655	21.3186	22.7264	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	234.0980	236.5272	230.4057	217.3737	200.9232	185.4620	175.1330	172.7038	178.8253	191.8573	208.3078	223.7690	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.9377	35.9377	35.9377	35.9377	35.9377	35.9377	35.9377	35.9377	35.9377	35.9377	35.9377	35.9377	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-103.5013	-103.5013	-103.5013	-103.5013	-103.5013	-103.5013	-103.5013	-103.5013	-103.5013	-103.5013	-103.5013	-103.5013	(71)
Water heating gains (Table 5)	44.5671	43.1549	40.2225	36.2358	33.6475	30.0031	26.9054	30.8744	32.2846	36.4109	41.0701	43.1608	(72)
Total internal gains	362.5900	361.1347	348.4131	327.5143	305.4225	284.9090	272.0969	276.1089	287.3082	308.3467	332.5095	351.4693	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g		FF		Access factor Table 6d		Gains W
						Specific data or Table 6b		Specific data or Table 6c				
Northeast				5.8300	11.2829	0.4600		0.0000		0.7700		23.2991 (75)
Southwest				7.1300	36.7938	0.4600		0.0000		0.7700		92.9208 (79)

Solar gains	116.2200	205.7046	302.0103	408.6607	489.1834	499.4793	475.7945	413.6061	338.6107	232.8899	140.6141	98.5481 (83)
Total gains	478.8099	566.8393	650.4234	736.1751	794.6059	784.3883	747.8914	689.7150	625.9189	541.2366	473.1236	450.0174 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, 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	44.1613	44.2670	44.3711	44.8665	44.9605	45.4029	45.4029	45.4858	45.2315	44.9605	44.7708	44.5743	
alpha	3.9441	3.9511	3.9581	3.9911	3.9974	4.0269	4.0269	4.0324	4.0154	3.9974	3.9847	3.9716	
util living area	0.9934	0.9866	0.9702	0.9252	0.8270	0.6671	0.5133	0.5703	0.8024	0.9522	0.9880	0.9948	(86)
MIT	19.4088	19.6182	19.9468	20.3649	20.7115	20.9145	20.9770	20.9652	20.8129	20.3533	19.8023	19.3713	(87)
Th 2	20.0265	20.0286	20.0307	20.0404	20.0422	20.0506	20.0506	20.0522	20.0474	20.0422	20.0385	20.0347	(88)
util rest of house	0.9918	0.9834	0.9630	0.9066	0.7843	0.5904	0.4114	0.4666	0.7392	0.9366	0.9846	0.9936	(89)
MIT 2	18.5677	18.7772	19.1031	19.5151	19.8332	20.0037	20.0424	20.0387	19.9302	19.5127	18.9690	18.5366	(90)
Living area fraction	18.6965	18.9060	19.2323	19.6452	19.9677	20.1431	20.1855	20.1805	20.0653	19.6414	19.0965	0.1531	(91)
MIT	18.6965	18.9060	19.2323	19.6452	19.9677	20.1431	20.1855	20.1805	20.0653	19.6414	19.0965	18.6644	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6965	18.9060	19.2323	19.6452	19.9677	20.1431	20.1855	20.1805	20.0653	19.6414	19.0965	18.6644	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9889	0.9786	0.9555	0.8974	0.7806	0.5984	0.4265	0.4814	0.7406	0.9283	0.9802	0.9912	(94)
Ext temp.	473.5132	554.7299	621.4763	660.6630	620.2410	469.3865	318.9439	332.0007	463.5434	502.4398	463.7601	446.0528	(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	1343.6658	1304.1002	1182.7260	987.1186	757.9318	503.2108	325.4936	342.5713	543.5896	828.8593	1104.4313	1337.5004	(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	647.3936	503.5769	417.5697	235.0480	102.4419	0.0000	0.0000	0.0000	0.0000	242.8561	461.2833	663.2370	(98)
Space heating per m2												3273.4066	(98)
												37.4789	(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	853.3393	671.7777	688.6765	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8638	0.9168	0.8933	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	737.0775	615.9039	615.1777	0.0000	0.0000	0.0000	0.0000	(102)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1014.5597	969.8984	903.7348	0.0000	0.0000	0.0000	0.0000 (103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	199.7872	263.3720	214.6865	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												677.8456 (104)
Cooled fraction									fC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	49.9468	65.8430	53.6716	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												169.4614 (107)
Space cooling per m2												1.9402 (108)
Energy for space heating												37.4789 (99)
Energy for space cooling												1.9402 (108)
Total												39.4191 (109)
Dwelling Fabric Energy Efficiency (DFEE)												39.4 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	43.6700 (1b)	x 2.4200 (2b)	= 105.6814 (1b) - (3b)
First floor	43.6700 (1c)	x 2.6700 (2c)	= 116.5989 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	87.3400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 222.2803 (5)

2. Ventilation rate

										main	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) =							0.1350 (8)
Pressure test										Yes							
Measured/design AP50																	5.0000
Infiltration rate																	0.3850 (18)
Number of sides sheltered																	2 (19)
Shelter factor										(20) = 1 - [0.075 x (19)] =							0.8500 (20)
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =							0.3272 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22)				
Adj infilt rate	0.4172	0.4090	0.4008	0.3599	0.3518	0.3109	0.3109	0.3027	0.3272	0.3518	0.3681	0.3845	(22a)				
Effective ac	0.5870	0.5837	0.5803	0.5648	0.5619	0.5483	0.5483	0.5458	0.5535	0.5619	0.5678	0.5739	(22b)				
													(25)				

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opaque door			2.1500	1.0000	2.1500		(26)					
TER Opening Type (Uw = 1.40)			12.9600	1.3258	17.1818		(27)					
gf			43.6700	0.1300	5.6771		(28a)					
external	51.7700	15.1100	36.6600	0.1800	6.5988		(29a)					
cold	43.6700		43.6700	0.1300	5.6771		(30)					
Total net area of external elements Aum(A, m2)			139.1100				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	37.2848		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.9375 (36)					
Total fabric heat loss						(33) + (36) =	46.2223 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 43.0601	Feb 42.8122	Mar 42.5693	Apr 41.4280	May 41.2144	Jun 40.2204	Jul 40.2204	Aug 40.0363	Sep 40.6033	Oct 41.2144	Nov 41.6464	Dec 42.0980 (38)
Heat transfer coeff	89.2825	89.0346	88.7916	87.6503	87.4367	86.4427	86.4427	86.2586	86.8256	87.4367	87.8687	88.3203 (39)
Average = Sum(39)m / 12 =												87.6493 (39)
HLP	Jan 1.0222	Feb 1.0194	Mar 1.0166	Apr 1.0036	May 1.0011	Jun 0.9897	Jul 0.9897	Aug 0.9876	Sep 0.9941	Oct 1.0011	Nov 1.0061	Dec 1.0112 (40)
HLP (average)												1.0035 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.5875 (42)
Average daily hot water use (litres/day)												95.6539 (43)
Daily hot water use	Jan 105.2193	Feb 101.3931	Mar 97.5670	Apr 93.7408	May 89.9147	Jun 86.0885	Jul 86.0885	Aug 89.9147	Sep 93.7408	Oct 97.5670	Nov 101.3931	Dec 105.2193 (44)
Energy conte	156.0372	136.4711	140.8260	122.7755	117.8060	101.6576	94.2007	108.0967	109.3877	127.4809	139.1553	151.1137 (45)
Energy content (annual)												Total = Sum(45)m = 1505.0083 (45)
Distribution loss (46)m = 0.15 x (45)m												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Heat gains from water heating, kWh/month	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
	33.1579	29.0001	29.9255	26.0898	25.0338	21.6022	20.0177	22.9706	23.2449	27.0897	29.5705	32.1117 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	129.3766	129.3766	129.3766	129.3766	129.3766	129.3766	129.3766	129.3766	129.3766	129.3766	129.3766	129.3766	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	22.1119	19.6396	15.9720	12.0918	9.0388	7.6309	8.2455	10.7178	14.3854	18.2655	21.3186	22.7264	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	234.0980	236.5272	230.4057	217.3737	200.9232	185.4620	175.1330	172.7038	178.8253	191.8573	208.3078	223.7690	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.9377	35.9377	35.9377	35.9377	35.9377	35.9377	35.9377	35.9377	35.9377	35.9377	35.9377	35.9377	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-103.5013	-103.5013	-103.5013	-103.5013	-103.5013	-103.5013	-103.5013	-103.5013	-103.5013	-103.5013	-103.5013	-103.5013	(71)
Water heating gains (Table 5)	44.5671	43.1549	40.2225	36.2358	33.6475	30.0031	26.9054	30.8744	32.2846	36.4109	41.0701	43.1608	(72)
Total internal gains	362.5900	361.1347	348.4131	327.5143	305.4225	284.9090	272.0969	276.1089	287.3082	308.3467	332.5095	351.4693	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
Northeast				5.8300	11.2829	0.6300	0.7000	0.7700	20.1031 (75)			
Southwest				7.1300	36.7938	0.6300	0.7000	0.7700	80.1745 (79)			
Solar gains	100.2776	177.4873	260.5823	352.6031	422.0802	430.9638	410.5279	356.8701	292.1621	200.9435	121.3255	85.0299 (83)
Total gains	462.8676	538.6220	608.9955	680.1175	727.5026	715.8728	682.6248	632.9791	579.4703	509.2901	453.8350	436.4991 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	67.9336	68.1227	68.3092	69.1986	69.3676	70.1653	70.1653	70.3150	69.8559	69.3676	69.0266	68.6736	
alpha	5.5289	5.5415	5.5539	5.6132	5.6245	5.6777	5.6777	5.6877	5.6571	5.6245	5.6018	5.5782	
util living area	0.9989	0.9972	0.9917	0.9687	0.8920	0.7233	0.5481	0.6097	0.8636	0.9828	0.9975	0.9992	(86)
MIT	19.8676	20.0127	20.2467	20.5562	20.8185	20.9608	20.9931	20.9880	20.8908	20.5481	20.1512	19.8443	(87)
Th 2	20.0648	20.0672	20.0695	20.0804	20.0824	20.0919	20.0919	20.0937	20.0882	20.0824	20.0783	20.0740	(88)
util rest of house	0.9986	0.9963	0.9887	0.9568	0.8522	0.6400	0.4398	0.4983	0.8001	0.9741	0.9965	0.9990	(89)
MIT 2	19.0241	19.1708	19.4052	19.7166	19.9576	20.0735	20.0901	20.0901	20.0260	19.7143	19.3184	19.0084	(90)
Living area fraction	19.1532	19.2997	19.5340	19.8451	20.0893	20.2093	20.2283	20.2275	20.1584	19.8420	19.4459	19.1363	(92)
MIT	19.1532	19.2997	19.5340	19.8451	20.0893	20.2093	20.2283	20.2275	20.1584	19.8420	19.4459	19.1363	(93)
Temperature adjustment													
adjusted MIT	19.1532	19.2997	19.5340	19.8451	20.0893	20.2093	20.2283	20.2275	20.1584	19.8420	19.4459	19.1363	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	461.9721	536.0574	600.7149	648.1199	620.2177	466.3848	311.5809	326.2097	466.9285	494.5636	451.8264	435.8876	(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	1326.1337	1282.0713	1157.3135	959.3450	733.5373	484.8866	313.6418	330.1582	526.0199	808.0882	1084.8202	1319.1828	(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	642.9362	501.3214	414.1094	224.0821	84.3098	0.0000	0.0000	0.0000	0.0000	233.2623	455.7555	657.1716	(98)
Space heating												3212.9482	(98)
Space heating per m2												36.7867	(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	812.5615	639.6761	655.5656	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9028	0.9523	0.9330	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	733.5709	609.1637	611.6542	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	934.4766	893.6128	837.4200	0.0000	0.0000	0.0000	0.0000	(103)
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	144.6521	211.6301	167.9697	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												524.2520	(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	36.1630	52.9075	41.9924	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling											131.0630 (107)
Space cooling per m2											1.5006 (108)
Energy for space heating											36.7867 (99)
Energy for space cooling											1.5006 (108)
Total											38.2873 (109)
Target Fabric Energy Efficiency (TFEE)											44.0 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	43.6700 (1b)	x 2.4200 (2b)	= 105.6814 (1b) - (3b)
First floor	43.6700 (1c)	x 2.6700 (2c)	= 116.5989 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	87.3400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 222.2803 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					30.0000 / (5) = 0.1350 (8)
Pressure test					Yes
Measured/design AP50					4.6000
Infiltration rate					0.3650 (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) =	0.3102 (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	0.3568	0.3490	0.3490	0.3180	0.3257	0.2870	0.2714	0.2714	0.2870	0.3180	0.3180	0.3257 (22b)
Effective ac	0.5636	0.5609	0.5609	0.5506	0.5531	0.5412	0.5368	0.5368	0.5412	0.5506	0.5506	0.5531 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front			2.1500	1.4000	3.0100		(26)
front (Uw = 1.30)			12.9600	1.2357	16.0152		(27)
gf			43.6700	0.1500	6.5505	75.0000	3275.2499 (28a)
external	51.7700	15.1100	36.6600	0.2000	7.3320	60.0000	2199.6000 (29a)
cold	43.6700		43.6700	0.0900	3.9303	9.0000	393.0300 (30)
Total net area of external elements Aum(A, m ²)			139.1100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	36.8380		(33)
party			87.2600	0.0000	0.0000	70.0000	6108.2001 (32)
gf			82.0000			9.0000	738.0000 (32c)
lf			105.0000			9.0000	945.0000 (32c)
lf			43.6700			18.0000	786.0600 (32d)
gf			43.6700			9.0000	393.0300 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 14838.1700 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 169.8897 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 14.0811 (36)
Total fabric heat loss (33) + (36) = 50.9191 (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	41.3441	41.1434	41.1434	40.3845	40.5676	39.6963	39.3786	39.3786	39.6963	40.3845	40.3845	40.5676 (38)
Heat transfer coeff	92.2632	92.0625	92.0625	91.3036	91.4867	90.6153	90.2977	90.2977	90.6153	91.3036	91.3036	91.4867 (39)
Average = Sum(39)m / 12 =												91.2582 (39)
HLP	1.0564	1.0541	1.0541	1.0454	1.0475	1.0375	1.0339	1.0339	1.0375	1.0454	1.0454	1.0475 (40)
HLP (average)												1.0449 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.5875 (42)
Average daily hot water use (litres/day) 95.6539 (43)

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	23.4056	20.4707	21.1239	18.4163	17.6709	15.2486	14.1301	16.2145	16.4082	19.1221	20.8733	22.6670 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	18.7639	16.9030	18.5757	17.7959	18.2578	17.5174	18.0070	18.1696	17.6692	18.4442	18.0390	18.7142 (61)
Total heat required for water heating calculated for each month	174.8011	153.3741	159.4016	140.5714	136.0638	119.1750	112.2077	126.2663	127.0569	145.9250	157.1943	169.8279 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	174.8011	153.3741	159.4016	140.5714	136.0638	119.1750	112.2077	126.2663	127.0569	145.9250	157.1943	169.8279 (64)
RHI water heating demand												
Heat gains from water heating, kWh/month	56.5733	49.6024	51.4686	45.2718	43.7349	38.1805	35.8235	40.4846	40.7887	46.9984	50.7789	54.9238 (65)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)												
Total per year (kWh/year) = Sum(64)m = 1721.8651 (64)												
1722 (64)												

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	155.2520	155.2520	155.2520	155.2520	155.2520	155.2520	155.2520	155.2520	155.2520	155.2520	155.2520	155.2520 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	53.3478	47.3830	38.5345	29.1731	21.8072	18.4106	19.8933	25.8580	34.7066	44.0680	51.4338	54.8305 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	349.4000	353.0257	343.8891	324.4384	299.8853	276.8089	261.3925	257.7668	266.9034	286.3541	310.9072	333.9836 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.1127	53.1127	53.1127	53.1127	53.1127	53.1127	53.1127	53.1127	53.1127	53.1127	53.1127	53.1127 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-103.5013	-103.5013	-103.5013	-103.5013	-103.5013	-103.5013	-103.5013	-103.5013	-103.5013	-103.5013	-103.5013	-103.5013 (71)
Water heating gains (Table 5)	76.0394	73.8131	69.1782	62.8775	58.7835	53.0285	48.1499	54.4147	56.6510	63.1699	70.5262	73.8224 (72)
Total internal gains	586.6506	582.0852	559.4651	524.3524	488.3395	456.1114	437.2990	445.9029	466.1243	501.4554	540.7306	570.4998 (73)

6. Solar gains

[Jan]												Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
Northeast												5.8300	9.5471	0.4600	0.0000	1.0000	25.6034 (75)
Southwest												7.1300	31.1332	0.4600	0.0000	1.0000	102.1108 (79)
Solar gains	127.7142	237.4656	367.7073	505.9609	592.2878	616.2407	575.4129	492.6734	416.8104	279.5412	160.4804	115.7955 (83)					
Total gains	714.3649	819.5508	927.1724	1030.3133	1080.6272	1072.3521	1012.7119	938.5763	882.9348	780.9966	701.2111	686.2954 (84)					

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	44.6734	44.7708	44.7708	45.1430	45.0526	45.4858	45.6459	45.6459	45.4858	45.1430	45.1430	45.0526
alpha	3.9782	3.9847	3.9847	4.0095	4.0035	4.0324	4.0431	4.0431	4.0324	4.0095	4.0095	4.0035
util living area	0.9722	0.9520	0.9114	0.8146	0.6637	0.4903	0.3868	0.4245	0.6458	0.8640	0.9523	0.9758 (86)
MIT	19.8071	20.0192	20.3048	20.6616	20.8838	20.9735	20.9918	20.9883	20.9184	20.6209	20.1652	19.7731 (87)
Th 2	20.0366	20.0385	20.0385	20.0457	20.0440	20.0522	20.0552	20.0552	20.0522	20.0457	20.0457	20.0440 (88)
util rest of house	0.9662	0.9422	0.8939	0.7803	0.6082	0.4189	0.3063	0.3391	0.5753	0.8302	0.9407	0.9707 (89)
MIT 2	18.9685	19.1763	19.4499	19.7839	19.9683	20.0395	20.0525	20.0511	20.0057	19.7564	19.3277	18.9410 (90)
Living area fraction									fLA = Living area / (4) =			0.1531 (91)
MIT	19.0969	19.3054	19.5808	19.9183	20.1085	20.1824	20.1963	20.1946	20.1454	19.8887	19.4559	19.0683 (92)
Temperature adjustment												0.0000
adjusted MIT	19.0969	19.3054	19.5808	19.9183	20.1085	20.1824	20.1963	20.1946	20.1454	19.8887	19.4559	19.0683 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	685.0305	764.7419	819.8195	798.8195	661.5363	460.0068	322.5053	330.3094	514.4506	643.4534	653.4965	661.5436 (94)
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	1328.3012	1289.3684	1185.8342	969.4874	714.3706	469.6092	324.7333	333.6101	547.8093	829.8345	1091.6197	1323.6606 (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	478.5933	352.5490	272.3149	122.8809	39.3088	0.0000	0.0000	0.0000	0.0000	138.6675	315.4488	492.6150 (98)
Space heating												2212.3782 (98)
RHI space heating demand												2212 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	43.6700 (1b)	x 2.4200 (2b)	= 105.6814 (1b) - (3b)
First floor	43.6700 (1c)	x 2.6700 (2c)	= 116.5989 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	87.3400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 222.2803 (5)

2. Ventilation rate

										main	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) =	0.1350 (8)
Pressure test										Yes							
Measured/design AP50										4.6000							
Infiltration rate										0.3650 (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) =					0.3102 (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	0.3955	0.3878	0.3800	0.3412	0.3335	0.2947	0.2947	0.2870	0.3102	0.3335	0.3490	0.3645	(22b)				
Effective ac	0.5782	0.5752	0.5722	0.5582	0.5556	0.5434	0.5434	0.5412	0.5481	0.5556	0.5609	0.5664	(25)				

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front			2.1500	1.4000	3.0100		(26)
front (Uw = 1.30)			12.9600	1.2357	16.0152		(27)
gf			43.6700	0.1500	6.5505	75.0000	3275.2499 (28a)
external	51.7700	15.1100	36.6600	0.2000	7.3320	60.0000	2199.6000 (29a)
cold	43.6700		43.6700	0.0900	3.9303	9.0000	393.0300 (30)
Total net area of external elements Aum(A, m ²)			139.1100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	36.8380		(33)
party			87.2600	0.0000	0.0000	70.0000	6108.2001 (32)
gf			82.0000			9.0000	738.0000 (32c)
lf			105.0000			9.0000	945.0000 (32c)
lf			43.6700			18.0000	786.0600 (32d)
gf			43.6700			9.0000	393.0300 (32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss
(28)...(30) + (32) + (32a)...(32e) = 14838.1700 (34)
169.8897 (35)
14.0811 (36)
(33) + (36) = 50.9191 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	42.4140	42.1912	41.9728	40.9471	40.7551	39.8617	39.8617	39.6963	40.2058	40.7551	41.1434	41.5493 (38)
Heat transfer coeff	93.3331	93.1103	92.8919	91.8661	91.6742	90.7808	90.7808	90.6153	91.1249	91.6742	92.0625	92.4684 (39)
Average = Sum(39)m / 12 =												91.8652 (39)
HLP	1.0686	1.0661	1.0636	1.0518	1.0496	1.0394	1.0394	1.0375	1.0433	1.0496	1.0541	1.0587 (40)
HLP (average)												1.0518 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	23.4056	20.4707	21.1239	18.4163	17.6709	15.2486	14.1301	16.2145	16.4082	19.1221	20.8733	22.6670 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	18.7639	16.9030	18.5757	17.7959	18.2578	17.5174	18.0070	18.1696	17.6692	18.4442	18.0390	18.7142 (61)
Total heat required for water heating calculated for each month	174.8011	153.3741	159.4016	140.5714	136.0638	119.1750	112.2077	126.2663	127.0569	145.9250	157.1943	169.8279 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	174.8011	153.3741	159.4016	140.5714	136.0638	119.1750	112.2077	126.2663	127.0569	145.9250	157.1943	169.8279 (64)
Heat gains from water heating, kWh/month	56.5733	49.6024	51.4686	45.2718	43.7349	38.1805	35.8235	40.4846	40.7887	46.9984	50.7789	54.9238 (65)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)												
Total per year (kWh/year) = Sum(64)m = 1721.8651 (64)												

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	155.2520	155.2520	155.2520	155.2520	155.2520	155.2520	155.2520	155.2520	155.2520	155.2520	155.2520	155.2520	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	53.3478	47.3830	38.5345	29.1731	21.8072	18.4106	19.8933	25.8580	34.7066	44.0680	51.4338	54.8305	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	349.4000	353.0257	343.8891	324.4384	299.8853	276.8089	261.3925	257.7668	266.9034	286.3541	310.9072	333.9836	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.1127	53.1127	53.1127	53.1127	53.1127	53.1127	53.1127	53.1127	53.1127	53.1127	53.1127	53.1127	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-103.5013	-103.5013	-103.5013	-103.5013	-103.5013	-103.5013	-103.5013	-103.5013	-103.5013	-103.5013	-103.5013	-103.5013	(71)
Water heating gains (Table 5)	76.0394	73.8131	69.1782	62.8775	58.7835	53.0285	48.1499	54.4147	56.6510	63.1699	70.5262	73.8224	(72)
Total internal gains	586.6506	582.0852	559.4651	524.3524	488.3395	456.1114	437.2990	445.9029	466.1243	501.4554	540.7306	570.4998	(73)

6. Solar gains

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

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	44.1613	44.2670	44.3711	44.8665	44.9605	45.4029	45.4029	45.4858	45.2315	44.9605	44.7708	44.5743	
alpha	3.9441	3.9511	3.9581	3.9911	3.9974	4.0269	4.0269	4.0324	4.0154	3.9974	3.9847	3.9716	
util living area	0.9718	0.9512	0.9097	0.8199	0.6776	0.5064	0.3738	0.4162	0.6357	0.8617	0.9525	0.9765	(86)
MIT	19.7630	19.9836	20.2921	20.6363	20.8654	20.9681	20.9926	20.9887	20.9218	20.6152	20.1289	19.7166	(87)
Th 2	20.0265	20.0286	20.0307	20.0404	20.0422	20.0506	20.0506	20.0522	20.0474	20.0422	20.0385	20.0347	(88)
util rest of house	0.9659	0.9414	0.8921	0.7873	0.6259	0.4380	0.2953	0.3339	0.5652	0.8283	0.9413	0.9716	(89)
MIT 2	18.9167	19.1331	19.4306	19.7559	19.9515	20.0344	20.0482	20.0482	20.0031	19.7474	19.2861	18.8777	(90)
Living area fraction	19.0463	19.2633	19.5625	19.8907	20.0914	20.1773	20.1927	20.1921	20.1437	19.8802	19.4151	19.0061	(91)
MIT	19.0463	19.2633	19.5625	19.8907	20.0914	20.1773	20.1927	20.1921	20.1437	19.8802	19.4151	19.0061	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0463	19.2633	19.5625	19.8907	20.0914	20.1773	20.1927	20.1921	20.1437	19.8802	19.4151	19.0061	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9585	0.9322	0.8822	0.7817	0.6287	0.4474	0.3072	0.3463	0.5727	0.8219	0.9324	0.9649	(94)
Ext temp.	706.9458	791.6228	839.6144	824.7371	706.4646	494.2285	324.1542	340.3834	518.8352	660.7201	674.4577	673.9962	(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	1376.3134	1337.3715	1213.3983	1009.6743	769.2728	506.3161	326.1525	343.6248	550.7351	850.7568	1133.7584	1369.0946	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating per m ²	498.0095	366.7431	278.0952	133.1548	46.7293	0.0000	0.0000	0.0000	0.0000	141.3873	330.6965	517.1533	(98)
												2311.9690	(98)
												26.4709	(99)

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.0000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													2485.9882 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	498.0095	366.7431	278.0952	133.1548	46.7293	0.0000	0.0000	0.0000	0.0000	141.3873	330.6965	517.1533	(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)	535.4941	394.3474	299.0271	143.1772	50.2465	0.0000	0.0000	0.0000	0.0000	152.0294	355.5876	556.0788	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	174.8011	153.3741	159.4016	140.5714	136.0638	119.1750	112.2077	126.2663	127.0569	145.9250	157.1943	169.8279	(64)
Efficiency of water heater (217)m	89.2009	89.0941	88.8833	88.4340	87.7477	87.0000	87.0000	87.0000	87.0000	88.4509	89.0111	89.2393	(216)
Fuel for water heating, kWh/month	195.9635	172.1485	179.3381	158.9563	155.0625	136.9828	128.9744	145.1337	146.0424	164.9786	176.6008	190.3062	(219)
Water heating fuel used													(219)
Annual totals kWh/year													
Space heating fuel - main system													2485.9882 (211)
Space heating fuel - secondary													0.0000 (215)
Electricity for pumps and fans:													
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													75.0000 (231)
Electricity for lighting (calculated in Appendix L)													376.8554 (232)
Total delivered energy for all uses													4888.3313 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2485.9882	3.4800	86.5124 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1950.4877	3.4800	67.8770 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	376.8554	13.1900	49.7072 (250)
Additional standing charges			120.0000 (251)
Total energy cost			333.9891 (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] =	1.0600 (257)
SAP value		85.2135
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	2485.9882	0.2160	536.9734 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1950.4877	0.2160	421.3054 (264)
Space and water heating			958.2788 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	376.8554	0.5190	195.5879 (268)
Total kg/year			1192.7917 (272)
CO2 emissions per m2			13.6600 (273)
EI value			87.9225
EI rating			88 (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	$3.48 / 0.8817 = 3.947$, stars = 4
Water heating environmental impact	$0.216 / 0.8817 = 0.2450$, stars = 4

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	43.6700 (1b)	x 2.4200 (2b)	= 105.6814 (1b) - (3b)
First floor	43.6700 (1c)	x 2.6700 (2c)	= 116.5989 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	87.3400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 222.2803 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					30.0000 / (5) = 0.1350 (8)
Pressure test					Yes
Measured/design AP50					4.6000
Infiltration rate					0.3650 (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) =	0.3102 (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	0.3568	0.3490	0.3490	0.3180	0.3257	0.2870	0.2714	0.2714	0.2870	0.3180	0.3180	0.3257 (22b)
Effective ac	0.5636	0.5609	0.5609	0.5506	0.5531	0.5412	0.5368	0.5368	0.5412	0.5506	0.5506	0.5531 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front			2.1500	1.4000	3.0100		(26)
front (Uw = 1.30)			12.9600	1.2357	16.0152		(27)
gf			43.6700	0.1500	6.5505	75.0000	3275.2499 (28a)
external	51.7700	15.1100	36.6600	0.2000	7.3320	60.0000	2199.6000 (29a)
cold	43.6700		43.6700	0.0900	3.9303	9.0000	393.0300 (30)
Total net area of external elements Aum(A, m ²)			139.1100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	36.8380		(33)
party			87.2600	0.0000	0.0000	70.0000	6108.2001 (32)
gf			82.0000			9.0000	738.0000 (32c)
lf			105.0000			9.0000	945.0000 (32c)
lf			43.6700			18.0000	786.0600 (32d)
gf			43.6700			9.0000	393.0300 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 14838.1700 (34)
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 169.8897 (35)
 Thermal bridges (Sum(L x Psi) calculated using Appendix K) 14.0811 (36)
 Total fabric heat loss (33) + (36) = 50.9191 (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	41.3441	41.1434	41.1434	40.3845	40.5676	39.6963	39.3786	39.3786	39.6963	40.3845	40.3845	40.5676 (38)
Heat transfer coeff	92.2632	92.0625	92.0625	91.3036	91.4867	90.6153	90.2977	90.2977	90.6153	91.3036	91.3036	91.4867 (39)
Average = Sum(39)m / 12 =												91.2582 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0564	1.0541	1.0541	1.0454	1.0475	1.0375	1.0339	1.0339	1.0375	1.0454	1.0454	1.0475 (40)
HLP (average)												1.0449 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.5875 (42)
Average daily hot water use (litres/day)												95.6539 (43)

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Distribution loss (46)m = 0.15 x (45)m	23.4056	20.4707	21.1239	18.4163	17.6709	15.2486	14.1301	16.2145	16.4082	19.1221	20.8733	22.6670 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	18.7639	16.9030	18.5757	17.7959	18.2578	17.5174	18.0070	18.1696	17.6692	18.4442	18.0390	18.7142 (61)
Total heat required for water heating calculated for each month	174.8011	153.3741	159.4016	140.5714	136.0638	119.1750	112.2077	126.2663	127.0569	145.9250	157.1943	169.8279 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	174.8011	153.3741	159.4016	140.5714	136.0638	119.1750	112.2077	126.2663	127.0569	145.9250	157.1943	169.8279 (64)
Heat gains from water heating, kWh/month	56.5733	49.6024	51.4686	45.2718	43.7349	38.1805	35.8235	40.4846	40.7887	46.9984	50.7789	54.9238 (65)
Solar input (sum of months) = Sum(63)m =												
Total per year (kWh/year) = Sum(64)m =												

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	155.2520	155.2520	155.2520	155.2520	155.2520	155.2520	155.2520	155.2520	155.2520	155.2520	155.2520	155.2520	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	53.3478	47.3830	38.5345	29.1731	21.8072	18.4106	19.8933	25.8580	34.7066	44.0680	51.4338	54.8305	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	349.4000	353.0257	343.8891	324.4384	299.8853	276.8089	261.3925	257.7668	266.9034	286.3541	310.9072	333.9836	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.1127	53.1127	53.1127	53.1127	53.1127	53.1127	53.1127	53.1127	53.1127	53.1127	53.1127	53.1127	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-103.5013	-103.5013	-103.5013	-103.5013	-103.5013	-103.5013	-103.5013	-103.5013	-103.5013	-103.5013	-103.5013	-103.5013	(71)
Water heating gains (Table 5)	76.0394	73.8131	69.1782	62.8775	58.7835	53.0285	48.1499	54.4147	56.6510	63.1699	70.5262	73.8224	(72)
Total internal gains	586.6506	582.0852	559.4651	524.3524	488.3395	456.1114	437.2990	445.9029	466.1243	501.4554	540.7306	570.4998	(73)

6. Solar gains

[Jan]												Gains	
	Area				Solar flux		g		FF		Access		W
	m2				Table 6a		or Table 6b		or Table 6c		factor		
					W/m2						Table 6d		
Northeast	5.8300				9.5471		0.4600		0.0000		1.0000		25.6034 (75)
Southwest	7.1300				31.1332		0.4600		0.0000		1.0000		102.1108 (79)
Solar gains	127.7142	237.4656	367.7073	505.9609	592.2878	616.2407	575.4129	492.6734	416.8104	279.5412	160.4804	115.7955 (83)	
Total gains	714.3649	819.5508	927.1724	1030.3133	1080.6272	1072.3521	1012.7119	938.5763	882.9348	780.9966	701.2111	686.2954 (84)	

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	44.6734	44.7708	44.7708	45.1430	45.0526	45.4858	45.6459	45.6459	45.4858	45.1430	45.1430	45.0526	
alpha	3.9782	3.9847	3.9847	4.0095	4.0035	4.0324	4.0431	4.0431	4.0324	4.0095	4.0095	4.0035	
util living area	0.9722	0.9520	0.9114	0.8146	0.6637	0.4903	0.3868	0.4245	0.6458	0.8640	0.9523	0.9758 (86)	
MIT	19.8071	20.0192	20.3048	20.6616	20.8838	20.9735	20.9918	20.9883	20.9184	20.6209	20.1652	19.7731 (87)	
Th 2	20.0366	20.0385	20.0385	20.0457	20.0440	20.0522	20.0552	20.0552	20.0522	20.0457	20.0457	20.0440 (88)	
util rest of house	0.9662	0.9422	0.8939	0.7803	0.6082	0.4189	0.3063	0.3391	0.5753	0.8302	0.9407	0.9707 (89)	
MIT 2	18.9685	19.1763	19.4499	19.7839	19.9683	20.0395	20.0525	20.0511	20.0057	19.7564	19.3277	18.9410 (90)	
Living area fraction	0.9662	0.9422	0.8939	0.7803	0.6082	0.4189	0.3063	0.3391	0.5753	0.8302	0.9407	0.9707 (89)	
MIT	19.0969	19.3054	19.5808	19.9183	20.1085	20.1824	20.1963	20.1946	20.1454	19.8887	19.4559	19.0683 (92)	
Temperature adjustment	19.0969	19.3054	19.5808	19.9183	20.1085	20.1824	20.1963	20.1946	20.1454	19.8887	19.4559	19.0683 (93)	
adjusted MIT	19.0969	19.3054	19.5808	19.9183	20.1085	20.1824	20.1963	20.1946	20.1454	19.8887	19.4559	19.0683 (93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	685.0305	764.7419	819.8195	798.8195	661.5363	460.0068	322.5053	330.3094	514.4506	643.4534	653.4965	661.5436 (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	1328.3012	1289.3684	1185.8342	969.4874	714.3706	469.6092	324.7333	333.6101	547.8093	829.8345	1091.6197	1323.6606 (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	478.5933	352.5490	272.3149	122.8809	39.3088	0.0000	0.0000	0.0000	0.0000	138.6675	315.4488	492.6150 (98)	
Space heating												2212.3782 (98)	
Space heating per m2												25.3306 (99)	

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.0000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													2378.9013 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	478.5933	352.5490	272.3149	122.8809	39.3088	0.0000	0.0000	0.0000	0.0000	138.6675	315.4488	492.6150	(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)	514.6165	379.0849	292.8117	132.1300	42.2675	0.0000	0.0000	0.0000	0.0000	149.1049	339.1922	529.6936	(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	174.8011	153.3741	159.4016	140.5714	136.0638	119.1750	112.2077	126.2663	127.0569	145.9250	157.1943	169.8279	(64)
Efficiency of water heater (217)m	89.1773	89.0689	88.8685	88.3740	87.6549	87.0000	87.0000	87.0000	87.0000	88.4364	88.9795	89.2114	(217)
Fuel for water heating, kWh/month	196.0152	172.1971	179.3679	159.0642	155.2267	136.9828	128.9744	145.1337	146.0424	165.0057	176.6634	190.3658	(219)
Water heating fuel used												1951.0392	(219)
Annual totals kWh/year													
Space heating fuel - main system												2378.9013	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												376.8554	(232)
Total delivered energy for all uses												4781.7959	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2378.9013	7.6100	181.0344 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1951.0392	7.6100	148.4741 (247)
Pumps and fans for heating	75.0000	31.0800	23.3100 (249)
Energy for lighting	376.8554	31.0800	117.1266 (250)
Additional standing charges			105.0000 (251)
Total energy cost			574.9451 (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	2378.9013	0.2160	513.8427 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1951.0392	0.2160	421.4245 (264)
Space and water heating			935.2671 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	376.8554	0.5190	195.5879 (268)
Total kg/year			1169.7801 (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	2378.9013	1.2200	2902.2595 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1951.0392	1.2200	2380.2679 (264)
Space and water heating			5282.5274 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	376.8554	3.0700	1156.9459 (268)
Primary energy kWh/year			6669.7233 (272)
Primary energy kWh/m2/year			76.3650 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 85
Current environmental impact rating: B 88

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

(For testing purposes):

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

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.2	-£ 57	-180 kg (15.3%)
U Solar photovoltaic panels	+ 10.1	-£ 499	-833 kg (84.1%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£57	2.06 kg/m²	B 86 B 90
Solar photovoltaic panels	£499	9.54 kg/m²	A 97 A 99
Total Savings	£556	11.59 kg/m²	

Potential energy efficiency rating: A 97
Potential environmental impact rating: A 99

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

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

	Current	Potential	Saving
Electricity	£140	£156	-£16
Mains gas	£435	£362	£72
Space heating	£309	£309	£0
Water heating	£148	£92	£57
Lighting	£117	£117	£0
Generated (PV)	-£0	-£499	£499
Total cost of fuels	£575	£19	£555
Total cost of uses	£574	£19	£556
Delivered energy	55 kWh/m²	26 kWh/m²	29 kWh/m²
Carbon dioxide emissions	1.2 tonnes	0.2 tonnes	1.0 tonnes
CO2 emissions per m²	13 kg/m²	2 kg/m²	12 kg/m²
Primary energy	76 kWh/m²	8 kWh/m²	68 kWh/m²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	43.6700 (1b)	x 2.4200 (2b)	= 105.6814 (1b) - (3b)
First floor	43.6700 (1c)	x 2.6700 (2c)	= 116.5989 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	87.3400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 222.2803 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1350 (8)
Pressure test					Yes
Measured/design AP50					4.6000
Infiltration rate					0.3650 (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) =	0.3102 (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	0.3955	0.3878	0.3800	0.3412	0.3335	0.2947	0.2947	0.2870	0.3102	0.3335	0.3490	0.3645 (22b)
Effective ac	0.5782	0.5752	0.5722	0.5582	0.5556	0.5434	0.5434	0.5412	0.5481	0.5556	0.5609	0.5664 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front			2.1500	1.4000	3.0100		(26)
front (Uw = 1.30)			12.9600	1.2357	16.0152		(27)
gf			43.6700	0.1500	6.5505	75.0000	3275.2499 (28a)
external	51.7700	15.1100	36.6600	0.2000	7.3320	60.0000	2199.6000 (29a)
cold	43.6700		43.6700	0.0900	3.9303	9.0000	393.0300 (30)
Total net area of external elements Aum(A, m ²)			139.1100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	36.8380		(33)
party			87.2600	0.0000	0.0000	70.0000	6108.2001 (32)
gf			82.0000			9.0000	738.0000 (32c)
lf			105.0000			9.0000	945.0000 (32c)
lf			43.6700			18.0000	786.0600 (32d)
gf			43.6700			9.0000	393.0300 (32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss
(28)...(30) + (32) + (32a)...(32e) = 14838.1700 (34)
169.8897 (35)
14.0811 (36)
(33) + (36) = 50.9191 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	42.4140	42.1912	41.9728	40.9471	40.7551	39.8617	39.8617	39.6963	40.2058	40.7551	41.1434	41.5493 (38)
Heat transfer coeff	93.3331	93.1103	92.8919	91.8661	91.6742	90.7808	90.7808	90.6153	91.1249	91.6742	92.0625	92.4684 (39)
Average = Sum(39)m / 12 =												91.8652 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0686	1.0661	1.0636	1.0518	1.0496	1.0394	1.0394	1.0375	1.0433	1.0496	1.0541	1.0587 (40)
HLP (average)												1.0518 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.5875 (42)
Average daily hot water use (litres/day)												95.6539 (43)

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	23.4056	20.4707	21.1239	18.4163	17.6709	15.2486	14.1301	16.2145	16.4082	19.1221	20.8733	22.6670 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	18.7639	16.9030	18.5757	17.7959	18.2578	17.5174	18.0070	18.1696	17.6692	18.4442	18.0390	18.7142 (61)
Total heat required for water heating calculated for each month	174.8011	153.3741	159.4016	140.5714	136.0638	119.1750	112.2077	126.2663	127.0569	145.9250	157.1943	169.8279 (62)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.7000 (H2)
Collector heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0050 (H3a)
Collector effective heat loss coefficient												1.8063 (H3b)
Collector performance ratio												2.5804 (H4)
Annual solar radiation per m2												1079.5246 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												1813.6014 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.2050 (H8)
Utilisation factor												0.5639 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												95.6539 (H14)
Volume ratio Veff/V												0.7841 (H15)
Solar storage volume factor												0.9514 (H16)
Solar input	-24.8070	-41.3957	-70.5016	-94.4860	-116.7295	-114.7637	-113.2470	-98.9445	-77.4934	-52.9189	-29.4246	-855.4710 (H17)
Solar input (sum of months) = Sum (63)m =												-855.4710 (63)
Output from w/h	149.9941	111.9784	88.9001	46.0854	19.3343	4.4113	0.0000	27.3218	49.5635	93.0062	127.7697	149.0687 (64)
Total per year (kWh/year) = Sum (64)m =												867.4334 (64)
Heat gains from water heating, kWh/month	56.5733	49.6024	51.4686	45.2718	43.7349	38.1805	35.8235	40.4846	40.7887	46.9984	50.7789	54.9238 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(66)
(66)m	155.2520	155.2520	155.2520	155.2520	155.2520	155.2520	155.2520	155.2520	155.2520	155.2520	155.2520	155.2520	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	53.3478	47.3830	38.5345	29.1731	21.8072	18.4106	19.8933	25.8580	34.7066	44.0680	51.4338	54.8305	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	349.4000	353.0257	343.8891	324.4384	299.8853	276.8089	261.3925	257.7668	266.9034	286.3541	310.9072	333.9836	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.1127	53.1127	53.1127	53.1127	53.1127	53.1127	53.1127	53.1127	53.1127	53.1127	53.1127	53.1127	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-103.5013	-103.5013	-103.5013	-103.5013	-103.5013	-103.5013	-103.5013	-103.5013	-103.5013	-103.5013	-103.5013	-103.5013	(71)
Water heating gains (Table 5)	76.0394	73.8131	69.1782	62.8775	58.7835	53.0285	48.1499	54.4147	56.6510	63.1699	70.5262	73.8224	(72)
Total internal gains	586.6506	582.0852	559.4651	524.3524	488.3395	456.1114	437.2990	445.9029	466.1243	501.4554	540.7306	570.4998	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b		FF Specific data or Table 6c	Access factor Table 6d		Gains W	
Northeast					5.8300	11.2829	0.4600		0.0000	1.0000		30.2586 (75)	
Southwest					7.1300	36.7938	0.4600		0.0000	1.0000		120.6764 (79)	

Solar gains	150.9350	267.1488	392.2211	530.7282	635.3031	648.6745	617.9149	537.1508	439.7541	302.4544	182.6157	127.9846	(83)
Total gains	737.5856	849.2340	951.6862	1055.0806	1123.6425	1104.7858	1055.2139	983.0537	905.8784	803.9098	723.3463	698.4844	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	44.1613	44.2670	44.3711	44.8665	44.9605	45.4029	45.4029	45.4858	45.2315	44.9605	44.7708	44.5743	
alpha	3.9441	3.9511	3.9581	3.9911	3.9974	4.0269	4.0269	4.0324	4.0154	3.9974	3.9847	3.9716	
util living area	0.9718	0.9512	0.9097	0.8199	0.6776	0.5064	0.3738	0.4162	0.6357	0.8617	0.9525	0.9765	(86)
MIT	19.7630	19.9836	20.2921	20.6363	20.8654	20.9681	20.9926	20.9887	20.9218	20.6152	20.1289	19.7166	(87)
Th 2	20.0265	20.0286	20.0307	20.0404	20.0422	20.0506	20.0506	20.0522	20.0474	20.0422	20.0385	20.0347	(88)
util rest of house	0.9659	0.9414	0.8921	0.7873	0.6259	0.4380	0.2953	0.3339	0.5652	0.8283	0.9413	0.9716	(89)
MIT 2	18.9167	19.1331	19.4306	19.7559	19.9515	20.0344	20.0482	20.0482	20.0031	19.7474	19.2861	18.8777	(90)
Living area fraction									fLA = Living area / (4) =			0.1531	(91)
MIT	19.0463	19.2633	19.5625	19.8907	20.0914	20.1773	20.1927	20.1921	20.1437	19.8802	19.4151	19.0061	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0463	19.2633	19.5625	19.8907	20.0914	20.1773	20.1927	20.1921	20.1437	19.8802	19.4151	19.0061	(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	0.9585	0.9322	0.8822	0.7817	0.6287	0.4474	0.3072	0.3463	0.5727	0.8219	0.9324	0.9649	(94)
Useful gains	706.9458	791.6228	839.6144	824.7371	706.4646	494.2285	324.1542	340.3834	518.8352	660.7201	674.4577	673.9962	(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													
	1376.3134	1337.3715	1213.3983	1009.6743	769.2728	506.3161	326.1525	343.6248	550.7351	850.7568	1133.7584	1369.0946	(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													
	498.0095	366.7431	278.0952	133.1548	46.7293	0.0000	0.0000	0.0000	0.0000	141.3873	330.6965	517.1533	(98)
Space heating												2311.9690	(98)
Space heating per m2											(98) / (4) =	26.4709	(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													2485.9882	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	498.0095	366.7431	278.0952	133.1548	46.7293	0.0000	0.0000	0.0000	0.0000	141.3873	330.6965	517.1533	(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)	535.4941	394.3474	299.0271	143.1772	50.2465	0.0000	0.0000	0.0000	0.0000	152.0294	355.5876	556.0788	(211)	
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)	
Water heating														
Water heating requirement	149.9941	111.9784	88.9001	46.0854	19.3343	4.4113	0.0000	27.3218	49.5635	93.0062	127.7697	149.0687	(64)	
Efficiency of water heater	89.2873	89.2799	89.2545	89.2091	89.1008	87.0000	87.0000	87.0000	87.0000	88.7852	89.1433	89.3109	(216)	
Fuel for water heating, kWh/month	167.9904	125.4240	99.6029	51.6600	21.6993	5.0705	0.0000	31.4044	56.9695	104.7541	143.3306	166.9098	(219)	
Water heating fuel used												974.8156	(219)	
Annual totals kWh/year														
Space heating fuel - main system													2485.9882	(211)
Space heating fuel - secondary													0.0000	(215)
Electricity for pumps and fans:														
central heating pump													30.0000	(230c)
main heating flue fan													45.0000	(230e)
pump for solar water heating													50.0000	(230g)
Total electricity for the above, kWh/year													125.0000	(231)
Electricity for lighting (calculated in Appendix L)													376.8554	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 2.50 * 1080 * 0.80) =									-1727.2394				-1727.2394	(233)
Total delivered energy for all uses													2235.4198	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2485.9882	3.4800	86.5124	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	974.8156	3.4800	33.9236	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Pump for solar water heating	50.0000	13.1900	6.5950	(249)
Energy for lighting	376.8554	13.1900	49.7072	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-1727.2394	13.1900	-227.8229	(252)
Total energy cost			78.8078	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)		0.2501	(257)
SAP value	[(255) x (256)] / [(4) + 45.0] =	96.5110	
SAP rating (Section 12)		97	(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	2485.9882	0.2160	536.9734 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	974.8156	0.2160	210.5602 (264)
Space and water heating			747.5336 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	376.8554	0.5190	195.5879 (268)
Energy saving/generation technologies			
PV Unit			
Total kg/year	-1727.2394	0.5190	-896.4372 (269)
CO2 emissions per m2			111.5593 (272)
EI value			1.2800 (273)
EI rating			98.8704
EI band			99 (274)
			A

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	43.6700 (1b)	x 2.4200 (2b)	= 105.6814 (1b) - (3b)
First floor	43.6700 (1c)	x 2.6700 (2c)	= 116.5989 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	87.3400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 222.2803 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					30.0000 / (5) = 0.1350 (8)
Pressure test					Yes
Measured/design AP50					4.6000
Infiltration rate					0.3650 (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) =	0.3102 (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	0.3568	0.3490	0.3490	0.3180	0.3257	0.2870	0.2714	0.2714	0.2870	0.3180	0.3180	0.3257 (22b)
Effective ac	0.5636	0.5609	0.5609	0.5506	0.5531	0.5412	0.5368	0.5368	0.5412	0.5506	0.5506	0.5531 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front			2.1500	1.4000	3.0100		(26)
front (Uw = 1.30)			12.9600	1.2357	16.0152		(27)
gf			43.6700	0.1500	6.5505	75.0000	3275.2499 (28a)
external	51.7700	15.1100	36.6600	0.2000	7.3320	60.0000	2199.6000 (29a)
cold	43.6700		43.6700	0.0900	3.9303	9.0000	393.0300 (30)
Total net area of external elements Aum(A, m ²)			139.1100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	36.8380		(33)
party			87.2600	0.0000	0.0000	70.0000	6108.2001 (32)
gf			82.0000			9.0000	738.0000 (32c)
lf			105.0000			9.0000	945.0000 (32c)
lf			43.6700			18.0000	786.0600 (32d)
gf			43.6700			9.0000	393.0300 (32e)

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

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 41.3441	Feb 41.1434	Mar 41.1434	Apr 40.3845	May 40.5676	Jun 39.6963	Jul 39.3786	Aug 39.3786	Sep 39.6963	Oct 40.3845	Nov 40.3845	Dec 40.5676 (38)
Heat transfer coeff	92.2632	92.0625	92.0625	91.3036	91.4867	90.6153	90.2977	90.2977	90.6153	91.3036	91.3036	91.4867 (39)
Average = Sum(39)m / 12 =												91.2582 (39)
HLP	Jan 1.0564	Feb 1.0541	Mar 1.0541	Apr 1.0454	May 1.0475	Jun 1.0375	Jul 1.0339	Aug 1.0339	Sep 1.0375	Oct 1.0454	Nov 1.0454	Dec 1.0475 (40)
HLP (average)												1.0449 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Distribution loss (46)m = 0.15 x (45)m	23.4056	20.4707	21.1239	18.4163	17.6709	15.2486	14.1301	16.2145	16.4082	19.1221	20.8733	22.6670 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	18.7639	16.9030	18.5757	17.7959	18.2578	17.5174	18.0070	18.1696	17.6692	18.4442	18.0390	18.7142 (61)
Total heat required for water heating calculated for each month	174.8011	153.3741	159.4016	140.5714	136.0638	119.1750	112.2077	126.2663	127.0569	145.9250	157.1943	169.8279 (62)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.7000 (H2)
Collector heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0050 (H3a)
Collector effective heat loss coefficient												1.8063 (H3b)
Collector performance ratio												2.5804 (H4)
Annual solar radiation per m2												1003.2404 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												1685.4438 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.1199 (H8)
Utilisation factor												0.5906 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												95.6539 (H14)
Volume ratio Veff/V												0.7841 (H15)
Solar storage volume factor												0.9514 (H16)
Solar input	-21.9832	-38.5364	-69.2212	-94.3368	-113.9728	-114.1818	-110.4451	-95.0437	-76.9241	-51.2230	-27.0809	-832.6195 (H17)
Solar input (sum of months) = Sum (63)m =												-832.6195 (63)
Output from w/h	152.8179	114.8376	90.1805	46.2346	22.0910	4.9932	1.7626	31.2226	50.1328	94.7020	130.1133	150.1575 (64)
Total per year (kWh/year) = Sum (64)m =												889.2457 (64)
Heat gains from water heating, kWh/month	56.5733	49.6024	51.4686	45.2718	43.7349	38.1805	35.8235	40.4846	40.7887	46.9984	50.7789	54.9238 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(66)
(66)m	155.2520	155.2520	155.2520	155.2520	155.2520	155.2520	155.2520	155.2520	155.2520	155.2520	155.2520	155.2520	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	53.3478	47.3830	38.5345	29.1731	21.8072	18.4106	19.8933	25.8580	34.7066	44.0680	51.4338	54.8305	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	349.4000	353.0257	343.8891	324.4384	299.8853	276.8089	261.3925	257.7668	266.9034	286.3541	310.9072	333.9836	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.1127	53.1127	53.1127	53.1127	53.1127	53.1127	53.1127	53.1127	53.1127	53.1127	53.1127	53.1127	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-103.5013	-103.5013	-103.5013	-103.5013	-103.5013	-103.5013	-103.5013	-103.5013	-103.5013	-103.5013	-103.5013	-103.5013	(71)
Water heating gains (Table 5)	76.0394	73.8131	69.1782	62.8775	58.7835	53.0285	48.1499	54.4147	56.6510	63.1699	70.5262	73.8224	(72)
Total internal gains	586.6506	582.0852	559.4651	524.3524	488.3395	456.1114	437.2990	445.9029	466.1243	501.4554	540.7306	570.4998	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d			Gains W
Northeast					5.8300	9.5471	0.4600	0.0000			1.0000			25.6034 (75)
Southwest					7.1300	31.1332	0.4600	0.0000			1.0000			102.1108 (79)
Solar gains	127.7142	237.4656	367.7073	505.9609	592.2878	616.2407	575.4129	492.6734	416.8104	279.5412	160.4804	115.7955	(83)	
Total gains	714.3649	819.5508	927.1724	1030.3133	1080.6272	1072.3521	1012.7119	938.5763	882.9348	780.9966	701.2111	686.2954	(84)	

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	44.6734	44.7708	44.7708	45.1430	45.0526	45.4858	45.6459	45.6459	45.4858	45.1430	45.1430	45.0526	
alpha	3.9782	3.9847	3.9847	4.0095	4.0035	4.0324	4.0431	4.0431	4.0324	4.0095	4.0095	4.0035	
util living area	0.9722	0.9520	0.9114	0.8146	0.6637	0.4903	0.3868	0.4245	0.6458	0.8640	0.9523	0.9758	(86)
MIT	19.8071	20.0192	20.3048	20.6616	20.8838	20.9735	20.9918	20.9883	20.9184	20.6209	20.1652	19.7731	(87)
Th 2	20.0366	20.0385	20.0385	20.0457	20.0440	20.0522	20.0552	20.0552	20.0522	20.0457	20.0457	20.0440	(88)
util rest of house	0.9662	0.9422	0.8939	0.7803	0.6082	0.4189	0.3063	0.3391	0.5753	0.8302	0.9407	0.9707	(89)
MIT 2	18.9685	19.1763	19.4499	19.7839	19.9683	20.0395	20.0525	20.0511	20.0057	19.7564	19.3277	18.9410	(90)
Living area fraction									fLA = Living area / (4) =			0.1531	(91)
MIT	19.0969	19.3054	19.5808	19.9183	20.1085	20.1824	20.1963	20.1946	20.1454	19.8887	19.4559	19.0683	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0969	19.3054	19.5808	19.9183	20.1085	20.1824	20.1963	20.1946	20.1454	19.8887	19.4559	19.0683	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9589	0.9331	0.8842	0.7753	0.6122	0.4290	0.3185	0.3519	0.5827	0.8239	0.9320	0.9639 (94)
Useful gains	685.0305	764.7419	819.8195	798.8195	661.5363	460.0068	322.5053	330.3094	514.4506	643.4534	653.4965	661.5436 (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	1328.3012	1289.3684	1185.8342	969.4874	714.3706	469.6092	324.7333	333.6101	547.8093	829.8345	1091.6197	1323.6606 (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	478.5933	352.5490	272.3149	122.8809	39.3088	0.0000	0.0000	0.0000	0.0000	138.6675	315.4488	492.6150 (98)
Space heating												2212.3782 (98)
Space heating per m2												25.3306 (99)
										(98) / (4) =		

Not applicable

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	2378.9013	0.2160	513.8427 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	999.8454	0.2160	215.9666 (264)
Space and water heating			729.8093 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	376.8554	0.5190	195.5879 (268)
Energy saving/generation technologies			
PV Unit	-1605.1846	0.5190	-833.0908 (269)
Total kg/year			157.1814 (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	2378.9013	1.2200	2902.2595 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	999.8454	1.2200	1219.8114 (264)
Space and water heating			4122.0709 (265)
Pumps and fans	125.0000	3.0700	383.7500 (267)
Energy for lighting	376.8554	3.0700	1156.9459 (268)
Energy saving/generation technologies			
PV Unit	-1605.1846	3.0700	-4927.9167 (269)
Primary energy kWh/year			734.8501 (272)
Primary energy kWh/m2/year			8.4137 (273)

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

Overheating Calculation Input Data

Dwelling type	MidTerrace 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	169.9 (calculated from construction elements)
Night ventilation	No
Ventilation rate during hot weather (ach)	4.00 (Windows half open)

Overheating Calculation

Summer ventilation heat loss coefficient	293.41 (P1)
Transmission heat loss coefficient	50.92 (37)
Summer heat loss coefficient	344.33 (P2)

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

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

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North East	5.8300	89.6552	0.4600	0.0000	1.0000	240.4372
South West	7.1300	112.1012	0.4600	0.0000	1.0000	367.6696
total:						608.1068

Solar gains	Jun 658	Jul 608	Aug 520	(P4)
Internal gains	453	434	443	
Total summer gains	1112	1042	963	(P5)
Summer gain/loss ratio	3.23	3.03	2.80	(P6)
Summer external temperature	14.70	16.40	16.30	
Thermal mass temperature increment (TMP = 169.9)	0.81	0.81	0.81	
Threshold temperature	18.74	20.24	19.91	(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 003	Issued on Date	26/02/2024
Assessment Reference	plot 3 chain	Prop Type Ref	22186
Property	64 Victoria Avenue, Blackley, MANCHESTER, M9 0RE		
SAP Rating	85 B	DER	15.95
Environmental	88 B	TER	16.51
CO ₂ Emissions (t/year)	1.17	% DER<TER	3.40
General Requirements Compliance	Pass	DfEE	39.42
		TfEE	44.03
		% DfEE<TfEE	10.47
Assessor Details	Mr. Patrick McGuigan, JSP Sustainability Ltd, Tel: 01904 435 325, technical@jspsustainability.co.uk		Assessor ID
			Y128-0001
Client			

SUMMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TfEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	16.51	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	15.95	kgCO ₂ /m ²	Pass
	-0.56 (-3.4%)	kgCO ₂ /m ²	

1b TfEE and DfEE

Target Fabric Energy Efficiency (TfEE)	44.03	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DfEE)	39.42	kWh/m ² /yr	
	-4.6 (-10.5%)	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	4.60 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

BASIC COMPLIANCE REPORT

Calculation Type: New Build (As Built)

Main heating system

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

Pass

Secondary heating system

None

5 Cylinder insulation

Hot water storage

No cylinder

6 Controls

Space heating controls

Programmer, room thermostat and TRVs

Pass

Hot water controls

No cylinder

Boiler interlock

Yes

Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings

100 %

Minimum

75 %

Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (West Pennines (England))

Not significant

Pass

Based on:

Overshading

Very little

Windows facing North East

5.83 m², No overhang

Windows facing South West

7.13 m², No overhang

Air change rate

0.00 ach

Blinds/curtains

None

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type

U-value

Filled Cavity with Edge Sealing

0.00 W/m²K

Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals

4.60 (measured in this dwelling)

Maximum

10.0

Pass

10 Key features

Party wall U-value

0.00 W/m²K

Roof U-value

0.09 W/m²K

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

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

Property Reference	Plot 003	Issued on Date	26/02/2024
Assessment Reference	plot 3 chain	Prop Type Ref	22186
Property	64 Victoria Avenue, Blackley, MANCHESTER, M9 0RE		
SAP Rating	85 B	DER	15.95
Environmental	88 B	% DER<TER	3.40
CO ₂ Emissions (t/year)	1.17	DFEE	39.42
General Requirements Compliance	Pass	% DFEE<TFEE	10.47
Assessor Details	Mr. Patrick McGuigan, JSP Sustainability Ltd, Tel: 01904 435 325, technical@jpsustainability.co.uk		Assessor ID
Client	Y128-0001		

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

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

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

7.0 Living Area	13.37	m ²
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8.0 Thermal Mass Parameter	Precise calculation	
Thermal Mass	169.89	kJ/m²K

9.0 External Walls						
Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area (m ²)	Nett Area (m ²)
external	Cavity Wall	Cavity wall : plasterboard on dabs, AAC block, filled cavity, any outside structure	0.20	60.00	51.77	36.66

9.1 Party Walls						
Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Area (m ²)	
party	Filled Cavity with Edge Sealing	Single plasterboard on dabs on both sides, dense blocks, cavity or cavity fill	0.00	70.00	87.26	

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

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

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

10.2 Internal Ceilings

Description	Construction	Kappa (kJ/m ² K)	Area (m ²)
gf	Other	9.00	43.67

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Area (m ²)
gf	Ground Floor - Solid	Suspended concrete floor, carpeted	0.15	75.00	43.67

11.2 Internal Floors

Description	Construction	Kappa (kJ/m ² K)	Area (m ²)
1f	Plasterboard ceiling, carpeted chipboard floor	18.00	43.67

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m ² K)
Front	BFRC data	Solid Door							1.40
front	BFRC data	Window	Double Low-E Soft 0.05			0.46			1.30

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m ²)	Curtain Closed
Front	Solid Door	[1] external	North East							2.15	
front	Window	[1] external	North East	None	0.00					5.83	
rear	Window	[1] external	South West	None	0.00					7.13	

14.0 Conservatory

None

15.0 Draught Proofing

100 %

16.0 Draught Lobby

No

17.0 Thermal Bridging

Calculate Bridges

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E1 Steel lintel with perforated steel base plate	10.11	0.358	No
Independently assessed	E3 Sill	7.50	0.020	No
Independently assessed	E4 Jamb	23.30	0.016	No
Independently assessed	E5 Ground floor (normal)	10.18	0.108	No
Independently assessed	E6 Intermediate floor within a dwelling	10.18	0.000	No
Independently assessed	E12 Gable (insulation at ceiling level)	10.18	0.108	No
Independently assessed	E18 Party wall between dwellings	20.34	0.092	No
Table K1 - Default	P1 Party wall - Ground floor	17.16	0.160	No
Table K1 - Default	P2 Party wall - Intermediate floor within a dwelling	17.16	0.000	No
Independently assessed	P4 Party wall - Roof (insulation at ceiling level)	17.16	0.182	No

Y-value	0.101	W/m ² K
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18.0 Pressure Testing

Designed AP ₅₀	Yes	
Property Tested ?	5.00	m ³ /(h.m ²) @ 50 Pa
As Built AP ₅₀	Yes	
	4.60	m ³ /(h.m ²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows half open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	0.00

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

Mechanical Ventilation

Mechanical Ventilation System Present

No

20.0 Fans, Open Fireplaces, Flues

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

21.0 Fixed Cooling System

No

22.0 Lighting

Internal

Total number of light fittings	1	
Total number of L.E.L. fittings	1	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	No
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23.0 Electricity Tariff

Standard

24.0 Main Heating 1

	Database	
Percentage of Heat	100	%
Database Ref. No.	18119	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.0	
In Summer	87.0	
Controls	CBE Programmer, room thermostat and TRVs	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2106	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	<= 35°C	
Combi boiler type	Standard Combi	
Combi keep hot type	None	

25.0 Main Heating 2

None

Community Heating

None

28.0 Water Heating

	HWP From main heating 1
Water Heating	Main Heating 1
Flue Gas Heat Recovery System	No
Waste Water Heat Recovery Instantaneous System 1	No

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

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

29.0 Hot Water Cylinder	None
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Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£57	B 86	
	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar photovoltaic panels, 2.5 kWp	£3,500 - £5,500	£499	A 97	

Energy performance certificate (EPC)

64 Victoria Avenue
Blackley
MANCHESTER
M9 0RE

Energy rating

B

Valid until: **25 February 2034**

Certificate number: **0340-3496-2320-2224-7561**

Property type Mid-terrace house

Total floor area 87 square metres

Rules on letting this property

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

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

Energy rating and score

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

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

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

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

For properties in England and Wales:

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

Score	Energy rating	Current	Potential
92+	A		97 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 4.6 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 76 kilowatt hours per square metre (kWh/m²).

How this affects your energy bills

An average household would need to spend **£574 per year on heating, hot water and lighting** in this property. These costs usually make up the majority of your energy bills.

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

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

Heating this property

Estimated energy needed in this property is:

- 2,212 kWh per year for heating
 - 1,722 kWh per year for hot water
-

Impact on the environment

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

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

Carbon emissions

An average household produces 6 tonnes of CO₂

This property produces 1.2 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	£57
2. Solar photovoltaic panels	£3,500 - £5,500	£499

Help paying for energy improvements

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

More ways to save energy

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

Who to contact about this certificate

Contacting the assessor

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

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

Contacting the accreditation scheme

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

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

About this assessment

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