

Regulations Compliance Report

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

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

Dwelling Details:

NEW DWELLING DESIGN STAGE

Total Floor Area: 89.1m²

Site Reference : Chain Road

Plot Reference: Plot 011

Address : Plot 011, 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) 18.18 kg/m²

Dwelling Carbon Dioxide Emission Rate (DER) 17.55 kg/m²

OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 53.2 kWh/m²

Dwelling Fabric Energy Efficiency (DFEE) 46.4 kWh/m²

OK

2 Fabric U-values

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

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

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

4 Heating efficiency

Main Heating system:	Database: (rev 500, product index 018119): Boiler systems with radiators or underfloor heating - mains gas Brand name: Vaillant Model: ecoTEC sustain 28 Model qualifier: VUW 286/7-2 (H-GB) (Combi) Efficiency 89.1 % SEDBUK2009 Minimum 88.0 %	OK
Secondary heating system:	None	

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5 Cylinder insulation

Hot water Storage: No cylinder

6 Controls

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

No cylinder
 Boiler interlock: Yes **OK**

7 Low energy lights

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

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (West Pennines): Not significant **OK**
 Based on:
 Overshading: Very Little
 Windows facing: North East 5.88m²
 Windows facing: South West 7.1m²
 Ventilation rate: 4.00
 Blinds/curtains: None

10 Key features

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

Code for Sustainable Homes Report

For use with Nov 2010 addendum 2014 England

Assessor and House Details

Assessor Name: Ben Tunningley
Property Address: Plot 011
 Chain Road
 Manchester
 M9

Assessor Number: STRO027495

Buiding regulation assessment

	kg/m ² /year
TER	18.18
DER	17.55

ENE 1 Assessment - Dwelling Emission Rate

Total Energy Type CO₂ Emissions for Codes Levels 1 - 5

	%	kg/m ² /year	
DER from SAP 2012 DER Worksheet		17.55	(ZC1)
TER		18.18	
Residual CO2 emissions offset from biofuel CHP		0	(ZC5)
CO2 emissions offset from additional allowable electricity generation		0	(ZC7)
Total CO2 emissions offset from SAP Section 16 allowances		0	
DER accounting for SAP Section 16 allowances		17.55	
% improvement DER/TER	3.5		

Total Energy Type CO2 Emissions for Codes Levels 6

	kg/m ² /year	
DER accounting for SAP Section 16 allowances	17.55	(ZC1)
CO2 emissions from appliances, equation (L14)	15.73	(ZC2)
CO2 emissions from cooking, equation (L16)	2.04	(ZC3)
Net CO2 emissions	36.4	(ZC8)

Result:

Credits awarded for ENE 1 = 0.5

Code Level = 3

ENE 2 - Fabric energy Efficiency

Fabric energy Efficiency: 46.39

Credits awarded for ENE 2 = 6.9

ENE 7 - Low or Zero Carbon (LZC) Technologies

Reduction in CO2 Emissions

	%	kg/m ² /year	
Standard Case CO2 emissions		36.39	
Standard DER		18.62	
Actual Case CO2 emissions		36.39	
Actual DER		18.62	
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 011

Address : Plot 011, Chain Road, Manchester, M9

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	44.55 (1a) x	2.42 (2a) =	107.81 (3a)
First floor	44.55 (1b) x	2.69 (2b) =	119.84 (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	89.1 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	227.65 (5)

2. Ventilation rate:

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

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.13 (8)
<i>If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)</i>			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
<i>if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35</i>			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)			0.38 (18)
<i>Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used</i>			
Number of sides sheltered			2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.85 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.32 (21)

Infiltration rate modified for monthly wind speed

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

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

Wind Factor (22a)m = (22)m ÷ 4

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

	0.41	0.41	0.4	0.36	0.35	0.31	0.31	0.3	0.32	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			5.88	x 1/[1/(1.3)+0.04]	= 7.27		(27)
Windows Type 2			7.1	x 1/[1/(1.3)+0.04]	= 8.77		(27)
Floor			44.55	x 0.15	= 6.6825	75	3341.25 (28)
Walls	113.99	15.13	98.86	x 0.2	= 19.77	60	5931.6 (29)
Roof	44.55	0	44.55	x 0.09	= 4.01	9	400.95 (30)
Total area of elements, m²			203.09				(31)
Party wall			26.78	x 0	= 0	70	1874.6 (32)
Internal wall **			83			9	747 (32c)
Internal wall **			107			9	963 (32c)
Internal floor			44.55			18	801.9 (32d)
Internal ceiling			44.55			9	400.95 (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) = 49.51 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 14461.25 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 162.3 (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

13.27 (36)

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

Total fabric heat loss

(33) + (36) =

62.78 (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
43.99	43.74	43.5	42.35	42.13	41.13	41.13	40.95	41.52	42.13	42.57	43.02

(38)

Heat transfer coefficient, W/K

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

(39)m=

106.78	106.53	106.28	105.13	104.92	103.92	103.92	103.73	104.3	104.92	105.35	105.81
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Average = Sum(39)_{1...12} /12=

105.13 (39)

Heat loss parameter (HLP), W/m²K

(40)m = (39)m ÷ (4)

(40)m=

1.2	1.2	1.19	1.18	1.18	1.17	1.17	1.16	1.17	1.18	1.18	1.19
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Average = Sum(40)_{1...12} /12=

1.18 (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

2.61

(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

96.26

(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=

105.89	102.04	98.19	94.34	90.49	86.64	86.64	90.49	94.34	98.19	102.04	105.89
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Total = Sum(44)_{1...12} =

1155.16 (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=

157.03	137.34	141.72	123.56	118.56	102.31	94.8	108.79	110.08	128.29	140.04	152.08
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Total = Sum(45)_{1...12} =

1514.6 (45)

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

(46)m=

23.55	20.6	21.26	18.53	17.78	15.35	14.22	16.32	16.51	19.24	21.01	22.81
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(46)

Water storage loss:

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

0

(47)

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

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

Water storage loss:

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

0

(48)

Temperature factor from Table 2b

0

(49)

Energy lost from water storage, kWh/year

(48) x (49) =

0

(50)

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

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

0

(51)

If community heating see section 4.3

Volume factor from Table 2a

0

(52)

Temperature factor from Table 2b

0

(53)

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Energy lost from water storage, kWh/year

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

0
0

(54)

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

(55)

Water storage loss calculated for each month

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

(56)m=

0	0	0	0	0	0	0	0	0	0	0	0
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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=

18.77	16.91	18.59	17.81	18.27	17.53	18.02	18.18	17.68	18.46	18.05	18.72
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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=

175.81	154.25	160.32	141.37	136.83	119.83	112.82	126.97	127.77	146.75	158.09	170.8
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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=

175.81	154.25	160.32	141.37	136.83	119.83	112.82	126.97	127.77	146.75	158.09	170.8
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Output from water heater (annual)_{1...12}

1731.6

(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=

56.91	49.89	51.77	45.54	43.99	38.4	36.03	40.72	41.02	47.27	51.08	55.25
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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
156.79	156.79	156.79	156.79	156.79	156.79	156.79	156.79	156.79	156.79	156.79	156.79

(66)

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

(67)m=

54.27	48.2	39.2	29.68	22.18	18.73	20.24	26.3	35.31	44.83	52.32	55.78
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(67)

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

(68)m=

354.35	358.02	348.76	329.03	304.13	280.73	265.09	261.42	270.68	290.41	315.31	338.71
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(68)

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

(69)m=

53.29	53.29	53.29	53.29	53.29	53.29	53.29	53.29	53.29	53.29	53.29	53.29
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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=

-104.53	-104.53	-104.53	-104.53	-104.53	-104.53	-104.53	-104.53	-104.53	-104.53	-104.53	-104.53
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(71)

Water heating gains (Table 5)

(72)m=

76.49	74.25	69.59	63.24	59.12	53.33	48.42	54.73	56.98	63.54	70.94	74.26
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(72)

Total internal gains =

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

(73)m=

593.66	589.03	566.1	530.51	493.99	461.34	442.31	451	471.52	507.33	547.13	577.3
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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	5.88	x	11.28	x	0.46	x	1.11	=	30.52	(75)
Northeast 0.9x	1	x	5.88	x	22.97	x	0.46	x	1.11	=	62.12	(75)
Northeast 0.9x	1	x	5.88	x	41.38	x	0.46	x	1.11	=	111.92	(75)
Northeast 0.9x	1	x	5.88	x	67.96	x	0.46	x	1.11	=	183.81	(75)
Northeast 0.9x	1	x	5.88	x	91.35	x	0.46	x	1.11	=	247.07	(75)
Northeast 0.9x	1	x	5.88	x	97.38	x	0.46	x	1.11	=	263.41	(75)
Northeast 0.9x	1	x	5.88	x	91.1	x	0.46	x	1.11	=	246.41	(75)
Northeast 0.9x	1	x	5.88	x	72.63	x	0.46	x	1.11	=	196.44	(75)
Northeast 0.9x	1	x	5.88	x	50.42	x	0.46	x	1.11	=	136.38	(75)
Northeast 0.9x	1	x	5.88	x	28.07	x	0.46	x	1.11	=	75.92	(75)
Northeast 0.9x	1	x	5.88	x	14.2	x	0.46	x	1.11	=	38.4	(75)
Northeast 0.9x	1	x	5.88	x	9.21	x	0.46	x	1.11	=	24.92	(75)
Southwest 0.9x	1	x	7.1	x	36.79		0.46	x	1.11	=	120.17	(79)
Southwest 0.9x	1	x	7.1	x	62.67		0.46	x	1.11	=	204.69	(79)
Southwest 0.9x	1	x	7.1	x	85.75		0.46	x	1.11	=	280.07	(79)
Southwest 0.9x	1	x	7.1	x	106.25		0.46	x	1.11	=	347.02	(79)
Southwest 0.9x	1	x	7.1	x	119.01		0.46	x	1.11	=	388.69	(79)
Southwest 0.9x	1	x	7.1	x	118.15		0.46	x	1.11	=	385.88	(79)
Southwest 0.9x	1	x	7.1	x	113.91		0.46	x	1.11	=	372.03	(79)
Southwest 0.9x	1	x	7.1	x	104.39		0.46	x	1.11	=	340.94	(79)
Southwest 0.9x	1	x	7.1	x	92.85		0.46	x	1.11	=	303.25	(79)
Southwest 0.9x	1	x	7.1	x	69.27		0.46	x	1.11	=	226.23	(79)
Southwest 0.9x	1	x	7.1	x	44.07		0.46	x	1.11	=	143.93	(79)
Southwest 0.9x	1	x	7.1	x	31.49		0.46	x	1.11	=	102.84	(79)

Solar gains in watts, calculated for each month

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

(83)m= 150.69 266.81 391.99 530.82 635.76 649.28 618.44 537.38 439.63 302.14 182.33 127.76 (83)

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

(84)m= 744.35 855.84 958.09 1061.33 1129.76 1110.63 1060.75 988.38 911.15 809.48 729.46 705.06 (84)

7. Mean internal temperature (heating season)

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

21 (85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(86)m=	0.97	0.95	0.92	0.84	0.72	0.56	0.42	0.46	0.68	0.88	0.96	0.98

(86)

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

(87)m= 19.47 19.7 20.05 20.46 20.76 20.93 20.98 20.97 20.86 20.45 19.89 19.43 (87)

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

(88)m= 19.92 19.92 19.93 19.94 19.94 19.95 19.95 19.95 19.94 19.94 19.93 19.93 (88)

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

(89)m= 0.97 0.95 0.9 0.81 0.67 0.48 0.32 0.37 0.61 0.85 0.94 0.97 (89)

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

(90)m=	18.55	18.78	19.12	19.51	19.78	19.91	19.94	19.94	19.86	19.51	18.98	18.52	(90)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =	0.16	(91)
---------------------------	------	------

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

(92)m=	18.7	18.93	19.26	19.66	19.93	20.07	20.1	20.1	20.02	19.66	19.12	18.66	(92)
--------	------	-------	-------	-------	-------	-------	------	------	-------	-------	-------	-------	------

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

(93)m=	18.7	18.93	19.26	19.66	19.93	20.07	20.1	20.1	20.02	19.66	19.12	18.66	(93)
--------	------	-------	-------	-------	-------	-------	------	------	-------	-------	-------	-------	------

8. Space heating requirement

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

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

Utilisation factor for gains, hm:

(94)m=	0.96	0.93	0.89	0.8	0.67	0.49	0.34	0.38	0.61	0.84	0.93	0.96	(94)
--------	------	------	------	-----	------	------	------	------	------	------	------	------	------

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

(95)m=	713.01	799.71	853.6	853.41	752.6	542.03	358.83	375.84	557.45	678.61	681.71	679.64	(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=	1537.41	1494.23	1356.3	1130.71	863.63	568.57	364.08	383.88	617.11	950.57	1266.17	1529.75	(97)
--------	---------	---------	--------	---------	--------	--------	--------	--------	--------	--------	---------	---------	------

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

(98)m=	613.35	466.72	374.01	199.65	82.61	0	0	0	0	202.34	420.82	632.48		
Total per year (kWh/year) = Sum(98) _{1...5,9...12} =													2991.98	(98)

Space heating requirement in kWh/m²/year

33.58	(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)

613.35	466.72	374.01	199.65	82.61	0	0	0	0	202.34	420.82	632.48
--------	--------	--------	--------	-------	---	---	---	---	--------	--------	--------

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

659.52	501.85	402.16	214.68	88.83	0	0	0	0	217.57	452.49	680.09
--------	--------	--------	--------	-------	---	---	---	---	--------	--------	--------

$$\text{Total (kWh/year) = Sum(211)}_{1...5,10...12} = 3217.18 \quad (211)$$

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)

175.81	154.25	160.32	141.37	136.83	119.83	112.82	126.97	127.77	146.75	158.09	170.8
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------

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

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(217)m=

89.31	89.24	89.08	88.73	88.11	87	87	87	87	88.71	89.16	89.34
-------	-------	-------	-------	-------	----	----	----	----	-------	-------	-------

 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=

196.84	172.86	179.97	159.32	155.3	137.74	129.68	145.94	146.86	165.42	177.31	191.17
--------	--------	--------	--------	-------	--------	--------	--------	--------	--------	--------	--------

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

1958.41

 (219)

Annual totals

Space heating fuel used, main system 1

kWh/year

kWh/year

Water heating fuel used

Electricity for pumps, fans and electric keep-hot

central heating pump:

30

 (230c)

boiler with a fan-assisted flue

45

 (230e)

Total electricity for the above, kWh/year

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

75

 (231)

Electricity for lighting

383.36

 (232)

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

5633.96

 (338)

10a. Fuel costs - individual heating systems:

	Fuel kWh/year	Fuel Price (Table 12)	Fuel Cost £/year		
Space heating - main system 1	(211) x	<table><tr><td>3.48</td></tr></table> x 0.01 =	3.48	<table><tr><td>111.96</td></tr></table> (240)	111.96
3.48					
111.96					
Space heating - main system 2	(213) x	<table><tr><td>0</td></tr></table> x 0.01 =	0	<table><tr><td>0</td></tr></table> (241)	0
0					
0					
Space heating - secondary	(215) x	<table><tr><td>13.19</td></tr></table> x 0.01 =	13.19	<table><tr><td>0</td></tr></table> (242)	0
13.19					
0					
Water heating cost (other fuel)	(219)	<table><tr><td>3.48</td></tr></table> x 0.01 =	3.48	<table><tr><td>68.15</td></tr></table> (247)	68.15
3.48					
68.15					
Pumps, fans and electric keep-hot	(231)	<table><tr><td>13.19</td></tr></table> x 0.01 =	13.19	<table><tr><td>9.89</td></tr></table> (249)	9.89
13.19					
9.89					
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a					
Energy for lighting	(232)	<table><tr><td>13.19</td></tr></table> x 0.01 =	13.19	<table><tr><td>50.57</td></tr></table> (250)	50.57
13.19					
50.57					
Additional standing charges (Table 12)			<table><tr><td>120</td></tr></table> (251)	120	
120					
Appendix Q items: repeat lines (253) and (254) as needed					
Total energy cost	(245)...(247) + (250)...(254) =		<table><tr><td>360.57</td></tr></table> (255)	360.57	
360.57					

11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		<table><tr><td>0.42</td><td>(256)</td></tr></table>	0.42	(256)
0.42	(256)			
Energy cost factor (ECF)	$[(255) \times (256)] \div [(4) + 45.0] =$	<table><tr><td>1.13</td><td>(257)</td></tr></table>	1.13	(257)
1.13	(257)			
SAP rating (Section 12)		<table><tr><td>84.25</td><td>(258)</td></tr></table>	84.25	(258)
84.25	(258)			

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year		
Space heating (main system 1)	(211) x	<table><tr><td>0.216</td></tr></table> =	0.216	<table><tr><td>694.91</td></tr></table> (261)	694.91
0.216					
694.91					
Space heating (secondary)	(215) x	<table><tr><td>0.519</td></tr></table> =	0.519	<table><tr><td>0</td></tr></table> (263)	0
0.519					
0					
Water heating	(219) x	<table><tr><td>0.216</td></tr></table> =	0.216	<table><tr><td>423.02</td></tr></table> (264)	423.02
0.216					
423.02					

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Space and water heating	(261) + (262) + (263) + (264) =			1117.93	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	198.96	(268)
Total CO ₂ , kg/year	sum of (265)...(271) =			1355.82	(272)
CO₂ emissions per m²	(272) ÷ (4) =			15.22	(273)
El rating (section 14)				86	(274)

13a. Primary Energy

	Energy kWh/year	Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x	1.22	=	3924.96	(261)
Space heating (secondary)	(215) x	3.07	=	0	(263)
Energy for water heating	(219) x	1.22	=	2389.26	(264)
Space and water heating	(261) + (262) + (263) + (264) =			6314.23	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	3.07	=	230.25	(267)
Electricity for lighting	(232) x	0	=	1176.92	(268)
'Total Primary Energy	sum of (265)...(271) =			7721.39	(272)
Primary energy kWh/m²/year	(272) ÷ (4) =			86.66	(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 011

Address : Plot 011, Chain Road, Manchester, M9

1. Overall dwelling dimensions:

	Area(m ²)		Av. Height(m)		Volume(m ³)
Ground floor	44.55	(1a) x	2.42	(2a) =	107.81
First floor	44.55	(1b) x	2.69	(2b) =	119.84
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	89.1	(4)			
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	227.65

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) =		0.32

Infiltration rate modified for monthly wind speed

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

Monthly average wind speed from Table 7

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

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Wind Factor (22a)m = (22)m ÷ 4

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

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

	0.41	0.41	0.4	0.36	0.35	0.31	0.31	0.3	0.32	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			5.88	x 1/[1/(1.3)+0.04]	= 7.27		(27)
Windows Type 2			7.1	x 1/[1/(1.3)+0.04]	= 8.77		(27)
Floor			44.55	x 0.15	= 6.6825	75	3341.25 (28)
Walls	113.99	15.13	98.86	x 0.2	= 19.77	60	5931.6 (29)
Roof	44.55	0	44.55	x 0.09	= 4.01	9	400.95 (30)
Total area of elements, m²			203.09				(31)
Party wall			26.78	x 0	= 0	70	1874.6 (32)
Internal wall **			83			9	747 (32c)
Internal wall **			107			9	963 (32c)
Internal floor			44.55			18	801.9 (32d)
Internal ceiling			44.55			9	400.95 (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) = 49.51 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 14461.25 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 162.3 (35)

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

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can be used instead of a detailed calculation.

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

13.27 (36)

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

Total fabric heat loss

(33) + (36) =

62.78 (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
43.99	43.74	43.5	42.35	42.13	41.13	41.13	40.95	41.52	42.13	42.57	43.02

(38)

Heat transfer coefficient, W/K

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

(39)m=

106.78	106.53	106.28	105.13	104.92	103.92	103.92	103.73	104.3	104.92	105.35	105.81
--------	--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	--------

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

105.13 (39)

Heat loss parameter (HLP), W/m²K

(40)m = (39)m ÷ (4)

(40)m=

1.2	1.2	1.19	1.18	1.18	1.17	1.17	1.16	1.17	1.18	1.18	1.19
-----	-----	------	------	------	------	------	------	------	------	------	------

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

1.18 (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

2.61

(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

96.26

(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=

105.89	102.04	98.19	94.34	90.49	86.64	86.64	90.49	94.34	98.19	102.04	105.89
--------	--------	-------	-------	-------	-------	-------	-------	-------	-------	--------	--------

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

1155.16 (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=

157.03	137.34	141.72	123.56	118.56	102.31	94.8	108.79	110.08	128.29	140.04	152.08
--------	--------	--------	--------	--------	--------	------	--------	--------	--------	--------	--------

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

1514.6 (45)

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

(46)m=

23.55	20.6	21.26	18.53	17.78	15.35	14.22	16.32	16.51	19.24	21.01	22.81
-------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(46)

Water storage loss:

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

0

(47)

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

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

Water storage loss:

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

0

(48)

Temperature factor from Table 2b

0

(49)

Energy lost from water storage, kWh/year

(48) x (49) =

0

(50)

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

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

0

(51)

If community heating see section 4.3

Volume factor from Table 2a

0

(52)

Temperature factor from Table 2b

0

(53)

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Energy lost from water storage, kWh/year

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

0
0

(54)

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

(55)

Water storage loss calculated for each month

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

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

(56)

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

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

(57)

Primary circuit loss (annual) from Table 3

0

(58)

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

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

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

(59)

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

(61)m=	18.77	16.91	18.59	17.81	18.27	17.53	18.02	18.18	17.68	18.46	18.05	18.72
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(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=	175.81	154.25	160.32	141.37	136.83	119.83	112.82	126.97	127.77	146.75	158.09	170.8
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------

(62)

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

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

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

(63)

Output from water heater

(64)m=	175.81	154.25	160.32	141.37	136.83	119.83	112.82	126.97	127.77	146.75	158.09	170.8
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------

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

1731.6

(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=	56.91	49.89	51.77	45.54	43.99	38.4	36.03	40.72	41.02	47.27	51.08	55.25
--------	-------	-------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------

(65)

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

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m=	130.66	130.66	130.66	130.66	130.66	130.66	130.66	130.66	130.66	130.66	130.66	130.66

(66)

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

(67)m=	22.51	20	16.26	12.31	9.2	7.77	8.39	10.91	14.65	18.6	21.71	23.14
--------	-------	----	-------	-------	-----	------	------	-------	-------	------	-------	-------

(67)

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

(68)m=	237.41	239.88	233.67	220.45	203.77	188.09	177.61	175.15	181.36	194.57	211.26	226.94
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

(68)

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

(69)m=	36.07	36.07	36.07	36.07	36.07	36.07	36.07	36.07	36.07	36.07	36.07	36.07
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(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=	-104.53	-104.53	-104.53	-104.53	-104.53	-104.53	-104.53	-104.53	-104.53	-104.53	-104.53	-104.53
--------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------

(71)

Water heating gains (Table 5)

(72)m=	76.49	74.25	69.59	63.24	59.12	53.33	48.42	54.73	56.98	63.54	70.94	74.26
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(72)

Total internal gains =

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

(73)m=	401.61	399.32	384.71	361.2	337.29	314.39	299.63	305.99	318.18	341.91	369.1	389.53
--------	--------	--------	--------	-------	--------	--------	--------	--------	--------	--------	-------	--------

(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	5.88	x	11.28	x	0.46	x	1.11	=	23.5	(75)
Northeast 0.9x	0.77	x	5.88	x	22.97	x	0.46	x	1.11	=	47.83	(75)
Northeast 0.9x	0.77	x	5.88	x	41.38	x	0.46	x	1.11	=	86.18	(75)
Northeast 0.9x	0.77	x	5.88	x	67.96	x	0.46	x	1.11	=	141.53	(75)
Northeast 0.9x	0.77	x	5.88	x	91.35	x	0.46	x	1.11	=	190.25	(75)
Northeast 0.9x	0.77	x	5.88	x	97.38	x	0.46	x	1.11	=	202.82	(75)
Northeast 0.9x	0.77	x	5.88	x	91.1	x	0.46	x	1.11	=	189.74	(75)
Northeast 0.9x	0.77	x	5.88	x	72.63	x	0.46	x	1.11	=	151.26	(75)
Northeast 0.9x	0.77	x	5.88	x	50.42	x	0.46	x	1.11	=	105.01	(75)
Northeast 0.9x	0.77	x	5.88	x	28.07	x	0.46	x	1.11	=	58.46	(75)
Northeast 0.9x	0.77	x	5.88	x	14.2	x	0.46	x	1.11	=	29.57	(75)
Northeast 0.9x	0.77	x	5.88	x	9.21	x	0.46	x	1.11	=	19.19	(75)
Southwest 0.9x	0.77	x	7.1	x	36.79		0.46	x	1.11	=	92.53	(79)
Southwest 0.9x	0.77	x	7.1	x	62.67		0.46	x	1.11	=	157.61	(79)
Southwest 0.9x	0.77	x	7.1	x	85.75		0.46	x	1.11	=	215.65	(79)
Southwest 0.9x	0.77	x	7.1	x	106.25		0.46	x	1.11	=	267.2	(79)
Southwest 0.9x	0.77	x	7.1	x	119.01		0.46	x	1.11	=	299.29	(79)
Southwest 0.9x	0.77	x	7.1	x	118.15		0.46	x	1.11	=	297.13	(79)
Southwest 0.9x	0.77	x	7.1	x	113.91		0.46	x	1.11	=	286.46	(79)
Southwest 0.9x	0.77	x	7.1	x	104.39		0.46	x	1.11	=	262.52	(79)
Southwest 0.9x	0.77	x	7.1	x	92.85		0.46	x	1.11	=	233.51	(79)
Southwest 0.9x	0.77	x	7.1	x	69.27		0.46	x	1.11	=	174.2	(79)
Southwest 0.9x	0.77	x	7.1	x	44.07		0.46	x	1.11	=	110.83	(79)
Southwest 0.9x	0.77	x	7.1	x	31.49		0.46	x	1.11	=	79.19	(79)

Solar gains in watts, calculated for each month

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

(83)m=

116.03	205.45	301.83	408.74	489.54	499.95	476.2	413.78	338.52	232.65	140.4	98.38
--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	-------	-------

 (83)

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

(84)m=

517.64	604.76	686.54	769.94	826.83	814.33	775.82	719.77	656.7	574.56	509.5	487.91
--------	--------	--------	--------	--------	--------	--------	--------	-------	--------	-------	--------

 (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	0.93	0.84	0.7	0.55	0.6	0.82	0.95	0.98	0.99

 (86)

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

(87)m=

19.17	19.38	19.73	20.19	20.59	20.86	20.95	20.94	20.73	20.21	19.61	19.13
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (87)

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

(88)m=

19.92	19.92	19.93	19.94	19.94	19.95	19.95	19.95	19.94	19.94	19.93	19.93
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (88)

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

(89)m=

0.99	0.98	0.96	0.91	0.8	0.62	0.43	0.49	0.75	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=	18.26	18.47	18.82	19.27	19.64	19.87	19.93	19.92	19.77	19.29	18.7	18.22	(90)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------	------

fLA = Living area ÷ (4) =	0.16	(91)
---------------------------	------	------

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

(92)m=	18.4	18.61	18.96	19.41	19.79	20.02	20.09	20.08	19.92	19.44	18.84	18.37	(92)
--------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(93)m=	18.4	18.61	18.96	19.41	19.79	20.02	20.09	20.08	19.92	19.44	18.84	18.37	(93)
--------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

8. Space heating requirement

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

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

Utilisation factor for gains, hm:

(94)m=	0.98	0.97	0.95	0.9	0.79	0.62	0.45	0.5	0.75	0.92	0.97	0.99	(94)
--------	------	------	------	-----	------	------	------	-----	------	------	------	------	------

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

(95)m=	509.54	588.48	652.03	689.62	653.56	506.44	349.65	362.38	492.34	529.55	496.32	481.61	(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=	1505.38	1460.82	1324.33	1105.16	848.78	563.54	362.79	381.99	607.54	927.23	1237.1	1498.85	(97)
--------	---------	---------	---------	---------	--------	--------	--------	--------	--------	--------	--------	---------	------

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

(98)m=	740.9	586.21	500.19	299.19	145.24	0	0	0	0	295.87	533.36	756.82		
Total per year (kWh/year) = Sum(98) _{1...5,9...12} =													3857.79	(98)

Space heating requirement in kWh/m²/year

43.3	(99)
------	------

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

Space heating:

Fraction of space heat from secondary/supplementary system

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

Fraction of space heat from main system(s)

(202) = 1 – (201) =

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

Fraction of total heating from main system 1

(204) = (202) × [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)

740.9	586.21	500.19	299.19	145.24	0	0	0	0	295.87	533.36	756.82
-------	--------	--------	--------	--------	---	---	---	---	--------	--------	--------

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

796.67	630.34	537.84	321.71	156.17	0	0	0	0	318.14	573.51	813.79
--------	--------	--------	--------	--------	---	---	---	---	--------	--------	--------

Total (kWh/year) =Sum(211)_{1...5,10...12}= 4148.16 (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)

175.81	154.25	160.32	141.37	136.83	119.83	112.82	126.97	127.77	146.75	158.09	170.8
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------

Efficiency of water heater

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

DER WorkSheet: New dwelling design stage

(217)m=

89.41	89.36	89.25	89.02	88.52	87	87	87	87	88.98	89.3	89.43
-------	-------	-------	-------	-------	----	----	----	----	-------	------	-------

 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=

196.63	172.62	179.62	158.81	154.57	137.74	129.68	145.94	146.86	164.92	177.04	190.98
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

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

1955.43

 (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

397.58

(232)

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

6576.17

(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	=	896	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	422.37	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1318.38	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	206.35	(268)
Total CO2, kg/year	sum of (265)...(271) =			1563.65	(272)
Dwelling CO2 Emission Rate	(272) ÷ (4) =			17.55	(273)
El rating (section 14)				84	(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 011

Address : Plot 011, Chain Road, Manchester, M9

1. Overall dwelling dimensions:

	Area(m ²)		Av. Height(m)		Volume(m ³)
Ground floor	44.55 (1a)	x	2.42 (2a)	=	107.81 (3a)
First floor	44.55 (1b)	x	2.69 (2b)	=	119.84 (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	89.1 (4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	227.65 (5)

2. Ventilation rate:

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

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.13 (8)
<i>If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)</i>			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
<i>if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35</i>			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)			0.38 (18)
<i>Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used</i>			
Number of sides sheltered			2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.85 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.32 (21)

Infiltration rate modified for monthly wind speed

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

Monthly average wind speed from Table 7

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

Wind Factor (22a)m = (22)m ÷ 4

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

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

	0.41	0.41	0.4	0.36	0.35	0.31	0.31	0.3	0.32	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	= 2.15		(26)
Windows Type 1			5.88	x 1/[1/(1.4)+0.04]	= 7.8		(27)
Windows Type 2			7.1	x 1/[1/(1.4)+0.04]	= 9.41		(27)
Floor			44.55	x 0.13	= 5.7915		(28)
Walls	113.99	15.13	98.86	x 0.18	= 17.79		(29)
Roof	44.55	0	44.55	x 0.13	= 5.79		(30)
Total area of elements, m²			203.09				(31)
Party wall			26.78	x 0	= 0		(32)
Internal wall **			83				(32c)
Internal wall **			107				(32c)
Internal floor			44.55				(32d)
Internal ceiling			44.55				(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) = 48.74 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 14461.25 (34)

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

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

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can be used instead of a detailed calculation.

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

10.46 (36)

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

Total fabric heat loss

(33) + (36) =

59.2 (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
43.99	43.74	43.5	42.35	42.13	41.13	41.13	40.95	41.52	42.13	42.57	43.02

(38)

Heat transfer coefficient, W/K

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

(39)m=

103.19	102.94	102.69	101.54	101.33	100.33	100.33	100.14	100.71	101.33	101.76	102.22
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

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

101.54 (39)

Heat loss parameter (HLP), W/m²K

(40)m = (39)m ÷ (4)

(40)m=

1.16	1.16	1.15	1.14	1.14	1.13	1.13	1.12	1.13	1.14	1.14	1.15
------	------	------	------	------	------	------	------	------	------	------	------

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

1.14 (40)

Number of days in month (Table 1a)

(41)m=

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

(41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

2.61

(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

96.26

(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=

105.89	102.04	98.19	94.34	90.49	86.64	86.64	90.49	94.34	98.19	102.04	105.89
--------	--------	-------	-------	-------	-------	-------	-------	-------	-------	--------	--------

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

1155.16 (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=

157.03	137.34	141.72	123.56	118.56	102.31	94.8	108.79	110.08	128.29	140.04	152.08
--------	--------	--------	--------	--------	--------	------	--------	--------	--------	--------	--------

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

1514.6 (45)

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

(46)m=

23.55	20.6	21.26	18.53	17.78	15.35	14.22	16.32	16.51	19.24	21.01	22.81
-------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(46)

Water storage loss:

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

0

(47)

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

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

Water storage loss:

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

0

(48)

Temperature factor from Table 2b

0

(49)

Energy lost from water storage, kWh/year

(48) x (49) =

0

(50)

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

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

0

(51)

If community heating see section 4.3

Volume factor from Table 2a

0

(52)

Temperature factor from Table 2b

0

(53)

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Energy lost from water storage, kWh/year

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

0
0

(54)

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

(55)

Water storage loss calculated for each month

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

(56)m=

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

(56)

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

(57)m=

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

(57)

Primary circuit loss (annual) from Table 3

0

(58)

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

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

(59)m=

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

(59)

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

(61)m=

50.96	46.03	50.04	46.52	46.11	42.73	44.15	46.11	46.52	50.04	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=

207.99	183.37	191.76	170.08	164.67	145.03	138.95	154.9	156.61	178.33	189.36	203.04
--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------

(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=

207.99	183.37	191.76	170.08	164.67	145.03	138.95	154.9	156.61	178.33	189.36	203.04
--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------

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

2084.08

(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=

64.95	57.17	59.63	52.71	50.95	44.7	42.56	47.7	48.23	55.17	58.89	63.31
-------	-------	-------	-------	-------	------	-------	------	-------	-------	-------	-------

(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
130.66	130.66	130.66	130.66	130.66	130.66	130.66	130.66	130.66	130.66	130.66	130.66

(66)

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

(67)m=

22.51	20	16.26	12.31	9.2	7.77	8.39	10.91	14.65	18.6	21.71	23.14
-------	----	-------	-------	-----	------	------	-------	-------	------	-------	-------

(67)

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

(68)m=

237.41	239.88	233.67	220.45	203.77	188.09	177.61	175.15	181.36	194.57	211.26	226.94
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

(68)

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

(69)m=

36.07	36.07	36.07	36.07	36.07	36.07	36.07	36.07	36.07	36.07	36.07	36.07
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(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=

-104.53	-104.53	-104.53	-104.53	-104.53	-104.53	-104.53	-104.53	-104.53	-104.53	-104.53	-104.53
---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------

(71)

Water heating gains (Table 5)

(72)m=

87.3	85.08	80.15	73.21	68.48	62.08	57.2	64.11	66.99	74.15	81.8	85.09
------	-------	-------	-------	-------	-------	------	-------	-------	-------	------	-------

(72)

Total internal gains =

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

(73)m=

412.43	410.15	395.28	371.17	346.65	323.14	308.41	315.37	328.19	352.52	379.96	400.36
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

(73)

6. Solar gains:

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

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Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast 0.9x	0.77	x	5.88	x	11.28	x	0.63	x	0.7	=	20.28	(75)
Northeast 0.9x	0.77	x	5.88	x	22.97	x	0.63	x	0.7	=	41.27	(75)
Northeast 0.9x	0.77	x	5.88	x	41.38	x	0.63	x	0.7	=	74.36	(75)
Northeast 0.9x	0.77	x	5.88	x	67.96	x	0.63	x	0.7	=	122.12	(75)
Northeast 0.9x	0.77	x	5.88	x	91.35	x	0.63	x	0.7	=	164.15	(75)
Northeast 0.9x	0.77	x	5.88	x	97.38	x	0.63	x	0.7	=	175	(75)
Northeast 0.9x	0.77	x	5.88	x	91.1	x	0.63	x	0.7	=	163.71	(75)
Northeast 0.9x	0.77	x	5.88	x	72.63	x	0.63	x	0.7	=	130.51	(75)
Northeast 0.9x	0.77	x	5.88	x	50.42	x	0.63	x	0.7	=	90.61	(75)
Northeast 0.9x	0.77	x	5.88	x	28.07	x	0.63	x	0.7	=	50.44	(75)
Northeast 0.9x	0.77	x	5.88	x	14.2	x	0.63	x	0.7	=	25.51	(75)
Northeast 0.9x	0.77	x	5.88	x	9.21	x	0.63	x	0.7	=	16.56	(75)
Southwest 0.9x	0.77	x	7.1	x	36.79		0.63	x	0.7	=	79.84	(79)
Southwest 0.9x	0.77	x	7.1	x	62.67		0.63	x	0.7	=	135.99	(79)
Southwest 0.9x	0.77	x	7.1	x	85.75		0.63	x	0.7	=	186.07	(79)
Southwest 0.9x	0.77	x	7.1	x	106.25		0.63	x	0.7	=	230.55	(79)
Southwest 0.9x	0.77	x	7.1	x	119.01		0.63	x	0.7	=	258.24	(79)
Southwest 0.9x	0.77	x	7.1	x	118.15		0.63	x	0.7	=	256.37	(79)
Southwest 0.9x	0.77	x	7.1	x	113.91		0.63	x	0.7	=	247.17	(79)
Southwest 0.9x	0.77	x	7.1	x	104.39		0.63	x	0.7	=	226.51	(79)
Southwest 0.9x	0.77	x	7.1	x	92.85		0.63	x	0.7	=	201.47	(79)
Southwest 0.9x	0.77	x	7.1	x	69.27		0.63	x	0.7	=	150.3	(79)
Southwest 0.9x	0.77	x	7.1	x	44.07		0.63	x	0.7	=	95.63	(79)
Southwest 0.9x	0.77	x	7.1	x	31.49		0.63	x	0.7	=	68.32	(79)

Solar gains in watts, calculated for each month

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

(83)m= 100.11 177.26 260.43 352.67 422.38 431.37 410.88 357.02 292.08 200.74 121.14 84.88 (83)

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

(84)m= 512.54 587.41 655.71 723.84 769.03 754.5 719.28 672.39 620.27 553.25 501.09 485.24 (84)

7. Mean internal temperature (heating season)

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

21 (85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(86)m=	1	1	0.99	0.97	0.91	0.76	0.59	0.65	0.88	0.98	1	1

(86)

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

(87)m= 19.72 19.87 20.12 20.44 20.74 20.93 20.98 20.98 20.84 20.46 20.03 19.7 (87)

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

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

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

	1	1	0.99	0.96	0.87	0.67	0.47	0.52	0.82	0.97	1	1
(89)m=												

(89)

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

(90)m=	18.25	18.47	18.82	19.3	19.71	19.93	19.97	19.97	19.84	19.33	18.71	18.22	(90)
--------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =	0.16	(91)
---------------------------	------	------

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

(92)m=	18.48	18.69	19.03	19.48	19.87	20.09	20.13	20.13	20	19.51	18.92	18.45	(92)
--------	-------	-------	-------	-------	-------	-------	-------	-------	----	-------	-------	-------	------

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

(93)m=	18.48	18.69	19.03	19.48	19.87	20.09	20.13	20.13	20	19.51	18.92	18.45	(93)
--------	-------	-------	-------	-------	-------	-------	-------	-------	----	-------	-------	-------	------

8. Space heating requirement

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

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

Utilisation factor for gains, hm:

(94)m=	1	0.99	0.98	0.95	0.86	0.68	0.49	0.54	0.82	0.97	0.99	1	(94)
--------	---	------	------	------	------	------	------	------	------	------	------	---	------

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

(95)m=	510.78	583.24	644.58	688.66	664.79	515.7	349.46	364.94	507.05	534.41	497.58	483.97	(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=	1463.49	1419.22	1286.42	1074.56	827.83	550.47	354.35	373.33	594.16	902.83	1202.86	1456.98	(97)
--------	---------	---------	---------	---------	--------	--------	--------	--------	--------	--------	---------	---------	------

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

(98)m=	708.82	561.78	477.53	277.85	121.3	0	0	0	0	274.1	507.81	723.92		
Total per year (kWh/year) = Sum(98) _{1...5,9...12} =													3653.11	(98)

Space heating requirement in kWh/m²/year

41	(99)
----	------

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

Space heating:

Fraction of space heat from secondary/supplementary system

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

Fraction of space heat from main system(s)

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

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

Fraction of total heating from main system 1

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

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

Efficiency of main space heating system 1

93.4	(206)
------	-------

Efficiency of secondary/supplementary heating system, %

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

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

kWh/year

Space heating requirement (calculated above)

708.82	561.78	477.53	277.85	121.3	0	0	0	0	274.1	507.81	723.92
--------	--------	--------	--------	-------	---	---	---	---	-------	--------	--------

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

758.9	601.48	511.27	297.48	129.88	0	0	0	0	293.47	543.69	775.08
-------	--------	--------	--------	--------	---	---	---	---	--------	--------	--------

$$\text{Total (kWh/year) = Sum(211)}_{1...5,10...12} = 3911.25 \quad (211)$$

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)

207.99	183.37	191.76	170.08	164.67	145.03	138.95	154.9	156.61	178.33	189.36	203.04
--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------

Efficiency of water heater

80.3	(216)
------	-------

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(217)m=

87.89	87.69	87.26	86.28	84.29	80.3	80.3	80.3	80.3	86.13	87.41	87.98
-------	-------	-------	-------	-------	------	------	------	------	-------	-------	-------

 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=

236.64	209.12	219.77	197.13	195.35	180.61	173.04	192.9	195.03	207.05	216.62	230.78
--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------

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

2454.04

 (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

397.58

(232)

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

6837.87

(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	=	844.83 (261)
Space heating (secondary)	(215) x	0.519	=	0 (263)
Water heating	(219) x	0.216	=	530.07 (264)
Space and water heating	(261) + (262) + (263) + (264) =			1374.9 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93 (267)
Electricity for lighting	(232) x	0.519	=	206.35 (268)
Total CO2, kg/year	sum of (265)...(271) =			1620.17 (272)

TER =

18.18

 (273)

SAP 2012 Overheating Assessment

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

Property Details: Plot 011

Dwelling type:	Semi-detached House
Located in:	England
Region:	West Pennines
Cross ventilation possible:	Yes
Number of storeys:	2
Front of dwelling faces:	North East
Overshading:	Very Little
Overhangs:	None
Thermal mass parameter:	Calculated 162.3
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:	300.5	(P1)
Transmission heat loss coefficient:	62.8	
Summer heat loss coefficient:	363.28	(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	5.88	89.66	0.46	0	1	242.5
South West (rear)	1 x	7.1	112.1	0.46	0	1	366.12
Total							608.62 (P3/P4)

Internal gains:

	June	July	August
Internal gains	458.34	439.31	448
Total summer gains	1117.37	1047.93	968.27 (P5)
Summer gain/loss ratio	3.08	2.88	2.67 (P6)
Mean summer external temperature (West Pennines)	14.7	16.4	16.3
Thermal mass temperature increment	0.86	0.86	0.86
Threshold temperature	18.64	20.15	19.83 (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 011			Issued on Date	03/11/2023
Assessment Reference	plot 11 chain	Prop Type Ref	22186		
Property	1h Chain Road, MANCHESTER, M9 6AJ				
SAP Rating	84 B	DER	17.34	TER	18.18
Environmental	87 B	% DER<TER	4.64		
CO ₂ Emissions (t/year)	1.31	DFEE	45.52	TFEE	53.21
General Requirements Compliance	Pass	% DFEE<TFEE	14.46		
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

Semi-Detached House, total floor area 89 m²

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

1a TER and DER

Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.18 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 17.34 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)53.2 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)45.5 kWh/m²/yrOK

2 Fabric U-values

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

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals: 3.89 (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 VUV 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: 5.88 m², No overhang
Windows facing South West: 7.10 m², No overhang
Air change rate: 0.00 ach
Blinds/curtains: None

10 Key features

Party wall U-value 0.00 W/m²K
Roof U-value 0.09 W/m²K
Air permeability 3.9 m³/m²h

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	44.5500 (1b)	x 2.4200 (2b)	= 107.8110 (1b) - (3b)
First floor	44.5500 (1c)	x 2.6900 (2c)	= 119.8395 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	89.1000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 227.6505 (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) = 0.1318 (8)
Pressure test					Yes
Measured/design AP50					3.8900
Infiltration rate					0.3263 (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) =		0.2773 (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	0.3536	0.3467	0.3397	0.3051	0.2981	0.2635	0.2635	0.2565	0.2773	0.2981	0.3120	0.3259 (22b)
Effective ac	0.5625	0.5601	0.5577	0.5465	0.5444	0.5347	0.5347	0.5329	0.5385	0.5444	0.5487	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)			12.9800	1.2357	16.0399		(27)
gf			44.5500	0.1500	6.6825	75.0000	3341.2499 (28a)
external	113.9900	15.1300	98.8600	0.2000	19.7720	60.0000	5931.5999 (29a)
cold	44.5500		44.5500	0.0900	4.0095	9.0000	400.9500 (30)
Total net area of external elements Aum(A, m ²)			203.0900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	49.5139		(33)
party			26.7800	0.0000	0.0000	70.0000	1874.6000 (32)
gf			83.0000			9.0000	747.0000 (32c)
1f			107.0000			9.0000	963.0000 (32c)
1f			44.5500			18.0000	801.9000 (32d)
gf			44.5500			9.0000	400.9500 (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) = 14461.2498 (34)
162.3036 (35)
13.2705 (36)
(33) + (36) = 62.7844 (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	42.2590	42.0767	41.8979	41.0582	40.9011	40.1698	40.1698	40.0344	40.4515	40.9011	41.2189	41.5512 (38)
Heat transfer coeff	105.0435	104.8611	104.6823	103.8426	103.6855	102.9542	102.9542	102.8188	103.2359	103.6855	104.0033	104.3356 (39)
Average = Sum(39)m / 12 =												103.8419 (39)
HLP	1.1789	1.1769	1.1749	1.1655	1.1637	1.1555	1.1555	1.1540	1.1587	1.1637	1.1673	1.1710 (40)
HLP (average)												1.1655 (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												2.6132 (42)
Average daily hot water use (litres/day)												96.2635 (43)
Daily hot water use	105.8899	102.0393	98.1888	94.3382	90.4877	86.6372	86.6372	90.4877	94.3382	98.1888	102.0393	105.8899 (44)
Energy conte	157.0316	137.3408	141.7234	123.5579	118.5568	102.3055	94.8011	108.7856	110.0849	128.2933	140.0422	152.0767 (45)
Energy content (annual)										Total = Sum(45)m =		1514.5997 (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	23.5547	20.6011	21.2585	18.5337	17.7835	15.3458	14.2202	16.3178	16.5127	19.2440	21.0063	22.8115 (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	18.7740	16.9117	18.5934	17.8108	18.2715	17.5287	18.0175	18.1822	17.6824	18.4602	18.0479	18.7239 (61)
Total heat required for water heating calculated for each month	175.8056	154.2526	160.3169	141.3687	136.8282	119.8342	112.8186	126.9678	127.7673	146.7535	158.0901	170.8006 (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	175.8056	154.2526	160.3169	141.3687	136.8282	119.8342	112.8186	126.9678	127.7673	146.7535	158.0901	170.8006 (64)
Heat gains from water heating, kWh/month	56.9065	49.8938	51.7714	45.5357	43.9880	38.3988	36.0257	40.7168	41.0238	47.2726	51.0760	55.2465 (65)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)												
Total per year (kWh/year) = Sum(64)m = 1731.6040 (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	130.6600	130.6600	130.6600	130.6600	130.6600	130.6600	130.6600	130.6600	130.6600	130.6600	130.6600	130.6600 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	22.5128	19.9956	16.2615	12.3110	9.2026	7.7693	8.3950	10.9121	14.6462	18.5967	21.7051	23.1385 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	237.4122	239.8758	233.6676	220.4511	203.7677	188.0876	177.6124	175.1488	181.3569	194.5734	211.2569	226.9369 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.0660	36.0660	36.0660	36.0660	36.0660	36.0660	36.0660	36.0660	36.0660	36.0660	36.0660	36.0660 (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)	-104.5280	-104.5280	-104.5280	-104.5280	-104.5280	-104.5280	-104.5280	-104.5280	-104.5280	-104.5280	-104.5280	-104.5280 (71)
Water heating gains (Table 5)	76.4872	74.2467	69.5852	63.2440	59.1236	53.3316	48.4217	54.7268	56.9775	63.5384	70.9389	74.2560 (72)
Total internal gains	401.6102	399.3161	384.7124	361.2042	337.2920	314.3865	299.6270	305.9857	318.1786	341.9065	369.0988	389.5294 (73)

6. Solar gains

[Jan]												Gains	
				Area m2	Solar flux Table 6a		g Table 6b		FF Table 6c		Access factor Table 6d		W
Northeast				5.8800	11.2829		0.4600		0.0000		0.7700		23.4989 (75)
Southwest				7.1000	36.7938		0.4600		0.0000		0.7700		92.5299 (79)
Solar gains	116.0288	205.4454	301.8319	408.7352	489.5365	499.9485	476.1975	413.7831	338.5170	232.6509	140.3972	98.3767	(83)
Total gains	517.6390	604.7615	686.5442	769.9394	826.8285	814.3350	775.8245	719.7688	656.6956	574.5575	509.4960	487.9061	(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	38.2414	38.3080	38.3734	38.6837	38.7423	39.0175	39.0175	39.0689	38.9110	38.7423	38.6239	38.5009
alpha	3.5494	3.5539	3.5582	3.5789	3.5828	3.6012	3.6012	3.6046	3.5941	3.5828	3.5749	3.5667
util living area	0.9907	0.9831	0.9666	0.9249	0.8376	0.6934	0.5457	0.5991	0.8130	0.9481	0.9843	0.9924 (86)
MIT	19.2025	19.4156	19.7617	20.2091	20.6050	20.8628	20.9568	20.9392	20.7403	20.2245	19.6289	19.1594 (87)
Th 2	19.9369	19.9385	19.9401	19.9477	19.9492	19.9558	19.9558	19.9570	19.9532	19.9492	19.9463	19.9433 (88)
util rest of house	0.9886	0.9793	0.9586	0.9059	0.7948	0.6127	0.4316	0.4853	0.7487	0.9312	0.9800	0.9907 (89)
MIT 2	18.2995	18.5120	18.8548	19.2944	19.6612	19.8794	19.9402	19.9331	19.7893	19.3179	18.7312	18.2614 (90)
Living area fraction	18.4409	18.6534	18.9968	19.4376	19.8090	20.0334	20.0994	20.0906	19.9382	19.4598	18.8717	18.4020 (92)
MIT	18.4409	18.6534	18.9968	19.4376	19.8090	20.0334	20.0994	20.0906	19.9382	19.4598	18.8717	18.4020 (93)
Temperature adjustment												0.0000
adjusted MIT	18.4409	18.6534	18.9968	19.4376	19.8090	20.0334	20.0994	20.0906	19.9382	19.4598	18.8717	18.4020 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9844	0.9730	0.9494	0.8947	0.7883	0.6193	0.4482	0.5010	0.7476	0.9211	0.9741	0.9872 (94)
Ext temp.	509.5748	588.4492	651.8028	688.8727	651.7783	504.3070	347.7242	360.6249	490.9516	529.2276	496.3063	481.6421 (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	1485.4073	1442.2009	1308.1892	1094.2506	840.7809	559.3868	360.2782	379.4656	602.7142	918.6326	1224.3008	1481.7787 (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	726.0194	573.7211	488.3514	291.8721	140.6179	0.0000	0.0000	0.0000	0.0000	289.7174	524.1561	744.1017 (98)
Space heating												3778.5570 (98)
Space heating per m ²												42.4080 (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													4062.9645 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	726.0194	573.7211	488.3514	291.8721	140.6179	0.0000	0.0000	0.0000	0.0000	289.7174	524.1561	744.1017	(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)	780.6660	616.9044	525.1091	313.8410	151.2021	0.0000	0.0000	0.0000	0.0000	311.5240	563.6087	800.1093	(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	175.8056	154.2526	160.3169	141.3687	136.8282	119.8342	112.8186	126.9678	127.7673	146.7535	158.0901	170.8006	(64)
Efficiency of water heater (217)m	89.3990	89.3472	89.2395	88.9986	88.4951	87.0000	87.0000	87.0000	87.0000	88.9685	89.2866	89.4243	(216)
Fuel for water heating, kWh/month	196.6526	172.6441	179.6479	158.8438	154.6168	137.7404	129.6765	145.9400	146.8589	164.9500	177.0592	191.0002	(219)
Water heating fuel used												1955.6304	(219)
Annual totals kWh/year													
Space heating fuel - main system												4062.9645	(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)												397.5825	(232)
Total delivered energy for all uses												6491.1773	(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	4062.9645	0.2160	877.6003 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1955.6304	0.2160	422.4162 (264)
Space and water heating			1300.0165 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	397.5825	0.5190	206.3453 (268)
Total CO2, kg/year			1545.2868 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			17.3400 (273)

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

DER		17.3400	ZC1
Total Floor Area	TFA	89.1000	
Assumed number of occupants	N	2.6132	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		15.7896	ZC2
CO2 emissions from cooking, equation (L16)		2.0395	ZC3
Total CO2 emissions		35.1691	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		35.1691	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	44.5500 (1b)	x 2.4200 (2b)	= 107.8110 (1b) - (3b)
First floor	44.5500 (1c)	x 2.6900 (2c)	= 119.8395 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	89.1000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 227.6505 (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) = 0.1318 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3818 (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) =				0.3245 (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	0.4138	0.4056	0.3975	0.3570	0.3489	0.3083	0.3083	0.3002	0.3245	0.3489	0.3651	0.3813 (22b)
Effective ac	0.5856	0.5823	0.5790	0.5637	0.5608	0.5475	0.5475	0.5451	0.5527	0.5608	0.5666	0.5727 (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)			12.9800	1.3258	17.2083		(27)					
gf			44.5500	0.1300	5.7915		(28a)					
external	113.9900	15.1300	98.8600	0.1800	17.7948		(29a)					
cold	44.5500		44.5500	0.1300	5.7915		(30)					
Total net area of external elements Aum(A, m2)			203.0900				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26) ... (30) + (32) =		48.7361		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.4600 (36)					
Total fabric heat loss						(33) + (36) =	59.1961 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 43.9928	Feb 43.7431	Mar 43.4983	Apr 42.3487	May 42.1336	Jun 41.1323	Jul 41.1323	Aug 40.9469	Sep 41.5180	Oct 42.1336	Nov 42.5687	Dec 43.0236 (38)
Heat transfer coeff	103.1889	102.9392	102.6944	101.5448	101.3297	100.3284	100.3284	100.1430	100.7141	101.3297	101.7648	102.2197 (39)
Average = Sum(39)m / 12 =												101.5438 (39)
HLP	Jan 1.1581	Feb 1.1553	Mar 1.1526	Apr 1.1397	May 1.1373	Jun 1.1260	Jul 1.1260	Aug 1.1239	Sep 1.1303	Oct 1.1373	Nov 1.1421	Dec 1.1472 (40)
HLP (average)												1.1397 (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												2.6132 (42)
Average daily hot water use (litres/day)												96.2635 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	105.8899	102.0393	98.1888	94.3382	90.4877	86.6372	86.6372	90.4877	94.3382	98.1888	102.0393	105.8899 (44)
Energy conte	157.0316	137.3408	141.7234	123.5579	118.5568	102.3055	94.8011	108.7856	110.0849	128.2933	140.0422	152.0767 (45)
Energy content (annual)												Total = Sum(45)m = 1514.5997 (45)
Distribution loss	(46)m = 0.15 x (45)m											
	23.5547	20.6011	21.2585	18.5337	17.7835	15.3458	14.2202	16.3178	16.5127	19.2440	21.0063	22.8115 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												

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Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Total heat required for water heating calculated for each month	50.9589	46.0274	50.0359	46.5230	46.1115	42.7252	44.1493	46.1115	46.5230	50.0359	49.3151	50.9589 (61)
Solar input	207.9905	183.3682	191.7594	170.0809	164.6683	145.0307	138.9504	154.8971	156.6078	178.3292	189.3572	203.0356 (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	207.9905	183.3682	191.7594	170.0809	164.6683	145.0307	138.9504	154.8971	156.6078	178.3292	189.3572	203.0356 (64)
	64.9527	57.1727	59.6320	52.7138	50.9480	44.6979	42.5587	47.6991	48.2340	55.1665	58.8928	63.3052 (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	130.6600	130.6600	130.6600	130.6600	130.6600	130.6600	130.6600	130.6600	130.6600	130.6600	130.6600	130.6600	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	22.5128	19.9956	16.2615	12.3110	9.2026	7.7693	8.3950	10.9121	14.6462	18.5967	21.7051	23.1385	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	237.4122	239.8758	233.6676	220.4511	203.7677	188.0876	177.6124	175.1488	181.3569	194.5734	211.2569	226.9369	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.0660	36.0660	36.0660	36.0660	36.0660	36.0660	36.0660	36.0660	36.0660	36.0660	36.0660	36.0660	(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)	-104.5280	-104.5280	-104.5280	-104.5280	-104.5280	-104.5280	-104.5280	-104.5280	-104.5280	-104.5280	-104.5280	-104.5280	(71)
Water heating gains (Table 5)	87.3021	85.0784	80.1506	73.2135	68.4785	62.0804	57.2025	64.1117	66.9916	74.1485	81.7955	85.0877	(72)
Total internal gains	412.4250	410.1478	395.2777	371.1737	346.6468	323.1352	308.4079	315.3705	328.1927	352.5166	379.9555	400.3611	(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					5.8800	11.2829	0.6300	0.7000			0.7700			20.2755 (75)
Southwest					7.1000	36.7938	0.6300	0.7000			0.7700			79.8372 (79)
Solar gains	100.1127	177.2636	260.4284	352.6674	422.3848	431.3686	410.8756	357.0228	292.0813	200.7373	121.1384	84.8820 (83)		
Total gains	512.5377	587.4114	655.7061	723.8411	769.0317	754.5039	719.2835	672.3934	620.2740	553.2539	501.0938	485.2431 (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	59.9629	60.1083	60.2516	60.9337	61.0630	61.6724	61.6724	61.7866	61.4363	61.0630	60.8019	60.5314	
alpha	4.9975	5.0072	5.0168	5.0622	5.0709	5.1115	5.1115	5.1191	5.0958	5.0709	5.0535	5.0354	
util living area	0.9984	0.9964	0.9908	0.9706	0.9074	0.7624	0.5931	0.6506	0.8796	0.9815	0.9966	0.9988	(86)
MIT	19.7248	19.8711	20.1156	20.4444	20.7417	20.9292	20.9843	20.9754	20.8420	20.4603	20.0340	19.7001	(87)
Th 2	19.9536	19.9559	19.9581	19.9686	19.9705	19.9796	19.9796	19.9813	19.9761	19.9705	19.9666	19.9624	(88)
util rest of house	0.9978	0.9952	0.9874	0.9588	0.8690	0.6732	0.4660	0.5232	0.8157	0.9720	0.9952	0.9983	(89)
MIT 2	18.2520	18.4672	18.8245	19.3035	19.7078	19.9303	19.9736	19.9707	19.8431	19.3334	18.7132	18.2220	(90)
Living area fraction	18.4826	18.6870	19.0267	19.4822	19.8697	20.0867	20.1319	20.1280	19.9995	19.5098	18.9200	18.4534	(91)
MIT	18.4826	18.6870	19.0267	19.4822	19.8697	20.0867	20.1319	20.1280	19.9995	19.5098	18.9200	18.4534	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.4826	18.6870	19.0267	19.4822	19.8697	20.0867	20.1319	20.1280	19.9995	19.5098	18.9200	18.4534	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	510.7753	583.2352	644.5764	688.6639	664.7880	515.6992	349.4617	364.9354	507.0509	534.4093	497.5762	483.9659	(94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1463.4853	1419.2190	1286.4178	1074.5627	827.8310	550.4693	354.3469	373.3338	594.1636	902.8276	1202.8613	1456.9806	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	708.8163	561.7811	477.5299	277.8472	121.3040	0.0000	0.0000	0.0000	0.0000	274.1032	507.8053	723.9229	(98)
Space heating												3653.1100	(98)
Space heating per m2												41.0001	(99)

8c. Space cooling requirement

Not applicable

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

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Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.4000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3911.2526 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	708.8163	561.7811	477.5299	277.8472	121.3040	0.0000	0.0000	0.0000	0.0000	274.1032	507.8053	723.9229	(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)	758.9040	601.4787	511.2740	297.4809	129.8758	0.0000	0.0000	0.0000	0.0000	293.4724	543.6887	775.0781	(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	207.9905	183.3682	191.7594	170.0809	164.6683	145.0307	138.9504	154.8971	156.6078	178.3292	189.3572	203.0356	(64)
Efficiency of water heater (217)m	87.8920	87.6860	87.2556	86.2794	84.2949	80.3000	80.3000	80.3000	80.3000	86.1300	87.4137	87.9763	(217)
Fuel for water heating, kWh/month	236.6432	209.1193	219.7675	197.1280	195.3479	180.6110	173.0391	192.8981	195.0284	207.0466	216.6219	230.7845	(219)
Water heating fuel used												2454.0355	(219)
Annual totals kWh/year													
Space heating fuel - main system												3911.2526	(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)												397.5825	(232)
Total delivered energy for all uses												6837.8706	(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	3911.2526	0.2160	844.8306 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2454.0355	0.2160	530.0717 (264)
Space and water heating			1374.9022 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	397.5825	0.5190	206.3453 (268)
Total CO2, kg/m2/year			1620.1725 (272)
Emissions per m2 for space and water heating			15.4310 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.3159 (272b)
Emissions per m2 for pumps and fans			0.4369 (272c)
Target Carbon Dioxide Emission Rate (TER) = (15.4310 * 1.00) + 2.3159 + 0.4369, rounded to 2 d.p.			18.1800 (273)

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CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	44.5500 (1b)	x 2.4200 (2b)	= 107.8110 (1b) - (3b)
First floor	44.5500 (1c)	x 2.6900 (2c)	= 119.8395 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	89.1000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 227.6505 (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) = 0.1318 (8)
Pressure test					Yes
Measured/design AP50					3.8900
Infiltration rate					0.3263 (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) =		0.2773 (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	0.3536	0.3467	0.3397	0.3051	0.2981	0.2635	0.2635	0.2565	0.2773	0.2981	0.3120	0.3259 (22b)
Effective ac	0.5625	0.5601	0.5577	0.5465	0.5444	0.5347	0.5347	0.5329	0.5385	0.5444	0.5487	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)			12.9800	1.2357	16.0399		(27)
gf			44.5500	0.1500	6.6825	75.0000	3341.2499 (28a)
external	113.9900	15.1300	98.8600	0.2000	19.7720	60.0000	5931.5999 (29a)
cold	44.5500		44.5500	0.0900	4.0095	9.0000	400.9500 (30)
Total net area of external elements Aum(A, m ²)			203.0900				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		49.5139		(33)
party			26.7800	0.0000	0.0000	70.0000	1874.6000 (32)
gf			83.0000			9.0000	747.0000 (32c)
1f			107.0000			9.0000	963.0000 (32c)
1f			44.5500			18.0000	801.9000 (32d)
gf			44.5500			9.0000	400.9500 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 14461.2498 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 162.3036 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 13.2705 (36)
Total fabric heat loss (33) + (36) = 62.7844 (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	42.2590	42.0767	41.8979	41.0582	40.9011	40.1698	40.1698	40.0344	40.4515	40.9011	41.2189	41.5512 (38)
Heat transfer coeff	105.0435	104.8611	104.6823	103.8426	103.6855	102.9542	102.9542	102.8188	103.2359	103.6855	104.0033	104.3356 (39)
Average = Sum(39)m / 12 =												103.8419 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1789	1.1769	1.1749	1.1655	1.1637	1.1555	1.1555	1.1540	1.1587	1.1637	1.1673	1.1710 (40)
HLP (average)												1.1655 (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												2.6132 (42)
Average daily hot water use (litres/day)												96.2635 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	105.8899	102.0393	98.1888	94.3382	90.4877	86.6372	86.6372	90.4877	94.3382	98.1888	102.0393	105.8899 (44)
Energy conte	157.0316	137.3408	141.7234	123.5579	118.5568	102.3055	94.8011	108.7856	110.0849	128.2933	140.0422	152.0767 (45)
Energy content (annual)										Total = Sum(45)m =		1514.5997 (45)

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CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	33.3692	29.1849	30.1162	26.2561	25.1933	21.7399	20.1452	23.1169	23.3930	27.2623	29.7590	32.3163 (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	130.6600	130.6600	130.6600	130.6600	130.6600	130.6600	130.6600	130.6600	130.6600	130.6600	130.6600	130.6600	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	22.5128	19.9956	16.2615	12.3110	9.2026	7.7693	8.3950	10.9121	14.6462	18.5967	21.7051	23.1385	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	237.4122	239.8758	233.6676	220.4511	203.7677	188.0876	177.6124	175.1488	181.3569	194.5734	211.2569	226.9369	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.0660	36.0660	36.0660	36.0660	36.0660	36.0660	36.0660	36.0660	36.0660	36.0660	36.0660	36.0660	(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)	-104.5280	-104.5280	-104.5280	-104.5280	-104.5280	-104.5280	-104.5280	-104.5280	-104.5280	-104.5280	-104.5280	-104.5280	(71)
Water heating gains (Table 5)	44.8511	43.4300	40.4788	36.4667	33.8620	30.1943	27.0769	31.0712	32.4903	36.6429	41.3319	43.4359	(72)
Total internal gains	366.9741	365.4994	352.6060	331.4269	309.0303	288.2492	275.2822	279.3300	290.6914	312.0110	336.4918	355.7093	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g		FF		Access		Gains	
						Specific data or Table 6b		Specific data or Table 6c		factor Table 6d		W	
Northeast				5.8800	11.2829	0.4600		0.0000		0.7700		23.4989 (75)	
Southwest				7.1000	36.7938	0.4600		0.0000		0.7700		92.5299 (79)	

Solar gains	116.0288	205.4454	301.8319	408.7352	489.5365	499.9485	476.1975	413.7831	338.5170	232.6509	140.3972	98.3767	(83)
Total gains	483.0029	570.9447	654.4378	740.1621	798.5668	788.1977	751.4797	693.1131	629.2084	544.6619	476.8890	454.0860	(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	38.2414	38.3080	38.3734	38.6837	38.7423	39.0175	39.0175	39.0689	38.9110	38.7423	38.6239	38.5009	
alpha	3.5494	3.5539	3.5582	3.5789	3.5828	3.6012	3.6012	3.6046	3.5941	3.5828	3.5749	3.5667	
util living area	0.9925	0.9859	0.9709	0.9322	0.8489	0.7079	0.5599	0.6164	0.8281	0.9552	0.9872	0.9940	(86)
MIT	19.1541	19.3697	19.7209	20.1769	20.5837	20.8529	20.9531	20.9333	20.7216	20.1889	19.5843	19.1118	(87)
Th 2	19.9369	19.9385	19.9401	19.9477	19.9492	19.9558	19.9558	19.9570	19.9532	19.9492	19.9463	19.9433	(88)
util rest of house	0.9908	0.9826	0.9638	0.9146	0.8078	0.6276	0.4442	0.5014	0.7662	0.9402	0.9837	0.9926	(89)
MIT 2	18.2515	18.4667	18.8151	19.2645	19.6436	19.8732	19.9387	19.9305	19.7755	19.2845	18.6873	18.2141	(90)
Living area fraction									fLA = Living area / (4) =			0.1566	(91)
MIT	18.3928	18.6081	18.9569	19.4073	19.7908	20.0266	20.0975	20.0875	19.9236	19.4261	18.8277	18.3546	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3928	18.6081	18.9569	19.4073	19.7908	20.0266	20.0975	20.0875	19.9236	19.4261	18.8277	18.3546	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9873	0.9770	0.9552	0.9035	0.8006	0.6336	0.4609	0.5170	0.7642	0.9305	0.9785	0.9896	(94)
Ext temp.	476.8568	557.8163	625.1291	668.7154	639.3569	499.4157	346.3640	358.3292	480.8284	506.7966	466.6327	449.3793	(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	1480.3567	1437.4450	1304.0172	1091.1082	838.8959	558.6883	360.0875	379.1433	601.2040	915.1380	1219.7244	1476.8323	(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	746.6040	591.1105	505.0928	304.1228	148.4570	0.0000	0.0000	0.0000	0.0000	303.8059	542.2260	764.4250	(98)
Space heating per m2												3905.8440	(98)
												(98) / (4) =	43.8366 (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	967.7696	761.8612	781.4228	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8028	0.8676	0.8378	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	776.9665	660.9717	654.6484	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	1020.2571	975.3083	908.9664	0.0000	0.0000	0.0000	0.0000 (103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling kWh												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	175.1692	233.8664	189.2126	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												598.2482 (104)
Cooled fraction									fC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)												
Intermittency factor	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	43.7923	58.4666	47.3032	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												149.5621 (107)
Space cooling per m2												1.6786 (108)
Energy for space heating												43.8366 (99)
Energy for space cooling												1.6786 (108)
Total												45.5152 (109)
Dwelling Fabric Energy Efficiency (DFEE)												45.5 (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	44.5500 (1b)	x 2.4200 (2b)	= 107.8110 (1b) - (3b)
First floor	44.5500 (1c)	x 2.6900 (2c)	= 119.8395 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	89.1000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 227.6505 (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) = 0.1318 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3818 (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) =	0.3245 (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	0.4138	0.4056	0.3975	0.3570	0.3489	0.3083	0.3083	0.3002	0.3245	0.3489	0.3651	0.3813 (22b)
Effective ac	0.5856	0.5823	0.5790	0.5637	0.5608	0.5475	0.5475	0.5451	0.5527	0.5608	0.5666	0.5727 (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
TER Opaque door			2.1500	1.0000	2.1500		(26)
TER Opening Type (Uw = 1.40)			12.9800	1.3258	17.2083		(27)
gf			44.5500	0.1300	5.7915		(28a)
external	113.9900	15.1300	98.8600	0.1800	17.7948		(29a)
cold	44.5500		44.5500	0.1300	5.7915		(30)
Total net area of external elements Aum(A, m ²)			203.0900				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		48.7361		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.4600 (36)
Total fabric heat loss						(33) + (36) =	59.1961 (37)
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)							
(38)m	43.9928	43.7431	43.4983	42.3487	42.1336	41.1323	41.1323
Heat transfer coeff	103.1889	102.9392	102.6944	101.5448	101.3297	100.3284	100.3284
Average = Sum(39)m / 12 =							101.5438 (39)
HLP	1.1581	1.1553	1.1526	1.1397	1.1373	1.1260	1.1260
HLP (average)							1.1472 (40)
Days in month	31	28	31	30	31	30	31
							31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.6132 (42)
Average daily hot water use (litres/day)												96.2635 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	105.8899	102.0393	98.1888	94.3382	90.4877	86.6372	86.6372	90.4877	94.3382	98.1888	102.0393	105.8899 (44)
Energy conte	157.0316	137.3408	141.7234	123.5579	118.5568	102.3055	94.8011	108.7856	110.0849	128.2933	140.0422	152.0767 (45)
Energy content (annual)											Total = Sum(45)m =	1514.5997 (45)
Distribution loss	(46)m = 0.15 x (45)m											
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Heat gains from water heating, kWh/month	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
	33.3692	29.1849	30.1162	26.2561	25.1933	21.7399	20.1452	23.1169	23.3930	27.2623	29.7590	32.3163 (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	130.6600	130.6600	130.6600	130.6600	130.6600	130.6600	130.6600	130.6600	130.6600	130.6600	130.6600	130.6600	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	22.5128	19.9956	16.2615	12.3110	9.2026	7.7693	8.3950	10.9121	14.6462	18.5967	21.7051	23.1385	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	237.4122	239.8758	233.6676	220.4511	203.7677	188.0876	177.6124	175.1488	181.3569	194.5734	211.2569	226.9369	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.0660	36.0660	36.0660	36.0660	36.0660	36.0660	36.0660	36.0660	36.0660	36.0660	36.0660	36.0660	(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)	-104.5280	-104.5280	-104.5280	-104.5280	-104.5280	-104.5280	-104.5280	-104.5280	-104.5280	-104.5280	-104.5280	-104.5280	(71)
Water heating gains (Table 5)	44.8511	43.4300	40.4788	36.4667	33.8620	30.1943	27.0769	31.0712	32.4903	36.6429	41.3319	43.4359	(72)
Total internal gains	366.9741	365.4994	352.6060	331.4269	309.0303	288.2492	275.2822	279.3300	290.6914	312.0110	336.4918	355.7093	(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			5.8800	11.2829	0.6300	0.7000	0.7700	20.2755 (75)				
Southwest			7.1000	36.7938	0.6300	0.7000	0.7700	79.8372 (79)				

Solar gains	100.1127	177.2636	260.4284	352.6674	422.3848	431.3686	410.8756	357.0228	292.0813	200.7373	121.1384	84.8820 (83)
Total gains	467.0867	542.7630	613.0344	684.0943	731.4152	719.6178	686.1579	636.3528	582.7727	512.7483	457.6302	440.5913 (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	59.9629	60.1083	60.2516	60.9337	61.0630	61.6724	61.6724	61.7866	61.4363	61.0630	60.8019	60.5314	
alpha	4.9975	5.0072	5.0168	5.0622	5.0709	5.1115	5.1115	5.1191	5.0958	5.0709	5.0535	5.0354	
util living area	0.9989	0.9975	0.9931	0.9765	0.9211	0.7853	0.6175	0.6795	0.9000	0.9865	0.9977	0.9992	(86)
MIT	19.6774	19.8249	20.0726	20.4079	20.7162	20.9185	20.9812	20.9701	20.8197	20.4210	19.9888	19.6533	(87)
Th 2	19.9536	19.9559	19.9581	19.9686	19.9705	19.9796	19.9796	19.9813	19.9761	19.9705	19.9666	19.9624	(88)
util rest of house	0.9986	0.9966	0.9905	0.9667	0.8865	0.6980	0.4873	0.5501	0.8423	0.9793	0.9968	0.9989	(89)
MIT 2	18.7445	18.8935	19.1418	19.4800	19.7702	19.9400	19.9746	19.9723	19.8694	19.4979	19.0660	18.7274	(90)
Living area fraction									fLA = Living area / (4) =			0.1566	(91)
MIT	18.8905	19.0393	19.2875	19.6252	19.9183	20.0932	20.1322	20.1285	20.0181	19.6424	19.2104	18.8724	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8905	19.0393	19.2875	19.6252	19.9183	20.0932	20.1322	20.1285	20.0181	19.6424	19.2104	18.8724	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	466.1573	540.3195	605.8062	658.3958	646.8553	510.0806	348.4281	362.9098	492.5678	500.4940	455.6991	439.9390	(94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1505.5803	1455.4886	1313.2052	1089.0935	832.7562	551.1215	354.3829	373.3815	596.0409	916.2637	1232.4178	1499.8051	(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	773.3307	614.9936	526.3049	310.1023	138.3103	0.0000	0.0000	0.0000	0.0000	309.3326	559.2375	788.5403	(98)
Space heating												4020.1522	(98)
Space heating per m2											(98) / (4) =	45.1196	(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	943.0874	742.4305	761.0870	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8350	0.9050	0.8760	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	787.5192	671.9012	666.7226	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	940.0988	898.9580	842.6233	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	109.8573	168.9302	130.8701	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												409.6576	(104)
Cooled fraction									fC = cooled area / (4) =			1.0000	(105)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	27.4643	42.2326	32.7175	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling											102.4144 (107)
Space cooling per m2											1.1494 (108)
Energy for space heating											45.1196 (99)
Energy for space cooling											1.1494 (108)
Total											46.2690 (109)
Target Fabric Energy Efficiency (TFEE)											53.2 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	44.5500 (1b)	x 2.4200 (2b)	= 107.8110 (1b) - (3b)
First floor	44.5500 (1c)	x 2.6900 (2c)	= 119.8395 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	89.1000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 227.6505 (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) = 0.1318 (8)
Pressure test					Yes
Measured/design AP50					3.8900
Infiltration rate					0.3263 (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) =		0.2773 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.6000	4.5000	4.5000	4.1000	4.2000	3.7000	3.5000	3.5000	3.7000	4.1000	4.1000	4.2000 (22)
Wind factor	1.1500	1.1250	1.1250	1.0250	1.0500	0.9250	0.8750	0.8750	0.9250	1.0250	1.0250	1.0500 (22a)
Adj infilt rate												
Effective ac	0.3189	0.3120	0.3120	0.2843	0.2912	0.2565	0.2427	0.2427	0.2565	0.2843	0.2843	0.2912 (22b)
	0.5509	0.5487	0.5487	0.5404	0.5424	0.5329	0.5294	0.5294	0.5329	0.5404	0.5404	0.5424 (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)			12.9800	1.2357	16.0399		(27)
gf			44.5500	0.1500	6.6825	75.0000	3341.2499 (28a)
external	113.9900	15.1300	98.8600	0.2000	19.7720	60.0000	5931.5999 (29a)
cold	44.5500		44.5500	0.0900	4.0095	9.0000	400.9500 (30)
Total net area of external elements Aum(A, m ²)			203.0900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	49.5139		(33)
party			26.7800	0.0000	0.0000	70.0000	1874.6000 (32)
gf			83.0000			9.0000	747.0000 (32c)
1f			107.0000			9.0000	963.0000 (32c)
1f			44.5500			18.0000	801.9000 (32d)
gf			44.5500			9.0000	400.9500 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	14461.2498 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							162.3036 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							13.2705 (36)
Total fabric heat loss						(33) + (36) =	62.7844 (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	41.3833	41.2189	41.2189	40.5978	40.7476	40.0344	39.7744	39.7744	40.0344	40.5978	40.5978	40.7476 (38)
Heat transfer coeff	104.1677	104.0033	104.0033	103.3822	103.5321	102.8188	102.5588	102.5588	102.8188	103.3822	103.3822	103.5321 (39)
Average = Sum(39)m / 12 =												103.3450 (39)
HLP	1.1691	1.1673	1.1673	1.1603	1.1620	1.1540	1.1511	1.1511	1.1540	1.1603	1.1603	1.1620 (40)
HLP (average)												1.1599 (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												2.6132 (42)
Average daily hot water use (litres/day)												96.2635 (43)
Daily hot water use	105.8899	102.0393	98.1888	94.3382	90.4877	86.6372	86.6372	90.4877	94.3382	98.1888	102.0393	105.8899 (44)
Energy conte	157.0316	137.3408	141.7234	123.5579	118.5568	102.3055	94.8011	108.7856	110.0849	128.2933	140.0422	152.0767 (45)
Energy content (annual)										Total = Sum(45)m =		1514.5997 (45)

FULL SAP CALCULATION PRINTOUT

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CALCULATION OF HEAT DEMAND 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	23.5547	20.6011	21.2585	18.5337	17.7835	15.3458	14.2202	16.3178	16.5127	19.2440	21.0063	22.8115 (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	18.7740	16.9117	18.5934	17.8108	18.2715	17.5287	18.0175	18.1822	17.6824	18.4602	18.0479	18.7239 (61)
Total heat required for water heating calculated for each month	175.8056	154.2526	160.3169	141.3687	136.8282	119.8342	112.8186	126.9678	127.7673	146.7535	158.0901	170.8006 (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	175.8056	154.2526	160.3169	141.3687	136.8282	119.8342	112.8186	126.9678	127.7673	146.7535	158.0901	170.8006 (64)
RHI water heating demand												
Heat gains from water heating, kWh/month	56.9065	49.8938	51.7714	45.5357	43.9880	38.3988	36.0257	40.7168	41.0238	47.2726	51.0760	55.2465 (65)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)												
Total per year (kWh/year) = Sum(64)m = 1731.6040 (64)												
1732 (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	156.7920	156.7920	156.7920	156.7920	156.7920	156.7920	156.7920	156.7920	156.7920	156.7920	156.7920	156.7920 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	54.2687	48.2010	39.1997	29.6767	22.1837	18.7284	20.2367	26.3044	35.3057	44.8287	52.3217	55.7770 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	354.3466	358.0236	348.7576	329.0315	304.1309	280.7278	265.0931	261.4161	270.6820	290.4081	315.3087	338.7118 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.2924	53.2924	53.2924	53.2924	53.2924	53.2924	53.2924	53.2924	53.2924	53.2924	53.2924	53.2924 (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)	-104.5280	-104.5280	-104.5280	-104.5280	-104.5280	-104.5280	-104.5280	-104.5280	-104.5280	-104.5280	-104.5280	-104.5280 (71)
Water heating gains (Table 5)	76.4872	74.2467	69.5852	63.2440	59.1236	53.3316	48.4217	54.7268	56.9775	63.5384	70.9389	74.2560 (72)
Total internal gains	593.6589	589.0276	566.0989	530.5086	493.9946	461.3442	442.3078	451.0037	471.5216	507.3316	547.1258	577.3013 (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												5.8800	9.5471	0.4600	0.0000	1.0000	25.8230 (75)
Southwest												7.1000	31.1332	0.4600	0.0000	1.0000	101.6812 (79)
Solar gains	127.5042	237.1664	367.4901	506.0531	592.7153	616.8196	575.9002	492.8842	416.6951	279.2544	160.2329	115.5941 (83)					
Total gains	721.1631	826.1940	933.5890	1036.5617	1086.7099	1078.1638	1018.2081	943.8878	888.2167	786.5860	707.3587	692.8954 (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	38.5630	38.6239	38.6239	38.8560	38.7997	39.0689	39.1679	39.1679	39.0689	38.8560	38.8560	38.7997
alpha	3.5709	3.5749	3.5749	3.5904	3.5866	3.6046	3.6112	3.6112	3.6046	3.5904	3.5904	3.5866
util living area	0.9724	0.9547	0.9200	0.8381	0.7035	0.5368	0.4298	0.4694	0.6878	0.8801	0.9550	0.9758 (86)
MIT	19.5533	19.7743	20.0876	20.5042	20.8019	20.9443	20.9801	20.9730	20.8564	20.4730	19.9524	19.5142 (87)
Th 2	19.9448	19.9463	19.9463	19.9519	19.9505	19.9570	19.9594	19.9594	19.9570	19.9519	19.9519	19.9505 (88)
util rest of house	0.9665	0.9453	0.9035	0.8052	0.6458	0.4554	0.3339	0.3690	0.6134	0.8480	0.9439	0.9706 (89)
MIT 2	18.6515	18.8684	19.1706	19.5641	19.8193	19.9298	19.9527	19.9498	19.8734	19.5459	19.0505	18.6175 (90)
Living area fraction									fLA = Living area / (4) =			0.1566 (91)
MIT	18.7927	19.0102	19.3142	19.7113	19.9732	20.0887	20.1135	20.1100	20.0273	19.6910	19.1917	18.7579 (92)
Temperature adjustment												0.0000
adjusted MIT	18.7927	19.0102	19.3142	19.7113	19.9732	20.0887	20.1135	20.1100	20.0273	19.6910	19.1917	18.7579 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	691.0035	772.3708	832.4819	825.7610	703.3069	502.5948	354.8289	362.4715	549.6904	659.6237	660.4945	667.2031 (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	1468.0021	1425.9077	1311.9170	1076.3381	794.4198	523.2116	360.3441	370.2398	609.4405	919.1728	1208.7165	1465.7960 (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	578.0870	439.1768	356.6997	180.4155	67.7880	0.0000	0.0000	0.0000	0.0000	193.1045	394.7198	594.1531 (98)
Space heating												2804.1445 (98)
RHI space heating demand												2804 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

FULL SAP CALCULATION PRINTOUT

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CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	44.5500 (1b)	x 2.4200 (2b)	= 107.8110 (1b) - (3b)
First floor	44.5500 (1c)	x 2.6900 (2c)	= 119.8395 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	89.1000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 227.6505 (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) = 0.1318 (8)
Pressure test					Yes
Measured/design AP50					3.8900
Infiltration rate					0.3263 (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) =	0.2773 (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	0.3536	0.3467	0.3397	0.3051	0.2981	0.2635	0.2635	0.2565	0.2773	0.2981	0.3120	0.3259 (22b)
Effective ac	0.5625	0.5601	0.5577	0.5465	0.5444	0.5347	0.5347	0.5329	0.5385	0.5444	0.5487	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)			12.9800	1.2357	16.0399		(27)
gf			44.5500	0.1500	6.6825	75.0000	3341.2499 (28a)
external	113.9900	15.1300	98.8600	0.2000	19.7720	60.0000	5931.5999 (29a)
cold	44.5500		44.5500	0.0900	4.0095	9.0000	400.9500 (30)
Total net area of external elements Aum(A, m ²)			203.0900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	49.5139		(33)
party			26.7800	0.0000	0.0000	70.0000	1874.6000 (32)
gf			83.0000			9.0000	747.0000 (32c)
1f			107.0000			9.0000	963.0000 (32c)
1f			44.5500			18.0000	801.9000 (32d)
gf			44.5500			9.0000	400.9500 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 14461.2498 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 162.3036 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 13.2705 (36)
Total fabric heat loss (33) + (36) = 62.7844 (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	42.2590	42.0767	41.8979	41.0582	40.9011	40.1698	40.1698	40.0344	40.4515	40.9011	41.2189	41.5512 (38)
Heat transfer coeff	105.0435	104.8611	104.6823	103.8426	103.6855	102.9542	102.9542	102.8188	103.2359	103.6855	104.0033	104.3356 (39)
Average = Sum(39)m / 12 =												103.8419 (39)
HLP	1.1789	1.1769	1.1749	1.1655	1.1637	1.1555	1.1555	1.1540	1.1587	1.1637	1.1673	1.1710 (40)
HLP (average)												1.1655 (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												2.6132 (42)
Average daily hot water use (litres/day)												96.2635 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	105.8899	102.0393	98.1888	94.3382	90.4877	86.6372	86.6372	90.4877	94.3382	98.1888	102.0393	105.8899 (44)
Energy conte	157.0316	137.3408	141.7234	123.5579	118.5568	102.3055	94.8011	108.7856	110.0849	128.2933	140.0422	152.0767 (45)
Energy content (annual)										Total = Sum(45)m =		1514.5997 (45)

FULL SAP CALCULATION PRINTOUT

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Distribution loss (46)m = 0.15 x (45)m	23.5547	20.6011	21.2585	18.5337	17.7835	15.3458	14.2202	16.3178	16.5127	19.2440	21.0063	22.8115 (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	18.7740	16.9117	18.5934	17.8108	18.2715	17.5287	18.0175	18.1822	17.6824	18.4602	18.0479	18.7239 (61)
Total heat required for water heating calculated for each month	175.8056	154.2526	160.3169	141.3687	136.8282	119.8342	112.8186	126.9678	127.7673	146.7535	158.0901	170.8006 (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	175.8056	154.2526	160.3169	141.3687	136.8282	119.8342	112.8186	126.9678	127.7673	146.7535	158.0901	170.8006 (64)
Heat gains from water heating, kWh/month	56.9065	49.8938	51.7714	45.5357	43.9880	38.3988	36.0257	40.7168	41.0238	47.2726	51.0760	55.2465 (65)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)												
Total per year (kWh/year) = Sum(64)m = 1731.6040 (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	156.7920	156.7920	156.7920	156.7920	156.7920	156.7920	156.7920	156.7920	156.7920	156.7920	156.7920	156.7920	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	54.2687	48.2010	39.1997	29.6767	22.1837	18.7284	20.2367	26.3044	35.3057	44.8287	52.3217	55.7770	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	354.3466	358.0236	348.7576	329.0315	304.1309	280.7278	265.0931	261.4161	270.6820	290.4081	315.3087	338.7118	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.2924	53.2924	53.2924	53.2924	53.2924	53.2924	53.2924	53.2924	53.2924	53.2924	53.2924	53.2924	(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)	-104.5280	-104.5280	-104.5280	-104.5280	-104.5280	-104.5280	-104.5280	-104.5280	-104.5280	-104.5280	-104.5280	-104.5280	(71)
Water heating gains (Table 5)	76.4872	74.2467	69.5852	63.2440	59.1236	53.3316	48.4217	54.7268	56.9775	63.5384	70.9389	74.2560	(72)
Total internal gains	593.6589	589.0276	566.0989	530.5086	493.9946	461.3442	442.3078	451.0037	471.5216	507.3316	547.1258	577.3013	(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												5.8800	11.2829	0.4600	0.0000	1.0000	30.5181 (75)
Southwest												7.1000	36.7938	0.4600	0.0000	1.0000	120.1687 (79)
Solar gains	150.6868	266.8122	391.9894	530.8249	635.7617	649.2838	618.4383	537.3806	439.6324	302.1441	182.3340	127.7619 (83)					
Total gains	744.3457	855.8398	958.0883	1061.3336	1129.7563	1110.6280	1060.7462	988.3843	911.1540	809.4757	729.4598	705.0632 (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	38.2414	38.3080	38.3734	38.6837	38.7423	39.0175	39.0175	39.0689	38.9110	38.7423	38.6239	38.5009
alpha	3.5494	3.5539	3.5582	3.5789	3.5828	3.6012	3.6012	3.6046	3.5941	3.5828	3.5749	3.5667
util living area	0.9720	0.9538	0.9182	0.8423	0.7162	0.5528	0.4154	0.4604	0.6778	0.8780	0.9551	0.9764 (86)
MIT	19.5075	19.7368	20.0750	20.4733	20.7745	20.9345	20.9820	20.9739	20.8621	20.4657	19.9124	19.4557 (87)
Th 2	19.9369	19.9385	19.9401	19.9477	19.9492	19.9558	19.9558	19.9570	19.9532	19.9492	19.9463	19.9433 (88)
util rest of house	0.9661	0.9445	0.9016	0.8110	0.6629	0.4756	0.3218	0.3635	0.6030	0.8462	0.9443	0.9714 (89)
MIT 2	18.5998	18.8250	19.1530	19.5314	19.7945	19.9219	19.9498	19.9476	19.8734	19.5358	19.0064	18.5599 (90)
Living area fraction									fLA = Living area / (4) =			0.1566 (91)
MIT	18.7419	18.9678	19.2973	19.6789	19.9480	20.0805	20.1114	20.1083	20.0282	19.6814	19.1483	18.6951 (92)
Temperature adjustment												0.0000
adjusted MIT	18.7419	18.9678	19.2973	19.6789	19.9480	20.0805	20.1114	20.1083	20.0282	19.6814	19.1483	18.6951 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9577	0.9338	0.8897	0.8019	0.6629	0.4852	0.3361	0.3780	0.6088	0.8367	0.9341	0.9638 (94)
Useful gains	712.8252	799.1923	852.3660	851.0841	748.8668	538.8887	356.5370	373.6259	554.7345	677.2867	681.3535	679.5349 (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	1517.0314	1475.1595	1339.6543	1119.3095	855.1937	564.2380	361.5109	381.2795	612.0065	941.6080	1253.0585	1512.3528 (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	598.3295	454.2499	362.5425	193.1222	79.1073	0.0000	0.0000	0.0000	0.0000	196.6551	411.6276	619.6165 (98)
Space heating												2915.2506 (98)
Space heating per m2											(98) / (4) =	32.7189 (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													3134.6781 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	598.3295	454.2499	362.5425	193.1222	79.1073	0.0000	0.0000	0.0000	0.0000	196.6551	411.6276	619.6165	(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)	643.3650	488.4408	389.8307	207.6583	85.0616	0.0000	0.0000	0.0000	0.0000	211.4570	442.6103	666.2543	(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	175.8056	154.2526	160.3169	141.3687	136.8282	119.8342	112.8186	126.9678	127.7673	146.7535	158.0901	170.8006	(64)
Efficiency of water heater (217)m	89.3007	89.2201	89.0584	88.7072	88.0755	87.0000	87.0000	87.0000	87.0000	88.6930	89.1470	89.3343	(216)
Fuel for water heating, kWh/month	196.8692	172.8899	180.0132	159.3655	155.3533	137.7404	129.6765	145.9400	146.8589	165.4623	177.3364	191.1926	(219)
Water heating fuel used												1958.6984	(219)
Annual totals kWh/year													
Space heating fuel - main system												3134.6781	(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)												383.3609	(232)
Total delivered energy for all uses												5551.7374	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3134.6781	3.4800	109.0868 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1958.6984	3.4800	68.1627 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	383.3609	13.1900	50.5653 (250)
Additional standing charges			120.0000 (251)
Total energy cost			357.7073 (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] =	1.1203 (257)
SAP value		84.3713
SAP rating (Section 12)		84 (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	3134.6781	0.2160	677.0905 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1958.6984	0.2160	423.0788 (264)
Space and water heating			1100.1693 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	383.3609	0.5190	198.9643 (268)
Total kg/year			1338.0586 (272)
CO2 emissions per m2			15.0200 (273)
EI value			86.6294
EI rating			87 (274)
EI band			B

Calculation of stars for heating and DHW

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9000 = 3.867$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9000 = 0.2400$, stars = 4
Water heating energy efficiency	$3.48 / 0.8829 = 3.941$, stars = 4
Water heating environmental impact	$0.216 / 0.8829 = 0.2446$, stars = 4

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	44.5500 (1b)	x 2.4200 (2b)	= 107.8110 (1b) - (3b)
First floor	44.5500 (1c)	x 2.6900 (2c)	= 119.8395 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	89.1000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 227.6505 (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) = 0.1318 (8)
Pressure test					Yes
Measured/design AP50					3.8900
Infiltration rate					0.3263 (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) =		0.2773 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.6000	4.5000	4.5000	4.1000	4.2000	3.7000	3.5000	3.5000	3.7000	4.1000	4.1000	4.2000 (22)
Wind factor	1.1500	1.1250	1.1250	1.0250	1.0500	0.9250	0.8750	0.8750	0.9250	1.0250	1.0250	1.0500 (22a)
Adj infilt rate												
Effective ac	0.3189	0.3120	0.3120	0.2843	0.2912	0.2565	0.2427	0.2427	0.2565	0.2843	0.2843	0.2912 (22b)
	0.5509	0.5487	0.5487	0.5404	0.5424	0.5329	0.5294	0.5294	0.5329	0.5404	0.5404	0.5424 (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)			12.9800	1.2357	16.0399		(27)
gf			44.5500	0.1500	6.6825	75.0000	3341.2499 (28a)
external	113.9900	15.1300	98.8600	0.2000	19.7720	60.0000	5931.5999 (29a)
cold	44.5500		44.5500	0.0900	4.0095	9.0000	400.9500 (30)
Total net area of external elements Aum(A, m ²)			203.0900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	49.5139		(33)
party			26.7800	0.0000	0.0000	70.0000	1874.6000 (32)
gf			83.0000			9.0000	747.0000 (32c)
1f			107.0000			9.0000	963.0000 (32c)
1f			44.5500			18.0000	801.9000 (32d)
gf			44.5500			9.0000	400.9500 (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) =	14461.2498 (34)
	162.3036 (35)
	13.2705 (36)
(33) + (36) =	62.7844 (37)
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)	
(38)m	Jan 41.3833 Feb 41.2189 Mar 41.2189 Apr 40.5978 May 40.7476 Jun 40.0344 Jul 39.7744 Aug 39.7744 Sep 40.0344 Oct 40.5978 Nov 40.5978 Dec 40.7476 (38)
Heat transfer coeff	104.1677 104.0033 104.0033 103.3822 103.5321 102.8188 102.5588 102.5588 102.8188 103.3822 103.3822 103.5321 (39)
Average = Sum(39)m / 12 =	103.3450 (39)
HLP	Jan 1.1691 Feb 1.1673 Mar 1.1673 Apr 1.1603 May 1.1620 Jun 1.1540 Jul 1.1511 Aug 1.1511 Sep 1.1540 Oct 1.1603 Nov 1.1603 Dec 1.1620 (40)
HLP (average)	1.1599 (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												2.6132	(42)
Average daily hot water use (litres/day)												96.2635	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	105.8899	102.0393	98.1888	94.3382	90.4877	86.6372	86.6372	90.4877	94.3382	98.1888	102.0393	105.8899	(44)
Energy conte	157.0316	137.3408	141.7234	123.5579	118.5568	102.3055	94.8011	108.7856	110.0849	128.2933	140.0422	152.0767	(45)
Energy content (annual)										Total = Sum(45)m =	1514.5997	(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	23.5547	20.6011	21.2585	18.5337	17.7835	15.3458	14.2202	16.3178	16.5127	19.2440	21.0063	22.8115 (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	18.7740	16.9117	18.5934	17.8108	18.2715	17.5287	18.0175	18.1822	17.6824	18.4602	18.0479	18.7239 (61)
Total heat required for water heating calculated for each month	175.8056	154.2526	160.3169	141.3687	136.8282	119.8342	112.8186	126.9678	127.7673	146.7535	158.0901	170.8006 (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	175.8056	154.2526	160.3169	141.3687	136.8282	119.8342	112.8186	126.9678	127.7673	146.7535	158.0901	170.8006 (64)
Heat gains from water heating, kWh/month	56.9065	49.8938	51.7714	45.5357	43.9880	38.3988	36.0257	40.7168	41.0238	47.2726	51.0760	55.2465 (65)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)												
Total per year (kWh/year) = Sum(64)m = 1731.6040 (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	156.7920	156.7920	156.7920	156.7920	156.7920	156.7920	156.7920	156.7920	156.7920	156.7920	156.7920	156.7920	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	54.2687	48.2010	39.1997	29.6767	22.1837	18.7284	20.2367	26.3044	35.3057	44.8287	52.3217	55.7770	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	354.3466	358.0236	348.7576	329.0315	304.1309	280.7278	265.0931	261.4161	270.6820	290.4081	315.3087	338.7118	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.2924	53.2924	53.2924	53.2924	53.2924	53.2924	53.2924	53.2924	53.2924	53.2924	53.2924	53.2924	(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)	-104.5280	-104.5280	-104.5280	-104.5280	-104.5280	-104.5280	-104.5280	-104.5280	-104.5280	-104.5280	-104.5280	-104.5280	(71)
Water heating gains (Table 5)	76.4872	74.2467	69.5852	63.2440	59.1236	53.3316	48.4217	54.7268	56.9775	63.5384	70.9389	74.2560	(72)
Total internal gains	593.6589	589.0276	566.0989	530.5086	493.9946	461.3442	442.3078	451.0037	471.5216	507.3316	547.1258	577.3013	(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	5.8800				9.5471		0.4600		0.0000		1.0000		25.8230 (75)	
Southwest	7.1000				31.1332		0.4600		0.0000		1.0000		101.6812 (79)	
Solar gains	127.5042	237.1664	367.4901	506.0531	592.7153	616.8196	575.9002	492.8842	416.6951	279.2544	160.2329	115.5941	(83)	
Total gains	721.1631	826.1940	933.5890	1036.5617	1086.7099	1078.1638	1018.2081	943.8878	888.2167	786.5860	707.3587	692.8954	(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	38.5630	38.6239	38.6239	38.8560	38.7997	39.0689	39.1679	39.1679	39.0689	38.8560	38.8560	38.7997	
alpha	3.5709	3.5749	3.5749	3.5904	3.5866	3.6046	3.6112	3.6112	3.6046	3.5904	3.5904	3.5866	
util living area	0.9724	0.9547	0.9200	0.8381	0.7035	0.5368	0.4298	0.4694	0.6878	0.8801	0.9550	0.9758	(86)
MIT	19.5533	19.7743	20.0876	20.5042	20.8019	20.9443	20.9801	20.9730	20.8564	20.4730	19.9524	19.5142	(87)
Th 2	19.9448	19.9463	19.9463	19.9519	19.9505	19.9570	19.9594	19.9594	19.9570	19.9519	19.9519	19.9505	(88)
util rest of house	0.9665	0.9453	0.9035	0.8052	0.6458	0.4554	0.3339	0.3690	0.6134	0.8480	0.9439	0.9706	(89)
MIT 2	18.6515	18.8684	19.1706	19.5641	19.8193	19.9298	19.9527	19.9498	19.8734	19.5459	19.0505	18.6175	(90)
Living area fraction	18.7927	19.0102	19.3142	19.7113	19.9732	20.0887	20.1135	20.1100	20.0273	19.6910	19.1917	18.7579	(91)
MIT	18.7927	19.0102	19.3142	19.7113	19.9732	20.0887	20.1135	20.1100	20.0273	19.6910	19.1917	18.7579	(92)
Temperature adjustment	18.7927	19.0102	19.3142	19.7113	19.9732	20.0887	20.1135	20.1100	20.0273	19.6910	19.1917	18.7579	(93)
adjusted MIT	18.7927	19.0102	19.3142	19.7113	19.9732	20.0887	20.1135	20.1100	20.0273	19.6910	19.1917	18.7579	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9582	0.9349	0.8917	0.7966	0.6472	0.4662	0.3485	0.3840	0.6189	0.8386	0.9337	0.9629	(94)
Useful gains	691.0035	772.3708	832.4819	825.7610	703.3069	502.5948	354.8289	362.4715	549.6904	659.6237	660.4945	667.2031	(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	1468.0021	1425.9077	1311.9170	1076.3381	794.4198	523.2116	360.3441	370.2398	609.4405	919.1728	1208.7165	1465.7960	(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	578.0870	439.1768	356.6997	180.4155	67.7880	0.0000	0.0000	0.0000	0.0000	193.1045	394.7198	594.1531	(98)
Space heating												2804.1445	(98)
Space heating per m2												31.4719	(99)
										(98) / (4) =			

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.0000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3015.2092 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	578.0870	439.1768	356.6997	180.4155	67.7880	0.0000	0.0000	0.0000	0.0000	193.1045	394.7198	594.1531	(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)	621.5989	472.2332	383.5480	193.9952	72.8903	0.0000	0.0000	0.0000	0.0000	207.6393	424.4299	638.8743	(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	175.8056	154.2526	160.3169	141.3687	136.8282	119.8342	112.8186	126.9678	127.7673	146.7535	158.0901	170.8006	(64)
Efficiency of water heater (217)m	89.2821	89.2005	89.0479	88.6569	87.9715	87.0000	87.0000	87.0000	87.0000	88.6796	89.1212	89.3123	(216)
Fuel for water heating, kWh/month	196.9103	172.9280	180.0345	159.4559	155.5371	137.7404	129.6765	145.9400	146.8589	165.4874	177.3878	191.2397	(219)
Water heating fuel used													(219)
Annual totals kWh/year													
Space heating fuel - main system													3015.2092 (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)													383.3609 (232)
Total delivered energy for all uses													5432.7666 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3015.2092	10.2300	308.4559 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1959.1965	10.2300	200.4258 (247)
Pumps and fans for heating	75.0000	36.7200	27.5400 (249)
Energy for lighting	383.3609	36.7200	140.7701 (250)
Additional standing charges			103.0000 (251)
Total energy cost			780.1918 (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	3015.2092	0.2160	651.2852 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1959.1965	0.2160	423.1864 (264)
Space and water heating			1074.4716 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	383.3609	0.5190	198.9643 (268)
Total kg/year			1312.3610 (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	3015.2092	1.2200	3678.5552 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1959.1965	1.2200	2390.2198 (264)
Space and water heating			6068.7749 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	383.3609	3.0700	1176.9181 (268)
Primary energy kWh/year			7475.9430 (272)
Primary energy kWh/m2/year			83.9051 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 84
Current environmental impact rating: B 87

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

(For testing purposes):

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

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.2	-£ 79	-180 kg (13.7%)
U Solar photovoltaic panels	+ 10.0	-£ 589	-833 kg (73.6%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£79	2.02 kg/m²	B 86 B 88
Solar photovoltaic panels	£589	9.35 kg/m²	A 96 A 97
Total Savings	£668	11.37 kg/m²	

Potential energy efficiency rating: A 96
Potential environmental impact rating: A 97

Fuel prices for cost data on this page from database revision number 531 TEST (31 Oct 2023)
Recommendation texts revision number 4.9c (22 Feb 2014)

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

	Current	Potential	Saving
Electricity	£168	£187	-£18
Mains gas	£612	£514	£97
Space heating	£439	£439	£0
Water heating	£200	£121	£79
Lighting	£141	£141	£0
Generated (PV)	-£0	-£589	£589
Total cost of fuels	£780	£112	£668
Total cost of uses	£780	£112	£668
Delivered energy	61 kWh/m²	33 kWh/m²	28 kWh/m²
Carbon dioxide emissions	1.3 tonnes	0.3 tonnes	1.0 tonnes
CO2 emissions per m²	15 kg/m²	3 kg/m²	11 kg/m²
Primary energy	84 kWh/m²	17 kWh/m²	67 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	44.5500 (1b)	x 2.4200 (2b)	= 107.8110 (1b) - (3b)
First floor	44.5500 (1c)	x 2.6900 (2c)	= 119.8395 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	89.1000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 227.6505 (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) = 0.1318 (8)
Pressure test					Yes
Measured/design AP50					3.8900
Infiltration rate					0.3263 (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) =	0.2773 (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	0.3536	0.3467	0.3397	0.3051	0.2981	0.2635	0.2635	0.2565	0.2773	0.2981	0.3120	0.3259 (22b)
Effective ac	0.5625	0.5601	0.5577	0.5465	0.5444	0.5347	0.5347	0.5329	0.5385	0.5444	0.5487	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)			12.9800	1.2357	16.0399		(27)
gf			44.5500	0.1500	6.6825	75.0000	3341.2499 (28a)
external	113.9900	15.1300	98.8600	0.2000	19.7720	60.0000	5931.5999 (29a)
cold	44.5500		44.5500	0.0900	4.0095	9.0000	400.9500 (30)
Total net area of external elements Aum(A, m ²)			203.0900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	49.5139		(33)
party			26.7800	0.0000	0.0000	70.0000	1874.6000 (32)
gf			83.0000			9.0000	747.0000 (32c)
1f			107.0000			9.0000	963.0000 (32c)
1f			44.5500			18.0000	801.9000 (32d)
gf			44.5500			9.0000	400.9500 (32e)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		14461.2498 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							162.3036 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							13.2705 (36)
Total fabric heat loss					(33) + (36) =		62.7844 (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	42.2590	42.0767	41.8979	41.0582	40.9011	40.1698	40.1698	40.0344	40.4515	40.9011	41.2189	41.5512 (38)
Heat transfer coeff	105.0435	104.8611	104.6823	103.8426	103.6855	102.9542	102.9542	102.8188	103.2359	103.6855	104.0033	104.3356 (39)
Average = Sum(39)m / 12 =												103.8419 (39)
HLP	1.1789	1.1769	1.1749	1.1655	1.1637	1.1555	1.1555	1.1540	1.1587	1.1637	1.1673	1.1710 (40)
HLP (average)												1.1655 (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												2.6132 (42)
Average daily hot water use (litres/day)												96.2635 (43)
Daily hot water use	105.8899	102.0393	98.1888	94.3382	90.4877	86.6372	86.6372	90.4877	94.3382	98.1888	102.0393	105.8899 (44)
Energy conte	157.0316	137.3408	141.7234	123.5579	118.5568	102.3055	94.8011	108.7856	110.0849	128.2933	140.0422	152.0767 (45)
Energy content (annual)										Total = Sum(45)m =		1514.5997 (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	23.5547	20.6011	21.2585	18.5337	17.7835	15.3458	14.2202	16.3178	16.5127	19.2440	21.0063	22.8115 (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	18.7740	16.9117	18.5934	17.8108	18.2715	17.5287	18.0175	18.1822	17.6824	18.4602	18.0479	18.7239 (61)
Total heat required for water heating calculated for each month	175.8056	154.2526	160.3169	141.3687	136.8282	119.8342	112.8186	126.9678	127.7673	146.7535	158.0901	170.8006 (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												1.1974 (H8)
Utilisation factor												0.5662 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												96.2635 (H14)
Volume ratio Veff/V												0.7791 (H15)
Solar storage volume factor												0.9501 (H16)
Solar input												-857.8137 (H17)
Solar input	-24.8749	-41.5090	-70.6946	-94.7448	-117.0492	-115.0780	-113.5572	-99.2155	-77.7056	-53.0638	-29.5052	-20.8160 (63)
Solar input (sum of months) = Sum (63)m =												-857.8137 (63)
Output from w/h	150.9307	112.7435	89.6222	46.6240	19.7791	4.7562	0.0000	27.7523	50.0617	93.6897	128.5849	149.9846 (64)
Total per year (kWh/year) = Sum (64)m =												874.5289 (64)
Heat gains from water heating, kWh/month	56.9065	49.8938	51.7714	45.5357	43.9880	38.3988	36.0257	40.7168	41.0238	47.2726	51.0760	55.2465 (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	156.7920	156.7920	156.7920	156.7920	156.7920	156.7920	156.7920	156.7920	156.7920	156.7920	156.7920	156.7920 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	54.2687	48.2010	39.1997	29.6767	22.1837	18.7284	20.2367	26.3044	35.3057	44.8287	52.3217	55.7770 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	354.3466	358.0236	348.7576	329.0315	304.1309	280.7278	265.0931	261.4161	270.6820	290.4081	315.3087	338.7118 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.2924	53.2924	53.2924	53.2924	53.2924	53.2924	53.2924	53.2924	53.2924	53.2924	53.2924	53.2924 (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)	-104.5280	-104.5280	-104.5280	-104.5280	-104.5280	-104.5280	-104.5280	-104.5280	-104.5280	-104.5280	-104.5280	-104.5280 (71)
Water heating gains (Table 5)	76.4872	74.2467	69.5852	63.2440	59.1236	53.3316	48.4217	54.7268	56.9775	63.5384	70.9389	74.2560 (72)
Total internal gains	593.6589	589.0276	566.0989	530.5086	493.9946	461.3442	442.3078	451.0037	471.5216	507.3316	547.1258	577.3013 (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					5.8800	11.2829	0.4600	0.0000			1.0000			30.5181 (75)
Southwest					7.1000	36.7938	0.4600	0.0000			1.0000			120.1687 (79)

Solar gains	150.6868	266.8122	391.9894	530.8249	635.7617	649.2838	618.4383	537.3806	439.6324	302.1441	182.3340	127.7619 (83)		
Total gains	744.3457	855.8398	958.0883	1061.3336	1129.7563	1110.6280	1060.7462	988.3843	911.1540	809.4757	729.4598	705.0632 (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	38.2414	38.3080	38.3734	38.6837	38.7423	39.0175	39.0175	39.0689	38.9110	38.7423	38.6239	38.5009	
alpha	3.5494	3.5539	3.5582	3.5789	3.5828	3.6012	3.6012	3.6046	3.5941	3.5828	3.5749	3.5667	
util living area	0.9720	0.9538	0.9182	0.8423	0.7162	0.5528	0.4154	0.4604	0.6778	0.8780	0.9551	0.9764 (86)	
MIT	19.5075	19.7368	20.0750	20.4733	20.7745	20.9345	20.9820	20.9739	20.8621	20.4657	19.9124	19.4557 (87)	
Th 2	19.9369	19.9385	19.9401	19.9477	19.9492	19.9558	19.9558	19.9570	19.9532	19.9492	19.9463	19.9433 (88)	
util rest of house	0.9661	0.9445	0.9016	0.8110	0.6629	0.4756	0.3218	0.3635	0.6030	0.8462	0.9443	0.9714 (89)	
MIT 2	18.5998	18.8250	19.1530	19.5314	19.7945	19.9219	19.9498	19.9476	19.8734	19.5358	19.0064	18.5539 (90)	
Living area fraction									fLA = Living area / (4) =			0.1566 (91)	
MIT	18.7419	18.9678	19.2973	19.6789	19.9480	20.0805	20.1114	20.1083	20.0282	19.6814	19.1483	18.6951 (92)	
Temperature adjustment												0.0000	
adjusted MIT	18.7419	18.9678	19.2973	19.6789	19.9480	20.0805	20.1114	20.1083	20.0282	19.6814	19.1483	18.6951 (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	0.9577	0.9338	0.8897	0.8019	0.6629	0.4852	0.3361	0.3780	0.6088	0.8367	0.9341	0.9638	(94)
Useful gains	712.8252	799.1923	852.3660	851.0841	748.8668	538.8887	356.5370	373.6259	554.7345	677.2867	681.3535	679.5349	(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													
	1517.0314	1475.1595	1339.6543	1119.3095	855.1937	564.2380	361.5109	381.2795	612.0065	941.6080	1253.0585	1512.3528	(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													
	598.3295	454.2499	362.5425	193.1222	79.1073	0.0000	0.0000	0.0000	0.0000	196.6551	411.6276	619.6165	(98)
Space heating													
Space heating per m2												2915.2506	(98)
											(98) / (4) =	32.7189	(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													3134.6781	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	598.3295	454.2499	362.5425	193.1222	79.1073	0.0000	0.0000	0.0000	0.0000	196.6551	411.6276	619.6165	(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)	643.3650	488.4408	389.8307	207.6583	85.0616	0.0000	0.0000	0.0000	0.0000	211.4570	442.6103	666.2543	(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	150.9307	112.7435	89.6222	46.6240	19.7791	4.7562	0.0000	27.7523	50.0617	93.6897	128.5849	149.9846	(64)	
Efficiency of water heater	89.3792	89.3871	89.3891	89.4005	89.3835	87.0000	87.0000	87.0000	87.0000	89.0096	89.2673	89.3992	(216)	
(217)m	89.3792	89.3871	89.3891	89.4005	89.3835	87.0000	87.0000	87.0000	87.0000	89.0096	89.2673	89.3992	(217)	
Fuel for water heating, kWh/month	168.8656	126.1295	100.2609	52.1518	22.1283	5.4669	0.0000	31.8992	57.5421	105.2580	144.0448	167.7695	(219)	
Water heating fuel used														
Annual totals kWh/year														
Space heating fuel - main system													3134.6781	(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)													383.3609	(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													2897.3163	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3134.6781	3.4800	109.0868	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	981.5167	3.4800	34.1568	(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	383.3609	13.1900	50.5653	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-1727.2394	13.1900	-227.8229	(252)
Total energy cost			102.4735	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)		0.3209	(257)
SAP value	[(255) x (256)] / [(4) + 45.0] =	95.5228	
SAP rating (Section 12)		96	(258)
SAP band		A	

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

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

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Space heating - main system 1	3134.6781	0.2160	677.0905 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	981.5167	0.2160	212.0076 (264)
Space and water heating			889.0981 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	383.3609	0.5190	198.9643 (268)
Energy saving/generation technologies			
PV Unit			
Total kg/year	-1727.2394	0.5190	-896.4372 (269)
CO2 emissions per m2			256.5002 (272)
EI value			2.8800 (273)
EI rating			97.4369
EI band			97 (274)
			A

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	44.5500 (1b)	x 2.4200 (2b)	= 107.8110 (1b) - (3b)
First floor	44.5500 (1c)	x 2.6900 (2c)	= 119.8395 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	89.1000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 227.6505 (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) = 0.1318 (8)
Pressure test					Yes
Measured/design AP50					3.8900
Infiltration rate					0.3263 (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) =		0.2773 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.6000	4.5000	4.5000	4.1000	4.2000	3.7000	3.5000	3.5000	3.7000	4.1000	4.1000	4.2000 (22)
Wind factor	1.1500	1.1250	1.1250	1.0250	1.0500	0.9250	0.8750	0.8750	0.9250	1.0250	1.0250	1.0500 (22a)
Adj infilt rate												
Effective ac	0.3189	0.3120	0.3120	0.2843	0.2912	0.2565	0.2427	0.2427	0.2565	0.2843	0.2843	0.2912 (22b)
	0.5509	0.5487	0.5487	0.5404	0.5424	0.5329	0.5294	0.5294	0.5329	0.5404	0.5404	0.5424 (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)			12.9800	1.2357	16.0399		(27)
gf			44.5500	0.1500	6.6825	75.0000	3341.2499 (28a)
external	113.9900	15.1300	98.8600	0.2000	19.7720	60.0000	5931.5999 (29a)
cold	44.5500		44.5500	0.0900	4.0095	9.0000	400.9500 (30)
Total net area of external elements Aum(A, m ²)			203.0900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	49.5139		(33)
party			26.7800	0.0000	0.0000	70.0000	1874.6000 (32)
gf			83.0000			9.0000	747.0000 (32c)
1f			107.0000			9.0000	963.0000 (32c)
1f			44.5500			18.0000	801.9000 (32d)
gf			44.5500			9.0000	400.9500 (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) = 14461.2498 (34)
162.3036 (35)
13.2705 (36)
(33) + (36) = 62.7844 (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	41.3833	41.2189	41.2189	40.5978	40.7476	40.0344	39.7744	39.7744	40.0344	40.5978	40.5978	40.7476 (38)
Heat transfer coeff	104.1677	104.0033	104.0033	103.3822	103.5321	102.8188	102.5588	102.5588	102.8188	103.3822	103.3822	103.5321 (39)
Average = Sum(39)m / 12 =												103.3450 (39)
HLP	1.1691	1.1673	1.1673	1.1603	1.1620	1.1540	1.1511	1.1511	1.1540	1.1603	1.1603	1.1620 (40)
HLP (average)												1.1599 (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												2.6132 (42)
Average daily hot water use (litres/day)												96.2635 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	105.8899	102.0393	98.1888	94.3382	90.4877	86.6372	86.6372	90.4877	94.3382	98.1888	102.0393	105.8899 (44)
Energy conte	157.0316	137.3408	141.7234	123.5579	118.5568	102.3055	94.8011	108.7856	110.0849	128.2933	140.0422	152.0767 (45)
Energy content (annual)										Total = Sum(45)m =		1514.5997 (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	23.5547	20.6011	21.2585	18.5337	17.7835	15.3458	14.2202	16.3178	16.5127	19.2440	21.0063	22.8115 (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	18.7740	16.9117	18.5934	17.8108	18.2715	17.5287	18.0175	18.1822	17.6824	18.4602	18.0479	18.7239 (61)
Total heat required for water heating calculated for each month	175.8056	154.2526	160.3169	141.3687	136.8282	119.8342	112.8186	126.9678	127.7673	146.7535	158.0901	170.8006 (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												1.1128 (H8)
Utilisation factor												0.5929 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												96.2635 (H14)
Volume ratio Veff/V												0.7791 (H15)
Solar storage volume factor												0.9501 (H16)
Solar input												-834.7789 (H17)
Solar input	-22.0403	-38.6364	-69.4007	-94.5815	-114.2684	-114.4779	-110.7316	-95.2902	-77.1236	-51.3559	-27.1512	-19.7214 (63)
Solar input (sum of months) = Sum (63)m =												-834.7789 (63)
Output from w/h	153.7653	115.6162	90.9162	46.7873	22.5598	5.3562	2.0870	31.6776	50.6437	95.3977	130.9389	151.0792 (64)
Total per year (kWh/year) = Sum (64)m =												896.8251 (64)
Heat gains from water heating, kWh/month	56.9065	49.8938	51.7714	45.5357	43.9880	38.3988	36.0257	40.7168	41.0238	47.2726	51.0760	55.2465 (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	156.7920	156.7920	156.7920	156.7920	156.7920	156.7920	156.7920	156.7920	156.7920	156.7920	156.7920	156.7920	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	54.2687	48.2010	39.1997	29.6767	22.1837	18.7284	20.2367	26.3044	35.3057	44.8287	52.3217	55.7770	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	354.3466	358.0236	348.7576	329.0315	304.1309	280.7278	265.0931	261.4161	270.6820	290.4081	315.3087	338.7118	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.2924	53.2924	53.2924	53.2924	53.2924	53.2924	53.2924	53.2924	53.2924	53.2924	53.2924	53.2924	(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)	-104.5280	-104.5280	-104.5280	-104.5280	-104.5280	-104.5280	-104.5280	-104.5280	-104.5280	-104.5280	-104.5280	-104.5280	(71)
Water heating gains (Table 5)	76.4872	74.2467	69.5852	63.2440	59.1236	53.3316	48.4217	54.7268	56.9775	63.5384	70.9389	74.2560	(72)
Total internal gains	593.6589	589.0276	566.0989	530.5086	493.9946	461.3442	442.3078	451.0037	471.5216	507.3316	547.1258	577.3013	(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					5.8800	9.5471	0.4600	0.0000			1.0000			25.8230 (75)
Southwest					7.1000	31.1332	0.4600	0.0000			1.0000			101.6812 (79)
Solar gains	127.5042	237.1664	367.4901	506.0531	592.7153	616.8196	575.9002	492.8842	416.6951	279.2544	160.2329	115.5941 (83)		
Total gains	721.1631	826.1940	933.5890	1036.5617	1086.7099	1078.1638	1018.2081	943.8878	888.2167	786.5860	707.3587	692.8954 (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	38.5630	38.6239	38.6239	38.8560	38.7997	39.0689	39.1679	39.1679	39.0689	38.8560	38.8560	38.7997	
alpha	3.5709	3.5749	3.5749	3.5904	3.5866	3.6046	3.6112	3.6112	3.6046	3.5904	3.5904	3.5866	
util living area	0.9724	0.9547	0.9200	0.8381	0.7035	0.5368	0.4298	0.4694	0.6878	0.8801	0.9550	0.9758	(86)
MIT	19.5533	19.7743	20.0876	20.5042	20.8019	20.9443	20.9801	20.9730	20.8564	20.4730	19.9524	19.5142	(87)
Th 2	19.9448	19.9463	19.9463	19.9519	19.9505	19.9570	19.9594	19.9594	19.9570	19.9519	19.9519	19.9505	(88)
util rest of house	0.9665	0.9453	0.9035	0.8052	0.6458	0.4554	0.3339	0.3690	0.6134	0.8480	0.9439	0.9706	(89)
MIT 2	18.6515	18.8684	19.1706	19.5641	19.8193	19.9298	19.9527	19.9498	19.8734	19.5459	19.0505	18.6175	(90)
Living area fraction									fLA = Living area / (4) =			0.1566	(91)
MIT	18.7927	19.0102	19.3142	19.7113	19.9732	20.0887	20.1135	20.1100	20.0273	19.6910	19.1917	18.7579	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7927	19.0102	19.3142	19.7113	19.9732	20.0887	20.1135	20.1100	20.0273	19.6910	19.1917	18.7579	(93)

8. Space heating requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9582	0.9349	0.8917	0.7966	0.6472	0.4662	0.3485	0.3840	0.6189	0.8386	0.9337	0.9629	(94)
Useful gains	691.0035	772.3708	832.4819	825.7610	703.3069	502.5948	354.8289	362.4715	549.6904	659.6237	660.4945	667.2031	(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													
	1468.0021	1425.9077	1311.9170	1076.3381	794.4198	523.2116	360.3441	370.2398	609.4405	919.1728	1208.7165	1465.7960	(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													
	578.0870	439.1768	356.6997	180.4155	67.7880	0.0000	0.0000	0.0000	0.0000	193.1045	394.7198	594.1531	(98)
Space heating													
Space heating per m2												2804.1445	(98)
											(98) / (4) =	31.4719	(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													3015.2092	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	578.0870	439.1768	356.6997	180.4155	67.7880	0.0000	0.0000	0.0000	0.0000	193.1045	394.7198	594.1531	(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)	621.5989	472.2332	383.5480	193.9952	72.8903	0.0000	0.0000	0.0000	0.0000	207.6393	424.4299	638.8743	(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	153.7653	115.6162	90.9162	46.7873	22.5598	5.3562	2.0870	31.6776	50.6437	95.3977	130.9389	151.0792	(64)	
Efficiency of water heater	89.3526	89.3579	89.3740	89.3654	89.2317	87.0000	87.0000	87.0000	87.0000	88.9854	89.2335	87.0000	(216)	
(217)m	89.3526	89.3579	89.3740	89.3654	89.2317	87.0000	87.0000	87.0000	87.0000	88.9854	89.2335	89.3752	(217)	
Fuel for water heating, kWh/month	172.0882	129.3856	101.7255	52.3550	25.2823	6.1566	2.3988	36.4110	58.2112	107.2060	146.7373	169.0393	(219)	
Water heating fuel used												1006.9967	(219)	
Annual totals kWh/year														
Space heating fuel - main system												3015.2092	(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)													383.3609	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 2.50 * 1003 * 0.80) =										-1605.1846		-1605.1846	(233)	
Total delivered energy for all uses												2925.3822	(238)	

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3015.2092	10.2300	308.4559	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1006.9967	10.2300	103.0158	(247)
Pumps and fans for heating	75.0000	36.7200	27.5400	(249)
Pump for solar water heating	50.0000	36.7200	18.3600	(249)
Energy for lighting	383.3609	36.7200	140.7701	(250)
Additional standing charges			103.0000	(251)
Energy saving/generation technologies				
PV Unit	-1605.1846	36.7200	-589.4238	(252)
Total energy cost			111.7180	(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	3015.2092	0.2160	651.2852	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1006.9967	0.2160	217.5113	(264)
Space and water heating			868.7965	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	383.3609	0.5190	198.9643	(268)
Energy saving/generation technologies				
PV Unit	-1605.1846	0.5190	-833.0908	(269)
Total kg/year			299.5450	(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	3015.2092	1.2200	3678.5552 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1006.9967	1.2200	1228.5360 (264)
Space and water heating			4907.0912 (265)
Pumps and fans	125.0000	3.0700	383.7500 (267)
Energy for lighting	383.3609	3.0700	1176.9181 (268)
Energy saving/generation technologies			
PV Unit	-1605.1846	3.0700	-4927.9167 (269)
Primary energy kWh/year			1539.8426 (272)
Primary energy kWh/m2/year			17.2822 (273)

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

Overheating Calculation Input Data

Dwelling type	SemiDetached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	West Pennines
Front of dwelling faces	North East
Overshading	Very little
Thermal mass parameter	162.3 (calculated from construction elements)
Night ventilation	No
Ventilation rate during hot weather (ach)	4.00 (Windows half open)

Overheating Calculation

Summer ventilation heat loss coefficient	300.50 (P1)
Transmission heat loss coefficient	62.78 (37)
Summer heat loss coefficient	363.28 (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	5.8800	89.6552	0.4600	0.0000	1.0000	242.4993
South West	7.1000	112.1012	0.4600	0.0000	1.0000	366.1226
total:						608.6218

Solar gains	Jun 659	Jul 609	Aug 520	(P4)
Internal gains	458	439	448	
Total summer gains	1117	1048	968	(P5)
Summer gain/loss ratio	3.08	2.88	2.67	(P6)
Summer external temperature	14.70	16.40	16.30	
Thermal mass temperature increment (TMP = 162.3)	0.86	0.86	0.86	
Threshold temperature	18.64	20.15	19.83	(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 011	Issued on Date	03/11/2023
Assessment Reference	plot 11 chain	Prop Type Ref	22186
Property	1h Chain Road, MANCHESTER, M9 6AJ		
SAP Rating	84 B	DER	17.34
Environmental	87 B	TER	18.18
CO ₂ Emissions (t/year)	1.31	% DER<TER	4.64
General Requirements Compliance	Pass	DfEE	45.52
		TfEE	53.21
		% DfEE<TfEE	14.46
Assessor Details	Mr. Patrick McGuigan, JSP Sustainability Ltd, Tel: 01904 435 325, technical@jpsustainability.co.uk		Assessor ID
			Y128-0001
Client			

SUMMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TfEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	18.18	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	17.34	kgCO ₂ /m ²	Pass
	-0.84 (-4.6%)	kgCO ₂ /m ²	

1b TfEE and DfEE

Target Fabric Energy Efficiency (TfEE)	53.21	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DfEE)	45.52	kWh/m ² /yr	
	-7.7 (-14.5%)	kWh/m ² /yr	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

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

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	3.89 (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

5.88 m², No overhang

Windows facing South West

7.10 m², No overhang

Air change rate

0.00 ach

Blinds/curtains

None

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type

U-value

Filled Cavity with Edge Sealing

0.00

W/m²K

Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals

3.89 (measured in this dwelling)

Maximum

10.0

Pass

10 Key features

Party wall U-value

0.00

W/m²K

Roof U-value

0.09

W/m²K

Air permeability

3.9

m³/m²h

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

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

Property Reference	Plot 011	Issued on Date	03/11/2023
Assessment Reference	plot 11 chain	Prop Type Ref	22186
Property	1h Chain Road, MANCHESTER, M9 6AJ		

SAP Rating	84 B	DER	17.34	TER	18.18
Environmental	87 B	% DER<TER	4.64		
CO ₂ Emissions (t/year)	1.31	DFEE	45.52	TFEE	53.21
General Requirements Compliance	Pass	% DFEE<TFEE	14.46		

Assessor Details	Mr. Patrick McGuigan, JSP Sustainability Ltd, Tel: 01904 435 325, technical@jpsustainability.co.uk	Assessor ID	Y128-0001
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Client	
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SUMMARY FOR INPUT DATA FOR: New Build (As Built)

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

6.0 Measurements		Heat Loss Perimeter	Internal Floor Area	Average Storey Height
	Ground Floor:	1.00 m	44.55 m ²	2.42 m
	1st Storey:	1.00 m	44.55 m ²	2.69 m

7.0 Living Area	13.95	m ²
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8.0 Thermal Mass Parameter	Precise calculation	
Thermal Mass	162.3	kJ/m ² K

9.0 External Walls						
Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area (m ²)	Nett Area (m ²)
external	Cavity Wall	Cavity wall : plasterboard on dabs, AAC block, filled cavity, any outside structure	0.20	60.00	113.99	98.86

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	26.78	

9.2 Internal Walls						
Description	Construction			Kappa (kJ/m ² K)	Area (m ²)	
gf	Plasterboard on timber frame			9.00	83.00	
1f	Plasterboard on timber frame			9.00	107.00	

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	44.55	44.55

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	44.55

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	44.55

11.2 Internal Floors

Description	Construction	Kappa (kJ/m ² K)	Area (m ²)
1f	Plasterboard ceiling, carpeted chipboard floor	18.00	44.55

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					5.88	
rear	Window	[1] external	South West	None	0.00					7.10	

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	10.15	0.358	No
Independently assessed	E3 Sill	7.54	0.020	No
Independently assessed	E4 Jamb	23.25	0.016	No
Independently assessed	E5 Ground floor (normal)	22.35	0.108	No
Independently assessed	E6 Intermediate floor within a dwelling	22.35	0.000	No
Independently assessed	E10 Eaves (insulation at ceiling level)	12.05	0.122	No
Independently assessed	E12 Gable (insulation at ceiling level)	10.30	0.108	No
Independently assessed	E16 Corner (normal)	20.40	0.068	No
Independently assessed	E18 Party wall between dwellings	10.20	0.092	No
Table K1 - Default	P1 Party wall - Ground floor	5.24	0.160	No
Table K1 - Default	P2 Party wall - Intermediate floor within a dwelling	5.24	0.000	No
Independently assessed	P4 Party wall - Roof (insulation at ceiling level)	5.24	0.182	No

Y-value	0.065	W/m ² K
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18.0 Pressure Testing

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

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather Windows half open

Cross ventilation possible Yes

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

Night Ventilation

Air change rate

Mechanical Ventilation

Mechanical Ventilation System Present

20.0 Fans, Open Fireplaces, Flues

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

21.0 Fixed Cooling System

22.0 Lighting

Internal

Total number of light fittings

Total number of L.E.L. fittings

Percentage of L.E.L. fittings %

External

External lights fitted

23.0 Electricity Tariff

24.0 Main Heating 1

Percentage of Heat %

Database Ref. No.

Fuel Type

Main Heating

SAP Code

In Winter

In Summer

Controls

PCDF Controls

Delayed Start Stat

Sap Code

Flue Type

Fan Assisted Flue

Is MHS Pumped

Heat Emitter

Flow Temperature

Combi boiler type

Combi keep hot type

25.0 Main Heating 2

Community Heating

28.0 Water Heating

Water Heating

Flue Gas Heat Recovery System

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

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

29.0 Hot Water Cylinder	None
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Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£79	B 86	
	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar photovoltaic panels, 2.5 kWp	£3,500 - £5,500	£589	A 96	