



Michael Hodgkinson Consultancy Ltd.

Pre-Construction Energy Assessment

Plots 1 & 2

17 South Street

Havant

PO9 1FH

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Assumptions

Design Air Test Value

Design permeability 7 m³/hm².

Water Use

Dwelling designed to achieve a water target of not more than 125 litres per person per day

Floor

Ground Floor U-Value 0.19 W/m²K (see calculation)

Walls

External U-Value 0.3 W/m²K (see calculation)

Dormer Walls U-Value 0.18 W/m²K (standard kingspan Specification)

Party Wall Unfilled Cavity with Effective sealing around all edges and in line with insulation layers in abutting elements.

note:- A full fill or solid party wall would give better results under SAP.

Roof

Insulated At rafters U-value roof 0.15 W/m²K (see calculation)

Flat ceiling U-Value 0.14 W/m²K (Loft Hatch with insulation 50 mm assumed) (see calculation)

Windows

Windows WER 'A' Transmittance 0.41 U-value 1.4 W/m²K

Heating Systems

Remeha 28c combi boiler. Time Temperature and Zone Control plus Weather compensator

Thermal Bridging

It as been assumed that Accredited Construction Details will be followed

Renewables

Solar PV 1 kWp on the South roof slope. (I have assumed significant shading but the site should be checked ensure feasibility)

Lighting

100% low energy fittings

What Will Be Needed On Completion

The following Items needed to validate the calculations

- A copy of the Air Test Certificate
- Confirmation of the individual 'Accredited Construction Details' adopted in the build. The full set of Accredited Construction Details can be down loaded from <http://www.planningportal.gov.uk/buildingregulations/approveddocuments/part1/bcassociateddocuments9/acd>. The individual details must signed by the Builder or Contracts Manager.
- Details of any variations to the plan and all items not detailed on plan ie. boiler actual make and model.
- Confirmation from an authorized person that the work was carried out in a workman like manor.

Contact Details

This report was compiled by Michael at Michael Hodgkinson Consultancy. If you need clarification on any of the issues please do not hesitate to call.

Telephone:- 0751 516 6814

E mail:- mikemhc@me.com

Regulations Compliance Report



Approved Document L1A 2010 edition assessed by Stroma FSAP 2009 program, Version: 1.5.0.37

Printed on 24 April 2013 at 07:22:54

Project Information:

Assessed By: Michael Hodgkinson (STRO002448)

Building Type: Semi-detached House

Dwelling Details:

NEW DWELLING DESIGN STAGE

Site Reference : Plot 1

Plot Reference: 356-1

Address : , Plot 1 Twittens Way, HAVANT, PO9 1FH

Client Details:

Name:

Address :

This report covers items included within the SAP calculations.

It is not a complete report of regulations compliance.

1 TER and DER

Fuel for main heating system: Natural gas

Fuel factor: 1.00 (natural gas)

Target Carbon Dioxide Emission Rate (TER)

21.92 kg/m²

Dwelling Carbon Dioxide Emission Rate (DER)

20.57 kg/m²

OK

2 Fabric U-values

Element

Average

Highest

External wall

0.30 (max. 0.30)

0.30 (max. 0.70)

OK

Party wall

0.20 (max. 0.20)

-

OK

Floor

0.19 (max. 0.25)

0.19 (max. 0.70)

OK

Roof

0.14 (max. 0.20)

0.15 (max. 0.35)

OK

Openings

1.51 (max. 2.00)

1.60 (max. 3.30)

OK

3 Air permeability

Air permeability at 50 pascals

7.00

Maximum

10.0

OK

4 Heating efficiency

Main Heating system:

Database: (rev 336, product index 010547):

Boiler system with radiators or underfloor - mains gas

Brand name: Broag Remeha

Model: Avanta Plus

Model qualifier: 28c

(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

Regulations Compliance Report



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 (South England):	Slight	OK
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Based on:

Overshading:	Average or unknown
Windows facing: North	1.8m ² ,
Windows facing: North	1.62m ² ,
Windows facing: North	1.1m ² ,
Windows facing: West	2.55m ² ,
Windows facing: South	3.15m ² ,
Roof windows facing: West	0.43m ²
Ventilation rate:	4.00
Blinds/curtains:	Dark-coloured curtain or roller blind shutter closed 50% of daylight hours

10 Key features

Doors U-value	1.1 W/m ² K
External Walls U-value	0.18 W/m ² K
Floors U-value	0.19 W/m ² K
Photovoltaic array	

SAP Input



Property Details: Plot 1

Address: , Plot 1 Twittens Way, HAVANT, PO9 1FH
Located in: England
Region: South England
UPRN:
Date of assessment: 21 August 2012
Date of certificate: 24 April 2013
Assessment type: New dwelling design stage
Transaction type: Marketed sale
Tenure type: Unknown
Related party disclosure: No related party
Thermal Mass Parameter: Indicative Value Medium
Dwelling designed to use less than 125 litres per Person per day: True

Property description:

Dwelling type: House
Detachment: Semi-detached
Year Completed: 2012
Floor Location: **Floor area:** **Storey height:**
 Floor 0 32.41 m² 2.625 m
 Floor 1 27.6 m² 2.2 m
Living area: 29.5 m² (fraction 0.492)
Front of dwelling faces: North

Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
entrance	Manufacturer	Solid			
wg01	BFRC	Windows	low-E, En = 0.05, soft coat	No	
wf02	BFRC	Windows	low-E, En = 0.05, soft coat	Yes	
wf01	BFRC	Windows	low-E, En = 0.05, soft coat	Yes	
wg02,03,04	BFRC	Windows	low-E, En = 0.05, soft coat	Yes	
d2g02	BFRC	Windows	low-E, En = 0.05, soft coat	Yes	
w1f01	Manufacturer	Roof Windows	low-E, En = 0.05, soft coat	Yes	Wood

Name:	Gap:	Frame Factor:	g-value:	U-value:	Area:	No. of Openings:
entrance	mm	0	0	1.1	2.1	1
wg01	16mm or more	0	0.41	1.6	1.8	1
wf02	16mm or more	0	0.41	1.6	1.62	1
wf01	16mm or more	0	0.41	1.6	1.1	1
wg02,03,04	16mm or more	0	0.41	1.6	0.85	3
d2g02	16mm or more	0	0.41	1.6	3.15	1
w1f01	16mm or more	0.7	0.6	1.5	0.43	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
entrance		external walls	East	1	2.1
wg01		external walls	North	1.2	1.5
wf02		external walls	North	1.2	1.35
wf01		external walls	North	0.915	1.2
wg02,03,04		external walls	West	0.63	1.35
d2g02		external walls	South	1.5	2.1
w1f01		pitched roof	West	0.55	0.78

Overshading: Average or unknown

Opaque Elements:

Type: **Gross area:** **Openings:** **Net area:** **U-value:** **Ru value:** **Curtain wall:** **Kappa:**

SAP Input



External Elements

external walls	83.92	12.32	71.6	0.3	0	False	N/A
dormer cheeks	1.547	0	1.55	0.18	0	False	N/A
Flat Ceiling	23.43	0	23.43	0.14	0		N/A
pitched roof	14	0.43	13.57	0.15	0		N/A
ground floor	32.41			0.19			N/A

Internal Elements

Party Elements

party wall	24.23						N/A
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Thermal bridges:

Thermal bridges:	User-defined (individual PSI-values)		
	Length	PSI-value	
	7.7	0.3	Other lintels (including other steel lintels)
	7.7	0.04	Sill
	24.6	0.05	Jamb
	19.167	0.16	Ground floor
	10.4	0.07	Intermediate floor between dwellings
	10	0.04	Eaves (insulation at rafter level)
	6	0.24	Gable (insulation at ceiling level)
	11	0.04	Gable (insulation at rafter level)
	15.1	0.09	Corner (normal)
	8.3	0.06	Party wall between dwellings
	2	0.12	Roof (insulation at ceiling level)
	2.4	0.02	Roof (insulation at rafter level)

Ventilation:

Pressure test:	Yes (As designed)
Ventilation:	Natural ventilation (extract fans)
Number of chimneys:	0
Number of open flues:	0
Number of fans:	3
Number of sides sheltered:	3
Pressure test:	7

Main heating system:

Main heating system:	Central heating systems with radiators or underfloor heating
	Gas boilers and oil boilers
	Fuel: mains gas
	Info Source: Boiler Database
	Database: (rev 336, product index 010547) SEDBUK2009 89.1%
	Brand name: Broag Remeha
	Model: Avanta Plus
	Model qualifier: 28c
	(Combi boiler)
	Systems with radiators
	Pump in heat space: Yes
	Delayed start

Main heating Control:

Main heating Control:	Programmer, room thermostat and TRVs
	Control code: 2106
	Boiler interlock: Yes

Secondary heating system:

Secondary heating system:	None
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Water heating:

Water heating:	From main heating system
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SAP Input



Water code: 901
Fuel :mains gas
No hot water cylinder
Solar panel: False

Others:

Electricity tariff:	standard tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Low rise urban / suburban
EPC language:	English
Wind turbine:	No
Photovoltaics:	<u>Photovoltaic 1</u> Installed Peak power: 1 Tilt of collector: 45° Overshading: Significant Collector Orientation: South
Assess Zero Carbon Home:	No

SAP WorkSheet: New dwelling design stage



User Details:

Assessor Name: Michael Hodgkinson **Stroma Number:** STRO002448
Software Name: Stroma FSAP 2009 **Software Version:** Version: 1.5.0.37

Property Address: Plot 1

Address : , Plot 1 Twittens Way, HAVANT, PO9 1FH

1. Overall dwelling dimensions:

	Area(m ²)		Ave Height(m)		Volume(m ³)
Ground floor	32.41	(1a) x	2.625	(2a) =	85.08
First floor	27.6	(1b) x	2.2	(2b) =	60.72
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	60.01	(4)			
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	145.8

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) =	0.21
<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			7
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)			0.56
<i>Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used</i>			
Number of sides on which sheltered			3
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.78
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.43

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=	5.4	5.1	5.1	4.5	4.1	3.9	3.7	3.7	4.2	4.5	4.8	5.1
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SAP WorkSheet: New dwelling design stage



Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.35	1.27	1.27	1.12	1.02	0.98	0.92	0.92	1.05	1.12	1.2	1.27
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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

	0.58	0.55	0.55	0.48	0.44	0.42	0.4	0.4	0.45	0.48	0.52	0.55
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Calculate effective air change rate for the applicable case

If mechanical ventilation:

(23a)

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

(23b)

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

(23c)

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

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)
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b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)
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c) If whole house extract ventilation or positive input ventilation from outside

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

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)
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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=	0.67	0.65	0.65	0.62	0.6	0.59	0.58	0.58	0.6	0.62	0.63	0.65	(24d)
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Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.67	0.65	0.65	0.62	0.6	0.59	0.58	0.58	0.6	0.62	0.63	0.65	(25)
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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			2.1	x 1.1	= 2.31		(26)
Windows Type 1			1.8	x 1/[1/(1.6) + 0.04]	= 2.71		(27)
Windows Type 2			1.62	x 1/[1/(1.6) + 0.04]	= 2.44		(27)
Windows Type 3			1.1	x 1/[1/(1.6) + 0.04]	= 1.65		(27)
Windows Type 4			0.85	x 1/[1/(1.6) + 0.04]	= 1.28		(27)
Windows Type 5			3.15	x 1/[1/(1.6) + 0.04]	= 4.74		(27)
Rooflights			0.43	x 1/[1/(1.5) + 0.04]	= 0.645		(27b)
Floor			32.41	x 0.19	= 6.1579		(28)
Walls Type1	83.92	12.32	71.6	x 0.3	= 21.48		(29)
Walls Type2	1.55	0	1.55	x 0.18	= 0.28		(29)
Roof Type1	23.43	0	23.43	x 0.14	= 3.28		(30)
Roof Type2	14	0.43	13.57	x 0.15	= 2.04		(30)
Total area of elements, m²			155.31				(31)
Party wall			24.23	x 0.2	= 4.85		(32)

* 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) = 56.36 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 15213.77 (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

SAP WorkSheet: New dwelling design stage



can be used instead of a detailed calculation.

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

12.07 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss

(33) + (36) =

68.43 (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=	32.19	31.31	31.31	29.7	28.75	28.3	27.87	27.87	28.98	29.7	30.48	31.31

(38)

Heat transfer coefficient, W/K

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

(39)m=	100.62	99.74	99.74	98.14	97.18	96.73	96.31	96.31	97.41	98.14	98.92	99.74
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Average = Sum(39)_{1...12} /12=

98.25 (39)

Heat loss parameter (HLP), W/m²K

(40)m = (39)m ÷ (4)

(40)m=	1.68	1.66	1.66	1.64	1.62	1.61	1.6	1.6	1.62	1.64	1.65	1.66
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Average = Sum(40)_{1...12} /12=

1.64 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

1.98

(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

81.27

(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=	89.4	86.15	82.9	79.65	76.39	73.14	73.14	76.39	79.65	82.9	86.15	89.4
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Total = Sum(44)_{1...12} =

975.25 (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=	132.89	116.23	119.94	104.56	100.33	86.58	80.23	92.06	93.16	108.57	118.51	128.7
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Total = Sum(45)_{1...12} =

1281.76 (45)

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

(46)m=	19.93	17.43	17.99	15.68	15.05	12.99	12.03	13.81	13.97	16.29	17.78	19.3
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(46)

Water storage loss:

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

0

(47)

Temperature factor from Table 2b

0

(48)

Energy lost from water storage, kWh/year

(47) x (48) =

0

(49)

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

Cylinder volume (litres) including any solar storage within same

0

(50)

If community heating and no tank in dwelling, enter 110 litres in box (50)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in box (50)

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

0

(51)

Volume factor from Table 2a

0

(52)

Temperature factor from Table 2b

0

(53)

Energy lost from water storage, kWh/year

((50) x (51) x (52) x (53) =

0

(54)

SAP WorkSheet: New dwelling design stage



Enter (49) or (54) in (55)

0

(55)

Water storage loss calculated for each month

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

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

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

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

Primary circuit loss (annual) from Table 3

0

(58)

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

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

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

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

(61)m=	45.56	39.65	42.24	39.28	38.93	36.07	37.27	38.93	39.28	42.24	42.48	45.56
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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=	178.45	155.88	162.18	143.84	139.26	122.65	117.5	130.99	132.44	150.81	161	174.25
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(62)

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

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

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

Output from water heater

(64)m=	178.45	155.88	162.18	143.84	139.26	122.65	117.5	130.99	132.44	150.81	161	174.25
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Output from water heater (annual)_{1...12}

1769.25

(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=	55.58	48.56	50.44	44.59	43.09	37.8	35.99	40.34	40.8	46.66	50.03	54.18
--------	-------	-------	-------	-------	-------	------	-------	-------	------	-------	-------	-------

(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=	118.92	118.92	118.92	118.92	118.92	118.92	118.92	118.92	118.92	118.92	118.92	118.92

(66)

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

(67)m=	39.41	35.01	28.47	21.55	16.11	13.6	14.7	19.1	25.64	32.56	38	40.51
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(67)

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

(68)m=	258.17	260.85	254.1	239.72	221.58	204.53	193.14	190.46	197.21	211.58	229.73	246.78
--------	--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------

(68)

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

(69)m=	48.87	48.87	48.87	48.87	48.87	48.87	48.87	48.87	48.87	48.87	48.87	48.87
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(69)

Pumps and fans gains (Table 5a)

(70)m=	10	10	10	10	10	10	10	10	10	10	10	10
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(70)

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

(71)m=	-79.28	-79.28	-79.28	-79.28	-79.28	-79.28	-79.28	-79.28	-79.28	-79.28	-79.28	-79.28
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

(71)

Water heating gains (Table 5)

(72)m=	74.7	72.26	67.8	61.93	57.92	52.51	48.38	54.22	56.66	62.72	69.48	72.82
--------	------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(72)

Total internal gains =

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

(73)m=	470.79	466.62	448.87	421.71	394.12	369.15	354.73	362.3	378.02	405.37	435.72	458.62
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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)	
North	0.77	x	1.8	x	10.73	x	1.11	x		=	6.1	(74)
North	0.77	x	1.62	x	10.73	x	1.11	x		=	5.49	(74)
North	0.77	x	1.1	x	10.73	x	1.11	x		=	3.72	(74)
North	0.77	x	1.8	x	20.36	x	1.11	x		=	11.57	(74)
North	0.77	x	1.62	x	20.36	x	1.11	x		=	10.41	(74)
North	0.77	x	1.1	x	20.36	x	1.11	x		=	7.07	(74)
North	0.77	x	1.8	x	33.31	x	1.11	x		=	18.93	(74)
North	0.77	x	1.62	x	33.31	x	1.11	x		=	17.04	(74)
North	0.77	x	1.1	x	33.31	x	1.11	x		=	11.57	(74)
North	0.77	x	1.8	x	54.64	x	1.11	x		=	31.05	(74)
North	0.77	x	1.62	x	54.64	x	1.11	x		=	27.94	(74)
North	0.77	x	1.1	x	54.64	x	1.11	x		=	18.97	(74)
North	0.77	x	1.8	x	75.22	x	1.11	x		=	42.74	(74)
North	0.77	x	1.62	x	75.22	x	1.11	x		=	38.47	(74)
North	0.77	x	1.1	x	75.22	x	1.11	x		=	26.12	(74)
North	0.77	x	1.8	x	84.09	x	1.11	x		=	47.78	(74)
North	0.77	x	1.62	x	84.09	x	1.11	x		=	43.01	(74)
North	0.77	x	1.1	x	84.09	x	1.11	x		=	29.2	(74)
North	0.77	x	1.8	x	79.12	x	1.11	x		=	44.96	(74)
North	0.77	x	1.62	x	79.12	x	1.11	x		=	40.46	(74)
North	0.77	x	1.1	x	79.12	x	1.11	x		=	27.48	(74)
North	0.77	x	1.8	x	61.56	x	1.11	x		=	34.98	(74)
North	0.77	x	1.62	x	61.56	x	1.11	x		=	31.49	(74)
North	0.77	x	1.1	x	61.56	x	1.11	x		=	21.38	(74)
North	0.77	x	1.8	x	41.09	x	1.11	x		=	23.35	(74)
North	0.77	x	1.62	x	41.09	x	1.11	x		=	21.01	(74)
North	0.77	x	1.1	x	41.09	x	1.11	x		=	14.27	(74)
North	0.77	x	1.8	x	24.81	x	1.11	x		=	14.1	(74)
North	0.77	x	1.62	x	24.81	x	1.11	x		=	12.69	(74)
North	0.77	x	1.1	x	24.81	x	1.11	x		=	8.62	(74)
North	0.77	x	1.8	x	13.22	x	1.11	x		=	7.51	(74)
North	0.77	x	1.62	x	13.22	x	1.11	x		=	6.76	(74)
North	0.77	x	1.1	x	13.22	x	1.11	x		=	4.59	(74)
North	0.77	x	1.8	x	8.94	x	1.11	x		=	5.08	(74)
North	0.77	x	1.62	x	8.94	x	1.11	x		=	4.57	(74)
North	0.77	x	1.1	x	8.94	x	1.11	x		=	3.11	(74)
South	0.77	x	3.15	x	47.32	x	0.41	x		=	47.06	(78)
South	0.77	x	3.15	x	77.18	x	0.41	x		=	76.76	(78)
South	0.77	x	3.15	x	94.25	x	0.41	x		=	93.72	(78)

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South	0.77	x	3.15	x	105.11	x	0.41	x		=	104.53	(78)
South	0.77	x	3.15	x	108.55	x	0.41	x		=	107.95	(78)
South	0.77	x	3.15	x	108.9	x	0.41	x		=	108.29	(78)
South	0.77	x	3.15	x	107.14	x	0.41	x		=	106.54	(78)
South	0.77	x	3.15	x	103.88	x	0.41	x		=	103.31	(78)
South	0.77	x	3.15	x	99.99	x	0.41	x		=	99.44	(78)
South	0.77	x	3.15	x	85.29	x	0.41	x		=	84.82	(78)
South	0.77	x	3.15	x	56.07	x	0.41	x		=	55.76	(78)
South	0.77	x	3.15	x	40.89	x	0.41	x		=	40.66	(78)
West	0.77	x	0.85	x	19.87	x	0.41	x		=	16	(80)
West	0.77	x	0.85	x	38.52	x	0.41	x		=	31.01	(80)
West	0.77	x	0.85	x	61.57	x	0.41	x		=	49.56	(80)
West	0.77	x	0.85	x	91.41	x	0.41	x		=	73.59	(80)
West	0.77	x	0.85	x	111.22	x	0.41	x		=	89.54	(80)
West	0.77	x	0.85	x	116.05	x	0.41	x		=	93.43	(80)
West	0.77	x	0.85	x	112.64	x	0.41	x		=	90.68	(80)
West	0.77	x	0.85	x	98.03	x	0.41	x		=	78.92	(80)
West	0.77	x	0.85	x	73.6	x	0.41	x		=	59.25	(80)
West	0.77	x	0.85	x	46.91	x	0.41	x		=	37.76	(80)
West	0.77	x	0.85	x	24.71	x	0.41	x		=	19.89	(80)
West	0.77	x	0.85	x	16.39	x	0.41	x		=	13.2	(80)
Rooflights 0.9x	1	x	0.43	x	26	x	0.6	x	0.7	=	4.23	(82)
Rooflights 0.9x	1	x	0.43	x	54	x	0.6	x	0.7	=	8.78	(82)
Rooflights 0.9x	1	x	0.43	x	94	x	0.6	x	0.7	=	15.28	(82)
Rooflights 0.9x	1	x	0.43	x	150	x	0.6	x	0.7	=	24.38	(82)
Rooflights 0.9x	1	x	0.43	x	190	x	0.6	x	0.7	=	30.88	(82)
Rooflights 0.9x	1	x	0.43	x	201	x	0.6	x	0.7	=	32.67	(82)
Rooflights 0.9x	1	x	0.43	x	194	x	0.6	x	0.7	=	31.53	(82)
Rooflights 0.9x	1	x	0.43	x	164	x	0.6	x	0.7	=	26.66	(82)
Rooflights 0.9x	1	x	0.43	x	116	x	0.6	x	0.7	=	18.85	(82)
Rooflights 0.9x	1	x	0.43	x	68	x	0.6	x	0.7	=	11.05	(82)
Rooflights 0.9x	1	x	0.43	x	33	x	0.6	x	0.7	=	5.36	(82)
Rooflights 0.9x	1	x	0.43	x	21	x	0.6	x	0.7	=	3.41	(82)

Solar gains in watts, calculated for each month

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

(83)m= 82.59 145.59 206.09 280.47 335.7 354.38 341.66 296.74 236.17 169.04 99.87 70.04 (83)

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

(84)m= 553.38 612.22 654.97 702.18 729.82 723.53 696.38 659.04 614.2 574.41 535.59 528.66 (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
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

SAP WorkSheet: New dwelling design stage



(86)m=	0.99	0.98	0.97	0.94	0.87	0.73	0.54	0.56	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=	19.41	19.58	19.88	20.22	20.61	20.87	20.97	20.97	20.78	20.34	19.77	19.45	(87)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(88)m=	19.56	19.57	19.57	19.59	19.6	19.61	19.61	19.6	19.59	19.58	19.57	(88)
--------	-------	-------	-------	-------	------	-------	-------	------	-------	-------	-------	------

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

(89)m=	0.99	0.98	0.96	0.92	0.81	0.62	0.37	0.39	0.72	0.92	0.98	0.99	(89)
--------	------	------	------	------	------	------	------	------	------	------	------	------	------

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

(90)m=	18.18	18.35	18.65	18.98	19.35	19.55	19.61	19.61	19.49	19.11	18.55	18.22	(90)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =	0.49	(91)
---------------------------	------	------

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

(92)m=	18.78	18.95	19.25	19.59	19.97	20.2	20.28	20.28	20.13	19.72	19.15	18.83	(92)
--------	-------	-------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------	------

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

(93)m=	18.63	18.8	19.1	19.44	19.82	20.05	20.13	20.13	19.98	19.57	19	18.68	(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	0.92	0.82	0.65	0.44	0.46	0.75	0.92	0.97	0.98	(94)
--------	------	------	------	------	------	------	------	------	------	------	------	------	------

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

(95)m=	543.56	596.06	625.14	644.65	601.42	473.69	303.26	301.56	460.87	527.05	521.08	519.82	(95)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Monthly average external temperature from Table 8

(96)m=	4.5	5	6.8	8.7	11.7	14.6	16.9	16.9	14.3	10.8	7	4.9	(96)
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Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m – (96)m]

(97)m=	1422.15	1376.75	1227.34	1054.05	789.25	527.06	310.92	310.63	553.06	860.21	1186.77	1374.17	(97)
--------	---------	---------	---------	---------	--------	--------	--------	--------	--------	--------	---------	---------	------

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

(98)m=	653.67	524.62	448.03	294.77	139.75	0	0	0	0	247.87	479.3	635.64	(98)
--------	--------	--------	--------	--------	--------	---	---	---	---	--------	-------	--------	------

Total per year (kWh/year) = Sum(98) _{1...5,9...12} =	3423.64	(98)
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Space heating requirement in kWh/m²/year

57.05	(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

90	(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)

653.67	524.62	448.03	294.77	139.75	0	0	0	0	247.87	479.3	635.64
--------	--------	--------	--------	--------	---	---	---	---	--------	-------	--------

$$(211)m = \{[(98)m \times (204)] + (210)m\} \times 100 \div (206) \quad (211)$$

726.3	582.91	497.81	327.52	155.27	0	0	0	0	275.41	532.55	706.26
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Total (kWh/year) =Sum(211) _{1...5,10...12} =	3804.04	(211)
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Space heating fuel (secondary), kWh/month

$$= \{[(98)m \times (201)] + (214) m\} \times 100 \div (208)$$

(215)m=	0	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)

	178.45	155.88	162.18	143.84	139.26	122.65	117.5	130.99	132.44	150.81	161	174.25	
Efficiency of water heater													79.9 (216)
(217)m=	87.62	87.47	87.07	86.42	84.66	79.9	79.9	79.9	79.9	85.89	87.23	87.62	(217)

Fuel for water heating, kWh/month

$$(219)m = (64)m \times 100 \div (217)m$$

(219)m=	203.65	178.21	186.25	166.45	164.5	153.5	147.06	163.94	165.76	175.58	184.57	198.88	
Total = Sum(219a) _{1..12} =													2088.36 (219)

Annual totals

	kWh/year	kWh/year
Space heating fuel used, main system 1		3804.04
Water heating fuel used		2088.36
Electricity for pumps, fans and electric keep-hot		
central heating pump:	130	(230c)
boiler with a fan-assisted flue	45	(230e)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	175 (231)
Electricity for lighting		278.41 (232)
Electricity generated by PVs		-548.08 (233)

10a. Fuel costs - individual heating systems:

	Fuel kWh/year	Fuel Price (Table 12)	Fuel Cost £/year
Space heating - main system 1	(211) x	3.1	117.93 (240)
Space heating - main system 2	(213) x	0	0 (241)
Space heating - secondary	(215) x	0	0 (242)
Water heating cost (other fuel)	(219)	3.1	64.74 (247)
Pumps, fans and electric keep-hot	(231)	11.46	20.06 (249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a			
Energy for lighting	(232)	11.46	31.91 (250)
Additional standing charges (Table 12)			106 (251)
	one of (233) to (235) x	11.46	-62.81 (252)
Appendix Q items: repeat lines (253) and (254) as needed			
Total energy cost	(245)...(247) + (250)...(254) =		277.82 (255)

11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.47 (256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.24 (257)

SAP WorkSheet: New dwelling design stage



SAP rating (Section 12)

82.65 (258)

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

	Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year
Space heating (main system 1)	(211) x	0.198	=	753.2 (261)
Space heating (secondary)	(215) x	0	=	0 (263)
Water heating	(219) x	0.198	=	413.5 (264)
Space and water heating	(261) + (262) + (263) + (264) =			1166.7 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.517	=	90.48 (267)
Electricity for lighting	(232) x	0.517	=	143.94 (268)
Energy saving/generation technologies Item 1		0.529	=	-289.93 (269)
Total CO2, kg/year		sum of (265)...(271) =		1111.18 (272)
CO2 emissions per m²		(272) ÷ (4) =		18.52 (273)
EI rating (section 14)				86 (274)

13a. Primary Energy

	Energy kWh/year	Primary factor		P. Energy kWh/year
Space heating (main system 1)	(211) x	1.02	=	3880.12 (261)
Space heating (secondary)	(215) x	0	=	0 (263)
Energy for water heating	(219) x	1.02	=	2130.13 (264)
Space and water heating	(261) + (262) + (263) + (264) =			6010.25 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	2.92	=	511 (267)
Electricity for lighting	(232) x	0	=	812.97 (268)
Energy saving/generation technologies Item 1		2.92	=	-1600.39 (269)
'Total Primary Energy		sum of (265)...(271) =		5733.82 (272)
Primary energy kWh/m²/year		(272) ÷ (4) =		95.55 (273)

Predicted Energy Assessment

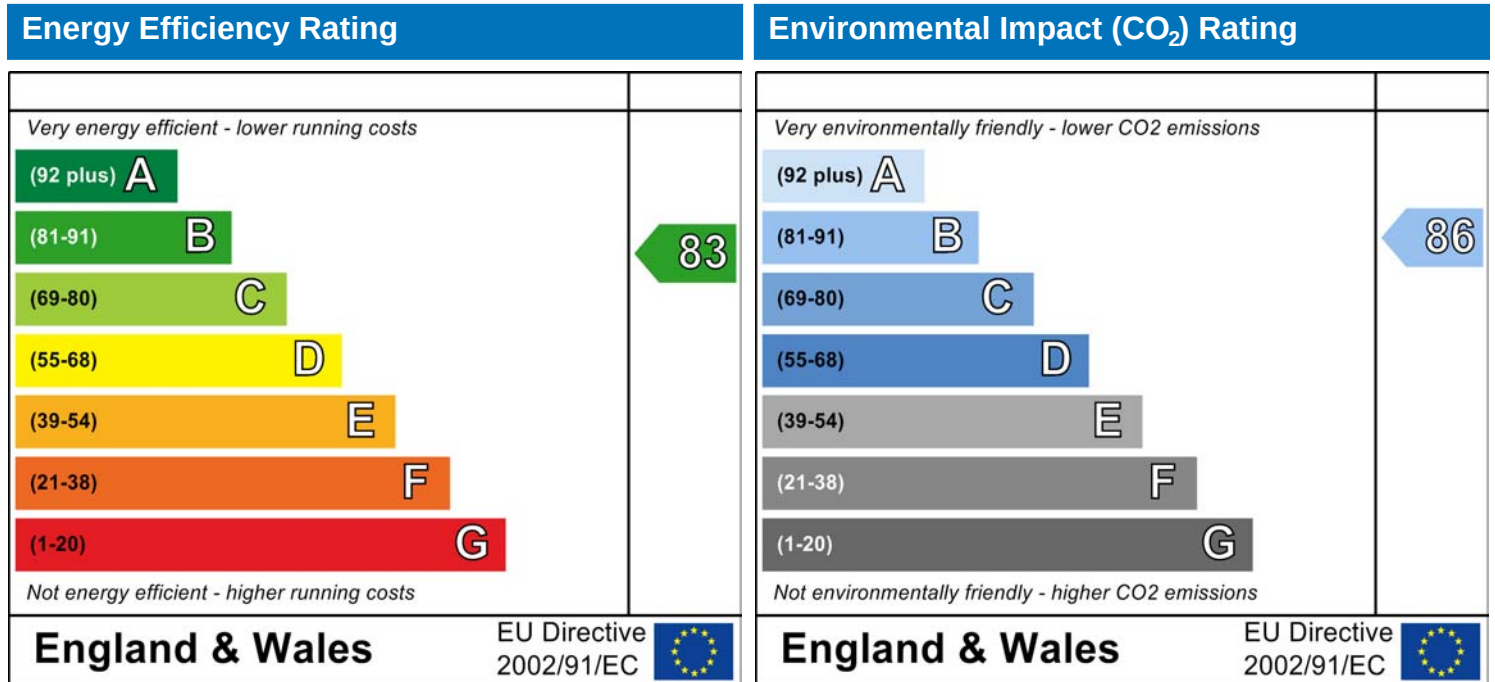
Plot 1 Twittens Way
HAVANT
PO9 1FH

Dwelling type:
Date of assessment:
Produced by:
Total floor area:

Semi-detached House
21 August 2012
Michael Hodgkinson
60.01 m²

This is a Predicted Energy Assessment for a property which is not yet complete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, an Energy Performance Certificate is required providing information about the energy performance of the completed property.

Energy performance has been assessed using the SAP 2009 methodology and is rated in terms of the energy use per square metre of floor area, energy efficiency based on fuel costs and environmental impact based on carbon dioxide (CO₂) emissions.



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO₂) emissions. The higher the rating the less impact it has on the environment.

Code for Sustainable Homes Report



Assessor and House Details

Assessor Name: Michael Hodgkinson
Property Address: Plot 1 Twittens Way
 HAVANT
 PO9 1FH
Assessor Number: STRO002448

Buiding regulation assessment

kg/m²/year
 TER 21.92
 DER 20.57
The following code calculations are taken from the Code for Sustainable Homes Technical Guide (Nov 10)

Ene 1 Assessment - Dwelling Emission Rate

Total Energy Type CO2 Emissions for Codes Levels 1 - 5

	%	kg/m ² /year	
DER from SAP 2009 DER Worksheet		20.57	(ZC1)
TER		21.92	
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		20.57	
% improvement DER/TER	6.2		

Total Energy Type CO2 Emissions for Codes Levels 6

	kg/m ² /year	
DER accounting for SAP Section 16 allowances	20.57	(ZC1)
CO2 emissions from appliances, equation (L14)	17.01	(ZC2)
CO2 emissions from cooking, equation (L16)	2.78	(ZC3)
Net CO2 emissions	40.4	(ZC8)

Result:

Credits awarded for Ene 1 = 0.8

Code Level = 3

Ene 2 - Fabric energy Efficiency

Fabric energy Efficiency: 71.31

Credits awarded for Ene 2 = 0

Ene 7 - Low or Zero Carbon (LZC) Technologies

Reduction in CO2 Emissions

	%	kg/m ² /year	
Standard Case CO2 emissions		46.31	
Standard DER		26.52	
Actual Case CO2 emissions		41.48	
Actual DER		21.69	
Reduction in CO2 emissions	10.43		

Credits awarded for Ene 7 = 1

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.

Regulations Compliance Report



Approved Document L1A 2010 edition assessed by Stroma FSAP 2009 program, Version: 1.5.0.37

Printed on 24 April 2013 at 07:22:46

Project Information:

Assessed By: Michael Hodgkinson (STRO002448)

Building Type: Semi-detached House

Dwelling Details:

NEW DWELLING DESIGN STAGE

Site Reference : Plot 1

Plot Reference: 356-1

Address : , Plot 1 Twittens Way, HAVANT, PO9 1FH

Client Details:

Name:

Address :

This report covers items included within the SAP calculations.

It is not a complete report of regulations compliance.

1 TER and DER

Fuel for main heating system: Natural gas

Fuel factor: 1.00 (natural gas)

Target Carbon Dioxide Emission Rate (TER) 21.92 kg/m²

Dwelling Carbon Dioxide Emission Rate (DER) 20.57 kg/m² **OK**

2 Fabric U-values

Element	Average	Highest	
External wall	0.30 (max. 0.30)	0.30 (max. 0.70)	OK
Party wall	0.20 (max. 0.20)	-	OK
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	OK
Roof	0.14 (max. 0.20)	0.15 (max. 0.35)	OK
Openings	1.51 (max. 2.00)	1.60 (max. 3.30)	OK

3 Air permeability

Air permeability at 50 pascals	7.00	
Maximum	10.0	OK

4 Heating efficiency

Main Heating system:	Database: (rev 336, product index 010547): Boiler system with radiators or underfloor - mains gas Brand name: Broag Remeha Model: Avanta Plus Model qualifier: 28c (Combi boiler) Efficiency 89.1 % SEDBUK2009 Minimum 88.0 %	OK
Secondary heating system:	None	

5 Cylinder insulation

Hot water Storage:	No cylinder
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6 Controls

Space heating controls	Programmer, room thermostat and TRVs	OK
Hot water controls:	No cylinder	
Boiler interlock:	Yes	OK

Regulations Compliance Report



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 (South England):	Slight	OK
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Based on:

Overshading:	Average or unknown
Windows facing: North	1.8m ² ,
Windows facing: North	1.62m ² ,
Windows facing: North	1.1m ² ,
Windows facing: West	2.55m ² ,
Windows facing: South	3.15m ² ,
Roof windows facing: West	0.43m ²
Ventilation rate:	4.00
Blinds/curtains:	Dark-coloured curtain or roller blind shutter closed 50% of daylight hours

10 Key features

Doors U-value	1.1 W/m ² K
External Walls U-value	0.18 W/m ² K
Floors U-value	0.19 W/m ² K
Photovoltaic array	

SAP Input



Property Details: Plot 1

Address: , Plot 1 Twittens Way, HAVANT, PO9 1FH
Located in: England
Region: South England
UPRN:
Date of assessment: 21 August 2012
Date of certificate: 24 April 2013
Assessment type: New dwelling design stage
Transaction type: Marketed sale
Tenure type: Unknown
Related party disclosure: No related party
Thermal Mass Parameter: Indicative Value Medium
Dwelling designed to use less than 125 litres per Person per day: True

Property description:

Dwelling type: House
Detachment: Semi-detached
Year Completed: 2012
Floor Location: **Floor area:** **Storey height:**
 Floor 0 32.41 m² 2.625 m
 Floor 1 27.6 m² 2.2 m
Living area: 29.5 m² (fraction 0.492)
Front of dwelling faces: North

Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
entrance	Manufacturer	Solid			
wg01	BFRC	Windows	low-E, En = 0.05, soft coat	No	
wf02	BFRC	Windows	low-E, En = 0.05, soft coat	Yes	
wf01	BFRC	Windows	low-E, En = 0.05, soft coat	Yes	
wg02,03,04	BFRC	Windows	low-E, En = 0.05, soft coat	Yes	
d2g02	BFRC	Windows	low-E, En = 0.05, soft coat	Yes	
w1f01	Manufacturer	Roof Windows	low-E, En = 0.05, soft coat	Yes	Wood

Name:	Gap:	Frame Factor:	g-value:	U-value:	Area:	No. of Openings:
entrance	mm	0	0	1.1	2.1	1
wg01	16mm or more	0	0.41	1.6	1.8	1
wf02	16mm or more	0	0.41	1.6	1.62	1
wf01	16mm or more	0	0.41	1.6	1.1	1
wg02,03,04	16mm or more	0	0.41	1.6	0.85	3
d2g02	16mm or more	0	0.41	1.6	3.15	1
w1f01	16mm or more	0.7	0.6	1.5	0.43	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
entrance		external walls	East	1	2.1
wg01		external walls	North	1.2	1.5
wf02		external walls	North	1.2	1.35
wf01		external walls	North	0.915	1.2
wg02,03,04		external walls	West	0.63	1.35
d2g02		external walls	South	1.5	2.1
w1f01		pitched roof	West	0.55	0.78

Overshading: Average or unknown

Opaque Elements:

Type: **Gross area:** **Openings:** **Net area:** **U-value:** **Ru value:** **Curtain wall:** **Kappa:**

SAP Input



External Elements

external walls	83.92	12.32	71.6	0.3	0	False	N/A
dormer cheeks	1.547	0	1.55	0.18	0	False	N/A
Flat Ceiling	23.43	0	23.43	0.14	0		N/A
pitched roof	14	0.43	13.57	0.15	0		N/A
ground floor	32.41			0.19			N/A

Internal Elements

Party Elements

party wall	24.23						N/A
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Thermal bridges:

Thermal bridges:	User-defined (individual PSI-values)		
	Length	PSI-value	
	7.7	0.3	Other lintels (including other steel lintels)
	7.7	0.04	Sill
	24.6	0.05	Jamb
	19.167	0.16	Ground floor
	10.4	0.07	Intermediate floor between dwellings
	10	0.04	Eaves (insulation at rafter level)
	6	0.24	Gable (insulation at ceiling level)
	11	0.04	Gable (insulation at rafter level)
	15.1	0.09	Corner (normal)
	8.3	0.06	Party wall between dwellings
	2	0.12	Roof (insulation at ceiling level)
	2.4	0.02	Roof (insulation at rafter level)

Ventilation:

Pressure test:	Yes (As designed)
Ventilation:	Natural ventilation (extract fans)
Number of chimneys:	0
Number of open flues:	0
Number of fans:	3
Number of sides sheltered:	3
Pressure test:	7

Main heating system:

Main heating system:	Central heating systems with radiators or underfloor heating
	Gas boilers and oil boilers
	Fuel: mains gas
	Info Source: Boiler Database
	Database: (rev 336, product index 010547) SEDBUK2009 89.1%
	Brand name: Broag Remeha
	Model: Avanta Plus
	Model qualifier: 28c
	(Combi boiler)
	Systems with radiators
	Pump in heat space: Yes
	Delayed start

Main heating Control:

Main heating Control:	Programmer, room thermostat and TRVs
	Control code: 2106
	Boiler interlock: Yes

Secondary heating system:

Secondary heating system:	None
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Water heating:

Water heating:	From main heating system
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SAP Input



Water code: 901
Fuel :mains gas
No hot water cylinder
Solar panel: False

Others:

Electricity tariff:	standard tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Low rise urban / suburban
EPC language:	English
Wind turbine:	No
Photovoltaics:	<u>Photovoltaic 1</u> Installed Peak power: 1 Tilt of collector: 45° Overshading: Significant Collector Orientation: South
Assess Zero Carbon Home:	No

SAP WorkSheet: New dwelling design stage



User Details:

Assessor Name: Michael Hodgkinson **Stroma Number:** STRO002448
Software Name: Stroma FSAP 2009 **Software Version:** Version: 1.5.0.37

Property Address: Plot 1

Address : , Plot 1 Twittens Way, HAVANT, PO9 1FH

1. Overall dwelling dimensions:

	Area(m ²)		Ave Height(m)		Volume(m ³)
Ground floor	32.41	(1a) x	2.625	(2a) =	85.08
First floor	27.6	(1b) x	2.2	(2b) =	60.72
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	60.01	(4)			
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	145.8

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) =	0.21
<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			7
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)			0.56
<i>Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used</i>			
Number of sides on which sheltered			3
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.78
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.43

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=	5.4	5.1	5.1	4.5	4.1	3.9	3.7	3.7	4.2	4.5	4.8	5.1
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SAP WorkSheet: New dwelling design stage



Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.35	1.27	1.27	1.12	1.02	0.98	0.92	0.92	1.05	1.12	1.2	1.27
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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

	0.58	0.55	0.55	0.48	0.44	0.42	0.4	0.4	0.45	0.48	0.52	0.55
--	------	------	------	------	------	------	-----	-----	------	------	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

(23a)

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

(23b)

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

(23c)

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

(24a)m= 0 0 0 0 0 0 0 0 0 0 0 0 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= 0.67 0.65 0.65 0.62 0.6 0.59 0.58 0.58 0.6 0.62 0.63 0.65 (24d)

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

(25)m= 0.67 0.65 0.65 0.62 0.6 0.59 0.58 0.58 0.6 0.62 0.63 0.65 (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			2.1	x 1.1	= 2.31		(26)
Windows Type 1			1.8	x 1/[1/(1.6) + 0.04]	= 2.71		(27)
Windows Type 2			1.62	x 1/[1/(1.6) + 0.04]	= 2.44		(27)
Windows Type 3			1.1	x 1/[1/(1.6) + 0.04]	= 1.65		(27)
Windows Type 4			0.85	x 1/[1/(1.6) + 0.04]	= 1.28		(27)
Windows Type 5			3.15	x 1/[1/(1.6) + 0.04]	= 4.74		(27)
Rooflights			0.43	x 1/[1/(1.5) + 0.04]	= 0.645		(27b)
Floor			32.41	x 0.19	= 6.1579		(28)
Walls Type1	83.92	12.32	71.6	x 0.3	= 21.48		(29)
Walls Type2	1.55	0	1.55	x 0.18	= 0.28		(29)
Roof Type1	23.43	0	23.43	x 0.14	= 3.28		(30)
Roof Type2	14	0.43	13.57	x 0.15	= 2.04		(30)
Total area of elements, m²			155.31				(31)
Party wall			24.23	x 0.2	= 4.85		(32)

* 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) = 56.36 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 15213.77 (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

SAP WorkSheet: New dwelling design stage



can be used instead of a detailed calculation.

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

12.07 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss

(33) + (36) =

68.43 (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=	32.19	31.31	31.31	29.7	28.75	28.3	27.87	27.87	28.98	29.7	30.48	31.31

(38)

Heat transfer coefficient, W/K

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

(39)m=	100.62	99.74	99.74	98.14	97.18	96.73	96.31	96.31	97.41	98.14	98.92	99.74
--------	--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

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

98.25 (39)

Heat loss parameter (HLP), W/m²K

(40)m = (39)m ÷ (4)

(40)m=	1.68	1.66	1.66	1.64	1.62	1.61	1.6	1.6	1.62	1.64	1.65	1.66
--------	------	------	------	------	------	------	-----	-----	------	------	------	------

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

1.64 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

1.98

(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

81.27

(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=	89.4	86.15	82.9	79.65	76.39	73.14	73.14	76.39	79.65	82.9	86.15	89.4
--------	------	-------	------	-------	-------	-------	-------	-------	-------	------	-------	------

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

975.25 (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=	132.89	116.23	119.94	104.56	100.33	86.58	80.23	92.06	93.16	108.57	118.51	128.7
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Total = Sum(45)_{1...12} =

1281.76 (45)

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

(46)m=	19.93	17.43	17.99	15.68	15.05	12.99	12.03	13.81	13.97	16.29	17.78	19.3
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(46)

Water storage loss:

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

0

(47)

Temperature factor from Table 2b

0

(48)

Energy lost from water storage, kWh/year

(47) x (48) =

0

(49)

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

Cylinder volume (litres) including any solar storage within same

0

(50)

If community heating and no tank in dwelling, enter 110 litres in box (50)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in box (50)

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

0

(51)

Volume factor from Table 2a

0

(52)

Temperature factor from Table 2b

0

(53)

Energy lost from water storage, kWh/year

((50) x (51) x (52) x (53) =

0

(54)

SAP WorkSheet: New dwelling design stage



Enter (49) 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

(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=	45.56	39.65	42.24	39.28	38.93	36.07	37.27	38.93	39.28	42.24	42.48	45.56
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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=	178.45	155.88	162.18	143.84	139.26	122.65	117.5	130.99	132.44	150.81	161	174.25
--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	-----	--------

(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=	178.45	155.88	162.18	143.84	139.26	122.65	117.5	130.99	132.44	150.81	161	174.25
--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	-----	--------

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

(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=	55.58	48.56	50.44	44.59	43.09	37.8	35.99	40.34	40.8	46.66	50.03	54.18
--------	-------	-------	-------	-------	-------	------	-------	-------	------	-------	-------	-------

(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=	118.92	118.92	118.92	118.92	118.92	118.92	118.92	118.92	118.92	118.92	118.92	118.92

(66)

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

(67)m=	39.41	35.01	28.47	21.55	16.11	13.6	14.7	19.1	25.64	32.56	38	40.51
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(67)

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

(68)m=	258.17	260.85	254.1	239.72	221.58	204.53	193.14	190.46	197.21	211.58	229.73	246.78
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(68)

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

(69)m=	48.87	48.87	48.87	48.87	48.87	48.87	48.87	48.87	48.87	48.87	48.87	48.87
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(69)

Pumps and fans gains (Table 5a)

(70)m=	10	10	10	10	10	10	10	10	10	10	10	10
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(70)

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

(71)m=	-79.28	-79.28	-79.28	-79.28	-79.28	-79.28	-79.28	-79.28	-79.28	-79.28	-79.28	-79.28
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

(71)

Water heating gains (Table 5)

(72)m=	74.7	72.26	67.8	61.93	57.92	52.51	48.38	54.22	56.66	62.72	69.48	72.82
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(72)

Total internal gains =

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

(73)m=	470.79	466.62	448.87	421.71	394.12	369.15	354.73	362.3	378.02	405.37	435.72	458.62
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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)	
North	0.77	x	1.8	x	10.73	x	1.11	x		=	6.1	(74)
North	0.77	x	1.62	x	10.73	x	1.11	x		=	5.49	(74)
North	0.77	x	1.1	x	10.73	x	1.11	x		=	3.72	(74)
North	0.77	x	1.8	x	20.36	x	1.11	x		=	11.57	(74)
North	0.77	x	1.62	x	20.36	x	1.11	x		=	10.41	(74)
North	0.77	x	1.1	x	20.36	x	1.11	x		=	7.07	(74)
North	0.77	x	1.8	x	33.31	x	1.11	x		=	18.93	(74)
North	0.77	x	1.62	x	33.31	x	1.11	x		=	17.04	(74)
North	0.77	x	1.1	x	33.31	x	1.11	x		=	11.57	(74)
North	0.77	x	1.8	x	54.64	x	1.11	x		=	31.05	(74)
North	0.77	x	1.62	x	54.64	x	1.11	x		=	27.94	(74)
North	0.77	x	1.1	x	54.64	x	1.11	x		=	18.97	(74)
North	0.77	x	1.8	x	75.22	x	1.11	x		=	42.74	(74)
North	0.77	x	1.62	x	75.22	x	1.11	x		=	38.47	(74)
North	0.77	x	1.1	x	75.22	x	1.11	x		=	26.12	(74)
North	0.77	x	1.8	x	84.09	x	1.11	x		=	47.78	(74)
North	0.77	x	1.62	x	84.09	x	1.11	x		=	43.01	(74)
North	0.77	x	1.1	x	84.09	x	1.11	x		=	29.2	(74)
North	0.77	x	1.8	x	79.12	x	1.11	x		=	44.96	(74)
North	0.77	x	1.62	x	79.12	x	1.11	x		=	40.46	(74)
North	0.77	x	1.1	x	79.12	x	1.11	x		=	27.48	(74)
North	0.77	x	1.8	x	61.56	x	1.11	x		=	34.98	(74)
North	0.77	x	1.62	x	61.56	x	1.11	x		=	31.49	(74)
North	0.77	x	1.1	x	61.56	x	1.11	x		=	21.38	(74)
North	0.77	x	1.8	x	41.09	x	1.11	x		=	23.35	(74)
North	0.77	x	1.62	x	41.09	x	1.11	x		=	21.01	(74)
North	0.77	x	1.1	x	41.09	x	1.11	x		=	14.27	(74)
North	0.77	x	1.8	x	24.81	x	1.11	x		=	14.1	(74)
North	0.77	x	1.62	x	24.81	x	1.11	x		=	12.69	(74)
North	0.77	x	1.1	x	24.81	x	1.11	x		=	8.62	(74)
North	0.77	x	1.8	x	13.22	x	1.11	x		=	7.51	(74)
North	0.77	x	1.62	x	13.22	x	1.11	x		=	6.76	(74)
North	0.77	x	1.1	x	13.22	x	1.11	x		=	4.59	(74)
North	0.77	x	1.8	x	8.94	x	1.11	x		=	5.08	(74)
North	0.77	x	1.62	x	8.94	x	1.11	x		=	4.57	(74)
North	0.77	x	1.1	x	8.94	x	1.11	x		=	3.11	(74)
South	0.77	x	3.15	x	47.32	x	0.41	x		=	47.06	(78)
South	0.77	x	3.15	x	77.18	x	0.41	x		=	76.76	(78)
South	0.77	x	3.15	x	94.25	x	0.41	x		=	93.72	(78)

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South	0.77	x	3.15	x	105.11	x	0.41	x		=	104.53	(78)
South	0.77	x	3.15	x	108.55	x	0.41	x		=	107.95	(78)
South	0.77	x	3.15	x	108.9	x	0.41	x		=	108.29	(78)
South	0.77	x	3.15	x	107.14	x	0.41	x		=	106.54	(78)
South	0.77	x	3.15	x	103.88	x	0.41	x		=	103.31	(78)
South	0.77	x	3.15	x	99.99	x	0.41	x		=	99.44	(78)
South	0.77	x	3.15	x	85.29	x	0.41	x		=	84.82	(78)
South	0.77	x	3.15	x	56.07	x	0.41	x		=	55.76	(78)
South	0.77	x	3.15	x	40.89	x	0.41	x		=	40.66	(78)
West	0.77	x	0.85	x	19.87	x	0.41	x		=	16	(80)
West	0.77	x	0.85	x	38.52	x	0.41	x		=	31.01	(80)
West	0.77	x	0.85	x	61.57	x	0.41	x		=	49.56	(80)
West	0.77	x	0.85	x	91.41	x	0.41	x		=	73.59	(80)
West	0.77	x	0.85	x	111.22	x	0.41	x		=	89.54	(80)
West	0.77	x	0.85	x	116.05	x	0.41	x		=	93.43	(80)
West	0.77	x	0.85	x	112.64	x	0.41	x		=	90.68	(80)
West	0.77	x	0.85	x	98.03	x	0.41	x		=	78.92	(80)
West	0.77	x	0.85	x	73.6	x	0.41	x		=	59.25	(80)
West	0.77	x	0.85	x	46.91	x	0.41	x		=	37.76	(80)
West	0.77	x	0.85	x	24.71	x	0.41	x		=	19.89	(80)
West	0.77	x	0.85	x	16.39	x	0.41	x		=	13.2	(80)
Rooflights 0.9x	1	x	0.43	x	26	x	0.6	x	0.7	=	4.23	(82)
Rooflights 0.9x	1	x	0.43	x	54	x	0.6	x	0.7	=	8.78	(82)
Rooflights 0.9x	1	x	0.43	x	94	x	0.6	x	0.7	=	15.28	(82)
Rooflights 0.9x	1	x	0.43	x	150	x	0.6	x	0.7	=	24.38	(82)
Rooflights 0.9x	1	x	0.43	x	190	x	0.6	x	0.7	=	30.88	(82)
Rooflights 0.9x	1	x	0.43	x	201	x	0.6	x	0.7	=	32.67	(82)
Rooflights 0.9x	1	x	0.43	x	194	x	0.6	x	0.7	=	31.53	(82)
Rooflights 0.9x	1	x	0.43	x	164	x	0.6	x	0.7	=	26.66	(82)
Rooflights 0.9x	1	x	0.43	x	116	x	0.6	x	0.7	=	18.85	(82)
Rooflights 0.9x	1	x	0.43	x	68	x	0.6	x	0.7	=	11.05	(82)
Rooflights 0.9x	1	x	0.43	x	33	x	0.6	x	0.7	=	5.36	(82)
Rooflights 0.9x	1	x	0.43	x	21	x	0.6	x	0.7	=	3.41	(82)

Solar gains in watts, calculated for each month

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

(83)m= 82.59 145.59 206.09 280.47 335.7 354.38 341.66 296.74 236.17 169.04 99.87 70.04 (83)

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

(84)m= 553.38 612.22 654.97 702.18 729.82 723.53 696.38 659.04 614.2 574.41 535.59 528.66 (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
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(86)m=	0.99	0.98	0.97	0.94	0.87	0.73	0.54	0.56	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=	19.41	19.58	19.88	20.22	20.61	20.87	20.97	20.97	20.78	20.34	19.77	19.45	(87)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(88)m=	19.56	19.57	19.57	19.59	19.6	19.61	19.61	19.6	19.59	19.58	19.57	(88)
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Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.96	0.92	0.81	0.62	0.37	0.39	0.72	0.92	0.98	0.99	(89)
--------	------	------	------	------	------	------	------	------	------	------	------	------	------

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

(90)m=	18.18	18.35	18.65	18.98	19.35	19.55	19.61	19.61	19.49	19.11	18.55	18.22	(90)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =	0.49	(91)
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Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.78	18.95	19.25	19.59	19.97	20.2	20.28	20.28	20.13	19.72	19.15	18.83	(92)
--------	-------	-------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------	------

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

(93)m=	18.63	18.8	19.1	19.44	19.82	20.05	20.13	20.13	19.98	19.57	19	18.68	(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
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Utilisation factor for gains, hm:

(94)m=	0.98	0.97	0.95	0.92	0.82	0.65	0.44	0.46	0.75	0.92	0.97	0.98	(94)
--------	------	------	------	------	------	------	------	------	------	------	------	------	------

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

(95)m=	543.56	596.06	625.14	644.65	601.42	473.69	303.26	301.56	460.87	527.05	521.08	519.82	(95)
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Monthly average external temperature from Table 8

(96)m=	4.5	5	6.8	8.7	11.7	14.6	16.9	16.9	14.3	10.8	7	4.9	(96)
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Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1422.15	1376.75	1227.34	1054.05	789.25	527.06	310.92	310.63	553.06	860.21	1186.77	1374.17	(97)
--------	---------	---------	---------	---------	--------	--------	--------	--------	--------	--------	---------	---------	------

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

(98)m=	653.67	524.62	448.03	294.77	139.75	0	0	0	0	247.87	479.3	635.64	(98)
--------	--------	--------	--------	--------	--------	---	---	---	---	--------	-------	--------	------

Total per year (kWh/year) = Sum(98) _{1...5,9...12} =	3423.64	(98)
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Space heating requirement in kWh/m²/year

57.05	(99)
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9a. Energy requirements – Individual heating systems including micro-CHP

Space heating:

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

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

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

Efficiency of main space heating system 1 90 (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)

653.67	524.62	448.03	294.77	139.75	0	0	0	0	247.87	479.3	635.64
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(211)m = {[(98)m x (204)] + (210)m } x 100 ÷ (206) (211)

726.3	582.91	497.81	327.52	155.27	0	0	0	0	275.41	532.55	706.26
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Total (kWh/year) =Sum(211) _{1...5,10...12} =	3804.04	(211)
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Space heating fuel (secondary), kWh/month

$$= \{[(98)m \times (201)] + (214) m\} \times 100 \div (208)$$

(215)m=	0	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)

	178.45	155.88	162.18	143.84	139.26	122.65	117.5	130.99	132.44	150.81	161	174.25	
Efficiency of water heater													79.9 (216)
(217)m=	87.62	87.47	87.07	86.42	84.66	79.9	79.9	79.9	79.9	85.89	87.23	87.62	(217)

Fuel for water heating, kWh/month

$$(219)m = (64)m \times 100 \div (217)m$$

(219)m=	203.65	178.21	186.25	166.45	164.5	153.5	147.06	163.94	165.76	175.58	184.57	198.88	
Total = Sum(219a) _{1..12} =													2088.36 (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:

130 (230c)

boiler with a fan-assisted flue

45 (230e)

Total electricity for the above, kWh/year

sum of (230a)...(230g) = 175 (231)

Electricity for lighting

278.41 (232)

Electricity generated by PVs

-548.08 (233)

10a. Fuel costs - individual heating systems:

	Fuel kWh/year	Fuel Price (Table 12)	Fuel Cost £/year
Space heating - main system 1	(211) x	3.1 x 0.01 =	117.93 (240)
Space heating - main system 2	(213) x	0 x 0.01 =	0 (241)
Space heating - secondary	(215) x	0 x 0.01 =	0 (242)
Water heating cost (other fuel)	(219)	3.1 x 0.01 =	64.74 (247)
Pumps, fans and electric keep-hot	(231)	11.46 x 0.01 =	20.06 (249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a			
Energy for lighting	(232)	11.46 x 0.01 =	31.91 (250)
Additional standing charges (Table 12)			106 (251)
	one of (233) to (235) x	11.46 x 0.01 =	-62.81 (252)

Appendix Q items: repeat lines (253) and (254) as needed

Total energy cost (245)...(247) + (250)...(254) = 277.82 (255)

11a. SAP rating - individual heating systems

Energy cost deflator (Table 12) 0.47 (256)

Energy cost factor (ECF) [(255) x (256)] ÷ [(4) + 45.0] = 1.24 (257)

SAP WorkSheet: New dwelling design stage



SAP rating (Section 12)

82.65 (258)

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

	Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year
Space heating (main system 1)	(211) x	0.198	=	753.2 (261)
Space heating (secondary)	(215) x	0	=	0 (263)
Water heating	(219) x	0.198	=	413.5 (264)
Space and water heating	(261) + (262) + (263) + (264) =			1166.7 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.517	=	90.48 (267)
Electricity for lighting	(232) x	0.517	=	143.94 (268)
Energy saving/generation technologies Item 1		0.529	=	-289.93 (269)
Total CO2, kg/year		sum of (265)...(271) =		1111.18 (272)
CO2 emissions per m²		(272) ÷ (4) =		18.52 (273)
EI rating (section 14)				86 (274)

13a. Primary Energy

	Energy kWh/year	Primary factor		P. Energy kWh/year
Space heating (main system 1)	(211) x	1.02	=	3880.12 (261)
Space heating (secondary)	(215) x	0	=	0 (263)
Energy for water heating	(219) x	1.02	=	2130.13 (264)
Space and water heating	(261) + (262) + (263) + (264) =			6010.25 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	2.92	=	511 (267)
Electricity for lighting	(232) x	0	=	812.97 (268)
Energy saving/generation technologies Item 1		2.92	=	-1600.39 (269)
'Total Primary Energy		sum of (265)...(271) =		5733.82 (272)
Primary energy kWh/m²/year		(272) ÷ (4) =		95.55 (273)

Predicted Energy Assessment

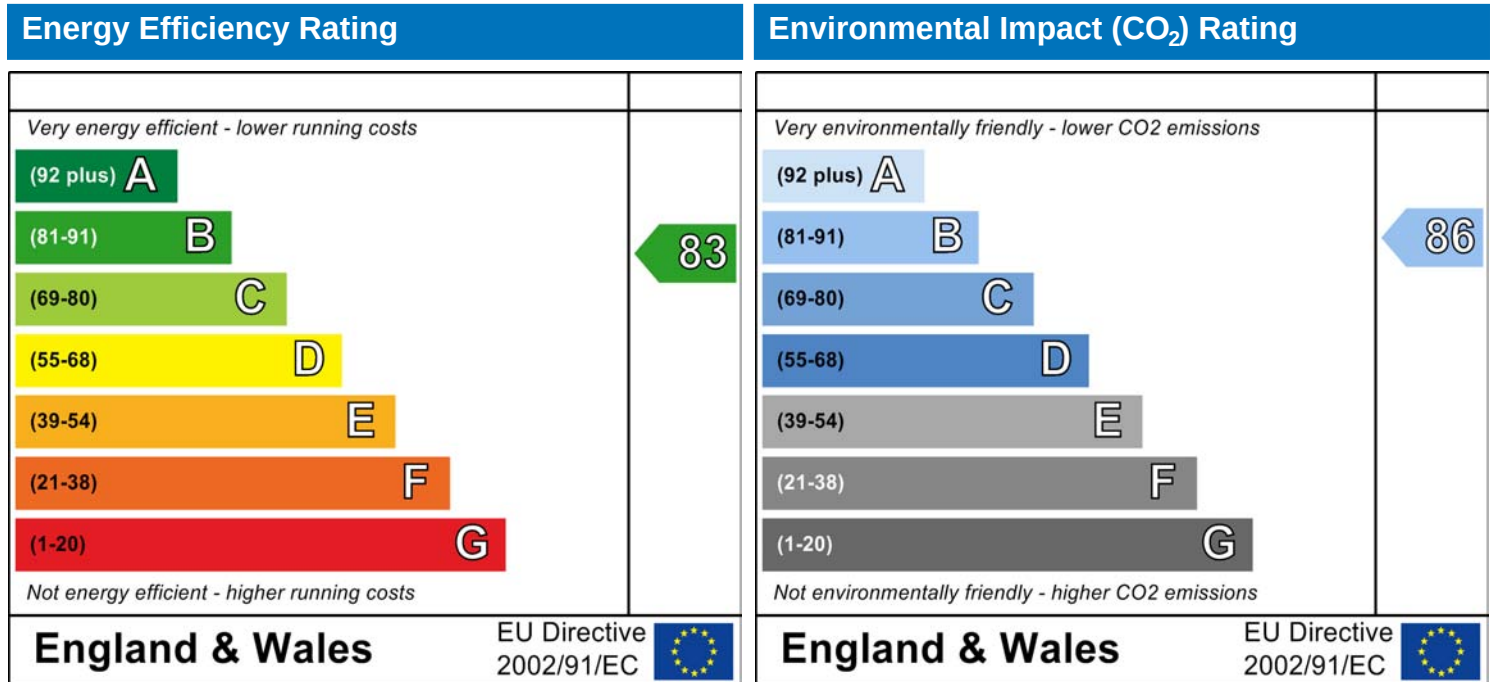
Plot 1 Twittens Way
HAVANT
PO9 1FH

Dwelling type:
Date of assessment:
Produced by:
Total floor area:

Semi-detached House
21 August 2012
Michael Hodgkinson
60.01 m²

This is a Predicted Energy Assessment for a property which is not yet complete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, an Energy Performance Certificate is required providing information about the energy performance of the completed property.

Energy performance has been assessed using the SAP 2009 methodology and is rated in terms of the energy use per square metre of floor area, energy efficiency based on fuel costs and environmental impact based on carbon dioxide (CO₂) emissions.



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO₂) emissions. The higher the rating the less impact it has on the environment.

Code for Sustainable Homes Report



Assessor and House Details

Assessor Name: Michael Hodgkinson
Property Address: Plot 1 Twittens Way
 HAVANT
 PO9 1FH
Assessor Number: STRO002448

Buiding regulation assessment

kg/m²/year
 TER 21.92
 DER 20.57
The following code calculations are taken from the Code for Sustainable Homes Technical Guide (Nov 10)

Ene 1 Assessment - Dwelling Emission Rate

Total Energy Type CO2 Emissions for Codes Levels 1 - 5

	%	kg/m ² /year	
DER from SAP 2009 DER Worksheet		20.57	(ZC1)
TER		21.92	
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		20.57	
% improvement DER/TER	6.2		

Total Energy Type CO2 Emissions for Codes Levels 6

	kg/m ² /year	
DER accounting for SAP Section 16 allowances	20.57	(ZC1)
CO2 emissions from appliances, equation (L14)	17.01	(ZC2)
CO2 emissions from cooking, equation (L16)	2.78	(ZC3)
Net CO2 emissions	40.4	(ZC8)

Result:

Credits awarded for Ene 1 = 0.8

Code Level = 3

Ene 2 - Fabric energy Efficiency

Fabric energy Efficiency: 71.31

Credits awarded for Ene 2 = 0

Ene 7 - Low or Zero Carbon (LZC) Technologies

Reduction in CO2 Emissions

	%	kg/m ² /year	
Standard Case CO2 emissions		46.31	
Standard DER		26.52	
Actual Case CO2 emissions		41.48	
Actual DER		21.69	
Reduction in CO2 emissions	10.43		

Credits awarded for Ene 7 = 1

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.

Regulations Compliance Report



Approved Document L1A 2010 edition assessed by Stroma FSAP 2009 program, Version: 1.5.0.37

Printed on 24 April 2013 at 07:22:41

Project Information:

Assessed By: Michael Hodgkinson (STRO002448)

Building Type: Semi-detached House

Dwelling Details:

NEW DWELLING DESIGN STAGE

Site Reference : Plot 2

Plot Reference: 356-2

Address : , Plot 2 Twittens Way, HAVANT, PO9 1FH

Client Details:

Name:

Address :

This report covers items included within the SAP calculations.

It is not a complete report of regulations compliance.

1 TER and DER

Fuel for main heating system: Natural gas

Fuel factor: 1.00 (natural gas)

Target Carbon Dioxide Emission Rate (TER) 21.56 kg/m²

Dwelling Carbon Dioxide Emission Rate (DER) 19.22 kg/m² **OK**

2 Fabric U-values

Element	Average	Highest	
External wall	0.30 (max. 0.30)	0.30 (max. 0.70)	OK
Party wall	0.20 (max. 0.20)	-	OK
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	OK
Roof	0.14 (max. 0.20)	0.15 (max. 0.35)	OK
Openings	1.35 (max. 2.00)	1.50 (max. 3.30)	OK

3 Air permeability

Air permeability at 50 pascals	7.00	
Maximum	10.0	OK

4 Heating efficiency

Main Heating system:	Database: (rev 336, product index 010547): Boiler system with radiators or underfloor - mains gas Brand name: Broag Remeha Model: Avanta Plus Model qualifier: 28c (Combi boiler) Efficiency 89.1 % SEDBUK2009 Minimum 88.0 %	OK
Secondary heating system:	None	

5 Cylinder insulation

Hot water Storage:	No cylinder
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6 Controls

Space heating controls	Time and temperature zone control	OK
Hot water controls:	No cylinder	
Boiler interlock:	Yes	OK

Regulations Compliance Report



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 (South England):	Slight	OK
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Based on:

Overshading:	Average or unknown
Windows facing: North	1.8m ² ,
Windows facing: North	1.62m ² ,
Windows facing: North	1.1m ² ,
Windows facing: East	2.55m ² ,
Windows facing: South	3.15m ² ,
Roof windows facing: West	0.43m ²
Ventilation rate:	4.00
Blinds/curtains:	Dark-coloured curtain or roller blind shutter closed 50% of daylight hours

10 Key features

Windows U-value	1.4 W/m ² K
Doors U-value	1.1 W/m ² K
External Walls U-value	0.18 W/m ² K
Floors U-value	0.19 W/m ² K
Photovoltaic array	

SAP Input



Property Details: Plot 2

Address: , Plot 2 Twittens Way, HAVANT, PO9 1FH
Located in: England
Region: South England
UPRN:
Date of assessment: 21 August 2012
Date of certificate: 24 April 2013
Assessment type: New dwelling design stage
Transaction type: Marketed sale
Tenure type: Unknown
Related party disclosure: No related party
Thermal Mass Parameter: Indicative Value Medium
Dwelling designed to use less than 125 litres per Person per day: True

Property description:

Dwelling type: House
Detachment: Semi-detached
Year Completed: 2013
Floor Location: **Floor area:** **Storey height:**
 Floor 0 31.83 m² 2.625 m
 Floor 1 27.6 m² 2.2 m
Living area: 29.5 m² (fraction 0.492)
Front of dwelling faces: North

Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
entrance	Manufacturer	Solid			
wg01	BFRC	Windows	low-E, En = 0.05, soft coat	Yes	
wf02	BFRC	Windows	low-E, En = 0.05, soft coat	Yes	
wf01	BFRC	Windows	low-E, En = 0.05, soft coat	Yes	
wg02,03,04	BFRC	Windows	low-E, En = 0.05, soft coat	Yes	
d2g02	BFRC	Windows	low-E, En = 0.05, soft coat	Yes	
w1f01	Manufacturer	Roof Windows	low-E, En = 0.05, soft coat	Yes	Wood

Name:	Gap:	Frame Factor:	g-value:	U-value:	Area:	No. of Openings:
entrance	mm	0	0	1.1	2.1	1
wg01	16mm or more	0	0.41	1.4	1.8	1
wf02	16mm or more	0	0.41	1.4	1.62	1
wf01	16mm or more	0	0.41	1.4	1.1	1
wg02,03,04	16mm or more	0	0.41	1.4	0.85	3
d2g02	16mm or more	0	0.41	1.4	3.15	1
w1f01	16mm or more	0.7	0.6	1.5	0.43	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
entrance		external walls	East	1	2.1
wg01		external walls	North	1.2	1.5
wf02		external walls	North	1.2	1.35
wf01		external walls	North	0.915	1.2
wg02,03,04		external walls	East	0.63	1.35
d2g02		external walls	South	1.5	2.1
w1f01		pitched roof	West	0.55	0.78

Overshading: Average or unknown

Opaque Elements:

Type: **Gross area:** **Openings:** **Net area:** **U-value:** **Ru value:** **Curtain wall:** **Kappa:**

SAP Input



External Elements

external walls	76.28	12.32	63.96	0.3	0	False	N/A
dormer cheeks	1.547	0	1.55	0.18	0	False	N/A
Flat Ceiling	23.43	0	23.43	0.14	0		N/A
pitched roof	14	0.43	13.57	0.15	0		N/A
ground floor	32.41			0.19			N/A

Internal Elements

Party Elements

party wall	24.23						N/A
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Thermal bridges:

Thermal bridges:	User-defined (individual PSI-values)		
	Length	PSI-value	
	7.7	0.3	Other lintels (including other steel lintels)
	7.7	0.04	Sill
	24.6	0.05	Jamb
	19.167	0.16	Ground floor
	10.4	0.07	Intermediate floor between dwellings
	10	0.04	Eaves (insulation at rafter level)
	6	0.24	Gable (insulation at ceiling level)
	11	0.04	Gable (insulation at rafter level)
	15.1	0.09	Corner (normal)
	8.3	0.06	Party wall between dwellings
	2	0.12	Roof (insulation at ceiling level)
	2.4	0.02	Roof (insulation at rafter level)

Ventilation:

Pressure test:	Yes (As designed)
Ventilation:	Natural ventilation (extract fans)
Number of chimneys:	0
Number of open flues:	0
Number of fans:	3
Number of sides sheltered:	3
Pressure test:	7

Main heating system:

Main heating system:	Central heating systems with radiators or underfloor heating
	Gas boilers and oil boilers
	Fuel: mains gas
	Info Source: Boiler Database
	Database: (rev 336, product index 010547) SEDBUK2009 89.1%
	Brand name: Broag Remeha
	Model: Avanta Plus
	Model qualifier: 28c
	(Combi boiler)
	Systems with radiators
	Pump in heat space: Yes
	Weather Compensator

Main heating Control:

Main heating Control:	Time and temperature zone control
	Control code: 2110
	Boiler interlock: Yes

Secondary heating system:

Secondary heating system:	None
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Water heating:

Water heating:	From main heating system
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SAP Input



Water code: 901
Fuel :mains gas
No hot water cylinder
Solar panel: False

Others:

Electricity tariff:	standard tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Low rise urban / suburban
EPC language:	English
Wind turbine:	No
Photovoltaics:	<u>Photovoltaic 1</u> Installed Peak power: 1 Tilt of collector: 45° Overshading: Significant Collector Orientation: South
Assess Zero Carbon Home:	No

SAP WorkSheet: New dwelling design stage



User Details:

Assessor Name: Michael Hodgkinson **Stroma Number:** STRO002448
Software Name: Stroma FSAP 2009 **Software Version:** Version: 1.5.0.37

Property Address: Plot 2

Address : , Plot 2 Twittens Way, HAVANT, PO9 1FH

1. Overall dwelling dimensions:

	Area(m ²)		Ave Height(m)		Volume(m ³)
Ground floor	31.83	(1a) x	2.625	(2a) =	83.55
First floor	27.6	(1b) x	2.2	(2b) =	60.72
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	59.43	(4)			
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	144.27
					(5)

2. Ventilation rate:

	main heating		Secondary heating		other		total		m ³ per hour
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0
Number of open flues	0	+	0	+	0	=	0	x 20 =	0
Number of intermittent fans							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) =	0.21	(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			7	(17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)			0.56	(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 on which sheltered			3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.78	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.43	(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=	5.4	5.1	5.1	4.5	4.1	3.9	3.7	3.7	4.2	4.5	4.8	5.1
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SAP WorkSheet: New dwelling design stage



Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.35	1.27	1.27	1.12	1.02	0.98	0.92	0.92	1.05	1.12	1.2	1.27
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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

	0.58	0.55	0.55	0.49	0.44	0.42	0.4	0.4	0.45	0.49	0.52	0.55
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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
---------	---	---	---	---	---	---	---	---	---	---	---	---

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

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

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

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

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

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

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

(24d)m=	0.67	0.65	0.65	0.62	0.6	0.59	0.58	0.58	0.6	0.62	0.63	0.65
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Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.67	0.65	0.65	0.62	0.6	0.59	0.58	0.58	0.6	0.62	0.63	0.65
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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			2.1	x 1.1	= 2.31		(26)
Windows Type 1			1.8	x 1/[1/(1.4) + 0.04]	= 2.39		(27)
Windows Type 2			1.62	x 1/[1/(1.4) + 0.04]	= 2.15		(27)
Windows Type 3			1.1	x 1/[1/(1.4) + 0.04]	= 1.46		(27)
Windows Type 4			0.85	x 1/[1/(1.4) + 0.04]	= 1.13		(27)
Windows Type 5			3.15	x 1/[1/(1.4) + 0.04]	= 4.18		(27)
Rooflights			0.43	x 1/[1/(1.5) + 0.04]	= 0.645		(27b)
Floor			32.41	x 0.19	= 6.1579		(28)
Walls Type1	76.28	12.32	63.96	x 0.3	= 19.19		(29)
Walls Type2	1.55	0	1.55	x 0.18	= 0.28		(29)
Roof Type1	23.43	0	23.43	x 0.14	= 3.28		(30)
Roof Type2	14	0.43	13.57	x 0.15	= 2.04		(30)
Total area of elements, m²			147.67				(31)
Party wall			24.23	x 0.2	= 4.85		(32)

* 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) = 52.25 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 16733.07 (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

SAP WorkSheet: New dwelling design stage



can be used instead of a detailed calculation.

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

12.07 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss

(33) + (36) =

64.32 (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
31.92	31.04	31.04	29.44	28.48	28.04	27.61	27.61	28.71	29.44	30.21	31.04

(38)

Heat transfer coefficient, W/K

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

(39)m=

96.24	95.36	95.36	93.76	92.8	92.36	91.94	91.94	93.03	93.76	94.54	95.36
-------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------

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

93.87 (39)

Heat loss parameter (HLP), W/m²K

(40)m = (39)m ÷ (4)

(40)m=

1.62	1.6	1.6	1.58	1.56	1.55	1.55	1.55	1.57	1.58	1.59	1.6
------	-----	-----	------	------	------	------	------	------	------	------	-----

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

1.58 (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

1.97

(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

80.88

(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=

88.97	85.73	82.5	79.26	76.03	72.79	72.79	76.03	79.26	82.5	85.73	88.97
-------	-------	------	-------	-------	-------	-------	-------	-------	------	-------	-------

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

970.56 (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=

132.25	115.67	119.36	104.06	99.85	86.16	79.84	91.62	92.71	108.05	117.94	128.08
--------	--------	--------	--------	-------	-------	-------	-------	-------	--------	--------	--------

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

1275.6 (45)

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

(46)m=

19.84	17.35	17.9	15.61	14.98	12.92	11.98	13.74	13.91	16.21	17.69	19.21
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(46)

Water storage loss:

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

0

(47)

Temperature factor from Table 2b

0

(48)

Energy lost from water storage, kWh/year

(47) x (48) =

0

(49)

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

Cylinder volume (litres) including any solar storage within same

0

(50)

If community heating and no tank in dwelling, enter 110 litres in box (50)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in box (50)

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

0

(51)

Volume factor from Table 2a

0

(52)

Temperature factor from Table 2b

0

(53)

Energy lost from water storage, kWh/year

((50) x (51) x (52) x (53) =

0

(54)

SAP WorkSheet: New dwelling design stage



Enter (49) 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

(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=	45.34	39.46	42.04	39.09	38.74	35.9	37.09	38.74	39.09	42.04	42.28	45.34
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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=	177.59	155.13	161.4	143.15	138.59	122.06	116.94	130.36	131.8	150.09	160.22	173.42
--------	--------	--------	-------	--------	--------	--------	--------	--------	-------	--------	--------	--------

(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=	177.59	155.13	161.4	143.15	138.59	122.06	116.94	130.36	131.8	150.09	160.22	173.42
--------	--------	--------	-------	--------	--------	--------	--------	--------	-------	--------	--------	--------

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

(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=	55.31	48.33	50.2	44.37	42.89	37.62	35.82	40.15	40.6	46.44	49.79	53.92
--------	-------	-------	------	-------	-------	-------	-------	-------	------	-------	-------	-------

(65)

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

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m=	117.93	117.93	117.93	117.93	117.93	117.93	117.93	117.93	117.93	117.93	117.93	117.93

(66)

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

(67)m=	39.02	34.66	28.18	21.34	15.95	13.47	14.55	18.91	25.38	32.23	37.62	40.1
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

(67)

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

(68)m=	255.98	258.64	251.94	237.69	219.7	202.8	191.5	188.85	195.54	209.79	227.78	244.69
--------	--------	--------	--------	--------	-------	-------	-------	--------	--------	--------	--------	--------

(68)

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

(69)m=	48.76	48.76	48.76	48.76	48.76	48.76	48.76	48.76	48.76	48.76	48.76	48.76
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(69)

Pumps and fans gains (Table 5a)

(70)m=	10	10	10	10	10	10	10	10	10	10	10	10
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(70)

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

(71)m=	-78.62	-78.62	-78.62	-78.62	-78.62	-78.62	-78.62	-78.62	-78.62	-78.62	-78.62	-78.62
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

(71)

Water heating gains (Table 5)

(72)m=	74.34	71.91	67.47	61.63	57.64	52.25	48.15	53.96	56.39	62.41	69.15	72.47
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(72)

Total internal gains =

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

(73)m=	467.41	463.27	445.66	418.73	391.36	366.59	352.27	359.79	375.38	402.5	432.61	455.33
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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)	
North	0.77	x	1.8	x	10.73	x	1.11	x		=	6.1	(74)
North	0.77	x	1.62	x	10.73	x	1.11	x		=	5.49	(74)
North	0.77	x	1.1	x	10.73	x	1.11	x		=	3.72	(74)
North	0.77	x	1.8	x	20.36	x	1.11	x		=	11.57	(74)
North	0.77	x	1.62	x	20.36	x	1.11	x		=	10.41	(74)
North	0.77	x	1.1	x	20.36	x	1.11	x		=	7.07	(74)
North	0.77	x	1.8	x	33.31	x	1.11	x		=	18.93	(74)
North	0.77	x	1.62	x	33.31	x	1.11	x		=	17.04	(74)
North	0.77	x	1.1	x	33.31	x	1.11	x		=	11.57	(74)
North	0.77	x	1.8	x	54.64	x	1.11	x		=	31.05	(74)
North	0.77	x	1.62	x	54.64	x	1.11	x		=	27.94	(74)
North	0.77	x	1.1	x	54.64	x	1.11	x		=	18.97	(74)
North	0.77	x	1.8	x	75.22	x	1.11	x		=	42.74	(74)
North	0.77	x	1.62	x	75.22	x	1.11	x		=	38.47	(74)
North	0.77	x	1.1	x	75.22	x	1.11	x		=	26.12	(74)
North	0.77	x	1.8	x	84.09	x	1.11	x		=	47.78	(74)
North	0.77	x	1.62	x	84.09	x	1.11	x		=	43.01	(74)
North	0.77	x	1.1	x	84.09	x	1.11	x		=	29.2	(74)
North	0.77	x	1.8	x	79.12	x	1.11	x		=	44.96	(74)
North	0.77	x	1.62	x	79.12	x	1.11	x		=	40.46	(74)
North	0.77	x	1.1	x	79.12	x	1.11	x		=	27.48	(74)
North	0.77	x	1.8	x	61.56	x	1.11	x		=	34.98	(74)
North	0.77	x	1.62	x	61.56	x	1.11	x		=	31.49	(74)
North	0.77	x	1.1	x	61.56	x	1.11	x		=	21.38	(74)
North	0.77	x	1.8	x	41.09	x	1.11	x		=	23.35	(74)
North	0.77	x	1.62	x	41.09	x	1.11	x		=	21.01	(74)
North	0.77	x	1.1	x	41.09	x	1.11	x		=	14.27	(74)
North	0.77	x	1.8	x	24.81	x	1.11	x		=	14.1	(74)
North	0.77	x	1.62	x	24.81	x	1.11	x		=	12.69	(74)
North	0.77	x	1.1	x	24.81	x	1.11	x		=	8.62	(74)
North	0.77	x	1.8	x	13.22	x	1.11	x		=	7.51	(74)
North	0.77	x	1.62	x	13.22	x	1.11	x		=	6.76	(74)
North	0.77	x	1.1	x	13.22	x	1.11	x		=	4.59	(74)
North	0.77	x	1.8	x	8.94	x	1.11	x		=	5.08	(74)
North	0.77	x	1.62	x	8.94	x	1.11	x		=	4.57	(74)
North	0.77	x	1.1	x	8.94	x	1.11	x		=	3.11	(74)
East	3	x	0.85	x	19.87	x	0.41	x		=	16	(76)
East	3	x	0.85	x	38.52	x	0.41	x		=	31.01	(76)
East	3	x	0.85	x	61.57	x	0.41	x		=	49.56	(76)

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East	3	x	0.85	x	91.41	x	0.41	x		=	73.59	(76)
East	3	x	0.85	x	111.22	x	0.41	x		=	89.54	(76)
East	3	x	0.85	x	116.05	x	0.41	x		=	93.43	(76)
East	3	x	0.85	x	112.64	x	0.41	x		=	90.68	(76)
East	3	x	0.85	x	98.03	x	0.41	x		=	78.92	(76)
East	3	x	0.85	x	73.6	x	0.41	x		=	59.25	(76)
East	3	x	0.85	x	46.91	x	0.41	x		=	37.76	(76)
East	3	x	0.85	x	24.71	x	0.41	x		=	19.89	(76)
East	3	x	0.85	x	16.39	x	0.41	x		=	13.2	(76)
South	0.77	x	3.15	x	47.32	x	0.41	x		=	47.06	(78)
South	0.77	x	3.15	x	77.18	x	0.41	x		=	76.76	(78)
South	0.77	x	3.15	x	94.25	x	0.41	x		=	93.72	(78)
South	0.77	x	3.15	x	105.11	x	0.41	x		=	104.53	(78)
South	0.77	x	3.15	x	108.55	x	0.41	x		=	107.95	(78)
South	0.77	x	3.15	x	108.9	x	0.41	x		=	108.29	(78)
South	0.77	x	3.15	x	107.14	x	0.41	x		=	106.54	(78)
South	0.77	x	3.15	x	103.88	x	0.41	x		=	103.31	(78)
South	0.77	x	3.15	x	99.99	x	0.41	x		=	99.44	(78)
South	0.77	x	3.15	x	85.29	x	0.41	x		=	84.82	(78)
South	0.77	x	3.15	x	56.07	x	0.41	x		=	55.76	(78)
South	0.77	x	3.15	x	40.89	x	0.41	x		=	40.66	(78)
Rooflights 0.9x	1	x	0.43	x	26	x	0.6	x	0.7	=	4.23	(82)
Rooflights 0.9x	1	x	0.43	x	54	x	0.6	x	0.7	=	8.78	(82)
Rooflights 0.9x	1	x	0.43	x	94	x	0.6	x	0.7	=	15.28	(82)
Rooflights 0.9x	1	x	0.43	x	150	x	0.6	x	0.7	=	24.38	(82)
Rooflights 0.9x	1	x	0.43	x	190	x	0.6	x	0.7	=	30.88	(82)
Rooflights 0.9x	1	x	0.43	x	201	x	0.6	x	0.7	=	32.67	(82)
Rooflights 0.9x	1	x	0.43	x	194	x	0.6	x	0.7	=	31.53	(82)
Rooflights 0.9x	1	x	0.43	x	164	x	0.6	x	0.7	=	26.66	(82)
Rooflights 0.9x	1	x	0.43	x	116	x	0.6	x	0.7	=	18.85	(82)
Rooflights 0.9x	1	x	0.43	x	68	x	0.6	x	0.7	=	11.05	(82)
Rooflights 0.9x	1	x	0.43	x	33	x	0.6	x	0.7	=	5.36	(82)
Rooflights 0.9x	1	x	0.43	x	21	x	0.6	x	0.7	=	3.41	(82)

Solar gains in watts, calculated for each month

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

(83)m= 82.59 145.59 206.09 280.47 335.7 354.38 341.66 296.74 236.17 169.04 99.87 70.04 (83)

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

(84)m= 550 608.86 651.76 699.2 727.06 720.97 693.92 656.53 611.55 571.55 532.49 525.37 (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
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

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(86)m=	0.99	0.98	0.97	0.94	0.86	0.71	0.52	0.55	0.81	0.94	0.98	0.99	(86)
--------	------	------	------	------	------	------	------	------	------	------	------	------	------

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

(87)m=	19.48	19.65	19.95	20.27	20.65	20.89	20.98	20.97	20.81	20.39	19.83	19.52	(87)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(88)m=	19.6	19.61	19.61	19.63	19.65	19.65	19.66	19.66	19.64	19.63	19.62	19.61	(88)
--------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(89)m=	0.99	0.98	0.96	0.92	0.8	0.6	0.36	0.38	0.71	0.91	0.98	0.99	(89)
--------	------	------	------	------	-----	-----	------	------	------	------	------	------	------

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

(90)m=	17.66	17.91	18.34	18.81	19.32	19.58	19.65	19.65	19.51	18.98	18.18	17.72	(90)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =	0.5	(91)
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Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.56	18.77	19.13	19.54	19.98	20.23	20.31	20.31	20.15	19.68	19	18.61	(92)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	----	-------	------

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

(93)m=	18.56	18.77	19.13	19.54	19.98	20.23	20.31	20.31	20.15	19.68	19	18.61	(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	0.91	0.82	0.65	0.44	0.46	0.75	0.92	0.97	0.98	(94)
--------	------	------	------	------	------	------	------	------	------	------	------	------	------

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

(95)m=	539.76	591.99	620.71	639.66	596.19	470.76	306.05	304.38	458.34	523.17	517.44	516.17	(95)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Monthly average external temperature from Table 8

(96)m=	4.5	5	6.8	8.7	11.7	14.6	16.9	16.9	14.3	10.8	7	4.9	(96)
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Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1353.43	1313.18	1176.28	1015.95	768.34	519.87	313.38	313.12	544.45	832.34	1134.35	1307.77	(97)
--------	---------	---------	---------	---------	--------	--------	--------	--------	--------	--------	---------	---------	------

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

(98)m=	605.38	484.64	413.34	270.93	128.07	0	0	0	0	230.03	444.18	588.95	(98)
--------	--------	--------	--------	--------	--------	---	---	---	---	--------	--------	--------	------

Total per year (kWh/year) = Sum(98) _{1...5,9...12} =	3165.53	(98)
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Space heating requirement in kWh/m²/year

53.26	(99)
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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

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

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

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

605.38	484.64	413.34	270.93	128.07	0	0	0	0	230.03	444.18	588.95
--------	--------	--------	--------	--------	---	---	---	---	--------	--------	--------

(211)m = {[(98)m x (204)] + (210)m } x 100 ÷ (206) (211)

650.94	521.12	444.46	291.32	137.71	0	0	0	0	247.34	477.61	633.28
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Total (kWh/year) =Sum(211) _{1...5,10...12} =	3403.79	(211)
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Space heating fuel (secondary), kWh/month

$$= \{[(98)m \times (201)] + (214) m\} \times 100 \div (208)$$

(215)m=	0	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)

	177.59	155.13	161.4	143.15	138.59	122.06	116.94	130.36	131.8	150.09	160.22	173.42		
Efficiency of water heater													79.9	(216)
(217)m=	87.49	87.32	86.91	86.23	84.45	79.9	79.9	79.9	79.9	85.72	87.08	87.48		(217)

Fuel for water heating, kWh/month

$$(219)m = (64)m \times 100 \div (217)m$$

(219)m=	202.98	177.65	185.7	166.01	164.11	152.77	146.35	163.16	164.96	175.09	183.99	198.23		
Total = Sum(219a) _{1..12} =													2080.98	(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:

130 (230c)

boiler with a fan-assisted flue

45 (230e)

Total electricity for the above, kWh/year

sum of (230a)...(230g) = 175 (231)

Electricity for lighting

275.63 (232)

Electricity generated by PVs

-548.08 (233)

10a. Fuel costs - individual heating systems:

	Fuel kWh/year	Fuel Price (Table 12)	Fuel Cost £/year
Space heating - main system 1	(211) x	3.1 x 0.01 =	105.52 (240)
Space heating - main system 2	(213) x	0 x 0.01 =	0 (241)
Space heating - secondary	(215) x	0 x 0.01 =	0 (242)
Water heating cost (other fuel)	(219)	3.1 x 0.01 =	64.51 (247)
Pumps, fans and electric keep-hot	(231)	11.46 x 0.01 =	20.06 (249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a			
Energy for lighting	(232)	11.46 x 0.01 =	31.59 (250)
Additional standing charges (Table 12)			106 (251)
	one of (233) to (235) x	11.46 x 0.01 =	-62.81 (252)

Appendix Q items: repeat lines (253) and (254) as needed

Total energy cost (245)...(247) + (250)...(254) = 264.86 (255)

11a. SAP rating - individual heating systems

Energy cost deflator (Table 12) 0.47 (256)

Energy cost factor (ECF) [(255) x (256)] ÷ [(4) + 45.0] = 1.19 (257)

SAP WorkSheet: New dwelling design stage



SAP rating (Section 12)

83.37 (258)

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

	Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x	0.198	=	673.95	(261)
Space heating (secondary)	(215) x	0	=	0	(263)
Water heating	(219) x	0.198	=	412.03	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1085.98	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.517	=	90.48	(267)
Electricity for lighting	(232) x	0.517	=	142.5	(268)
Energy saving/generation technologies Item 1		0.529	=	-289.93	(269)
Total CO2, kg/year		sum of (265)...(271) =		1029.02	(272)
CO2 emissions per m²		(272) ÷ (4) =		17.31	(273)
EI rating (section 14)				87	(274)

13a. Primary Energy

	Energy kWh/year	Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x	1.02	=	3471.87	(261)
Space heating (secondary)	(215) x	0	=	0	(263)
Energy for water heating	(219) x	1.02	=	2122.6	(264)
Space and water heating	(261) + (262) + (263) + (264) =			5594.47	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	2.92	=	511	(267)
Electricity for lighting	(232) x	0	=	804.83	(268)
Energy saving/generation technologies Item 1		2.92	=	-1600.39	(269)
'Total Primary Energy		sum of (265)...(271) =		5309.9	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =		89.35	(273)

Predicted Energy Assessment

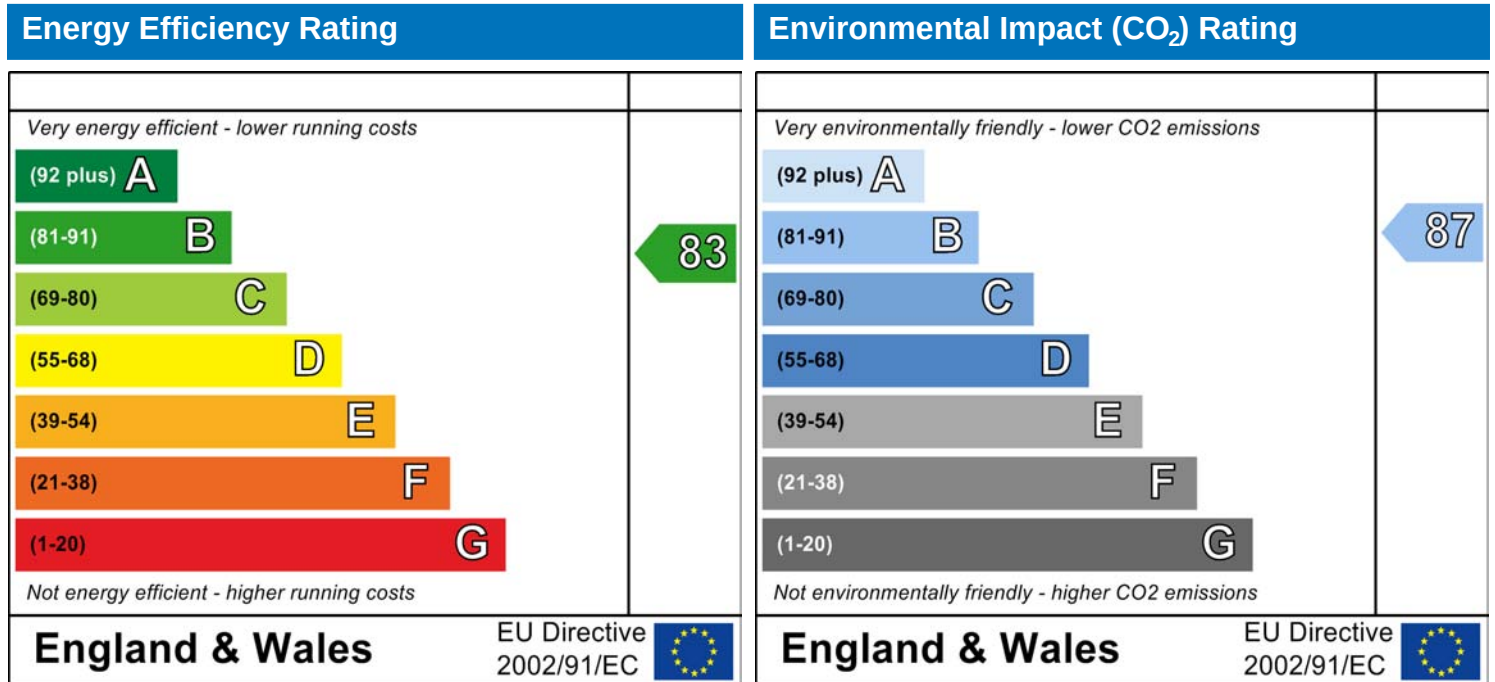
Plot 2 Twittens Way
HAVANT
PO9 1FH

Dwelling type:
Date of assessment:
Produced by:
Total floor area:

Semi-detached House
21 August 2012
Michael Hodgkinson
59.43 m²

This is a Predicted Energy Assessment for a property which is not yet complete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, an Energy Performance Certificate is required providing information about the energy performance of the completed property.

Energy performance has been assessed using the SAP 2009 methodology and is rated in terms of the energy use per square metre of floor area, energy efficiency based on fuel costs and environmental impact based on carbon dioxide (CO₂) emissions.



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO₂) emissions. The higher the rating the less impact it has on the environment.

Code for Sustainable Homes Report



Assessor and House Details

Assessor Name: Michael Hodgkinson
Property Address: Plot 2 Twittens Way
 HAVANT
 PO9 1FH
Assessor Number: STRO002448

Buiding regulation assessment

kg/m²/year
 TER 21.56
 DER 19.22
The following code calculations are taken from the Code for Sustainable Homes Technical Guide (Nov 10)

Ene 1 Assessment - Dwelling Emission Rate

Total Energy Type CO2 Emissions for Codes Levels 1 - 5

	%	kg/m ² /year	
DER from SAP 2009 DER Worksheet		19.22	(ZC1)
TER		21.56	
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		19.22	
% improvement DER/TER	10.9		

Total Energy Type CO2 Emissions for Codes Levels 6

	kg/m ² /year	
DER accounting for SAP Section 16 allowances	19.22	(ZC1)
CO2 emissions from appliances, equation (L14)	17.04	(ZC2)
CO2 emissions from cooking, equation (L16)	2.8	(ZC3)
Net CO2 emissions	39.1	(ZC8)

Result:

Credits awarded for Ene 1 = 1.4

Code Level = 3

Ene 2 - Fabric energy Efficiency

Fabric energy Efficiency: 68.07

Credits awarded for Ene 2 = 0

Ene 7 - Low or Zero Carbon (LZC) Technologies

Reduction in CO2 Emissions

	%	kg/m ² /year	
Standard Case CO2 emissions		45.68	
Standard DER		25.85	
Actual Case CO2 emissions		40.81	
Actual DER		20.98	
Reduction in CO2 emissions	10.66		

Credits awarded for Ene 7 = 1

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.

U Value Calculation

Software: Stroma U-value Calculator - Version 0.92
 Date Printed: 24/04/2013 07:24
 Construction Type: Floor - Beam & Block Floor 356
 Calculation Method: BS EN ISO 6946 / BS EN ISO 13370

Floor Construction

No	Description	Main Element			Bridging Element		
		Thickness	λ	R-value	λ	R-value	Fraction
-	Internal Surface Resistance	-	-	0.17	-	-	-
1	Concrete Medium Density	100	1.35	0.074	1.13	0.088	0.099
2	Phenolic Foam Board	100	0.025	4	-	-	-
3	Screed (1200)	65	0.41	0.159	-	-	-
4	Underfloor Resistance	0	-	0.17	-	-	-
		$\Sigma=265\text{mm}$		$\Sigma=4.573$			

Resistances

Lower Limit	Upper Limit	Average
4.574	4.574	4.574 m ² K/W

Soil Properties

Perimeter	19.17m
Area	32m ²
Wall Thickness	300mm
Ground Type - Default $\lambda=$	2W/mK
Rse	0.04
Resistance on column Rg	0m ² K/W
The height of the floor above external ground level	0.2m
Depth of underfloor space below ground	0.2m
U-value of walls	1.5W/m ² K
Mean wind speed	5m/s
Wind shielding factor	0.05
Ventilation openings per metre length	0.0015m ² /m

U-value Corrections

No Correction Values

Average Temperature - Underfloor Space

Internal Temperature	18°C
External Temperature	6°C
Average Temperature in Underfloor Space	7.7°C

U-value

Ug - U-value of the Ground	0.98
Uf - U-value of the Floor	0.219
Ux - U-value for Ventilation Equivalent	0.343
U-value	0.188
U-value rounded	0.19 W/m²K

U Value Calculation

Software: Stroma U-value Calculator - Version 0.92
 Date Printed: 24/04/2013 07:23
 Construction Type: Wall - External Wall 356
 Calculation Method: BS EN ISO 6946

Wall Construction

No	Description	Main Element			Bridging Element		
		Thickness	λ	R-value	λ	R-value	Fraction
-	Internal Surface Resistance	-	-	0.13	-	-	-
1	Plasterboard Standard	12.5	0.21	0.06	-	-	-
2	Plaster Dabs Cavity	15	0.1	0.15	0.43	0.035	0.2001
3	Concrete Block (Medium Density 14	100	0.57	0.175	0.88	0.106	0.0667
4	FR4000 (50 mm)	50	0.022	2.273	-	-	-
5	Unventilated Cavity	50	-	0.44	-	-	-
6	Brickwork Outer Leaf - BRE	102.5	0.77	0.133	0.94	0.109	0.1712
-	External Surface Resistance	-	-	0.04	-	-	-
		$\Sigma=330\text{mm}$		$\Sigma=3.401$			

Resistances

Lower Limit	Upper Limit	Average
3.329	3.368	3.349 m ² K/W

U-value Corrections

No Correction Values

U-value

U-value	0.299
U-value rounded	0.3 W/m ² K

U Value Calculation

Software: Stroma U-value Calculator - Version 0.92
 Date Printed: 24/04/2013 07:23
 Construction Type: Roof - Roof insulated at Ceiling Level
 Calculation Method: BS EN ISO 6946

Roof Construction

No	Description	Main Element			Bridging Element		
		Thickness	λ	R-value	λ	R-value	Fraction
-	Internal Surface Resistance	-	-	0.1	-	-	-
1	Plasterboard Standard	12	0.21	0.057	-	-	-
2	Mineral Wool Quilt	100	0.042	2.381	0.13	0.769	0.0633
3	Mineral Wool Quilt	200	0.042	4.762	-	-	-
4	Roof space	-	-	0.2	-	-	-
-	External Surface Resistance	-	-	0.04	-	-	-
		$\Sigma=312\text{mm}$		$\Sigma=7.54$			

Resistances

Lower Limit	Upper Limit	Average
7.261	7.412	7.337 m ² K/W

U-value Corrections

Corrective Description	Correction Value
Loft Hatch	0.003
$\Sigma=0.003$	

U-value

U-value uncorrected	0.133
Total U-value Corrections	0.003
U-value	0.136
U-value rounded	0.14 W/m ² K

U Value Calculation

Software: Stroma U-value Calculator - Version 0.92
 Date Printed: 24/04/2013 07:23
 Construction Type: Roof - Roof Insulated at Rafter level
 Calculation Method: BS EN ISO 6946

Roof Construction

No	Description	Main Element			Bridging Element		
		Thickness	λ	R-value	λ	R-value	Fraction
-	Internal Surface Resistance	-	-	0.1	-	-	-
1	Plasterboard Standard	12	0.21	0.057	-	-	-
2	FR4000 (25 mm)	25	0.022	1.136	-	-	-
3	XR4000 (150 mm)	150	0.022	6.818	0.13	1.154	0.0633
4	Tiles (Clay)	8	1	0.008	-	-	-
-	External Surface Resistance	-	-	0.04	-	-	-
		$\Sigma=195\text{mm}$		$\Sigma=8.16$			

Resistances

Lower Limit	Upper Limit	Average
6.543	7.134	6.838 m ² K/W

U-value Corrections

No Correction Values

U-value

U-value	0.146
U-value rounded	0.15 W/m ² K