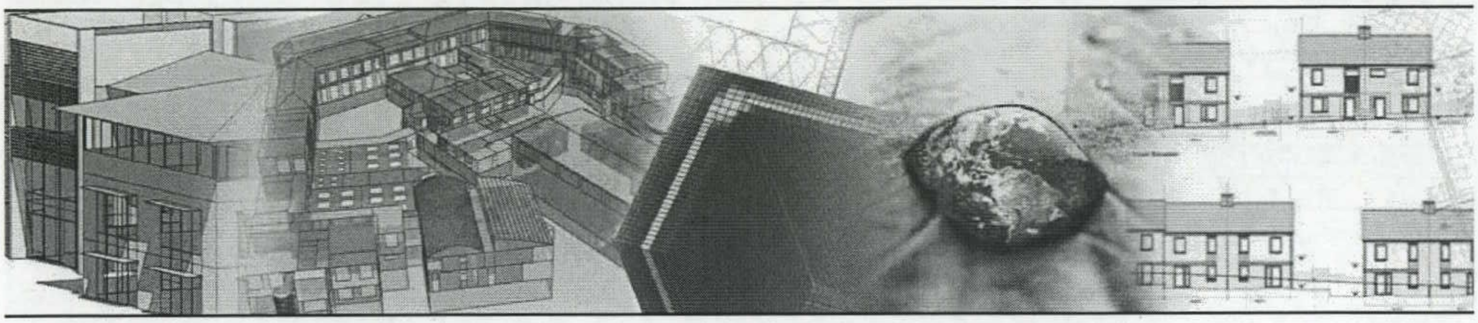
STROMA TECH



SAP Summary Report

61 Belmont Road
Twickenham
As Designed
Part L1A (2012)

Ref: 01-16-55567
Issue Date 01/02/2016
Prepared for: Hazan Smith & Partners

Project Name	61 Belmont Road
Project Number	01-16-55567
Revision	-
SAP Assessor	Joseph Price-Buchanan
Assessor Number	STRO016219

Project Status
SAP compliance achieved

Project Status Details
SAP compliance achieved, but assumptions have been made that require client review and response to finalise the calculations, please see details below;

Comments by Assessor

DISCLAIMER

The results in the attached schedule have been prepared based on drawings, specification and other correspondence provided, unless otherwise stated above. Any deviation from any of this document or the specifications will invalidate the SAP, DER, and TER results.

Project Name	61 Belmont Road
Project Number	01-16-55567
Revision	-
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Project Status
SAP compliance achieved

SAP Summary Report													
Property Type	Plot	Built Form	TER	DER	Percent Improvement	Total Floor Area	FEE	Air permeability	Air Target (if Sample testing, only applies to 2010 B Regs)	Building Regulations Results	DFEE - BR 2012	TFEE - BR 2012
House	Plot 1	Detached	23.36	15.01	35.74	79.49	66.60	4	n/a	Yes	66.60	79.10

01/02/2016

Project Name	61 Belmont Road
Project Number	01-16-55567
Revision	-
SAP Assessor	Joseph Price-Buchanan
Assessor Reference	STRO016219

Design SAP Input Data Table

Description		Reference/Source	Details	Comments
Fabric U-values (W/m^2K)	Roof	Architect calculation	0.15	100mm phenolic foam board between studs, 50mm board over (0.02λ), 12.5mm plasterboard
	External Wall	Architect calculation	0.20	100mm concrete block, 150mm mineral wool quilt (0.02λ), brick outer leaf
	Ground Floor	Architect calculation	0.13	75mm screed, 150mm Celotex (0.022λ), 100mm concrete beam & block
	Windows / Roof light	Email & specification	1.40	Double glazed, Argon filled, low-e
	Doors	Email & specification	1.20	Double glazed, Argon filled, low-e
	y-value	Default	0.03	Based on accredited construction details and enhanced details for lintel and ground floor junctions
Thermal Mass		Specification	Indicative - Low	
Ventilation	Airtightness $m3/(hr.m^2)$	Email	4.0	
	Mechanical Ventilation	Email & Specification	Natural ventilation and intermittent extract fans	
Heating	Main Heating System	Email confirmation	Potterton Promax Ultra 24 ErP	
	Controls	Email confirmation	Time and temperature zone control	
	Water Heating	Specification	From main heating system	
	Secondary Heating System	N/A	None	
Low energy lighting		Email Specification	100%	
Renewables		Email Specification	1.55 kWp	

REVISION	DESCRIPTION OF AMENDMENTS	DATE
1	First issue	01/02/2016

STROMA® TECHNOLOGY

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.1.24
Printed on 01 February 2016 at 09:59:37

Project Information:

Assessed By: Joseph Price-Buchanan (STRO016219) **Building Type:** Detached House

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 79.49m²

Site Reference : 61 Belmont Road - Twickenham **Plot Reference:** 01-16-55567 Plot 1 PL1

Address :

Client Details:

Name: Hazan Smith & Partners

Address :

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

1a TER and DER

Fuel for main heating system: Mains gas		
Fuel factor: 1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	23.36 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	15.01 kg/m²	OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	79.2 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	66.6 kWh/m²	
		OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.20 (max. 0.30)	0.20 (max. 0.70)	OK
Floor	0.13 (max. 0.25)	0.13 (max. 0.70)	OK
Roof	0.15 (max. 0.20)	0.15 (max. 0.35)	OK
Openings	1.21 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.00 (design value)	
Maximum	10.0	OK

4 Heating efficiency

Main Heating system:

Database: (rev 387, product index 017614):
Boiler systems with radiators or underfloor heating - mains gas
Brand name: Potterton
Model: Promax Ultra
Model qualifier: Combi 24 ErP
(Combi)
Efficiency 89.1 % SEDBUK2009
Minimum 88.0 % OK

Secondary heating system: None

Regulations Compliance Report

5 Cylinder insulation		
Hot water Storage:	No cylinder	
6 Controls		
Space heating controls	Time and temperature zone control by device in database	OK
Hot water controls:	No cylinder	
Boiler interlock:	Yes	OK
7 Low energy lights		
Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	OK
8 Mechanical ventilation		
Not applicable		
9 Summertime temperature		
Overheating risk (Thames valley):	Medium	OK
Based on:		
Overshading:	Average or unknown	
Windows facing: South East	0.92m²	
Windows facing: North West	16.36m²	
Windows facing: South West	12.82m²	
Windows facing: North East	4.89m²	
Ventilation rate:	3.00	
Blinds/curtains:	Dark-coloured curtain or roller blind Closed 100% of daylight hours	
10 Key features		
Thermal bridging	0.034 W/m²K	
Photovoltaic array		

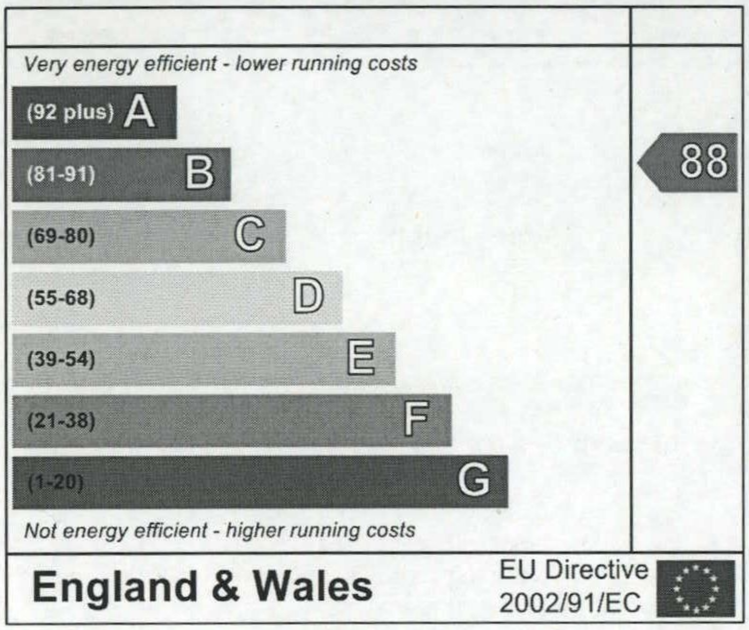
Predicted Energy Assessment

Dwelling type:	Detached House
Date of assessment:	24 January 2016
Produced by:	Joseph Price-Buchanan
Total floor area:	79.49 m²

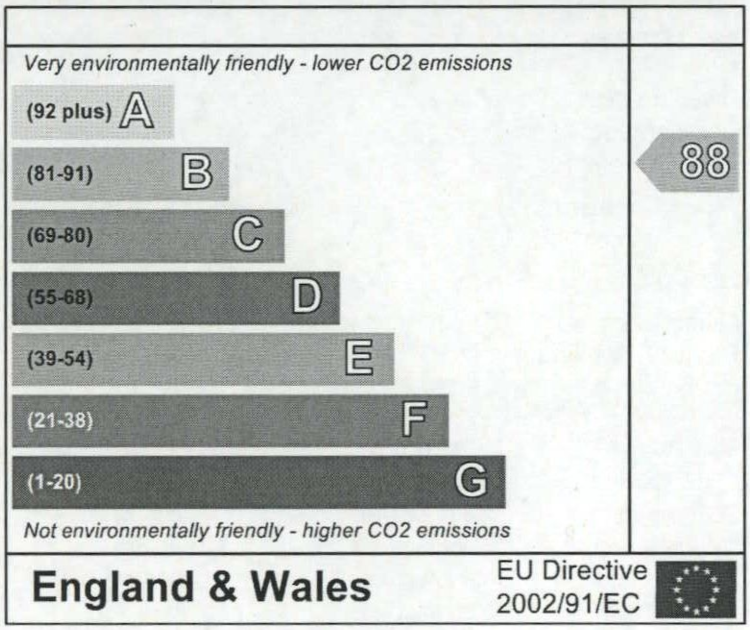
This is a Predicted Energy Assessment for a property which is not yet complete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, an Energy Performance Certificate is required providing information about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

Energy performance has been assessed using the SAP 2012 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.

Energy Efficiency Rating



Environmental Impact (CO_2) Rating



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 carbonn dioxide (CO2) emissions. The higher the rating the less impact it has on the environment.

SAP Input

Property Details: 01-16-55567 Plot 1 PL1

Address:	
Located in:	England
Region:	Thames valley
UPRN:	
Date of assessment:	24 January 2016
Date of certificate:	01 February 2016
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	387

Property description:

Dwelling type:	House	
Detachment:	Detached	
Year Completed:	2016	
Floor Location:	**Floor area:**	**Storey height:**
Floor 0	79.49 m²	3.32 m
Living area:	17.478 m² (fraction 0.22)	
Front of dwelling faces:	South East	

Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
SE Elevation	Manufacturer	Solid			Wood
SE Elevation	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	PVC-U
NW Elevation	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	PVC-U
SW Elevation	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	PVC-U
NE Elevation	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	PVC-U

Name:	Gap:	Frame Factor:	g-value:	U-value:	Area:	No. of Openings:
SE Elevation	mm	0.7	0	1.4	2	1
SE Elevation	16mm or more	0.7	0.5	1.2	0.92	1
NW Elevation	16mm or more	0.7	0.5	1.2	16.36	1
SW Elevation	16mm or more	0.7	0.5	1.2	12.82	1
NE Elevation	16mm or more	0.7	0.5	1.2	4.89	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
SE Elevation		External Wall	South East	0	0
SE Elevation		External Wall	South East	0	0
NW Elevation		External Wall	North West	0	0
SW Elevation		External Wall	South West	0	0
NE Elevation		External Wall	North East	0	0

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
External Wall	118.12	36.99	81.13	0.2	0	False	N/A
Pitched Roof	84.44	0	84.44	0.15	0		N/A
Ground Floor	79.49			0.13			N/A
Internal Elements							

SAP Input

Party Elements

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0341

	Length	Psi-value		
	22.67	0.01	E1	Steel lintel with perforated steel base plate
[Approved]	21.77	0.04	E3	Sill
[Approved]	29.3	0.05	E4	Jamb
	48.61	0.067	E5	Ground floor (normal)
[Approved]	18.4	0.04	E11	Eaves (insulation at rafter level)
[Approved]	32.22	0.04	E13	Gable (insulation at rafter level)
[Approved]	15.981	0.09	E16	Corner (normal)
[Approved]	4.015	-0.09	E17	Corner (inverted internal area greater than external area)
[Approved]	9.81	0.07	E6	Intermediate floor within a dwelling

Ventilation:

Pressure test:	Yes (As designed)
Ventilation:	Natural ventilation (extract fans)
Number of chimneys:	0
Number of open flues:	0
Number of fans:	2
Number of passive stacks:	0
Number of sides sheltered:	2
Pressure test:	4

Main heating system:

Main heating system:

Boiler systems with radiators or underfloor heating
Gas boilers and oil boilers
Fuel: mains gas
Info Source: Boiler Database
Database: (rev 387, product index 017614) Efficiency: Winter 86.7 % Summer: 90.0
Brand name: Potterton
Model: Promax Ultra
Model qualifier: Combi 24 ErP
(Combi boiler)
Systems with radiators
Central heating pump : 2013 or later
Design flow temperature: Design flow temperature<=35°C
Boiler interlock: Yes

Main heating Control:

Main heating Control:

Time and temperature zone control by device in database
Control code: 2112

Secondary heating system:

Secondary heating system: None

Water heating:

Water heating:

From main heating system
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%

SAP Input

Terrain type:	Low rise urban / suburban
EPC language:	English
Wind turbine:	No
Photovoltaics:	Photovoltaic 1 Installed Peak power: 1.55 Tilt of collector: 30° Overshading: None or very little Collector Orientation: South East
Assess Zero Carbon Home:	No

SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Joseph Price-Buchanan	**Stroma Number:**	STRO016219
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.1.24

Property Address: 01-16-55567 Plot 1 PL1

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	79.49	(1a) x	3.32	(2a) =	263.91	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	79.49	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	263.91	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.08	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

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 *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*		0	(11)
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		4	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16) *Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used*		0.28	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.23	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

SAP WorkSheet: New dwelling design stage

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

0.3	0.29	0.29	0.26	0.25	0.22	0.22	0.22	0.23	0.25	0.26	0.28

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

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

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

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

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

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

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

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.54	0.54	0.54	0.53	0.53	0.52	0.52	0.52	0.53	0.53	0.53	0.54	(24d)

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

(25)m=	0.54	0.54	0.54	0.53	0.53	0.52	0.52	0.52	0.53	0.53	0.53	0.54	(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	x	1.4	=	2.8			(26)
Windows Type 1			0.92	x1/[1/(1.2)+ 0.04]		=	1.05			(27)
Windows Type 2			16.36	x1/[1/(1.2)+ 0.04]		=	18.73			(27)
Windows Type 3			12.82	x1/[1/(1.2)+ 0.04]		=	14.68			(27)
Windows Type 4			4.89	x1/[1/(1.2)+ 0.04]		=	5.6			(27)
Floor			79.49	x	0.13	=	10.3337			(28)
Walls	118.12	36.99	81.13	x	0.2	=	16.23			(29)
Roof	84.44	0	84.44	x	0.15	=	12.67			(30)
Total area of elements, m²			282.05							(31)

** 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) = 82.09 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 14371.66 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 9.61 (36)

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

Total fabric heat loss (33) + (36) = 91.7 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	47.43	47.28	47.14	46.44	46.31	45.7	45.7	45.59	45.94	46.31	46.57	46.85	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	139.13	138.98	138.83	138.14	138.01	137.4	137.4	137.29	137.64	138.01	138.27	138.55

Average = $Sum(39)_{1…12}$ /12= 138.14 (39)

Heat loss parameter (HLP), W/m²K — (40)m = (39)m ÷ (4)

(40)m=	1.75	1.75	1.75	1.74	1.74	1.73	1.73	1.73	1.73	1.74	1.74	1.74

Average = Sum(40)$_{1...12}$ /12= 1.74 (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 — 2.45 (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 — 92.46 (43)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(44)m=	101.71	98.01	94.31	90.61	86.91	83.22	83.22	86.91	90.61	94.31	98.01	101.71

Total = Sum(44)$_{1...12}$ = 1109.54 (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=	150.83	131.92	136.13	118.68	113.87	98.26	91.06	104.49	105.74	123.23	134.51	146.07

Total = Sum(45)$_{1...12}$ = 1454.78 (45)

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

(46)m=	22.62	19.79	20.42	17.8	17.08	14.74	13.66	15.67	15.86	18.48	20.18	21.91

(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel — 0 (47)

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

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

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): — 0 (48)

Temperature factor from Table 2b — 0 (49)

Energy lost from water storage, kWh/year — (48) x (49) = 0 (50)

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

Hot water storage loss factor from Table 2 (kWh/litre/day) — 0 (51)

If community heating see section 4.3

Volume factor from Table 2a — 0 (52)

Temperature factor from Table 2b — 0 (53)

Energy lost from water storage, kWh/year — (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) — 0 (55)

Water storage loss calculated for each month — ((56)m = (55) × (41)m

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

(56)

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

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

(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

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

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

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

(59)

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

(61)m=	21.08	19.01	20.98	20.24	20.86	20.12	20.76	20.82	20.19	20.93	20.34	21.06	(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=	171.91	150.93	157.11	138.91	134.73	118.39	111.81	125.31	125.92	144.16	154.85	167.13	(62)

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

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

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

Output from water heater

(64)m=	171.91	150.93	157.11	138.91	134.73	118.39	111.81	125.31	125.92	144.16	154.85	167.13	

Output from water heater (annual)$_{1...12}$ 1701.17 (64)

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

(65)m=	55.42	48.61	50.51	44.52	43.08	37.7	35.47	39.95	40.2	46.21	49.81	53.83	(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):

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m=	147.19	147.19	147.19	147.19	147.19	147.19	147.19	147.19	147.19	147.19	147.19	147.19	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	48.67	43.23	35.16	26.61	19.9	16.8	18.15	23.59	31.66	40.2	46.92	50.02	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	325.93	329.31	320.79	302.64	279.74	258.21	243.83	240.45	248.97	267.12	290.02	311.55	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	52.17	52.17	52.17	52.17	52.17	52.17	52.17	52.17	52.17	52.17	52.17	52.17	(69)
Pumps and fans gains (Table 5a)													
(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)
Losses e.g. evaporation (negative values) (Table 5)													
(71)m=	-98.12	-98.12	-98.12	-98.12	-98.12	-98.12	-98.12	-98.12	-98.12	-98.12	-98.12	-98.12	(71)
Water heating gains (Table 5)													
(72)m=	74.49	72.34	67.89	61.83	57.9	52.37	47.67	53.69	55.84	62.1	69.18	72.36	(72)
Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m													
(73)m=	553.32	549.12	528.06	495.32	461.77	431.61	413.88	421.97	440.71	473.66	510.36	538.16	(73)

6. Solar gains:

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

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast	0.9x	0.77	x	4.89	x	11.28	x	0.5	x	0.7	=	13.38	(75)
Northeast	0.9x	0.77	x	4.89	x	22.97	x	0.5	x	0.7	=	27.24	(75)
Northeast	0.9x	0.77	x	4.89	x	41.38	x	0.5	x	0.7	=	49.08	(75)
Northeast	0.9x	0.77	x	4.89	x	67.96	x	0.5	x	0.7	=	80.6	(75)
Northeast	0.9x	0.77	x	4.89	x	91.35	x	0.5	x	0.7	=	108.34	(75)

Northeast 0.9x	0.77	x	4.89	x	97.38	x	0.5	x	0.7	=	115.5	(75)
Northeast 0.9x	0.77	x	4.89	x	91.1	x	0.5	x	0.7	=	108.05	(75)
Northeast 0.9x	0.77	x	4.89	x	72.63	x	0.5	x	0.7	=	86.14	(75)
Northeast 0.9x	0.77	x	4.89	x	50.42	x	0.5	x	0.7	=	59.8	(75)
Northeast 0.9x	0.77	x	4.89	x	28.07	x	0.5	x	0.7	=	33.29	(75)
Northeast 0.9x	0.77	x	4.89	x	14.2	x	0.5	x	0.7	=	16.84	(75)
Northeast 0.9x	0.77	x	4.89	x	9.21	x	0.5	x	0.7	=	10.93	(75)
Southeast 0.9x	0.77	x	0.92	x	36.79	x	0.5	x	0.7	=	8.21	(77)
Southeast 0.9x	0.77	x	0.92	x	62.67	x	0.5	x	0.7	=	13.99	(77)
Southeast 0.9x	0.77	x	0.92	x	85.75	x	0.5	x	0.7	=	19.14	(77)
Southeast 0.9x	0.77	x	0.92	x	106.25	x	0.5	x	0.7	=	23.71	(77)
Southeast 0.9x	0.77	x	0.92	x	119.01	x	0.5	x	0.7	=	26.56	(77)
Southeast 0.9x	0.77	x	0.92	x	118.15	x	0.5	x	0.7	=	26.36	(77)
Southeast 0.9x	0.77	x	0.92	x	113.91	x	0.5	x	0.7	=	25.42	(77)
Southeast 0.9x	0.77	x	0.92	x	104.39	x	0.5	x	0.7	=	23.29	(77)
Southeast 0.9x	0.77	x	0.92	x	92.85	x	0.5	x	0.7	=	20.72	(77)
Southeast 0.9x	0.77	x	0.92	x	69.27	x	0.5	x	0.7	=	15.46	(77)
Southeast 0.9x	0.77	x	0.92	x	44.07	x	0.5	x	0.7	=	9.83	(77)
Southeast 0.9x	0.77	x	0.92	x	31.49	x	0.5	x	0.7	=	7.03	(77)
Southwest 0.9x	0.77	x	12.82	x	36.79		0.5	x	0.7	=	114.41	(79)
Southwest 0.9x	0.77	x	12.82	x	62.67		0.5	x	0.7	=	194.88	(79)
Southwest 0.9x	0.77	x	12.82	x	85.75		0.5	x	0.7	=	266.65	(79)
Southwest 0.9x	0.77	x	12.82	x	106.25		0.5	x	0.7	=	330.39	(79)
Southwest 0.9x	0.77	x	12.82	x	119.01		0.5	x	0.7	=	370.06	(79)
Southwest 0.9x	0.77	x	12.82	x	118.15		0.5	x	0.7	=	367.39	(79)
Southwest 0.9x	0.77	x	12.82	x	113.91		0.5	x	0.7	=	354.2	(79)
Southwest 0.9x	0.77	x	12.82	x	104.39		0.5	x	0.7	=	324.6	(79)
Southwest 0.9x	0.77	x	12.82	x	92.85		0.5	x	0.7	=	288.72	(79)
Southwest 0.9x	0.77	x	12.82	x	69.27		0.5	x	0.7	=	215.39	(79)
Southwest 0.9x	0.77	x	12.82	x	44.07		0.5	x	0.7	=	137.04	(79)
Southwest 0.9x	0.77	x	12.82	x	31.49		0.5	x	0.7	=	97.91	(79)
Northwest 0.9x	0.77	x	16.36	x	11.28	x	0.5	x	0.7	=	44.77	(81)
Northwest 0.9x	0.77	x	16.36	x	22.97	x	0.5	x	0.7	=	91.13	(81)
Northwest 0.9x	0.77	x	16.36	x	41.38	x	0.5	x	0.7	=	164.2	(81)
Northwest 0.9x	0.77	x	16.36	x	67.96	x	0.5	x	0.7	=	269.66	(81)
Northwest 0.9x	0.77	x	16.36	x	91.35	x	0.5	x	0.7	=	362.47	(81)
Northwest 0.9x	0.77	x	16.36	x	97.38	x	0.5	x	0.7	=	386.43	(81)
Northwest 0.9x	0.77	x	16.36	x	91.1	x	0.5	x	0.7	=	361.5	(81)
Northwest 0.9x	0.77	x	16.36	x	72.63	x	0.5	x	0.7	=	288.19	(81)
Northwest 0.9x	0.77	x	16.36	x	50.42	x	0.5	x	0.7	=	200.08	(81)
Northwest 0.9x	0.77	x	16.36	x	28.07	x	0.5	x	0.7	=	111.37	(81)

Northwest 0.9x	0.77	x	16.36	x	14.2	x	0.5	x	0.7	=	56.33	(81)
Northwest 0.9x	0.77	x	16.36	x	9.21	x	0.5	x	0.7	=	36.56	(81)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	180.77	327.24	499.06	704.36	867.43	895.69	849.17	722.23	569.32	375.51	220.04	152.43	(83)

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

(84)m=	734.1	876.36	1027.12	1199.68	1329.2	1327.3	1263.06	1144.2	1010.03	849.17	730.4	690.59	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.93	0.91	0.86	0.78	0.66	0.53	0.42	0.47	0.65	0.83	0.91	0.94	(86)

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

(87)m=	17.95	18.31	18.9	19.62	20.25	20.67	20.86	20.82	20.46	19.63	18.66	17.87	(87)

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

(88)m=	19.5	19.51	19.51	19.51	19.52	19.52	19.52	19.52	19.52	19.52	19.51	19.51	(88)

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

(89)m=	0.92	0.89	0.84	0.74	0.6	0.44	0.3	0.34	0.57	0.79	0.89	0.93	(89)

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

(90)m=	17.78	18	18.37	18.81	19.18	19.41	19.49	19.48	19.31	18.84	18.23	17.73	(90)

fLA = Living area ÷ (4) = | 0.22 | (91)

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

(92)m=	17.81	18.07	18.48	18.99	19.41	19.68	19.79	19.77	19.56	19.01	18.32	17.76	(92)

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

(93)m=	17.81	18.07	18.48	18.99	19.41	19.68	19.79	19.77	19.56	19.01	18.32	17.76	(93)

8. Space heating requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.91	0.87	0.82	0.72	0.6	0.45	0.32	0.37	0.57	0.77	0.88	0.92	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	665.65	764.36	838.51	867.16	793.23	596.89	405.01	417.8	576.78	655.41	639.83	632.44	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1880.31	1830.55	1663.68	1393.92	1064.43	698.64	438.25	462.84	751.86	1160.91	1551.84	1878.71	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	903.71	716.48	613.93	379.27	201.78	0	0	0	0	376.09	656.65	927.22	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = | 4775.13 | (98)

Space heating requirement in kWh/m²/year | 60.07 | (99)

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

Space heating:

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

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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)	903.71	716.48	613.93	379.27	201.78	0	0	0	0	376.09	656.65	927.22		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	971.73	770.41	660.14	407.82	216.96	0	0	0	0	404.4	706.07	997.02		(211)
Total (kWh/year) =Sum(211)$_{1...5,10...12}$=													5134.54	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208) (215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10...12}$=													0	(215)

Water heating

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Output from water heater (calculated above)	171.91	150.93	157.11	138.91	134.73	118.39	111.81	125.31	125.92	144.16	154.85	167.13		
Efficiency of water heater													86.7	(216)
(217)m=	89.46	89.41	89.31	89.09	88.65	86.7	86.7	86.7	86.7	89.06	89.35	89.48		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m (219)m=	192.17	168.81	175.92	155.92	151.98	136.55	128.97	144.54	145.24	161.87	173.31	186.78		
Total = Sum(219a)$_{1...12}$ =													1922.05	(219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			5134.54	
Water heating fuel used			1922.05	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			343.81	(232)
Electricity generated by PVs			-1276.19	(233)

10a. Fuel costs - individual heating systems:

	Fuel kWh/year	**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211) x	3.48	x 0.01 =	178.68	(240)
Space heating - main system 2	(213) x	0	x 0.01 =	0	(241)
Space heating - secondary	(215) x	13.19	x 0.01 =	0	(242)
Water heating cost (other fuel)	(219)	3.48	x 0.01 =	66.89	(247)
Pumps, fans and electric keep-hot	(231)	13.19	x 0.01 =	9.89	(249)

(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a

Energy for lighting	(232)	13.19	x 0.01 =	45.35	(250)
Additional standing charges (Table 12)				120	(251)
	one of (233) to (235) x)	13.19	x 0.01 =	-168.33	(252)
Appendix Q items: repeat lines (253) and (254) as needed					
Total energy cost	(245)...(247) + (250)...(254) =			252.48	(255)

11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	0.85	(257)
SAP rating (Section 12)		88.12	(258)

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

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	1109.06	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	415.16	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1524.23	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	178.44	(268)
Energy saving/generation technologies					
Item 1		0.519	=	-662.34	(269)
Total CO2, kg/year		sum of (265)…(271) =		1079.24	(272)
CO2 emissions per m²		(272) ÷ (4) =		13.58	(273)
EI rating (section 14)				88	(274)

13a. Primary Energy

	Energy kWh/year	**Primary** factor		**P. Energy** kWh/year	
Space heating (main system 1)	(211) x	1.22	=	6264.14	(261)
Space heating (secondary)	(215) x	3.07	=	0	(263)
Energy for water heating	(219) x	1.22	=	2344.91	(264)
Space and water heating	(261) + (262) + (263) + (264) =			8609.05	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	3.07	=	230.25	(267)
Electricity for lighting	(232) x	0	=	1055.5	(268)
Energy saving/generation technologies					
Item 1		3.07	=	-3917.91	(269)
'Total Primary Energy		sum of (265)…(271) =		5976.89	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =		75.19	(273)

SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 01 February 2016

Property Details: 01-16-55567 Plot 1 PL1

Dwelling type:	Detached House
Located in:	England
Region:	Thames valley
Cross ventilation possible:	Yes
Number of storeys:	1
Front of dwelling faces:	South East
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	Dark-coloured curtain or roller blind
Ventilation rate during hot weather (ach):	3 (Windows open half the time)

Overheating Details:

Summer ventilation heat loss coefficient:	261.27	**(P1)**
Transmission heat loss coefficient:	91.7	
Summer heat loss coefficient:	352.97	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
South East (SE Elevation)	0	1
North West (NW Elevation)	0	1
South West (SW Elevation)	0	1
North East (NE Elevation)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
South East (SE Elevation)	0.85	0.9	1	0.76	**(P8)**
North West (NW Elevation)	0.85	0.9	1	0.76	**(P8)**
South West (SW Elevation)	0.85	0.9	1	0.76	**(P8)**
North East (NE Elevation)	0.85	0.9	1	0.76	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
South East (SE Elevation)	0.9 x	0.92	119.92	0.5	0.7	0.76	26.59	
North West (NW Elevation)	0.9 x	16.36	98.85	0.5	0.7	0.76	389.68	
South West (SW Elevation)	0.9 x	12.82	119.92	0.5	0.7	0.76	370.48	
North East (NE Elevation)	0.9 x	4.89	98.85	0.5	0.7	0.76	116.48	
						Total	903.22	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	428.61	410.88	418.97	
Total summer gains	1391.85	1314.11	1203.48	**(P5)**
Summer gain/loss ratio	3.94	3.72	3.41	**(P6)**
Mean summer external temperature (Thames valley)	16	17.9	17.8	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	21.24	22.92	22.51	**(P7)**
Likelihood of high internal temperature	**Slight**	**Medium**	**Medium**	

SAP 2012 Overheating Assessment

Assessment of likelihood of high internal temperature: Medium