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DESIGN AND ACCESS STATEMENT
134 Torriano Avenue
London NW5 2RY

APPLICATION FOR PLANNING PERMISSION
February 2018

Prepared by Binom Architects
on behalf of Mark Webber

CONTENTS:

1. INTRODUCTION

This Design and Access Statement has been prepared by Binom Architects on behalf of Mr.Webber, in support of the application for planning permission for a house extension located in 134 Torriano Avenue, NW5 2RY, in Kentish Town, London.

The proposal consists of the alterations to the Ground Floor plan to replace the existing kitchen back extension, and the opening of a new door in the rear facade to access the new terrace from first floor staircase landing level.

The purpose is to improve the living areas in contact with the garden, providing a flexible open plan more suited to a contemporary way of life.

This statement aims to justify the proposal and demonstrate that there will be no detrimental effects on the surrounding area.

134 Torriano Avenue, Location Plan

2. SITE DESCRIPTION

The local area of Tufnell Park reaches into Dartmouth Park and Kentish Town being predominantly residential having some local streets of small independent shops which are popular and thriving.

Brecknock Road forms the boundary between the original Edwardian properties and the 1950's blocks of flats to the East. These flats are typically set within gardens which set back from the pavement edge and vary in design and quality. Many of the properties within the Edwardian street were designed as single family houses and many have now been divided into flats and bedsits. The area has been, until recently, very run down and untidy with various roof extensions and window replacements. Local streets have lost much of the original regimented and repetitive quality that Edwardian streets would originally have had.

View from the corner between Brecknock Road and Torriano Avenue

134 Torriano Avenue, front elevation.

Mansard roof and back extensions vary considerably throughout the area with some of traditional design and others more modern in style. The area is not within a conservation area. However, the neighbourhood does have an unique character and sense of identity which is endearing. This includes ad-hoc roof treatment, colours and replacement windows.

The corner building beside 134 Torriano Avenue, 99 Brecknock Road, has an additional floor within the roof space built behind the parapet wall, also a new extension at Ground Floor level which is used as roof terrace by the occupiers at first floor level. The adjacent neighbour located at 132 Torriano Avenue has built a back extension at Ground Floor level which provides a balcony at First Floor level, similar in size to our proposal.


134 Torriano Avenue, rear elevation, view from Brecknock Road

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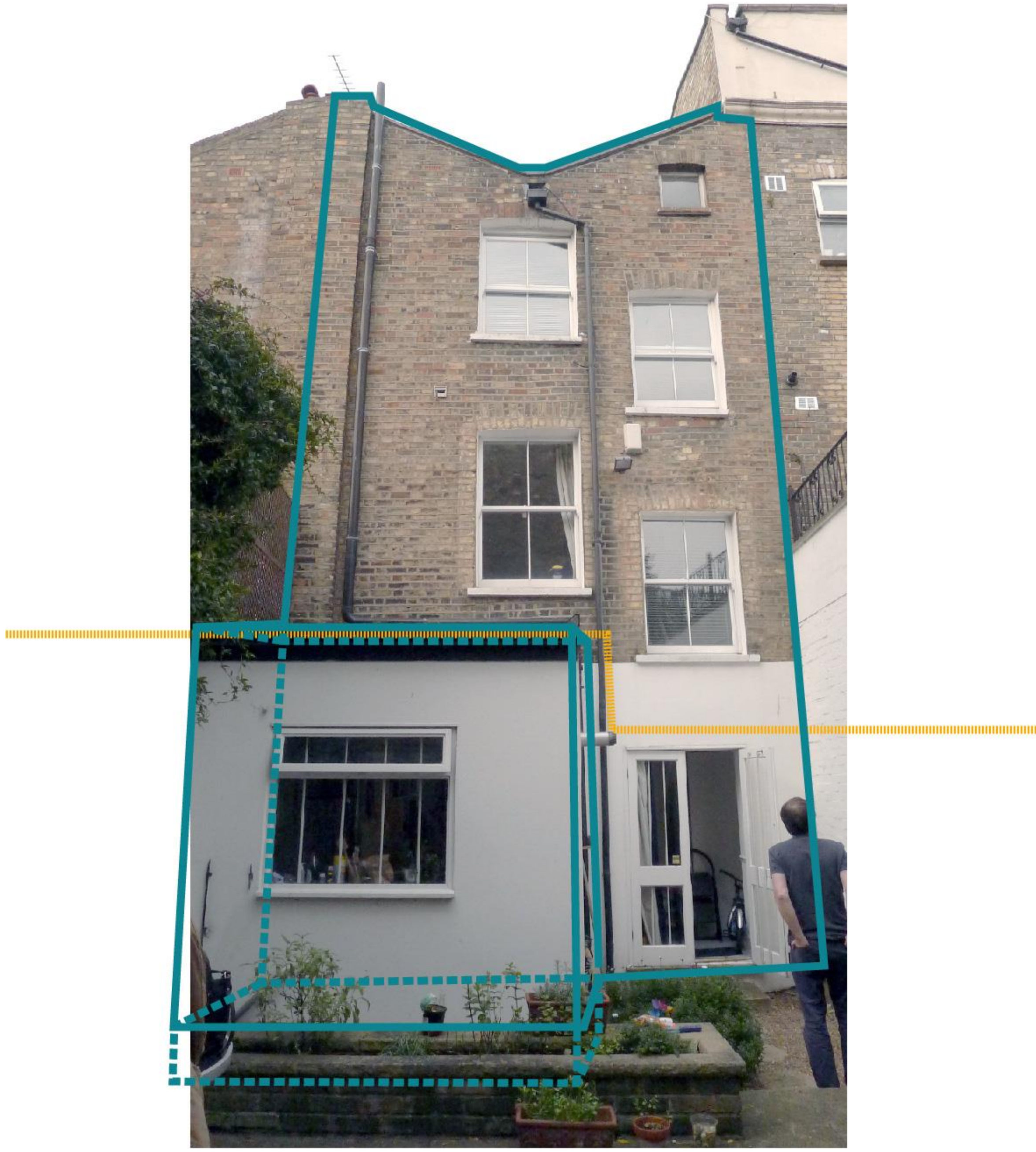
134 Torriano Avenue, existing rear elevation

3. DESCRIPTION OF THE PROPOSAL: EXTERNAL ALTERATIONS TO GROUND AND FIRST FLOOR LEVELS

The existing rear extension is of poor quality, it comprises a small kitchen facing the garden. The extension provided this additional functional area to the house but at the same time reduced the amount of natural light creating some dark inner living spaces. It also reduced the connectivity with the rear garden. Also, the lack of insulation in the room, the associated problems of temperature and condensation, and its lack of connectivity with the rest of the house, makes it in an unpleasant space to stay.

The proposed layouts are shown on the Binom Architects PDF drawings accompanying this application for Planning Permission. The scheme aims to provide additional and more functional living spaces at Ground Floor to accommodate the family comfortably, promoting a direct connection with the rear garden. The proposal comprises the following:

Ground floor:

- Demolition of existing rear extension
- Erection of a new single storey rear extension which would cover the full width of the existing rear façade.
- New extension will protrude from the existing rear façade 3.86m and will be 3.2m high, therefore the whole proposal will not be visible from street level.
- Partial removal of tiled floor to the existing garden in exchange of a new soft grass area.
- Drainage manhole cover to be relocated to suit the new kitchen layout.
- New glazed façade to the new extension to improve the visual connection between garden-family house.
- High quality contemporary light materials such as timber/painted brick/tiles and glass will be used rather than mimicking those of the existing building. This would also help to separate the perception between the 19th Century town house and the contemporary addition, so each volume enhances the values of the other.

First floor:

- New balcony at first floor level.
- Alterations to the existing rear facade: Existing window lintel and sill to WFF 02 (Sash window) will be raised and lowered down to accommodate the new entrance to the balcony. This timber sash window located at the first floor staircase landing level will be replaced by a single glazed door and fixed glazed panel.
- A built-in front planter faced in timber, metal balustrade and timber decking are the main materials for this part of the extension, as well as a new rooflight to introduce as much light as possible to the existing period building.
- Existing drainage and water pipes running across the rear façade at first floor level will be relocated within the new roof to the extension.
- The boundary wall will maintain the current height on both sides
- There is an existing ventilation pipe from 99 Brecknock Road building to the party wall which will need to be re-routed within the new extension build up.

Second floor loft area – rear facade:

- Existing water pipe from roof level will be re-located to the edge of the façade.

134 Torriano Avenue, proposed rear elevation

4. AREA SCHEDULE

The total existing internal area is 120 sqm/ split in 3 floors. The front garden is approximately 17 sqm and the back garden occupies and area of 39 sqm including the hard paved area between the house and the garden wall.

The proposed extension will add 11 sqm to the existing house at Ground Floor level mainly occupying the stone/ground area between the existing extension side wall facade and the garden wall to 99 Brecknock Road building. The new balcony will have 19sqm to be used also as extension of the existing garden.

The area of the garden where plants grow will be mostly preserved, given that the portion that will be occupied by the extension presents a screed floor covered in gravel and is not currently used.

5. CONCLUSION

The carefully designed configuration and the choice of external and internal finishes will provide a high quality architectural addition to the existing building, while having no negative impact in the surrounding area.

The proposal presented by Binom Architects has been prepared after careful consideration of the information available on the existing building and our knowledge of the construction typologies, techniques and materials used.

In conclusion we believe that this proposal observes all the relevant Camden Council's policies and will enhance the existing features of this building contributing positively to the Kentish Town historic environment.

6. APPENDICES

Appendix A: PART L COMPIANCE REPORT

OG ENERGY
OG Energy Ltd
First Floor, 2E Berol House, 25 Ashley Road
London, N17 9LJ; og@ogenergy.co.uk

MID-TERRACE HOUSE,
134, TORRIANO AVENUE
LONDON NW5 2RY

Part L1B Compliance Checklist
-2010 PART L1B BUILDING REGULATIONS-

Paragraph	Requirement	Comments	Pass/ Fail
4.1 a (5.3-5.4)	**Newly constructed and replacement thermal elements:** Area weighted average U-value: Walls: 0.28 W/m^{2}K Pitched roof, insulation at rafter level: 0.18 W/m^{2}K Pitched roof, insulation at ceiling level: 0.16 W/m^{2}K Flat roof: 0.18 W/m^{2}K Floor: 0.22 W/m^{2}K	- Newly constructed ground floor will achieve U-value of 0.22 W/m^{2}K - Newly constructed external walls will achieve U-value of 0.28 W/m^{2}K - Newly constructed flat roof will achieve U-value of 0.18 W/m^{2}K - Upgraded pitched roof, insulation at ceiling level will achieve U-value of 0.16 W/m^{2}K	**Pass**
4.1 b (4.19)	**Controlled fittings performance (applies to new or replacement fittings):** Area weighted average U-value: Window, roof window or rooflight: 1.6 W/m^{2}K Glazed doors: 1.8 W/m^{2}K Solid doors: 1.8 W/m^{2}K	- New windows and rooflights will achieve U-value of 1.6 W/m^{2}K or lower - New glazed doors will achieve U-value of 1.8 W/m^{2}K or lower	**Pass**
4.2	**Area of windows, roof windows and doors** Maximum area of openings in extension: 25% of the extension floor area + area of openings which, as a result of the extension works, no longer exist.	- Area of openings in the extensions: 14.03 m^2 - Floor area of the proposed extensions: 18.20 m^2 - Area of existing removed openings: 5.78 m^2 - Area of openings in notional extension: 10.33 m^2	**Pass (par. 4.6)**

4.3 (4.24)	**Minimum efficiencies and controls of heating and hot water system:** - Efficiency of appliances not less then that recommended for its type in the Domestic Heating Compliance Guide (Minimum gas boiler SEDBUK 2009 efficiency 88%, minimum heat pump CoP of 2.2) - Controls that meet the minimum requirements as given in the Domestic Heating Compliance Guide	- Regular condensing boiler Vaillant ecoTEC plus 630 H system A - Controls will meet the minimum requirements as given in the Domestic Heating Compliance Guide	**Pass**
4.3 (4.24 a)	**Insulation of pipes and ducts** Insulated to standards that are not worse than those set out in the Domestic Heating Compliance Guide	- Fully insulated primary pipework	**Pass**
4.3 (4.24 c)	**Mechanical cooling** Energy efficiency ratio EER > 2.4	- Proposed building works do not include provision of mechanical cooling	**N/A**
4.3 (4.24 d)	**Fixed internal lighting** - Provide fixed energy efficient light fittings that number not less than three per four fixed light fittings. - Low energy light fittings should have lamps with luminous efficacy greater than 45 lamp lumens per circuit-watt and total output greater than 400 lamp lumens	- At least 75% of all lights in the new extension will be low energy	**Pass**
4.3 (4.24 e)	**Fixed external lighting** - Lamp capacity does not exceed 100 W per fitting and the lamp automatically switches off when there is enough daylight and when it is not required OR - Only low energy light fittings are provided	Builder's submission	**N/A**
4.3 (4.30)	**Commissioning of controlled services**	Builder's submission	**N/A**
4.15 b (5.5-5.6)	**Continuity of insulation and airtightness:** - Avoid thermal bridges in insulation caused by gaps, at the joints between elements and edges of elements - Reduce unwanted air leakage through the new envelope parts - Adopt Accredited Construction Details where practical	Builder's submission	**N/A**

4.6	**More design flexibility using SAP2012** Demonstrate that CO2 emissions from all the dwellings in the building as it will become are no greater than if each dwelling had been improved following the guidance set out in paragraphs 4.1 to 4.3	CO2 emissions from building built to the standards set out in paragraphs 4.1 to 4.3 (notional house): 5,956.10 $kgCO_2$ / year CO2 emissions from building as proposed : 4,562.75 $kgCO_2$ / year (Supporting SAP worksheets attached)	**Pass**

Ondrej Gajdos

OG Energy Ltd

SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Ondrej Gajdos	**Stroma Number:**	STRO006629
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.10

Property Address: 134, Torriano Avenue

Address : 134, Torriano Avenue, LONDON, NW5 2RY

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Ground floor	58.1	(1a)	x	2.75	(2a)	=	159.77	(3a)
First floor	38.8	(1b)	x	3.05	(2b)	=	118.34	(3b)
Second floor	38.8	(1c)	x	2.75	(2c)	=	106.7	(3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	135.7	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)		=	384.81	(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							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.08	(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		0	(11)

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

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		15	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.83	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.78	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.64	(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

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

0.82	0.8	0.79	0.71	0.69	0.61	0.61	0.59	0.64	0.69	0.72	0.75

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=	0.83	0.82	0.81	0.75	0.74	0.69	0.69	0.68	0.71	0.74	0.76	0.78	(24d)

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

(25)m=	0.83	0.82	0.81	0.75	0.74	0.69	0.69	0.68	0.71	0.74	0.76	0.78	(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			1.83	x	3	=	5.49			(26)
Windows Type 1			0.39	x1/[1/(4.8)+ 0.04]		=	1.57			(27)
Windows Type 2			2.44	x1/[1/(4.8)+ 0.04]		=	9.83			(27)
Windows Type 3			1.36	x1/[1/(4.8)+ 0.04]		=	5.48			(27)
Windows Type 4			1.36	x1/[1/(4.8)+ 0.04]		=	5.48			(27)
Windows Type 5			2	x1/[1/(4.8)+ 0.04]		=	8.05			(27)
Windows Type 6			1.75	x1/[1/(4.8)+ 0.04]		=	7.05			(27)
Windows Type 7			6.44	x1/[1/(1.8)+ 0.04]		=	10.81			(27)
Windows Type 8			1.93	x1/[1/(1.8)+ 0.04]		=	3.24			(27)
Windows Type 9			2.13	x1/[1/(4.8)+ 0.04]		=	8.58			(27)
Windows Type 10			1.56	x1/[1/(4.8)+ 0.04]		=	6.28			(27)
Windows Type 11			0.28	x1/[1/(4.8)+ 0.04]		=	1.13			(27)
Rooflights			1.95	x1/[1/(1.6) + 0.04]		=	3.12			(27b)
Floor Type 1			39.9	x	0.36	=	14.364			(28)
Floor Type 2			18.2	x	0.22	=	4.004			(28)
Walls Type1	73.23	22.34	50.89	x	2.1	=	106.87			(29)
Walls Type2	13.25	6.44	6.81	x	0.28	=	1.91			(29)

Roof Type1	38.8	0	38.8	x	2.3	=	89.24			(30)
Roof Type2	1.7	0	1.7	x	2.3	=	3.91			(30)
Roof Type3	17.6	1.95	15.65	x	0.18	=	2.82			(30)

Total area of elements, m² 202.68 (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) = 320.41 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (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 can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 30.4 (36)

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

Total fabric heat loss (33) + (36) = 350.81 (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=	105.99	104.34	102.73	95.13	93.71	87.09	87.09	85.86	89.64	93.71	96.58	99.59	(38)

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

(39)m=	456.8	455.15	453.53	445.94	444.51	437.9	437.9	436.67	440.45	444.51	447.39	450.4	

Average = Sum(39)$_{1…12}$ /12= 445.93 (39)

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

(40)m=	3.37	3.35	3.34	3.29	3.28	3.23	3.23	3.22	3.25	3.28	3.3	3.32	

Average = Sum(40)$_{1…12}$ /12= 3.29 (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 2.91 (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) + 36 103.27 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 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=	113.6	109.47	105.34	101.21	97.08	92.95	92.95	97.08	101.21	105.34	109.47	113.6	

Total = Sum(44)$_{1…12}$ = 1239.3 (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=	168.47	147.34	152.05	132.56	127.19	109.76	101.71	116.71	118.1	137.64	150.24	163.15	

Total = Sum(45)$_{1…12}$ = 1624.91 (45)

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

(46)m=	25.27	22.1	22.81	19.88	19.08	16.46	15.26	17.51	17.72	20.65	22.54	24.47	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 170 (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) =	170	(50)
b) If manufacturer's declared cylinder loss factor is not known:			
Hot water storage loss factor from Table 2 (kWh/litre/day)		0.02	(51)
If community heating see section 4.3			
Volume factor from Table 2a		0.89	(52)
Temperature factor from Table 2b		0.54	(53)
Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	1.56	(54)
Enter (50) or (54) in (55)		1.56	(55)

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

(56)m=	48.4	43.72	48.4	46.84	48.4	46.84	48.4	48.4	46.84	48.4	46.84	48.4	(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=	48.4	43.72	48.4	46.84	48.4	46.84	48.4	48.4	46.84	48.4	46.84	48.4	(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=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

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

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(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=	240.13	212.07	223.71	201.91	198.86	179.11	173.37	188.37	187.46	209.3	219.6	234.82	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)
(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

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

Output from water heater

(64)m=	240.13	212.07	223.71	201.91	198.86	179.11	173.37	188.37	187.46	209.3	219.6	234.82	

Output from water heater (annual)1…12 — 2468.72 (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=	113.35	100.78	107.89	99.56	99.62	91.98	91.15	96.14	94.75	103.1	105.44	111.58	(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=	174.5	174.5	174.5	174.5	174.5	174.5	174.5	174.5	174.5	174.5	174.5	174.5	(66)

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

(67)m=	84.82	75.34	61.27	46.39	34.67	29.27	31.63	41.11	55.18	70.07	81.78	87.18	(67)

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

(68)m=	454.43	459.14	447.26	421.96	390.03	360.02	339.97	335.25	347.13	372.43	404.37	434.38	(68)

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

(69)m=	55.36	55.36	55.36	55.36	55.36	55.36	55.36	55.36	55.36	55.36	55.36	55.36	(69)

Pumps and fans gains (Table 5a)

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

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

(71)m=	-116.34	-116.34	-116.34	-116.34	-116.34	-116.34	-116.34	-116.34	-116.34	-116.34	-116.34	-116.34	(71)

Water heating gains (Table 5)

(72)m=	152.35	149.96	145.01	138.28	133.9	127.75	122.51	129.22	131.6	138.57	146.44	149.97	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	815.13	807.98	777.07	730.15	682.13	640.56	617.64	629.11	657.45	704.6	756.11	795.06	(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)	
North	0.9x	0.77	x	1.36	x	10.63	x	0.85	x	0.7	=	5.96	(74)
North	0.9x	0.77	x	1.36	x	20.32	x	0.85	x	0.7	=	11.4	(74)
North	0.9x	0.77	x	1.36	x	34.53	x	0.85	x	0.7	=	19.36	(74)
North	0.9x	0.77	x	1.36	x	55.46	x	0.85	x	0.7	=	31.1	(74)
North	0.9x	0.77	x	1.36	x	74.72	x	0.85	x	0.7	=	41.9	(74)
North	0.9x	0.77	x	1.36	x	79.99	x	0.85	x	0.7	=	44.85	(74)
North	0.9x	0.77	x	1.36	x	74.68	x	0.85	x	0.7	=	41.88	(74)
North	0.9x	0.77	x	1.36	x	59.25	x	0.85	x	0.7	=	33.22	(74)
North	0.9x	0.77	x	1.36	x	41.52	x	0.85	x	0.7	=	23.28	(74)
North	0.9x	0.77	x	1.36	x	24.19	x	0.85	x	0.7	=	13.56	(74)
North	0.9x	0.77	x	1.36	x	13.12	x	0.85	x	0.7	=	7.36	(74)
North	0.9x	0.77	x	1.36	x	8.86	x	0.85	x	0.7	=	4.97	(74)
Southeast	0.9x	0.77	x	6.44	x	36.79	x	0.63	x	0.7	=	72.42	(77)
Southeast	0.9x	0.77	x	1.93	x	36.79	x	0.63	x	0.7	=	21.7	(77)
Southeast	0.9x	0.77	x	2.13	x	36.79	x	0.85	x	0.7	=	32.32	(77)
Southeast	0.9x	0.77	x	1.56	x	36.79	x	0.85	x	0.7	=	47.33	(77)
Southeast	0.9x	0.77	x	0.28	x	36.79	x	0.85	x	0.7	=	4.25	(77)
Southeast	0.9x	0.77	x	6.44	x	62.67	x	0.63	x	0.7	=	123.35	(77)
Southeast	0.9x	0.77	x	1.93	x	62.67	x	0.63	x	0.7	=	36.97	(77)
Southeast	0.9x	0.77	x	2.13	x	62.67	x	0.85	x	0.7	=	55.04	(77)
Southeast	0.9x	0.77	x	1.56	x	62.67	x	0.85	x	0.7	=	80.63	(77)
Southeast	0.9x	0.77	x	0.28	x	62.67	x	0.85	x	0.7	=	7.24	(77)
Southeast	0.9x	0.77	x	6.44	x	85.75	x	0.63	x	0.7	=	168.77	(77)
Southeast	0.9x	0.77	x	1.93	x	85.75	x	0.63	x	0.7	=	50.58	(77)
Southeast	0.9x	0.77	x	2.13	x	85.75	x	0.85	x	0.7	=	75.31	(77)
Southeast	0.9x	0.77	x	1.56	x	85.75	x	0.85	x	0.7	=	110.32	(77)
Southeast	0.9x	0.77	x	0.28	x	85.75	x	0.85	x	0.7	=	9.9	(77)
Southeast	0.9x	0.77	x	6.44	x	106.25	x	0.63	x	0.7	=	209.12	(77)

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Southeast	0.9x	0.77	x	1.93	x	106.25	x	0.63	x	0.7	=	62.67	(77)
Southeast	0.9x	0.77	x	2.13	x	106.25	x	0.85	x	0.7	=	93.32	(77)
Southeast	0.9x	0.77	x	1.56	x	106.25	x	0.85	x	0.7	=	136.69	(77)
Southeast	0.9x	0.77	x	0.28	x	106.25	x	0.85	x	0.7	=	12.27	(77)
Southeast	0.9x	0.77	x	6.44	x	119.01	x	0.63	x	0.7	=	234.23	(77)
Southeast	0.9x	0.77	x	1.93	x	119.01	x	0.63	x	0.7	=	70.2	(77)
Southeast	0.9x	0.77	x	2.13	x	119.01	x	0.85	x	0.7	=	104.52	(77)
Southeast	0.9x	0.77	x	1.56	x	119.01	x	0.85	x	0.7	=	153.11	(77)
Southeast	0.9x	0.77	x	0.28	x	119.01	x	0.85	x	0.7	=	13.74	(77)
Southeast	0.9x	0.77	x	6.44	x	118.15	x	0.63	x	0.7	=	232.54	(77)
Southeast	0.9x	0.77	x	1.93	x	118.15	x	0.63	x	0.7	=	69.69	(77)
Southeast	0.9x	0.77	x	2.13	x	118.15	x	0.85	x	0.7	=	103.77	(77)
Southeast	0.9x	0.77	x	1.56	x	118.15	x	0.85	x	0.7	=	152	(77)
Southeast	0.9x	0.77	x	0.28	x	118.15	x	0.85	x	0.7	=	13.64	(77)
Southeast	0.9x	0.77	x	6.44	x	113.91	x	0.63	x	0.7	=	224.19	(77)
Southeast	0.9x	0.77	x	1.93	x	113.91	x	0.63	x	0.7	=	67.19	(77)
Southeast	0.9x	0.77	x	2.13	x	113.91	x	0.85	x	0.7	=	100.04	(77)
Southeast	0.9x	0.77	x	1.56	x	113.91	x	0.85	x	0.7	=	146.54	(77)
Southeast	0.9x	0.77	x	0.28	x	113.91	x	0.85	x	0.7	=	13.15	(77)
Southeast	0.9x	0.77	x	6.44	x	104.39	x	0.63	x	0.7	=	205.46	(77)
Southeast	0.9x	0.77	x	1.93	x	104.39	x	0.63	x	0.7	=	61.57	(77)
Southeast	0.9x	0.77	x	2.13	x	104.39	x	0.85	x	0.7	=	91.68	(77)
Southeast	0.9x	0.77	x	1.56	x	104.39	x	0.85	x	0.7	=	134.3	(77)
Southeast	0.9x	0.77	x	0.28	x	104.39	x	0.85	x	0.7	=	12.05	(77)
Southeast	0.9x	0.77	x	6.44	x	92.85	x	0.63	x	0.7	=	182.75	(77)
Southeast	0.9x	0.77	x	1.93	x	92.85	x	0.63	x	0.7	=	54.77	(77)
Southeast	0.9x	0.77	x	2.13	x	92.85	x	0.85	x	0.7	=	81.55	(77)
Southeast	0.9x	0.77	x	1.56	x	92.85	x	0.85	x	0.7	=	119.45	(77)
Southeast	0.9x	0.77	x	0.28	x	92.85	x	0.85	x	0.7	=	10.72	(77)
Southeast	0.9x	0.77	x	6.44	x	69.27	x	0.63	x	0.7	=	136.33	(77)
Southeast	0.9x	0.77	x	1.93	x	69.27	x	0.63	x	0.7	=	40.86	(77)
Southeast	0.9x	0.77	x	2.13	x	69.27	x	0.85	x	0.7	=	60.84	(77)
Southeast	0.9x	0.77	x	1.56	x	69.27	x	0.85	x	0.7	=	89.11	(77)
Southeast	0.9x	0.77	x	0.28	x	69.27	x	0.85	x	0.7	=	8	(77)
Southeast	0.9x	0.77	x	6.44	x	44.07	x	0.63	x	0.7	=	86.74	(77)
Southeast	0.9x	0.77	x	1.93	x	44.07	x	0.63	x	0.7	=	25.99	(77)
Southeast	0.9x	0.77	x	2.13	x	44.07	x	0.85	x	0.7	=	38.71	(77)
Southeast	0.9x	0.77	x	1.56	x	44.07	x	0.85	x	0.7	=	56.7	(77)
Southeast	0.9x	0.77	x	0.28	x	44.07	x	0.85	x	0.7	=	5.09	(77)
Southeast	0.9x	0.77	x	6.44	x	31.49	x	0.63	x	0.7	=	61.97	(77)
Southeast	0.9x	0.77	x	1.93	x	31.49	x	0.63	x	0.7	=	18.57	(77)

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Southeast	0.9x	0.77	x	2.13	x	31.49	x	0.85	x	0.7	=	27.65	(77)
Southeast	0.9x	0.77	x	1.56	x	31.49	x	0.85	x	0.7	=	40.51	(77)
Southeast	0.9x	0.77	x	0.28	x	31.49	x	0.85	x	0.7	=	3.64	(77)
West	0.9x	0.77	x	1.36	x	19.64	x	0.85	x	0.7	=	11.01	(80)
West	0.9x	0.77	x	1.36	x	38.42	x	0.85	x	0.7	=	21.55	(80)
West	0.9x	0.77	x	1.36	x	63.27	x	0.85	x	0.7	=	35.48	(80)
West	0.9x	0.77	x	1.36	x	92.28	x	0.85	x	0.7	=	51.75	(80)
West	0.9x	0.77	x	1.36	x	113.09	x	0.85	x	0.7	=	63.42	(80)
West	0.9x	0.77	x	1.36	x	115.77	x	0.85	x	0.7	=	64.92	(80)
West	0.9x	0.77	x	1.36	x	110.22	x	0.85	x	0.7	=	61.81	(80)
West	0.9x	0.77	x	1.36	x	94.68	x	0.85	x	0.7	=	53.09	(80)
West	0.9x	0.77	x	1.36	x	73.59	x	0.85	x	0.7	=	41.27	(80)
West	0.9x	0.77	x	1.36	x	45.59	x	0.85	x	0.7	=	25.57	(80)
West	0.9x	0.77	x	1.36	x	24.49	x	0.85	x	0.7	=	13.73	(80)
West	0.9x	0.77	x	1.36	x	16.15	x	0.85	x	0.7	=	9.06	(80)
Northwest	0.9x	0.77	x	0.39	x	11.28	x	0.85	x	0.7	=	1.81	(81)
Northwest	0.9x	0.77	x	2.44	x	11.28	x	0.85	x	0.7	=	11.35	(81)
Northwest	0.9x	0.77	x	2	x	11.28	x	0.85	x	0.7	=	18.61	(81)
Northwest	0.9x	0.77	x	1.75	x	11.28	x	0.85	x	0.7	=	16.28	(81)
Northwest	0.9x	0.77	x	0.39	x	22.97	x	0.85	x	0.7	=	3.69	(81)
Northwest	0.9x	0.77	x	2.44	x	22.97	x	0.85	x	0.7	=	23.11	(81)
Northwest	0.9x	0.77	x	2	x	22.97	x	0.85	x	0.7	=	37.88	(81)
Northwest	0.9x	0.77	x	1.75	x	22.97	x	0.85	x	0.7	=	33.14	(81)
Northwest	0.9x	0.77	x	0.39	x	41.38	x	0.85	x	0.7	=	6.65	(81)
Northwest	0.9x	0.77	x	2.44	x	41.38	x	0.85	x	0.7	=	41.63	(81)
Northwest	0.9x	0.77	x	2	x	41.38	x	0.85	x	0.7	=	68.25	(81)
Northwest	0.9x	0.77	x	1.75	x	41.38	x	0.85	x	0.7	=	59.72	(81)
Northwest	0.9x	0.77	x	0.39	x	67.96	x	0.85	x	0.7	=	10.93	(81)
Northwest	0.9x	0.77	x	2.44	x	67.96	x	0.85	x	0.7	=	68.37	(81)
Northwest	0.9x	0.77	x	2	x	67.96	x	0.85	x	0.7	=	112.08	(81)
Northwest	0.9x	0.77	x	1.75	x	67.96	x	0.85	x	0.7	=	98.07	(81)
Northwest	0.9x	0.77	x	0.39	x	91.35	x	0.85	x	0.7	=	14.69	(81)
Northwest	0.9x	0.77	x	2.44	x	91.35	x	0.85	x	0.7	=	91.9	(81)
Northwest	0.9x	0.77	x	2	x	91.35	x	0.85	x	0.7	=	150.66	(81)
Northwest	0.9x	0.77	x	1.75	x	91.35	x	0.85	x	0.7	=	131.83	(81)
Northwest	0.9x	0.77	x	0.39	x	97.38	x	0.85	x	0.7	=	15.66	(81)
Northwest	0.9x	0.77	x	2.44	x	97.38	x	0.85	x	0.7	=	97.98	(81)
Northwest	0.9x	0.77	x	2	x	97.38	x	0.85	x	0.7	=	160.62	(81)
Northwest	0.9x	0.77	x	1.75	x	97.38	x	0.85	x	0.7	=	140.54	(81)
Northwest	0.9x	0.77	x	0.39	x	91.1	x	0.85	x	0.7	=	14.65	(81)
Northwest	0.9x	0.77	x	2.44	x	91.1	x	0.85	x	0.7	=	91.66	(81)

Northwest 0.9x	0.77	x	2	x	91.1	x	0.85	x	0.7	=	150.26	(81)
Northwest 0.9x	0.77	x	1.75	x	91.1	x	0.85	x	0.7	=	131.47	(81)
Northwest 0.9x	0.77	x	0.39	x	72.63	x	0.85	x	0.7	=	11.68	(81)
Northwest 0.9x	0.77	x	2.44	x	72.63	x	0.85	x	0.7	=	73.07	(81)
Northwest 0.9x	0.77	x	2	x	72.63	x	0.85	x	0.7	=	119.79	(81)
Northwest 0.9x	0.77	x	1.75	x	72.63	x	0.85	x	0.7	=	104.81	(81)
Northwest 0.9x	0.77	x	0.39	x	50.42	x	0.85	x	0.7	=	8.11	(81)
Northwest 0.9x	0.77	x	2.44	x	50.42	x	0.85	x	0.7	=	50.73	(81)
Northwest 0.9x	0.77	x	2	x	50.42	x	0.85	x	0.7	=	83.16	(81)
Northwest 0.9x	0.77	x	1.75	x	50.42	x	0.85	x	0.7	=	72.77	(81)
Northwest 0.9x	0.77	x	0.39	x	28.07	x	0.85	x	0.7	=	4.51	(81)
Northwest 0.9x	0.77	x	2.44	x	28.07	x	0.85	x	0.7	=	28.24	(81)
Northwest 0.9x	0.77	x	2	x	28.07	x	0.85	x	0.7	=	46.29	(81)
Northwest 0.9x	0.77	x	1.75	x	28.07	x	0.85	x	0.7	=	40.51	(81)
Northwest 0.9x	0.77	x	0.39	x	14.2	x	0.85	x	0.7	=	2.28	(81)
Northwest 0.9x	0.77	x	2.44	x	14.2	x	0.85	x	0.7	=	14.28	(81)
Northwest 0.9x	0.77	x	2	x	14.2	x	0.85	x	0.7	=	23.42	(81)
Northwest 0.9x	0.77	x	1.75	x	14.2	x	0.85	x	0.7	=	20.49	(81)
Northwest 0.9x	0.77	x	0.39	x	9.21	x	0.85	x	0.7	=	1.48	(81)
Northwest 0.9x	0.77	x	2.44	x	9.21	x	0.85	x	0.7	=	9.27	(81)
Northwest 0.9x	0.77	x	2	x	9.21	x	0.85	x	0.7	=	15.2	(81)
Northwest 0.9x	0.77	x	1.75	x	9.21	x	0.85	x	0.7	=	13.3	(81)
Rooflights 0.9x	1	x	1.95	x	26	x	0.63	x	0.7	=	20.12	(82)
Rooflights 0.9x	1	x	1.95	x	54	x	0.63	x	0.7	=	41.79	(82)
Rooflights 0.9x	1	x	1.95	x	96	x	0.63	x	0.7	=	74.3	(82)
Rooflights 0.9x	1	x	1.95	x	150	x	0.63	x	0.7	=	116.09	(82)
Rooflights 0.9x	1	x	1.95	x	192	x	0.63	x	0.7	=	148.6	(82)
Rooflights 0.9x	1	x	1.95	x	200	x	0.63	x	0.7	=	154.79	(82)
Rooflights 0.9x	1	x	1.95	x	189	x	0.63	x	0.7	=	146.28	(82)
Rooflights 0.9x	1	x	1.95	x	157	x	0.63	x	0.7	=	121.51	(82)
Rooflights 0.9x	1	x	1.95	x	115	x	0.63	x	0.7	=	89	(82)
Rooflights 0.9x	1	x	1.95	x	66	x	0.63	x	0.7	=	51.08	(82)
Rooflights 0.9x	1	x	1.95	x	33	x	0.63	x	0.7	=	25.54	(82)
Rooflights 0.9x	1	x	1.95	x	21	x	0.63	x	0.7	=	16.25	(82)

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

(83)m=	263.17	475.79	720.28	1002.46	1218.8	1251	1189.12	1022.24	817.55	544.89	320.32	221.87	(83)

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

(84)m=	1078.3	1283.76	1497.35	1732.61	1900.93	1891.56	1806.75	1651.35	1475	1249.49	1076.44	1016.93	(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=	0.99	0.99	0.98	0.96	0.91	0.83	0.73	0.77	0.9	0.97	0.99	0.99		(86)

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

(87)m=	17.77	18.01	18.47	19.14	19.8	20.38	20.7	20.63	20.14	19.3	18.44	17.75		(87)

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

(88)m=	18.58	18.58	18.59	18.61	18.62	18.64	18.64	18.64	18.63	18.62	18.61	18.6		(88)

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

(89)m=	0.99	0.98	0.97	0.93	0.85	0.68	0.45	0.51	0.81	0.95	0.98	0.99		(89)

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

(90)m=	15.89	16.13	16.59	17.26	17.89	18.4	18.6	18.58	18.23	17.43	16.57	15.88		(90)
									fLA = Living area ÷ (4) =				0.37	(91)

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

(92)m=	16.58	16.82	17.28	17.95	18.6	19.13	19.37	19.34	18.93	18.12	17.26	16.57		(92)

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

(93)m=	16.58	16.82	17.28	17.95	18.6	19.13	19.37	19.34	18.93	18.12	17.26	16.57		(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	0.98	0.96	0.92	0.85	0.73	0.56	0.62	0.82	0.94	0.98	0.99		(94)
Useful gains, hmGm , W = (94)m x (84)m														
(95)m=	1060.9	1251.81	1434.5	1596	1617.49	1372.66	1010.23	1015.8	1215.14	1174.04	1050.5	1002.74		(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=	5609.42	5426.1	4891.33	4036.05	3065.12	1984.66	1212.85	1281.69	2129.13	3341.98	4545.01	5570.81		(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m														
(98)m=	3384.1	2805.13	2571.88	1756.84	1077.04	0	0	0	0	1612.95	2516.05	3398.65		
								Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =					19122.62	(98)
Space heating requirement in kWh/m²/year													140.92	(99)

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

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		84	(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)														
	3384.1	2805.13	2571.88	1756.84	1077.04	0	0	0	0	1612.95	2516.05	3398.65		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)														(211)
	4028.68	3339.44	3061.77	2091.47	1282.19	0	0	0	0	1920.18	2995.29	4046.01		
								Total (kWh/year) =Sum(211)$_{1...5,10...12}$=					22765.02	(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

Output from water heater (calculated above)

240.13	212.07	223.71	201.91	198.86	179.11	173.37	188.37	187.46	209.3	219.6	234.82

Efficiency of water heater 74 (216)

(217)m=	83.25	83.21	83.1	82.85	82.27	74	74	74	74	82.72	83.1	83.27	(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	288.43	254.87	269.2	243.72	241.72	242.04	234.29	254.56	253.32	253.04	264.26	281.99

Total = Sum(219a)$_{1...12}$ = 3081.43 (219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			22765.02	
Water heating fuel used			3081.43	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		120		(230c)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		120	(231)
Electricity for lighting			599.2	(232)

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 =	792.22	(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 =	107.23	(247)
Pumps, fans and electric keep-hot	(231)	13.19	x 0.01 =	15.83	(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 =	79.03	(250)
Additional standing charges (Table 12)				120	(251)

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

Total energy cost (245)...(247) + (250)…(254) = 1114.32 (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] =	2.59	(257)
SAP rating (Section 12)		63.87	(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	=	4917.25	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	665.59	(264)
Space and water heating	(261) + (262) + (263) + (264) =			5582.84	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	62.28	(267)
Electricity for lighting	(232) x	0.519	=	310.99	(268)
Total CO2, kg/year		sum of (265)…(271) =		5956.1	(272)
CO2 emissions per m²		(272) ÷ (4) =		43.89	(273)
EI rating (section 14)				56	(274)

13a. Primary Energy

	Energy kWh/year	**Primary** factor		**P. Energy** kWh/year	
Space heating (main system 1)	(211) x	1.22	=	27773.33	(261)
Space heating (secondary)	(215) x	3.07	=	0	(263)
Energy for water heating	(219) x	1.22	=	3759.35	(264)
Space and water heating	(261) + (262) + (263) + (264) =			31532.68	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	3.07	=	368.4	(267)
Electricity for lighting	(232) x	0	=	1839.55	(268)
‘Total Primary Energy		sum of (265)…(271) =		33740.63	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =		248.64	(273)

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User Details:

Assessor Name:	Ondrej Gajdos	**Stroma Number:**	STRO006629
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.10

Property Address: 134, Torriano Avenue

Address : 134, Torriano Avenue, LONDON, NW5 2RY

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Ground floor	58.1	(1a)	x	2.75	(2a)	=	159.77	(3a)
First floor	38.8	(1b)	x	3.05	(2b)	=	118.34	(3b)
Second floor	38.8	(1c)	x	2.75	(2c)	=	106.7	(3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	135.7	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)		=	384.81	(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							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.08	(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		0	(11)

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

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		15	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.83	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.78	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.64	(21)

Infiltration rate modified for monthly wind speed

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

Monthly average wind speed from Table 7

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

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Wind Factor (22a)m = (22)m ÷ 4

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

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

0.82	0.8	0.79	0.71	0.69	0.61	0.61	0.59	0.64	0.69	0.72	0.75

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=	0.83	0.82	0.81	0.75	0.74	0.69	0.69	0.68	0.71	0.74	0.76	0.78	(24d)

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

(25)m=	0.83	0.82	0.81	0.75	0.74	0.69	0.69	0.68	0.71	0.74	0.76	0.78	(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			1.83	x	3	=	5.49			(26)
Windows Type 1			0.39	x1/[1/(4.8)+ 0.04]		=	1.57			(27)
Windows Type 2			2.44	x1/[1/(4.8)+ 0.04]		=	9.83			(27)
Windows Type 3			1.36	x1/[1/(4.8)+ 0.04]		=	5.48			(27)
Windows Type 4			1.36	x1/[1/(4.8)+ 0.04]		=	5.48			(27)
Windows Type 5			2	x1/[1/(4.8)+ 0.04]		=	8.05			(27)
Windows Type 6			1.75	x1/[1/(4.8)+ 0.04]		=	7.05			(27)
Windows Type 7			8.74	x1/[1/(1.8)+ 0.04]		=	14.68			(27)
Windows Type 8			2.63	x1/[1/(1.8)+ 0.04]		=	4.42			(27)
Windows Type 9			2.13	x1/[1/(4.8)+ 0.04]		=	8.58			(27)
Windows Type 10			1.56	x1/[1/(4.8)+ 0.04]		=	6.28			(27)
Windows Type 11			0.28	x1/[1/(4.8)+ 0.04]		=	1.13			(27)
Rooflights			2.66	x1/[1/(1.6) + 0.04]		=	4.256			(27b)
Floor Type 1			39.9	x	0.36	=	14.364			(28)
Floor Type 2			18.2	x	0.22	=	4.004			(28)
Walls Type1	73.23	23.04	50.19	x	2.1	=	105.4			(29)
Walls Type2	13.25	8.74	4.51	x	0.28	=	1.26			(29)

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Roof Type1	38.8	0	38.8	x	0.16	=	6.21			(30)
Roof Type2	1.7	0	1.7	x	2.3	=	3.91			(30)
Roof Type3	17.6	2.66	14.94	x	0.18	=	2.69			(30)
Total area of elements, m²			202.68							(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) =	241.24	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	0	(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 can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K		30.4	(36)

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

Total fabric heat loss	(33) + (36) =	271.64	(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=	105.99	104.34	102.73	95.13	93.71	87.09	87.09	85.86	89.64	93.71	96.58	99.59	(38)

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

(39)m=	377.63	375.98	374.36	366.77	365.35	358.73	358.73	357.5	361.28	365.35	368.22	371.23	

Average = Sum(39)$_{1…12}$ /12= 366.76 (39)

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

(40)m=	2.78	2.77	2.76	2.7	2.69	2.64	2.64	2.63	2.66	2.69	2.71	2.74	

Average = Sum(40)$_{1…12}$ /12= 2.7 (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 — 2.91 (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 — 103.27 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 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=	113.6	109.47	105.34	101.21	97.08	92.95	92.95	97.08	101.21	105.34	109.47	113.6	

Total = Sum(44)$_{1…12}$ = 1239.3 (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=	168.47	147.34	152.05	132.56	127.19	109.76	101.71	116.71	118.1	137.64	150.24	163.15	

Total = Sum(45)$_{1…12}$ = 1624.91 (45)

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

(46)m=	25.27	22.1	22.81	19.88	19.08	16.46	15.26	17.51	17.72	20.65	22.54	24.47	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel — 170 (47)

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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) =	170	(50)
b) If manufacturer's declared cylinder loss factor is not known:			
Hot water storage loss factor from Table 2 (kWh/litre/day)		0.02	(51)
If community heating see section 4.3			
Volume factor from Table 2a		0.89	(52)
Temperature factor from Table 2b		0.54	(53)
Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	1.56	(54)
Enter (50) or (54) in (55)		1.56	(55)

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

(56)m=	48.4	43.72	48.4	46.84	48.4	46.84	48.4	48.4	46.84	48.4	46.84	48.4	(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=	48.4	43.72	48.4	46.84	48.4	46.84	48.4	48.4	46.84	48.4	46.84	48.4	(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=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

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

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(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=	240.13	212.07	223.71	201.91	198.86	179.11	173.37	188.37	187.46	209.3	219.6	234.82	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)
(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

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

Output from water heater

(64)m=	240.13	212.07	223.71	201.91	198.86	179.11	173.37	188.37	187.46	209.3	219.6	234.82

Output from water heater (annual)$_{1...12}$ — 2468.72 (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=	113.35	100.78	107.89	99.56	99.62	91.98	91.15	96.14	94.75	103.1	105.44	111.58	(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=	174.5	174.5	174.5	174.5	174.5	174.5	174.5	174.5	174.5	174.5	174.5	174.5	(66)

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

(67)m=	67.86	60.27	49.02	37.11	27.74	23.42	25.3	32.89	44.15	56.05	65.42	69.74	(67)

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

(68)m=	454.43	459.14	447.26	421.96	390.03	360.02	339.97	335.25	347.13	372.43	404.37	434.38	(68)

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

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(69)m=	55.36	55.36	55.36	55.36	55.36	55.36	55.36	55.36	55.36	55.36	55.36	55.36	(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=	-116.34	-116.34	-116.34	-116.34	-116.34	-116.34	-116.34	-116.34	-116.34	-116.34	-116.34	-116.34	(71)

Water heating gains (Table 5)

(72)m=	152.35	149.96	145.01	138.28	133.9	127.75	122.51	129.22	131.6	138.57	146.44	149.97	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	791.16	785.91	757.81	713.87	668.2	627.71	604.31	613.89	639.41	683.58	732.76	770.62	(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)	
North	0.9x	0.77	x	1.36	x	10.63	x	0.85	x	0.7	=	5.96	(74)
North	0.9x	0.77	x	1.36	x	20.32	x	0.85	x	0.7	=	11.4	(74)
North	0.9x	0.77	x	1.36	x	34.53	x	0.85	x	0.7	=	19.36	(74)
North	0.9x	0.77	x	1.36	x	55.46	x	0.85	x	0.7	=	31.1	(74)
North	0.9x	0.77	x	1.36	x	74.72	x	0.85	x	0.7	=	41.9	(74)
North	0.9x	0.77	x	1.36	x	79.99	x	0.85	x	0.7	=	44.85	(74)
North	0.9x	0.77	x	1.36	x	74.68	x	0.85	x	0.7	=	41.88	(74)
North	0.9x	0.77	x	1.36	x	59.25	x	0.85	x	0.7	=	33.22	(74)
North	0.9x	0.77	x	1.36	x	41.52	x	0.85	x	0.7	=	23.28	(74)
North	0.9x	0.77	x	1.36	x	24.19	x	0.85	x	0.7	=	13.56	(74)
North	0.9x	0.77	x	1.36	x	13.12	x	0.85	x	0.7	=	7.36	(74)
North	0.9x	0.77	x	1.36	x	8.86	x	0.85	x	0.7	=	4.97	(74)
Southeast	0.9x	0.77	x	8.74	x	36.79	x	0.63	x	0.7	=	98.28	(77)
Southeast	0.9x	0.77	x	2.63	x	36.79	x	0.63	x	0.7	=	29.57	(77)
Southeast	0.9x	0.77	x	2.13	x	36.79	x	0.85	x	0.7	=	32.32	(77)
Southeast	0.9x	0.77	x	1.56	x	36.79	x	0.85	x	0.7	=	47.33	(77)
Southeast	0.9x	0.77	x	0.28	x	36.79	x	0.85	x	0.7	=	4.25	(77)
Southeast	0.9x	0.77	x	8.74	x	62.67	x	0.63	x	0.7	=	167.4	(77)
Southeast	0.9x	0.77	x	2.63	x	62.67	x	0.63	x	0.7	=	50.37	(77)
Southeast	0.9x	0.77	x	2.13	x	62.67	x	0.85	x	0.7	=	55.04	(77)
Southeast	0.9x	0.77	x	1.56	x	62.67	x	0.85	x	0.7	=	80.63	(77)
Southeast	0.9x	0.77	x	0.28	x	62.67	x	0.85	x	0.7	=	7.24	(77)
Southeast	0.9x	0.77	x	8.74	x	85.75	x	0.63	x	0.7	=	229.05	(77)
Southeast	0.9x	0.77	x	2.63	x	85.75	x	0.63	x	0.7	=	68.92	(77)
Southeast	0.9x	0.77	x	2.13	x	85.75	x	0.85	x	0.7	=	75.31	(77)
Southeast	0.9x	0.77	x	1.56	x	85.75	x	0.85	x	0.7	=	110.32	(77)
Southeast	0.9x	0.77	x	0.28	x	85.75	x	0.85	x	0.7	=	9.9	(77)
Southeast	0.9x	0.77	x	8.74	x	106.25	x	0.63	x	0.7	=	283.8	(77)

Southeast 0.9x	0.77	x	2.63	x	106.25	x	0.63	x	0.7	=	85.4	(77)
Southeast 0.9x	0.77	x	2.13	x	106.25	x	0.85	x	0.7	=	93.32	(77)
Southeast 0.9x	0.77	x	1.56	x	106.25	x	0.85	x	0.7	=	136.69	(77)
Southeast 0.9x	0.77	x	0.28	x	106.25	x	0.85	x	0.7	=	12.27	(77)
Southeast 0.9x	0.77	x	8.74	x	119.01	x	0.63	x	0.7	=	317.88	(77)
Southeast 0.9x	0.77	x	2.63	x	119.01	x	0.63	x	0.7	=	95.66	(77)
Southeast 0.9x	0.77	x	2.13	x	119.01	x	0.85	x	0.7	=	104.52	(77)
Southeast 0.9x	0.77	x	1.56	x	119.01	x	0.85	x	0.7	=	153.11	(77)
Southeast 0.9x	0.77	x	0.28	x	119.01	x	0.85	x	0.7	=	13.74	(77)
Southeast 0.9x	0.77	x	8.74	x	118.15	x	0.63	x	0.7	=	315.59	(77)
Southeast 0.9x	0.77	x	2.63	x	118.15	x	0.63	x	0.7	=	94.96	(77)
Southeast 0.9x	0.77	x	2.13	x	118.15	x	0.85	x	0.7	=	103.77	(77)
Southeast 0.9x	0.77	x	1.56	x	118.15	x	0.85	x	0.7	=	152	(77)
Southeast 0.9x	0.77	x	0.28	x	118.15	x	0.85	x	0.7	=	13.64	(77)
Southeast 0.9x	0.77	x	8.74	x	113.91	x	0.63	x	0.7	=	304.26	(77)
Southeast 0.9x	0.77	x	2.63	x	113.91	x	0.63	x	0.7	=	91.56	(77)
Southeast 0.9x	0.77	x	2.13	x	113.91	x	0.85	x	0.7	=	100.04	(77)
Southeast 0.9x	0.77	x	1.56	x	113.91	x	0.85	x	0.7	=	146.54	(77)
Southeast 0.9x	0.77	x	0.28	x	113.91	x	0.85	x	0.7	=	13.15	(77)
Southeast 0.9x	0.77	x	8.74	x	104.39	x	0.63	x	0.7	=	278.83	(77)
Southeast 0.9x	0.77	x	2.63	x	104.39	x	0.63	x	0.7	=	83.91	(77)
Southeast 0.9x	0.77	x	2.13	x	104.39	x	0.85	x	0.7	=	91.68	(77)
Southeast 0.9x	0.77	x	1.56	x	104.39	x	0.85	x	0.7	=	134.3	(77)
Southeast 0.9x	0.77	x	0.28	x	104.39	x	0.85	x	0.7	=	12.05	(77)
Southeast 0.9x	0.77	x	8.74	x	92.85	x	0.63	x	0.7	=	248.01	(77)
Southeast 0.9x	0.77	x	2.63	x	92.85	x	0.63	x	0.7	=	74.63	(77)
Southeast 0.9x	0.77	x	2.13	x	92.85	x	0.85	x	0.7	=	81.55	(77)
Southeast 0.9x	0.77	x	1.56	x	92.85	x	0.85	x	0.7	=	119.45	(77)
Southeast 0.9x	0.77	x	0.28	x	92.85	x	0.85	x	0.7	=	10.72	(77)
Southeast 0.9x	0.77	x	8.74	x	69.27	x	0.63	x	0.7	=	185.02	(77)
Southeast 0.9x	0.77	x	2.63	x	69.27	x	0.63	x	0.7	=	55.67	(77)
Southeast 0.9x	0.77	x	2.13	x	69.27	x	0.85	x	0.7	=	60.84	(77)
Southeast 0.9x	0.77	x	1.56	x	69.27	x	0.85	x	0.7	=	89.11	(77)
Southeast 0.9x	0.77	x	0.28	x	69.27	x	0.85	x	0.7	=	8	(77)
Southeast 0.9x	0.77	x	8.74	x	44.07	x	0.63	x	0.7	=	117.71	(77)
Southeast 0.9x	0.77	x	2.63	x	44.07	x	0.63	x	0.7	=	35.42	(77)
Southeast 0.9x	0.77	x	2.13	x	44.07	x	0.85	x	0.7	=	38.71	(77)
Southeast 0.9x	0.77	x	1.56	x	44.07	x	0.85	x	0.7	=	56.7	(77)
Southeast 0.9x	0.77	x	0.28	x	44.07	x	0.85	x	0.7	=	5.09	(77)
Southeast 0.9x	0.77	x	8.74	x	31.49	x	0.63	x	0.7	=	84.11	(77)
Southeast 0.9x	0.77	x	2.63	x	31.49	x	0.63	x	0.7	=	25.31	(77)

SAP WorkSheet: New dwelling design stage

Southeast	0.9x	0.77	x	2.13	x	31.49	x	0.85	x	0.7	=	27.65	(77)
Southeast	0.9x	0.77	x	1.56	x	31.49	x	0.85	x	0.7	=	40.51	(77)
Southeast	0.9x	0.77	x	0.28	x	31.49	x	0.85	x	0.7	=	3.64	(77)
West	0.9x	0.77	x	1.36	x	19.64	x	0.85	x	0.7	=	11.01	(80)
West	0.9x	0.77	x	1.36	x	38.42	x	0.85	x	0.7	=	21.55	(80)
West	0.9x	0.77	x	1.36	x	63.27	x	0.85	x	0.7	=	35.48	(80)
West	0.9x	0.77	x	1.36	x	92.28	x	0.85	x	0.7	=	51.75	(80)
West	0.9x	0.77	x	1.36	x	113.09	x	0.85	x	0.7	=	63.42	(80)
West	0.9x	0.77	x	1.36	x	115.77	x	0.85	x	0.7	=	64.92	(80)
West	0.9x	0.77	x	1.36	x	110.22	x	0.85	x	0.7	=	61.81	(80)
West	0.9x	0.77	x	1.36	x	94.68	x	0.85	x	0.7	=	53.09	(80)
West	0.9x	0.77	x	1.36	x	73.59	x	0.85	x	0.7	=	41.27	(80)
West	0.9x	0.77	x	1.36	x	45.59	x	0.85	x	0.7	=	25.57	(80)
West	0.9x	0.77	x	1.36	x	24.49	x	0.85	x	0.7	=	13.73	(80)
West	0.9x	0.77	x	1.36	x	16.15	x	0.85	x	0.7	=	9.06	(80)
Northwest	0.9x	0.77	x	0.39	x	11.28	x	0.85	x	0.7	=	1.81	(81)
Northwest	0.9x	0.77	x	2.44	x	11.28	x	0.85	x	0.7	=	11.35	(81)
Northwest	0.9x	0.77	x	2	x	11.28	x	0.85	x	0.7	=	18.61	(81)
Northwest	0.9x	0.77	x	1.75	x	11.28	x	0.85	x	0.7	=	16.28	(81)
Northwest	0.9x	0.77	x	0.39	x	22.97	x	0.85	x	0.7	=	3.69	(81)
Northwest	0.9x	0.77	x	2.44	x	22.97	x	0.85	x	0.7	=	23.11	(81)
Northwest	0.9x	0.77	x	2	x	22.97	x	0.85	x	0.7	=	37.88	(81)
Northwest	0.9x	0.77	x	1.75	x	22.97	x	0.85	x	0.7	=	33.14	(81)
Northwest	0.9x	0.77	x	0.39	x	41.38	x	0.85	x	0.7	=	6.65	(81)
Northwest	0.9x	0.77	x	2.44	x	41.38	x	0.85	x	0.7	=	41.63	(81)
Northwest	0.9x	0.77	x	2	x	41.38	x	0.85	x	0.7	=	68.25	(81)
Northwest	0.9x	0.77	x	1.75	x	41.38	x	0.85	x	0.7	=	59.72	(81)
Northwest	0.9x	0.77	x	0.39	x	67.96	x	0.85	x	0.7	=	10.93	(81)
Northwest	0.9x	0.77	x	2.44	x	67.96	x	0.85	x	0.7	=	68.37	(81)
Northwest	0.9x	0.77	x	2	x	67.96	x	0.85	x	0.7	=	112.08	(81)
Northwest	0.9x	0.77	x	1.75	x	67.96	x	0.85	x	0.7	=	98.07	(81)
Northwest	0.9x	0.77	x	0.39	x	91.35	x	0.85	x	0.7	=	14.69	(81)
Northwest	0.9x	0.77	x	2.44	x	91.35	x	0.85	x	0.7	=	91.9	(81)
Northwest	0.9x	0.77	x	2	x	91.35	x	0.85	x	0.7	=	150.66	(81)
Northwest	0.9x	0.77	x	1.75	x	91.35	x	0.85	x	0.7	=	131.83	(81)
Northwest	0.9x	0.77	x	0.39	x	97.38	x	0.85	x	0.7	=	15.66	(81)
Northwest	0.9x	0.77	x	2.44	x	97.38	x	0.85	x	0.7	=	97.98	(81)
Northwest	0.9x	0.77	x	2	x	97.38	x	0.85	x	0.7	=	160.62	(81)
Northwest	0.9x	0.77	x	1.75	x	97.38	x	0.85	x	0.7	=	140.54	(81)
Northwest	0.9x	0.77	x	0.39	x	91.1	x	0.85	x	0.7	=	14.65	(81)
Northwest	0.9x	0.77	x	2.44	x	91.1	x	0.85	x	0.7	=	91.66	(81)

Northwest 0.9x	0.77	x	2	x	91.1	x	0.85	x	0.7	=	150.26	(81)
Northwest 0.9x	0.77	x	1.75	x	91.1	x	0.85	x	0.7	=	131.47	(81)
Northwest 0.9x	0.77	x	0.39	x	72.63	x	0.85	x	0.7	=	11.68	(81)
Northwest 0.9x	0.77	x	2.44	x	72.63	x	0.85	x	0.7	=	73.07	(81)
Northwest 0.9x	0.77	x	2	x	72.63	x	0.85	x	0.7	=	119.79	(81)
Northwest 0.9x	0.77	x	1.75	x	72.63	x	0.85	x	0.7	=	104.81	(81)
Northwest 0.9x	0.77	x	0.39	x	50.42	x	0.85	x	0.7	=	8.11	(81)
Northwest 0.9x	0.77	x	2.44	x	50.42	x	0.85	x	0.7	=	50.73	(81)
Northwest 0.9x	0.77	x	2	x	50.42	x	0.85	x	0.7	=	83.16	(81)
Northwest 0.9x	0.77	x	1.75	x	50.42	x	0.85	x	0.7	=	72.77	(81)
Northwest 0.9x	0.77	x	0.39	x	28.07	x	0.85	x	0.7	=	4.51	(81)
Northwest 0.9x	0.77	x	2.44	x	28.07	x	0.85	x	0.7	=	28.24	(81)
Northwest 0.9x	0.77	x	2	x	28.07	x	0.85	x	0.7	=	46.29	(81)
Northwest 0.9x	0.77	x	1.75	x	28.07	x	0.85	x	0.7	=	40.51	(81)
Northwest 0.9x	0.77	x	0.39	x	14.2	x	0.85	x	0.7	=	2.28	(81)
Northwest 0.9x	0.77	x	2.44	x	14.2	x	0.85	x	0.7	=	14.28	(81)
Northwest 0.9x	0.77	x	2	x	14.2	x	0.85	x	0.7	=	23.42	(81)
Northwest 0.9x	0.77	x	1.75	x	14.2	x	0.85	x	0.7	=	20.49	(81)
Northwest 0.9x	0.77	x	0.39	x	9.21	x	0.85	x	0.7	=	1.48	(81)
Northwest 0.9x	0.77	x	2.44	x	9.21	x	0.85	x	0.7	=	9.27	(81)
Northwest 0.9x	0.77	x	2	x	9.21	x	0.85	x	0.7	=	15.2	(81)
Northwest 0.9x	0.77	x	1.75	x	9.21	x	0.85	x	0.7	=	13.3	(81)
Rooflights 0.9x	1	x	2.66	x	26	x	0.63	x	0.7	=	27.45	(82)
Rooflights 0.9x	1	x	2.66	x	54	x	0.63	x	0.7	=	57.01	(82)
Rooflights 0.9x	1	x	2.66	x	96	x	0.63	x	0.7	=	101.35	(82)
Rooflights 0.9x	1	x	2.66	x	150	x	0.63	x	0.7	=	158.36	(82)
Rooflights 0.9x	1	x	2.66	x	192	x	0.63	x	0.7	=	202.7	(82)
Rooflights 0.9x	1	x	2.66	x	200	x	0.63	x	0.7	=	211.15	(82)
Rooflights 0.9x	1	x	2.66	x	189	x	0.63	x	0.7	=	199.54	(82)
Rooflights 0.9x	1	x	2.66	x	157	x	0.63	x	0.7	=	165.75	(82)
Rooflights 0.9x	1	x	2.66	x	115	x	0.63	x	0.7	=	121.41	(82)
Rooflights 0.9x	1	x	2.66	x	66	x	0.63	x	0.7	=	69.68	(82)
Rooflights 0.9x	1	x	2.66	x	33	x	0.63	x	0.7	=	34.84	(82)
Rooflights 0.9x	1	x	2.66	x	21	x	0.63	x	0.7	=	22.17	(82)

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

(83)m=	304.23	548.46	825.96	1142.15	1382.01	1415.68	1346.81	1162.19	935.09	627	370.03	256.66	(83)

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

(84)m=	1095.4	1334.37	1583.77	1856.02	2050.21	2043.39	1951.12	1776.08	1574.5	1310.58	1102.79	1027.28	(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	0.99	0.97	0.94	0.88	0.77	0.65	0.71	0.87	0.96	0.99	0.99	(86)

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

(87)m=	18.22	18.47	18.92	19.55	20.14	20.61	20.83	20.79	20.39	19.63	18.83	18.2	(87)

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

(88)m=	18.86	18.87	18.88	18.91	18.91	18.94	18.94	18.94	18.93	18.91	18.9	18.89	(88)

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

(89)m=	0.99	0.98	0.96	0.92	0.82	0.63	0.4	0.47	0.77	0.94	0.98	0.99	(89)

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

(90)m=	16.51	16.76	17.21	17.84	18.39	18.79	18.91	18.9	18.64	17.94	17.14	16.51	(90)

fLA = Living area ÷ (4) = 0.37 (91)

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

(92)m=	17.14	17.39	17.84	18.47	19.04	19.46	19.62	19.6	19.28	18.56	17.76	17.13	(92)

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

(93)m=	17.14	17.39	17.84	18.47	19.04	19.46	19.62	19.6	19.28	18.56	17.76	17.13	(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=	0.99	0.97	0.95	0.91	0.82	0.67	0.5	0.56	0.79	0.93	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	1079.19	1300.89	1511.04	1684.73	1681.6	1375.12	976.07	993.48	1247.9	1223.7	1077.04	1014.52	(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=	4847.49	4696.28	4245.61	3510.65	2680.08	1743.82	1083.34	1142.75	1873.22	2908.15	3926.79	4800.05	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	2803.61	2281.7	2034.52	1314.66	742.87	0	0	0	0	1253.23	2051.82	2816.43	

Total per year (kWh/year) = $Sum(98)_{1...5,9...12}$ = 15298.84 (98)

Space heating requirement in kWh/m²/year 112.74 (99)

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

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		90.4	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	2803.61	2281.7	2034.52	1314.66	742.87	0	0	0	0	1253.23	2051.82	2816.43	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	3101.34	2524.01	2250.57	1454.27	821.76	0	0	0	0	1386.31	2269.71	3115.52	

Total (kWh/year) =$Sum(211)_{1...5,10....12}$= 16923.49 (211)

SAP WorkSheet: New dwelling design stage

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

Output from water heater (calculated above)

240.13	212.07	223.71	201.91	198.86	179.11	173.37	188.37	187.46	209.3	219.6	234.82

Efficiency of water heater 79.7 (216)

(217)m=	89.45	89.38	89.21	88.81	87.91	79.7	79.7	79.7	79.7	88.7	89.24	89.48	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	268.45	237.27	250.76	227.34	226.21	224.73	217.53	236.35	235.2	235.98	246.07	262.44

Total = Sum(219a)$_{1...12}$ = 2868.34 (219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			16923.49	
Water heating fuel used			2868.34	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			479.36	(232)

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 =	588.94	(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 =	99.82	(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 =	63.23	(250)
Additional standing charges (Table 12)				120	(251)

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

Total energy cost (245)...(247) + (250)…(254) = 881.88 (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] =	2.05	(257)
SAP rating (Section 12)		71.41	(258)

12a. CO_2 emissions – Individual heating systems including micro-CHP

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	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211)	x	0.216	=	3655.47	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.216	=	619.56	(264)
Space and water heating	(261) + (262) + (263) + (264) =				4275.04	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	38.93	(267)
Electricity for lighting	(232)	x	0.519	=	248.79	(268)
Total CO2, kg/year			sum of (265)…(271) =		4562.75	(272)
CO2 emissions per m²			(272) ÷ (4) =		33.62	(273)
EI rating (section 14)					66	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211)	x	1.22	=	20646.66	(261)
Space heating (secondary)	(215)	x	3.07	=	0	(263)
Energy for water heating	(219)	x	1.22	=	3499.38	(264)
Space and water heating	(261) + (262) + (263) + (264) =				24146.04	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	3.07	=	230.25	(267)
Electricity for lighting	(232)	x	0	=	1471.64	(268)
‘Total Primary Energy			sum of (265)…(271) =		25847.93	(272)
Primary energy kWh/m²/year			(272) ÷ (4) =		190.48	(273)