17 Middle Field
London NW8 6ND

PART L COMPLIANCE (2013) &
SAP ASSESSMENT REPORT (SAP 2012)

Issue 3

EAC ltd

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1 RESULTS BASED ON CURRENT PROPOSALS

1.1 The proposed development is for the construction of a newbuild house. The target standards for this scheme are to achieve

1.1.1 compliance under the Building Regulations Part L 2013

1.1.2 CO2 reduction of 35% beyond Part L 2013 Building Regulations

1.1.3 20% of the energy reduction to come from renewable sources.

1.1.4 Water efficiency of 110 litres per person per day.

1.2 The Outline Specification in the Appendix shows the data used in the base SAP calculation. These standards have been based on the drawings and specification provided.

1.3 The two targets of Carbon emissions and energy apply differently. The use of the ASHP provides a large reduction on CO2 emissions over the Part L2013 standard, partly due to the manner in which the TER for Part L2013 is calculated. When using electricity the TER is inflated using a fuel factor. ASHP uses less energy than a gas fired system, but produces more CO2.

1.4 The methodology to demonstrate compliance under Camden's requirements are

1.4.1 Produce a specification using energy efficiency measures, the use of an ASHP and the use of PV that achieves a 35% reduction in Carbon emissions over Part L2013

1.4.2 Compare the energy use of the proposed specification to that of a dwelling based on the TER assessment.

1.5 Results Tables

SAP AND PART L RESULTS

	Energy Rating Results SAP 2012			2013 Build Regulations Part L													
	FLOOR AREA	SAP	CO2 kg/yr	DER kgCO2/m2/yr	**TER kgCO2/m2/yr**	DFEE	**TFEE**	% Difference DER/TER	1A-CO2	1B-DFEE	2A U values	2B efficiencies	2C Lighting	3 overheating	4- air permeability	OVERALL
	510	86	5124	10.73	**18.05**	44.9	**52.8**	-40.55%	P	P	P	P	P	P	P	pass

RESULTS FOR ENERGY AND CARBON EMISSIONS

ENERGY USED BASED ON TER		
	KWH / yr	kgCO2/yr
heating	22,985	7,282
hot water	2,898	918
auxiliary	75	39
lighting	969	969
cooling	0	0
ELEC generation	0	0
total REGULATED	26,927	9,207

ENERGY USED BASED ON proposed specification with ASHP		
	KWH / yr	kgCO2/yr
heating	6,070	3,150
hot water	1,403	728
auxiliary	1,926	999
lighting	966	501
cooling	181	94
ELEC generation	0	0
total REGULATED	10,546	5,473

summary	KWH / yr	kgCO2/yr
	energy	carbon emissions
TER	26,927	9,207
ASHP with PV	10,546	5,473
reduction	-61%	-41%

1.6 To comply with Part L the house needs to

- achieve a DER (Dwelling Emissions Rate) that is less than the TER (Target Emissions Rate) – criteria 1.
- achieve a DFEE (Dwelling Fabric Energy Efficiency) that is less than the TFEE (Target Fabric Energy Efficiency) – criteria 1.
- U Values must be within the limited values – criteria 2A
- heating system efficiencies and controls must comply with DBSCG – criteria 2B
- numbers of lowE lights criteria 2c
- meet requirements regarding the potential for the home to overheat in summer (criteria 3. This is a separate calculation from the energy issues, and does not affect the energy results
- Air permeability must be within certain limits Criteria 4

1.7 **With the Current Outline Specification as summarised in the Appendix the dwelling COMPLIES with Part L 2013.**

1.8 The table in appendix C shows the proposed water use figures for the house. These show a total water use of less than 110 litres/person/day. (Based on Building Regulations Part G calculation methodology).

1.9 The results also show that the house complies with the Local Authority requirements for a 35% improvement over Part L2013, and a 20% reduction in energy from renewable sources, and less than 110 litres/person/day.

2 APPENDIX – A - OUTLINE SPECIFICATION

Element			U value	Construction	
Floor	1	Basement floor	**0.13**	concrete slab; 100mm kingspan K3 (k=0.022)	
	2	Ground floor	**0.17**	concrete slab; 100mm kingspan K3 (k=0.022)	
	3	Floor over bin store	**0.20**	200mm timber joists with 200mm mineral wool between	
Walls	1	Brick faced external wall	**0.19**	103mm clay bricks; 100mm wide cavity; 100mm Xtratherm+CavityTherm PIR insulation; Inner leaf 7N/mm2 blocks AAC k=0.19; 15mm lightweight plaster finish.	
	2	clad wall	**0.19**	cladding on dense block; 100mm wide cavity; 100mm Xtratherm+CavityTherm PIR insulation; Inner leaf 7N/mm2 blocks AAC k=0.19; 15mm lightweight plaster finish.	
	3	Binstore / house	**0.16**	140mm thermalite 7N/mm2 blocks AAC k=0.19 and 110 xtratherm screwed to wall; render	
	4	Dormer	**0.16**	Code 5 lead sheet cladding; 12mm WBP ply; 50mm minimum ventilation between sw framing; 120mm Xtratherm XT/PR insulation between framing; 50mm Xtartherm PR insulation across inner face with joints sealed with aluminium tape; 25mm battens, 13mm plasterboard and skimcoat.	
		Basement wall	**0.18**	300mm concrete; 50mm battens /cavity; 75mm insulation (k=0.022); plasterboard	
		Party	**0.00**	Solid or fully filled with sealed edges	
Roof		Basement inc roof light	**0.15**	Inverted roof Fx = 0.002 250mm Kingspan N300 insulation k=0.038 Concrete slab Plasterboard on battens	
		Sedum roof To grd floor	**0.15**	Inverted roof Fx = 0.002 250mm Kingspan N300 insulation k=0.038 Concrete slab Plasterboard on battens	
		Sloping 2nd floor	**0.13**	150mm rafters with insulation between (k=0.022); 50mm insulation (k=0.022) below; plasterboard	
		Dormer flat roof	**0.13**	150mm joists with insulation between (k=0.022); 50mm insulation (k=0.022) below; plasterboard	

Windows		New windows	**1.40**	Aluminium timber composite windows with double glazing (6mm cavity), LowE, argon fill 16+mm gap.	
		Roof windows	**1.30**	Aluminium timber composite windows with double glazing (6mm cavity), LowE, argon fill 16+mm gap.	
Doors		new Entrance door s	**1.20**	Aluminium timber composite	
Thermal bridging			**ACD**	All to Accredited Construction detail standards Lintelos to enhanced ACD standards Ψ=0.010 SEE TABLE	
Thermal mass			**MEDIUM**	default value	

Space Heating 1	System	Air Source Heat Pump installed by registered mcs installer
	FGHRS	none
	Emitter	Underfloor heating – wet system
	Controls	full time and temperature zone control
	Compensator	None
	Delayed start	none
Space Heating 2		none

Hot water	System	From Main system
	Hot Water Cylinder	300 litre megaflo Eco or similar heat loss=1.89 kWh/day
	HWC Controls	Thermostat Separately timed Primary pipes insulated
	Summer immersion	yes
	Water use	Less than 125 litres / person / day

Secondary heating	Gas	None
	Electric	None
	solid	None

Ventilation	Air permeability	Design Air permeability rate – 4 m3/hm2
	Chimneys / flues	none
	Extract ventilation	none
	Other ventilation	none
	MVHR	Sentinel kinetic Plus 2 number systems each supporting 5 wet rooms
Lights	Internal	Min standard required by Part L 75% dedicated lowE lights Proposal LED and LowE min – 100%
	External	lowE
Cooling		To be cooling to all habitable rooms - To habitable rooms. 110m2 basement 150m2 ground floor 56m2 1st floor 45m2 2nd floor Total – 361m2 Split / multi split system EER=3.2
Renewables	Solar thermal	none
	PV	None

Summer Over heating	Cross ventilation	yes
	Window ventilation	Taken to be as fully open half the time

3 APPENDIX – B – THERMAL BRIDGING

These are tables of all the junctions in the ACD list. We have indicated which junctions are present in this building with a "Y" in the 1st column. Extra columns are available for Enhanced ACDs (EACD) and Constructive Details values (CD) should they wish to be used.

K1 Ref	JUNCTION	Junction present	USE	JUNCTION REF	ACD	default	EACD ref. no.	EACD	CD ref num	CD block k=
E1	Steel, lintel baseplate perforated				0.5	1				
E2	Other lintels (incl steel)	Y	ENHANCED		0.3	1	MV101 (B)			
E3	Sill	Y	ACD		0.04	0.08				
E4	Jamb	Y	ACD		0.05	0.1				
E5	Ground floor (normal)	Y	ACD		0.16	0.32				
E19	ground floor (inverted)				0.07					
E20	exposed floor (normal)				0.32					
E21	exposed floor (inverted)				0.32					
E22	Basement floor	Y	ACD		0.07					
E6	Internal floor within dwelling	Y	ACD		0.07	0.14				
E7	party floor between dwellings				0.07	0.14				
E8	Balcony within dwelling (continuous insulation)				0.0	0.0				
E9	Balcony between dwellings (continuous insulation)				0.02	0.04				
E23	balcony (support penetrates insulation)				none	1.00				
E10	Eaves (insulation at ceiling level)				0.06	0.12				
E24	Eaves (insulation at ceiling level inverted)				none	0.24				
E11	Eaves (insulation at rafter level)	Y	ACD		0.04	0.08				
E12	Gable (insulation at ceiling level)				0.24	0.48				
E13	Gable (insulation at rafter level)	Y	ACD		0.04	0.08				
E14	Flat roof	Y	ACD		0.04	0.08				
E15	Flat roof with parapet				0.28	0.56				
E16	Corner normal	Y	ACD		None	0.18				
E17	Corner invert	Y	ACD		None	0				
E18	Party wall between dwellings	Y	ACD		0.06	0.12				
E25	staggered party wall between dwellings				none	0.12				

JUNCTIONS WITH A PARTY WALL

K1 Ref	JUNCTION	Junction present	USE	JUNCTION REF	ACD	default	EACD ref. no.	EACD	CD ref num	CD block k=0.11
P1	Ground floor	Y	ACD		none	0.16				
P6	Ground floor inverted				none	0.07				
P2	Internal floor within dwelling				None	0.04				
P3	Internal floor between dwellings				none	0.04				
P7	exposed floor (normal)				none	0.16				
P8	exposed floor (inverted)				none	0.24				
P4	Roof (insulation at ceiling level)	Y	ACD		none	0.24				
P5	Roof (insulation at rafter level)				none	0.04				

JUNCTIONS WITH A ROOF OR A ROOM-IN-A-ROOF

K1 Ref	JUNCTION	Junction present	USE	JUNCTION REF	ACD	default	EACD ref. no.	EACD	CD ref num	
R1	Head	Y	ACD		none	0.08				
R2	sill	Y	ACD		none	0.06				
R3	Jamb	Y	ACD		None	0.08				
R4	ridge (vaulted ceiling)	Y	ACD		none	0.08				
R5	Ridge inverted				none	0.04				
R6	flat ceiling				none	0.06				
R7	flat ceiling (inverted)				none	0.04				
R8	roof wall (rafter)				none	0.06				
R9	roof wall (flat ceiling)				none	0.04				

4 APPENDIX – C – WATER USE

WATER EFFICIENCY CALCULATOR FOR PART G						
installation type	unit of measure	NUMBER	capacity/flow rate	Use factor	fixed use (litres / person / day)	litres / person / day
WC single flush	flush vol (litres)	none		4.42	0	0
WC dual flush	flush vol (litres)			1.46	0	0
	flush vol (litres)			2.96	0	0
WCs multiple fittings	ave effective flush vol	5	3.062	4.42	0	13.53404
Taps (excl kit / utility)	flow rate (litres/min)	6	4	1.58	1.58	7.9
Bath (where shower present)	capacity to overflow litres	2	140	0.11	0	15.4
Shower (where bath present)	flow rate (litres/min)	3	9.666666667	4.37	0	42.24333333
Bath only	capacity to overflow litres	none		0.5	0	0
shower only	flow rate (litres/min)	0	0	5.6	0	0
Kit / utility taps	flow rate (litres/min)	2	5	0.44	10.36	12.56
washing machine	litres/kg dry load	default figure	8.17	2.1	0	17.157
dishwasher	litres/place setting	default figure	1.25	3.6	0	4.5
waste disposal	litres/use	none	0	3.08	0	0
water softener	litres/ pers / day	not present	0	1	0	0
			total calculated use Litres / person / day			113.29
grey water		none				0.00
rainwater		none				0.00
normalisation						0.91
			total calculated use Litres / person / day CfSH			103.10
external water use						5.00
Part G Building Regulation TARGET		**125** **L / p / day**	**total calculated use Litres / person / day Building Regulations**			**108.10**

Installation Type	fitting	rate
WCs multiple fittings	Armitage Shanks Conceala or similar	4 /2.6
Taps (excl kit / utility)	Armitage Shanks Contour 21 or similar	4 L/min
Bath (where shower present)	Ideal Standard Concept or similar	200 litres
Shower (where bath present)	Artema System rain or similar	9 L/min
Bath only		
shower only		
Kit / utility taps	Ideal Standard Active or similar	5 L/min
washing machine	default	8.17 L/kg dry load
dishwasher	default	4.25 /place setting

5 DEFINITIONS

SAP Standard Assessment Procedure. This is another form of energy rating which does not take account of such things as appliances, (cookers lights etc.) or location factors. For example, whether the dwelling is in a warm climate such as Cornwall, or a cold climate such as Aberdeen. The NHER would register the differences in heating costs, whereas the SAP does not.

DER Dwelling Emission Rate New build only; The estimated annual CO2 emissions per square meter due to space heating, water heating, ventilation and internal lighting, minus any CO2 emissions saved by the generation of electricity

TER Target Emission Rate New build only; To meet one of the criterion for compliance with Part L1A, the dwelling CO2 emission rate (DER) must be no greater than a target emission rate based on a notional dwelling of the same size and shape.

DFEE Fabric Energy Efficiency Assessment. A measure of the energy efficiency of the fabric of the proposed dwelling. To comply with Part L it must be the DFEE must be less than or equal to the TFEE. Measured in kWh/m2/yr, covering space heating and space cooling energy demand.

TFEE Target Fabric Energy Efficiency Assessment. A measure of the target energy efficiency of the fabric of the dwelling. It is the FEE of the Notional dwelling plus 15%. Measured in kWh/m2/yr, covering space heating and space cooling energy demand.

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Element	Limiting U Values Part L1A 2013	Values used in TER
Floor	0.25	0.13
wall	0.30	0.18
roof	0.20	0.13
window	2.0	1.40
door	2.0	1.20
thermal bridging	0.15	ACD
Air permeability	10.0	5 m3/hm2

TER Worksheet
Design - Draft

This design submission has been carried out using Approved SAP software. It has been prepared from plans and specifications and may not reflect the property as constructed.

Assessor name	Mr David Johnston	Assessor number	3641
Client		Last modified	15/06/2015
Address	17 Middle Field, London, NW8 6ND		

1. Overall dwelling dimensions

	Area (m²)		Average storey height (m)		Volume (m³)	
Lowest occupied	155.30	(1a) x	2.95	(2a) =	458.14	(3a)
+1	160.88	(1b) x	3.42	(2b) =	550.21	(3b)
+2	96.90	(1c) x	2.83	(2c) =	274.23	(3c)
+3	96.90	(1d) x	1.68	(2d) =	162.79	(3d)
Total floor area (1a) + (1b) + (1c) + (1d)...(1n) =	509.98	(4)				
Dwelling volume				(3a) + (3b) + (3c) + (3d)...(3n) =	1445.36	(5)

2. Ventilation rate

		m³ per hour	
Number of chimneys	0	x 40 = 0	(6a)
Number of open flues	0	x 20 = 0	(6b)
Number of intermittent fans	4	x 10 = 40	(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, fans, PSVs	(6a) + (6b) + (7a) + (7b) + (7c) =	40	÷ (5) = 0.03	(8)

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

Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area	5.00	(17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)	0.28	(18)
Number of sides on which the dwelling is sheltered	3	(19)
Shelter factor 1 - [0.075 x (19)] =	0.78	(20)
Infiltration rate incorporating shelter factor (18) x (20) =	0.22	(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 U2	5.10	5.00	4.90	4.40	4.30	3.80	3.80	3.70	4.00	4.30	4.50	4.70	(22)
Wind factor (22)m ÷ 4	1.28	1.25	1.23	1.10	1.08	0.95	0.95	0.93	1.00	1.08	1.13	1.18	(22a)
Adjusted infiltration rate (allowing for shelter and wind factor) (21) x (22a)m	0.27	0.27	0.26	0.24	0.23	0.20	0.20	0.20	0.22	0.23	0.24	0.25	(22b)

Calculate effective air change rate for the applicable case:

If mechanical ventilation: air change rate through system	N/A	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor from Table 4h	N/A	(23c)
d) natural ventilation or whole house positive input ventilation from loft		

0.54	0.54	0.53	0.53	0.53	0.52	0.52	0.52	0.52	0.53	0.53	0.53	(24d)

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

0.54	0.54	0.53	0.53	0.53	0.52	0.52	0.52	0.52	0.53	0.53	0.53	(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	κ-value, kJ/m².K	A x κ, kJ/K	
Window			82.90	x	1.33	=	109.91			(27)
Door			3.18	x	1.00	=	3.18			(26)
Roof window			22.22	x	1.59	=	35.37			(27a)
Basement floor			155.30	x	0.13	=	20.19			(28)
Ground floor			33.02	x	0.13	=	4.29			(28a)
Exposed floor			1.81	x	0.13	=	0.24			(28b
External wall			297.00	x	0.18	=	53.46			(29a)
Party wall			24.75	x	0.00	=	0.00			(32)
Roof			157.81	x	0.13	=	20.52			(30)
Total area of external elements ∑A, m²			753.24							(31)

Fabric heat loss, W/K = ∑(A × U)	(26)...(30) + (32) =	247.15 (33)
Heat capacity Cm = ∑(A x κ)	(28)...(30) + (32) + (32a)...(32e) =	N/A (34)
Thermal mass parameter (TMP) in kJ/m²K		250.00 (35)
Thermal bridges: ∑(L x Ψ) calculated using Appendix K		28.80 (36)
Total fabric heat loss	(33) + (36) =	275.95 (37)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ventilation heat loss calculated monthly 0.33 x (25)m x (5)													
	256.44	255.74	255.06	251.85	251.25	248.45	248.45	247.93	249.53	251.25	252.46	253.73	(38)
Heat transfer coefficient, W/K (37)m + (38)m													
	532.39	531.69	531.01	527.80	527.20	524.40	524.40	523.89	525.48	527.20	528.41	529.68	
										Average = ∑(39)1...12/12 =		527.80	(39)
Heat loss parameter (HLP), W/m²K (39)m ÷ (4)													
	1.04	1.04	1.04	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.04	1.04	
										Average = ∑(40)1...12/12 =		1.03	(40)
Number of days in month (Table 1a)													
	31.00	28.00	31.00	30.00	31.00	30.00	31.00	31.00	30.00	31.00	30.00	31.00	(40)

4. Water heating energy requirement

Assumed occupancy, N	3.40 (42)
Annual average hot water usage in litres per day Vd,average = (25 x N) + 36	115.07 (43)

	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)													
	126.57	121.97	117.37	112.77	108.16	103.56	103.56	108.16	112.77	117.37	121.97	126.57	
											∑(44)1...12 =	1380.80	(44)
Energy content of hot water used = 4.18 x Vd,m x nm x Tm/3600 kWh/month (see Tables 1b, 1c 1d)													
	187.70	164.17	169.41	147.69	141.71	122.29	113.32	130.03	131.59	153.35	167.40	181.78	
											∑(45)1...12 =	1810.44	(45)
Distribution loss 0.15 x (45)m													
	28.16	24.63	25.41	22.15	21.26	18.34	17.00	19.51	19.74	23.00	25.11	27.27	(46)

Storage volume (litres) including any solar or WWHRS storage within same vessel	300.00 (47)
Water storage loss:	
a) If manufacturer's declared loss factor is known (kWh/day)	2.11 (48)

Temperature factor from Table 2b	0.54	(49)
Energy lost from water storage (kWh/day) (48) x (49)	1.14	(50)
Enter (50) or (54) in (55)	1.14	(55)

Water storage loss calculated for each month (55) x (41)m

35.37	31.94	35.37	34.23	35.37	34.23	35.37	35.37	34.23	35.37	34.23	35.37	(56)

If the vessel contains dedicated solar storage or dedicated WWHRS (56)m x [(47) - Vs] ÷ (47), else (56)

35.37	31.94	35.37	34.23	35.37	34.23	35.37	35.37	34.23	35.37	34.23	35.37	(57)

Primary circuit loss for each month from Table 3

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 for each month from Table 3a, 3b or 3c

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(61)

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

246.33	217.12	228.03	204.43	200.34	179.03	171.95	188.66	188.33	211.98	224.13	240.41	(62)

Solar DHW input calculated using Appendix G or Appendix H

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(63)

Output from water heater for each month (kWh/month) (62)m + (63)m

246.33	217.12	228.03	204.43	200.34	179.03	171.95	188.66	188.33	211.98	224.13	240.41	

∑(64)1...12 = 2500.75 (64)

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

109.31	96.95	103.23	94.50	94.02	86.05	84.58	90.14	89.14	97.89	101.05	107.35	(65)

5. Internal gains

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5)	170.25	170.25	170.25	170.25	170.25	170.25	170.25	170.25	170.25	170.25	170.25	170.25	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	54.85	48.72	39.62	30.00	22.42	18.93	20.46	26.59	35.69	45.31	52.89	56.38	(67)
Appliance gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	612.14	618.49	602.48	568.41	525.39	484.96	457.95	451.60	467.61	501.68	544.70	585.13	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	40.02	40.02	40.02	40.02	40.02	40.02	40.02	40.02	40.02	40.02	40.02	40.02	(69)
Pump and fan gains (Table 5a)	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	(70)
Losses e.g. evaporation (Table 5)	-136.20	-136.20	-136.20	-136.20	-136.20	-136.20	-136.20	-136.20	-136.20	-136.20	-136.20	-136.20	(71)
Water heating gains (Table 5)	146.93	144.27	138.75	131.25	126.38	119.52	113.68	121.16	123.81	131.58	140.35	144.28	(72)
Total internal gains (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m	891.00	888.56	857.93	806.72	751.26	700.48	669.17	676.42	704.18	755.65	815.01	862.86	(73)

6. Solar gains

	Access factor Table 6d		Area m²		Solar flux W/m²		g specific data or Table 6b		FF specific data or Table 6c		Gains W	
South	0.54	x	15.73	x	46.75	x 0.9 x	0.63	x	0.70	=	157.62	(78)
West	0.54	x	13.95	x	19.64	x 0.9 x	0.63	x	0.70	=	58.72	(80)
South	0.77	x	15.30	x	46.75	x 0.9 x	0.63	x	0.70	=	218.61	(78)
West	0.77	x	15.59	x	19.64	x 0.9 x	0.63	x	0.70	=	93.58	(80)
East	0.77	x	22.33	x	19.64	x 0.9 x	0.63	x	0.70	=	134.03	(76)

West	1.00	x	13.86	x	19.64	x 0.9 x	0.63	x	0.70	= 108.04 (80)
West	1.00	x	1.73	x	26.61	x 0.9 x	0.63	x	0.70	= 18.27 (80)
East	1.00	x	6.63	x	26.61	x 0.9 x	0.63	x	0.70	= 70.02 (76)

Solar gains in watts ∑(74)m...(82)m

858.88	1566.12	2363.79	3212.67	3794.89	3837.12	3671.63	3237.68	2663.65	1795.59	1048.81	721.34 (83)

Total gains - internal and solar (73)m + (83)m

1749.88	2454.68	3221.72	4019.40	4546.15	4537.60	4340.80	3914.10	3367.83	2551.23	1863.81	1584.21 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1(˚C) 21.00 (85)

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

Utilisation factor for gains for living area n1,m (see Table 9a)

1.00	1.00	0.99	0.97	0.88	0.70	0.52	0.60	0.88	0.99	1.00	1.00 (86)

Mean internal temp of living area T1 (steps 3 to 7 in Table 9c)

19.66	19.85	20.16	20.53	20.83	20.96	20.99	20.99	20.87	20.44	19.97	19.63 (87)

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

20.05	20.05	20.05	20.05	20.06	20.06	20.06	20.06	20.06	20.06	20.05	20.05 (88)

Utilisation factor for gains for rest of dwelling n2,m

1.00	1.00	0.99	0.96	0.83	0.61	0.42	0.49	0.81	0.99	1.00	1.00 (89)

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

18.22	18.51	18.95	19.49	19.88	20.04	20.06	20.06	19.95	19.38	18.68	18.18 (90)

Living area fraction Living area ÷ (4) = 0.24 (91)

Mean internal temperature for the whole dwelling fLA x T1 +(1 - fLA) x T2

18.56	18.83	19.24	19.74	20.11	20.26	20.28	20.28	20.17	19.63	18.99	18.52 (92)

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

18.56	18.83	19.24	19.74	20.11	20.26	20.28	20.28	20.17	19.63	18.99	18.52 (93)

8. Space heating requirement

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

Utilisation factor for gains, ηm

1.00	1.00	0.99	0.95	0.83	0.63	0.44	0.51	0.82	0.98	1.00	1.00 (94)

Useful gains, ηmGm, W (94)m x (84)m

1749.41	2450.63	3191.74	3826.59	3794.79	2860.22	1917.12	2004.10	2768.44	2511.70	1862.10	1583.97 (95)

Monthly average external temperature from Table U1

4.30	4.90	6.50	8.90	11.70	14.60	16.60	16.40	14.10	10.60	7.10	4.20 (96)

Heat loss rate for mean internal temperature, Lm, W [(39)m x [(93)m - (96)m]

7593.57	7404.45	6762.82	5720.69	4432.39	2965.86	1929.57	2030.82	3189.17	4760.29	6281.09	7584.91 (97)

Space heating requirement, kWh/month 0.024 x [(97)m - (95)m] x (41)m

4348.05	3328.96	2656.88	1363.76	474.37	0.00	0.00	0.00	0.00	1672.95	3181.67	4464.70

∑(98)1...5, 10...12 = 21491.34 (98)

Space heating requirement kWh/m²/year (98) ÷ (4) = 42.14 (99)

9a. Energy requirements - individual heating systems including micro-CHP

Space heating

Fraction of space heat from secondary/supplementary system (table 11) 0.00 (201)

Fraction of space heat from main system(s) 1 - (201) = 1.00 (202)

Fraction of space heat from main system 2 0.00 (202)

Fraction of total space heat from main system 1 (202) x [1- (203)] = 1.00 (204)

Fraction of total space heat from main system 2 (202) x (203) = 0.00 (205)

Efficiency of main system 1 (%) | 93.50 | (206)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating fuel (main system 1), kWh/month	4650.32	3560.39	2841.58	1458.56	507.35	0.00	0.00	0.00	0.00	1789.25	3402.85	4775.08

∑(211)1...5, 10...12 = 22985.39 (211)

Water heating

Efficiency of water heater	89.85	89.76	89.55	88.95	87.03	79.80	79.80	79.80	79.80	89.16	89.71	89.88 (217)
Water heating fuel, kWh/month	274.15	241.88	254.64	229.84	230.19	224.34	215.47	236.42	236.00	237.77	249.85	267.47

∑(219a)1...12 = 2898.01 (219)

Annual totals

Space heating fuel - main system 1 | 22985.39

Water heating fuel | 2898.01

Electricity for pumps, fans and electric keep-hot (Table 4f)

central heating pump or water pump within warm air heating unit | 30.00 (230c)

boiler flue fan | 45.00 (230e)

Total electricity for the above, kWh/year | 75.00 (231)

Electricity for lighting (Appendix L) | 968.75 (232)

Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) = 26927.16 (238)

10a. Fuel costs - individual heating systems including micro-CHP

	Fuel kWh/year		Fuel price		Fuel cost £/year	
Space heating - main system 1	22985.39	x	3.48	x 0.01 =	799.89	(240)
Water heating	2898.01	x	3.48	x 0.01 =	100.85	(247)
Pumps and fans	75.00	x	13.19	x 0.01 =	9.89	(249)
Electricity for lighting	968.75	x	13.19	x 0.01 =	127.78	(250)
Additional standing charges					120.00	(251)
Total energy cost				(240)...(242) + (245)...(254) =	1158.41	(255)

11a. SAP rating - individual heating systems including micro-CHP

Energy cost deflator (Table 12) | 0.42 (256)

Energy cost factor (ECF) | 0.88 (257)

SAP value | 87.77

SAP rating (section 13) | 88 (258)

SAP band | B

12a. CO_2 emissions - individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO_2/kWh		Emissions kg CO_2/year	
Space heating - main system 1	22985.39	x	0.22	=	4964.84	(261)
Water heating	2898.01	x	0.22	=	625.97	(264)
Space and water heating				(261) + (262) + (263) + (264) =	5590.82	(265)
Pumps and fans	75.00	x	0.52	=	38.93	(267)
Electricity for lighting	968.75	x	0.52	=	502.78	(268)
Total CO_2, kg/year				(265)...(271) =	6132.52	(272)
Dwelling CO_2 emission rate				(272) ÷ (4) =	18.05	(273)
EI value					85.19	

EI rating (section 14)	85	(274)
EI band	B	

13a. Primary energy - individual heating systems including micro-CHP

	Energy kWh/year		Primary factor		Primary Energy kWh/year	
Space heating - main system 1	22985.39	x	1.22	=	28042.18	(261)
Water heating	2898.01	x	1.22	=	3535.57	(264)
Space and water heating			(261) + (262) + (263) + (264) =		31577.75	(265)
Pumps and fans	75.00	x	3.07	=	230.25	(267)
Electricity for lighting	968.75	x	3.07	=	2974.08	(268)
Primary energy kWh/year					34782.08	(272)
Dwelling primary energy rate kWh/m2/year					68.20	(273)

DER Worksheet
Design - Draft

This design submission has been carried out using Approved SAP software. It has been prepared from plans and specifications and may not reflect the property as constructed.

Assessor name	Mr David Johnston	Assessor number	3641
Client		Last modified	15/06/2015
Address	17 Middle Field, London, NW8 6ND		

1. Overall dwelling dimensions

	Area (m²)		Average storey height (m)		Volume (m³)	
Lowest occupied	155.30	(1a) x	2.95	(2a) =	458.14	(3a)
+1	160.88	(1b) x	3.42	(2b) =	550.21	(3b)
+2	96.90	(1c) x	2.83	(2c) =	274.23	(3c)
+3	96.90	(1d) x	1.68	(2d) =	162.79	(3d)
Total floor area (1a) + (1b) + (1c) + (1d)...(1n) =	509.98	(4)				
Dwelling volume				(3a) + (3b) + (3c) + (3d)...(3n) =	1445.36	(5)

2. Ventilation rate

			m³ per hour	
Number of chimneys	0	x 40 =	0	(6a)
Number of open flues	0	x 20 =	0	(6b)
Number of intermittent fans	0	x 10 =	0	(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, fans, PSVs (6a) + (6b) + (7a) + (7b) + (7c) =	0	÷ (5) =	0.00	(8)

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

Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area	4.00	(17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)	0.20	(18)
Number of sides on which the dwelling is sheltered	3	(19)
Shelter factor 1 - [0.075 x (19)] =	0.78	(20)
Infiltration rate incorporating shelter factor (18) x (20) =	0.16	(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 U2	5.10	5.00	4.90	4.40	4.30	3.80	3.80	3.70	4.00	4.30	4.50	4.70	(22)
Wind factor (22)m ÷ 4	1.28	1.25	1.23	1.10	1.08	0.95	0.95	0.93	1.00	1.08	1.13	1.18	(22a)
Adjusted infiltration rate (allowing for shelter and wind factor) (21) x (22a)m	0.20	0.19	0.19	0.17	0.17	0.15	0.15	0.14	0.16	0.17	0.17	0.18	(22b)

Calculate effective air change rate for the applicable case:

If mechanical ventilation: air change rate through system	0.50	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor from Table 4h	75.65	(23c)
a) If balanced mechanical ventilation with heat recovery (MVHR) (22b)m + (23b) x [1 - (23c) ÷ 100]		

0.32	0.32	0.31	0.29	0.29	0.27	0.27	0.27	0.28	0.29	0.30	0.30	(24a)

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

0.32	0.32	0.31	0.29	0.29	0.27	0.27	0.27	0.28	0.29	0.30	0.30	(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	κ-value, kJ/m².K	A x κ, kJ/K	
Window			82.90	x	1.33	=	109.91			(27)
Door			3.18	x	1.20	=	3.82			(26)
Roof window			22.22	x	1.24	=	27.46			(27a)
Basement floor			155.30	x	0.13	=	20.19			(28)
Ground floor			33.02	x	0.17	=	5.61			(28a)
Exposed floor			1.81	x	0.20	=	0.36			(28b
External wall			275.34	x	0.19	=	52.31			(29a)
External wall			21.66	x	0.16	=	3.47			(29a)
Party wall			24.75	x	0.00	=	0.00			(32)
Roof			72.90	x	0.15	=	10.94			(30)
Roof			84.91	x	0.13	=	11.04			(30)
Total area of external elements ∑A, m²			753.24							(31)

Fabric heat loss, W/K = ∑(A × U)	(26)...(30) + (32) =	245.10 (33)
Heat capacity Cm = ∑(A x κ)	(28)...(30) + (32) + (32a)...(32e) =	N/A (34)
Thermal mass parameter (TMP) in kJ/m²K		250.00 (35)
Thermal bridges: ∑(L x Ψ) calculated using Appendix K		31.57 (36)
Total fabric heat loss	(33) + (36) =	276.67 (37)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ventilation heat loss calculated monthly 0.33 x (25)m x (5)													
	152.33	150.48	148.64	139.39	137.55	128.30	128.30	126.46	132.00	137.55	141.24	144.94	(38)
Heat transfer coefficient, W/K (37)m + (38)m													
	429.00	427.15	425.31	416.06	414.22	404.97	404.97	403.13	408.67	414.22	417.91	421.61	
Average = ∑(39)1...12/12 =												415.60	(39)
Heat loss parameter (HLP), W/m²K (39)m ÷ (4)													
	0.84	0.84	0.83	0.82	0.81	0.79	0.79	0.79	0.80	0.81	0.82	0.83	
Average = ∑(40)1...12/12 =												0.81	(40)
Number of days in month (Table 1a)													
	31.00	28.00	31.00	30.00	31.00	30.00	31.00	31.00	30.00	31.00	30.00	31.00	(40)

4. Water heating energy requirement

Assumed occupancy, N	3.40 (42)
Annual average hot water usage in litres per day Vd,average = (25 x N) + 36	115.07 (43)

	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)													
	126.57	121.97	117.37	112.77	108.16	103.56	103.56	108.16	112.77	117.37	121.97	126.57	
∑(44)1...12 =												1380.80	(44)
Energy content of hot water used = 4.18 x Vd,m x nm x Tm/3600 kWh/month (see Tables 1b, 1c 1d)													
	187.70	164.17	169.41	147.69	141.71	122.29	113.32	130.03	131.59	153.35	167.40	181.78	
∑(45)1...12 =												1810.44	(45)
Distribution loss 0.15 x (45)m													
	28.16	24.63	25.41	22.15	21.26	18.34	17.00	19.51	19.74	23.00	25.11	27.27	(46)

Storage volume (litres) including any solar or WWHRS storage within same vessel 300.00 (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day)	1.89	(48)
Temperature factor from Table 2b	0.54	(49)
Energy lost from water storage (kWh/day) (48) x (49)	1.02	(50)
Enter (50) or (54) in (55)	1.02	(55)

Water storage loss calculated for each month (55) x (41)m

	31.64	28.58	31.64	30.62	31.64	30.62	31.64	31.64	30.62	31.64	30.62	31.64 (56)

If the vessel contains dedicated solar storage or dedicated WWHRS (56)m x [(47) - Vs] ÷ (47), else (56)

	31.64	28.58	31.64	30.62	31.64	30.62	31.64	31.64	30.62	31.64	30.62	31.64 (57)

Primary circuit loss for each month from Table 3

	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 for each month from Table 3a, 3b or 3c

	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 (61)

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

	242.61	213.76	224.31	200.82	196.62	175.42	168.22	184.94	184.72	208.25	220.53	236.68 (62)

Solar DHW input calculated using Appendix G or Appendix H

	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 (63)

Output from water heater for each month (kWh/month) (62)m + (63)m

	242.61	213.76	224.31	200.82	196.62	175.42	168.22	184.94	184.72	208.25	220.53	236.68

∑(64)1...12 = 2456.86 (64)

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

	106.33	94.26	100.25	91.61	91.04	83.16	81.60	87.16	86.26	94.91	98.16	104.36 (65)

5. Internal gains

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5)	170.25	170.25	170.25	170.25	170.25	170.25	170.25	170.25	170.25	170.25	170.25	170.25	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	54.70	48.58	39.51	29.91	22.36	18.88	20.40	26.51	35.59	45.18	52.74	56.22	(67)
Appliance gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	612.14	618.49	602.48	568.41	525.39	484.96	457.95	451.60	467.61	501.68	544.70	585.13	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	40.02	40.02	40.02	40.02	40.02	40.02	40.02	40.02	40.02	40.02	40.02	40.02	(69)
Pump and fan gains (Table 5a)	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	(70)
Losses e.g. evaporation (Table 5)	-136.20	-136.20	-136.20	-136.20	-136.20	-136.20	-136.20	-136.20	-136.20	-136.20	-136.20	-136.20	(71)
Water heating gains (Table 5)	142.92	140.26	134.74	127.24	122.37	115.51	109.68	117.15	119.80	127.57	136.34	140.27	(72)
Total internal gains (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m	886.83	884.41	853.81	802.63	747.19	696.42	665.10	672.33	700.07	751.51	810.85	858.70	(73)

6. Solar gains

	Access factor Table 6d		Area m²		Solar flux W/m²		g specific data or Table 6b		FF specific data or Table 6c		Gains W	
South	0.54	x	15.73	x	46.75	x 0.9 x	0.63	x	0.70	=	157.62	(78)
West	0.54	x	13.95	x	19.64	x 0.9 x	0.63	x	0.70	=	58.72	(80)
South	0.77	x	15.30	x	46.75	x 0.9 x	0.63	x	0.70	=	218.61	(78)

West	0.77	x	15.59	x	19.64	x 0.9 x	0.63	x	0.70	=	93.58	(80)
East	0.77	x	22.33	x	19.64	x 0.9 x	0.63	x	0.70	=	134.03	(76)
West	1.00	x	13.86	x	19.64	x 0.9 x	0.63	x	0.80	=	123.48	(80)
West	1.00	x	1.73	x	26.61	x 0.9 x	0.63	x	0.80	=	20.88	(80)
East	1.00	x	6.63	x	26.61	x 0.9 x	0.63	x	0.80	=	80.02	(76)

Solar gains in watts ∑(74)m...(82)m

886.93	1621.81	2457.57	3352.71	3969.42	4017.09	3842.43	3382.44	2773.79	1862.21	1083.92	744.31

(83)

Total gains - internal and solar (73)m + (83)m

1773.76	2506.22	3311.38	4155.34	4716.61	4713.51	4507.53	4054.78	3473.85	2613.72	1894.77	1603.01

(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1(˚C) 21.00 (85)

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

Utilisation factor for gains for living area n1,m (see Table 9a)

1.00	1.00	0.99	0.94	0.77	0.55	0.39	0.46	0.77	0.99	1.00	1.00

(86)

Mean internal temp of living area T1 (steps 3 to 7 in Table 9c)

19.95	20.15	20.44	20.78	20.95	21.00	21.00	21.00	20.97	20.66	20.23	19.93

(87)

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

20.22	20.22	20.22	20.24	20.24	20.26	20.26	20.26	20.25	20.24	20.24	20.23

(88)

Utilisation factor for gains for rest of dwelling n2,m

1.00	1.00	0.99	0.92	0.72	0.48	0.33	0.38	0.70	0.98	1.00	1.00

(89)

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

18.77	19.07	19.49	19.98	20.20	20.26	20.26	20.26	20.23	19.83	19.20	18.75

(90)

Living area fraction Living area ÷ (4) = 0.24 (91)

Mean internal temperature for the whole dwelling fLA x T1 +(1 - fLA) x T2

19.05	19.32	19.72	20.17	20.38	20.43	20.43	20.44	20.40	20.03	19.45	19.03

(92)

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

19.05	19.32	19.72	20.17	20.38	20.43	20.43	20.44	20.40	20.03	19.45	19.03

(93)

8. Space heating requirement

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

Utilisation factor for gains, ηm

1.00	1.00	0.99	0.92	0.73	0.50	0.34	0.40	0.71	0.98	1.00	1.00

(94)

Useful gains, ηmGm, W (94)m x (84)m

1773.43	2502.02	3268.09	3805.90	3437.14	2351.09	1552.05	1625.27	2478.81	2552.25	1893.24	1602.86

(95)

Monthly average external temperature from Table U1

4.30	4.90	6.50	8.90	11.70	14.60	16.60	16.40	14.10	10.60	7.10	4.20

(96)

Heat loss rate for mean internal temperature, Lm, W [(39)m x [(93)m - (96)m]

6328.55	6160.23	5620.60	4688.63	3595.38	2361.64	1552.75	1627.13	2576.07	3904.89	5160.55	6253.06

(97)

Space heating requirement, kWh/month 0.024 x [(97)m - (95)m] x (41)m

3389.01	2458.32	1750.27	635.57	117.73	0.00	0.00	0.00	0.00	1006.37	2352.46	3459.75

∑(98)1...5, 10...12 = 15169.47 (98)

Space heating requirement kWh/m²/year (98) ÷ (4) 29.75 (99)

8c. Space cooling requirement

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

Heat loss rate Lm

0.00	0.00	0.00	0.00	0.00	3806.76	2996.81	3063.76	0.00	0.00	0.00	0.00

(100)

Utilisation factor for loss ηm

0.00	0.00	0.00	0.00	0.00	0.97	0.99	0.98	0.00	0.00	0.00	0.00	(101)

Useful loss ηmLm (watts) (100)m x (101)m

0.00	0.00	0.00	0.00	0.00	3711.33	2970.55	3012.56	0.00	0.00	0.00	0.00	(102)

Gains

0.00	0.00	0.00	0.00	0.00	5557.31	5320.00	4823.53	0.00	0.00	0.00	0.00	(103)

Space cooling requirement, whole dwelling, continuous (kWh) 0.024 x [(103)m - (102)m] x (41)m

0.00	0.00	0.00	0.00	0.00	1329.11	1747.99	1347.37	0.00	0.00	0.00	0.00	

∑(104)6...8 = 4424.46 (104)

Cooled fraction — cooled area ÷ (4) = 0.71 (105)

Intermittency factor (Table 10)

0.00	0.00	0.00	0.00	0.00	0.25	0.25	0.25	0.00	0.00	0.00	0.00	

∑(106)6...8 = 0.75 (106)

Space cooling requirement (104)m x (105) x (106)m

0.00	0.00	0.00	0.00	0.00	235.21	309.34	238.44	0.00	0.00	0.00	0.00	

∑(107)6...8 = 782.99 (107)

Space cooling requirement kWh/m²/year — (107) ÷ (4) = 1.54 (108)

9a. Energy requirements - individual heating systems including micro-CHP

Space heating

Fraction of space heat from secondary/supplementary system (table 11) — 0.00 (201)

Fraction of space heat from main system(s) — 1 - (201) = 1.00 (202)

Fraction of space heat from main system 2 — 0.00 (202)

Fraction of total space heat from main system 1 — (202) x [1- (203)] = 1.00 (204)

Fraction of total space heat from main system 2 — (202) x (203) = 0.00 (205)

Efficiency of main system 1 (%) — 249.90 (206)

Cooling system energy efficiency ratio (Table 10c) — 4.32 (209)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating fuel (main system 1), kWh/month													
	1356.14	983.72	700.39	254.33	47.11	0.00	0.00	0.00	0.00	402.71	941.36	1384.45	

∑(211)1...5, 10...12 = 6070.22 (211)

Water heating

Efficiency of water heater

175.10	175.10	175.10	175.10	175.10	175.10	175.10	175.10	175.10	175.10	175.10	175.10	(217)

Water heating fuel, kWh/month

138.55	122.08	128.10	114.69	112.29	100.18	96.07	105.62	105.49	118.93	125.94	135.17	

∑(219a)1...12 = 1403.12 (219)

Space cooling fuel, kWh/month

0.00	0.00	0.00	0.00	0.00	54.45	71.61	55.19	0.00	0.00	0.00	0.00	

∑(221)6...8 = 181.25 (221)

Annual totals

Space heating fuel - main system 1 — 6070.22

Water heating fuel — 1403.12

Space cooling fuel — 181.25

Electricity for pumps, fans and electric keep-hot (Table 4f)

mechanical ventilation fans - balanced, extract or positive input from outside — 1895.59 (230a)

central heating pump or water pump within warm air heating unit — 30.00 (230c)

Total electricity for the above, kWh/year — 1925.59 (231)

Electricity for lighting (Appendix L) — 966.00 (232)

Total delivered energy for all uses	(211)...(221) + (231) + (232)...(237b) =	10546.18	(238)

10a. Fuel costs - individual heating systems including micro-CHP

	Fuel kWh/year		Fuel price		Fuel cost £/year	
Space heating - main system 1	6070.22	x	13.19	x 0.01 =	800.66	(240)
Water heating	1403.12	x	13.19	x 0.01 =	185.07	(247)
Space cooling	181.25	x	13.19	x 0.01 =	23.91	(248)
Pumps and fans	1925.59	x	13.19	x 0.01 =	253.99	(249)
Electricity for lighting	966.00	x	13.19	x 0.01 =	127.42	(250)
Additional standing charges					0.00	(251)
Total energy cost				(240)...(242) + (245)...(254) =	1391.04	(255)

11a. SAP rating - individual heating systems including micro-CHP

Energy cost deflator (Table 12)	0.42	(256)
Energy cost factor (ECF)	1.05	(257)
SAP value	85.31	
SAP rating (section 13)	85	(258)
SAP band	B	

12a. CO_2 emissions - individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO_2/kWh		Emissions kg CO_2/year	
Space heating - main system 1	6070.22	x	0.52	=	3150.44	(261)
Water heating	1403.12	x	0.52	=	728.22	(264)
Space and water heating			(261) + (262) + (263) + (264) =		3878.66	(265)
Space cooling	181.25	x	0.52	=	94.07	(266)
Pumps and fans	1925.59	x	0.52	=	999.38	(267)
Electricity for lighting	966.00	x	0.52	=	501.35	(268)
Total CO_2, kg/year				(265)...(271) =	5473.47	(272)
Dwelling CO_2 emission rate				(272) ÷ (4) =	10.73	(273)
EI value					86.78	
EI rating (section 14)					87	(274)
EI band					B	

13a. Primary energy - individual heating systems including micro-CHP

	Energy kWh/year		Primary factor		Primary Energy kWh/year	
Space heating - main system 1	6070.22	x	3.07	=	18635.57	(261)
Water heating	1403.12	x	3.07	=	4307.57	(264)
Space and water heating			(261) + (262) + (263) + (264) =		22943.14	(265)
Space cooling	181.25	x	3.07	=	3.07	(266)
Pumps and fans	1925.59	x	3.07	=	5911.57	(267)
Electricity for lighting	966.00	x	3.07	=	2965.62	(268)
Primary energy kWh/year					32376.76	(272)
Dwelling primary energy rate kWh/m2/year					63.49	(273)