8 APPENDIX

Appendix A: Meeting Notes with Camden Energy officer

BUILDINGS

MINUTES OF MEETING

Project	**Maitland Park Kiln Place**
Subject	**Planning Policy with regard to Energy**
Date	**02/10/13**
Location	**Camden Council Town Hall Extension**
Meeting no.	**01**
Taken by	**Neil Clements**
Participants	**Harold Garner, Neil Clements**
Next meeting	**Non set**

Date 03/10/2013

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Ref 31879 MEP 2013/10/02

Introduction

The projects are in early stage and at present consists of the following.

Kiln Place

This will consist of 15-20 new units made of houses and apartments. The project is located on the Kiln Place Estate Gospel Oak and consists of a number of infill developments located in 4-5 sites across the estate.

Maitland Park

This will consist of 120-130 units which are located on Grafton Terrace and Maitland Park Villa's. The scheme will be a mix of houses and apartments. In addition a small community centre (200-300m^2) will be built at the corner of Grafton Terrace. Both schemes will be a mix of affordable and for market properties.

Camden Planning Policy

- HG advised that Camden planning would expect both schemes to meet CFSH level 4 as a minimum.
- HG advised that for Camden planning 20% renewables would not be mandatory. What can reasonably be achieved should be provided.
- HG noted that if scheme was called in by the GLA then the scheme would require to have carbon emission 40% below building regulations part L (In force October 2013).

1/2

BUILDINGS

- It was also noted that if called in then the GLA lean, clean, green hierarchy would be required to complied to which is likely to include requirements for CHP and renewables.
- Camden would require an energy statement to be submitted with the applications showing the extent to which each stage of the energy hierarchy had reduced emissions.
- Camden would not encourage or support CHP on either site, but would expect to see a proportion of energy demands met by renewables
- Biomass was not considered a feasible option due to air quality issues.
- NC asked if the scheme needed to consider PV's on adjacent buildings to meet carbon targets, if this is acceptable to planning. HG noted in principle this would be acceptable. Note other Camden council departments(housing) need to agree to the use of roof spaces.
- HG noted the need to complete the CIP Sustainability Guidance approach to test the cost benefit of going beyond Code 4
- HG advised against modelling cost benefits of Code 5 and 6 and instead focus on the assessment of the baseline Code 4 scheme against an enhanced fabric efficiency model based on passivhaus principles.
- HG noted that if the schemes are proposed to be sold on for development by others then testing for a higher than Code 4 standard is unnecessary as this would burden the planning permission with higher targets than that required by planning policy and would threaten scheme economics .HG to discuss with Julia Farr.
- HG suggested we consider increasing energy improvements on community centre because this would be retained by the Council as an asset/liability and low running costs would be useful to the Council and community group
- HG suggested that if it is possible and installed that any PV's on the Grafton road site are connected to the community centre meter to allow some funding back into the community.
- HG advised whilst CHP will not be required we should consider a central heating scheme(s) for Maitland Place. It was noted that Camden's housing departments preference was for individual boilers serving each property. This would be acceptable to planning if CFSH L4 is met. HG advised that the consultant should advise on the most energy efficient heating solution and this should then be followed.

2/2

Appendix B: DER Worksheet from NHER 5.4.2 SAP Calculation:

Synopsis of the Modeling Input Data

Unit No	U Value (w/m^{2}K)		Air tightness (m^3/hm^2@50 Pa)	Code level	DER	TER	Improvement over TER	ENE 01	FEE	ENE 02	Renewables	Conclusion
Unit 1.7	Element				Kg CO_2/m^2/year			Credit	kWh/m^2/year	Credits		No renewable technology is required to achieve Code level 4. Air tightness: 2.5 m^3/hm^2@50 Pa U Value: See Column 2 **Recommended Solution.**
Site 1	Roof	0.10										
3 stories Detached Dwelling	Floor	0.10	2.5	4	13.98	18.93	**-26.15% Passed**	3.1	46.4	6.8	N/A	
	Wall	0.15										
	Glazing	1.00										
	Total Glazing Area	25 m^2										
Unit 2.2	**U Value** (w/m^{2}K)		**Air tightness** (m^3/hm^2@50 Pa)	**Code level**	**DER**	**TER**	**Improvement over TER**	**ENE 01**	**FEE**	**ENE 02**	**Renewables**	**Conclusion**
	U Value	w/m^2						Credit	kWh/m^2/year	Credits		No renewable technology is required to achieve Code level 4. Air tightness: 1.5 m^3/hm^2@50 Pa U Value: See Column 2 **Recommended Solution.**
	Roof	0.10										
	Floor	0.10						3	55.9	3.8	N/A	
	Wall	0.15	1.5	4	16.05	21.68	**-25.97% Passed**					
	Glazing	1.0										
	Total Glazing Area	39.61 m^2										

Unit 3.1	U Value (w/m^2K)		Air tightness (m^3/hm^2@50 Pa)	Code level	DER	TER	Improvement over TER	ENE 01	FEE	ENE 02	Renewables	Conclusion
	U Value	w/m^2						Credit	$kWh/m^2/year$	Credits		In order to achieve Code level 4, 0.4kWpeak of PV is required. This equates to 2 no of South facing PV Panels. Each panel size is approximately (990 x 1640)mm Ref: Ecolution Renewables. Air tightness of 2 m^3/hm^2@50 Pa is recommended. U Value : Please see column 2. **Recommended Solution.**
	Roof	0.10										
	Floor	0.10	2	4	14.06	19.25	-26.96% **Passed Code 4**	3.1	43.5	4.7	PV	
	Wall	0.15										
	Glazing	1.0										
	Total opening Area	24 m^2										

Unit No	U Value (w/m^2K)		Air tightness (m^3/hm^2@50 Pa)	Code level	DER	TER	Improvement over TER	ENE 01	FEE	ENE 02	Renewables	Conclusion
Unit 5.3	U Value	w/m^2										In order to achieve Code level 4, 0.4kWpeak of PV is required. This equates to 2 no of South facing PV Panels. Each panel size is approximately (990 x 1640)mm Ref: Ecolution Renewables. Air tightness of 2 m^3/hm^2@50 Pa is recommended. U Value : Please see column 2.**Recommended Solution.**
	Roof	0.10						3.3	63.3	0	PV	
	Floor	0.10										
	Wall	0.15	2	3	19.04	26.87	**-29.14% Code level 4 achieved**					
	Glazing	1.0										
	Total opening Area	13.72										

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	Mrs Farah Naz	Assessor number	1
Client		Last modified	21/02/2014
Address	1.7 Ste 01 1.7 Kiln Place, Camden, Camden, Gospel Oak London, UK, NW5		

1. Overall dwelling dimensions

		Area (m^2)			Average storey height (m)			Volume (m^3)	
Lowest occupied		44.87	(1a)	x	2.66	(2a)	=	119.35	(3a)
+1		38.00	(1b)	x	3.00	(2b)	=	114.00	(3b)
+2		36.15	(1c)	x	3.00	(2c)	=	108.45	(3c)
Total floor area	(1a) + (1b) + (1c) + (1d)...(1n) =	119.02	(4)						
Dwelling volume					(3a) + (3b) + (3c) + (3d)...(3n) =			341.80	(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	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, fans, PSVs	(6a) + (6b) + (7a) + (7b) + (7c) =	30	÷ (5) =	0.09	(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		10.00	(17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)		0.59	(18)

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

Number of sides on which dwelling is sheltered		2	(19)
Shelter factor	1 - [0.075 x (19)] =	0.85	(20)
Adjusted infiltration rate	(18) x (20) =	0.50	(21)

Infiltration rate modified for monthly wind speed:

Monthly average wind speed from Table 7

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(22)m	5.40	5.10	5.10	4.50	4.10	3.90	3.70	3.70	4.20	4.50	4.80	5.10

∑(22)1...12 = 54.10 (22)

Wind Factor (22a)m = (22)m ÷ 4

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(22a)m	1.35	1.27	1.27	1.12	1.02	0.98	0.92	0.92	1.05	1.12	1.20	1.27

∑(22a)1...12 = 13.52 (22a)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(22b)m	0.67	0.64	0.64	0.56	0.51	0.49	0.46	0.46	0.52	0.56	0.60	0.64

∑(22b)1...12 = 6.76 (22b)

Calculate effective air change rate for the applicable case:

If mechanical ventilation: air change rate through system	N/A	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)), otherwise (23b) = (23a)	N/A	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	N/A	(23c)

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	0.73	0.70	0.70	0.66	0.63	0.62	0.61	0.61	0.64	0.66	0.68	0.70	(24d)

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

(25)m	0.73	0.70	0.70	0.66	0.63	0.62	0.61	0.61	0.64	0.66	0.68	0.70	(25)

3. Heat losses and heat loss parameter

The κ-value is the heat capacity per unit area, see Table 1e.

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	
Doors			1.85	x	2.00	=	3.70	N/A	N/A	(26)
Window*			27.90	x	1.85	=	51.68	N/A	N/A	(27)
Ground floor			42.69	x	0.25	=	10.67	N/A	N/A	(28a)
Party Wall			29.34	x	0.00	=	0.00	N/A	N/A	(32)
External wall			154.16	x	0.35	=	53.95	N/A	N/A	(29a)
Roof			48.69	x	0.16	=	7.79	N/A	N/A	(30)
Total area of external elements ∑A, m²			275.29	(31)						

** for windows and roof windows, effective window U-value is calculated using formula 1/[(1/UValue)+0.04] paragraph 3.2*

Fabric heat loss, W/K = ∑(A × U)	(26)...(30) + (32) =	127.79	(33)
Heat capacity Cm = ∑(A x κ)	(28)...(30) + (32) + (32a)...(32e) =	N/A	(34)
Thermal mass parameter (TMP) in kJ/m²K	Calculated separately =	250.00	(35)
Thermal bridges: ∑(L x Ψ) calculated using Appendix K		30.28	(36)
if details of thermal bridging are not known then (36) = 0.15 x (31)			
Total fabric heat loss	(33) + (36) =	158.07	(37)

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

(38)m	82.05	79.28	79.28	74.21	71.19	69.78	68.44	68.44	71.92	74.21	76.67	79.28	(38)

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

(39)m	240.13	237.36	237.36	232.29	229.26	227.85	226.52	226.52	229.99	232.29	234.74	237.36

Average = ∑(39)1...12/12 = 232.64 (39)

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

(40)m	2.02	1.99	1.99	1.95	1.93	1.91	1.90	1.90	1.93	1.95	1.97	1.99

Average = ∑(40)1...12/12 = 1.95 (40)

4. Water heating energy requirement

kWh/year

Assumed occupancy, N 2.86 (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) + 36 107.49 (43)

Annual average hot water usage has been reduced by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)												
(44)m	118.23	113.94	109.64	105.34	101.04	96.74	96.74	101.04	105.34	109.64	113.94	118.23

∑(44)1...12 = 1289.83 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x Tm/3600 kWh/month (see Tables 1b, 1c 1d)

(45)m	175.76	153.72	158.62	138.29	132.70	114.51	106.11	121.76	123.21	143.59	156.74	170.21

∑(45)1...12 =	1695.22 (45)

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

For community heating include distribution loss whether or not hot water tank is present

Distribution loss 0.15 x (45)m

(46)m	26.36	23.06	23.79	20.74	19.90	17.18	15.92	18.26	18.48	21.54	23.51	25.53	(46)

Water storage loss:

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

Cylinder volume (litres) including any solar storage within same cylinder	150.00	(50)
If community heating and no tank in dwelling, enter 110 litres in box (50)		
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in box (50)		
Hot water storage loss factor from Table 2 (kWh/litre/day)	0.02	(51)
If community heating see SAP 2009 section 4.3		
Volume factor from Table 2a	0.93	(52)
Temperature factor from Table 2b	0.54	(53)
Energy lost from water storage, kWh/day (50) x (51) x (52) x (53)	1.44	(54)
Enter (49) or (54) in (55)	1.44	(55)

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

(56)m	44.53	40.22	44.53	43.09	44.53	43.09	44.53	44.53	43.09	44.53	43.09	44.53	(56)

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

(57)m	44.53	40.22	44.53	43.09	44.53	43.09	44.53	44.53	43.09	44.53	43.09	44.53	(57)

Primary circuit loss (annual) from Table 3	610.00	(58)

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

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

(59)m	51.81	46.79	51.81	50.14	51.81	50.14	51.81	51.81	50.14	51.81	50.14	51.81	(59)

Combi loss for each month from Table 3a, 3b or 3c (enter '0' if not a combi boiler)

(61)m	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 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m	272.09	240.73	254.96	231.52	229.03	207.73	202.44	218.10	216.44	239.93	249.97	266.55	(62)

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

(63)m	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)1...12 =	0.00	(63)

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

(64)m	272.09	240.73	254.96	231.52	229.03	207.73	202.44	218.10	216.44	239.93	249.97	266.55	
											∑(64)1...12 =	2829.51	(64)

if (64)m < 0 then set to 0

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

(65)m	135.51	120.72	129.81	120.57	121.19	112.66	112.35	117.55	115.55	124.81	126.70	133.66	(65)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	142.97	142.97	142.97	142.97	142.97	142.97	142.97	142.97	142.97	142.97	142.97	142.97	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m	43.03	38.22	31.08	23.53	17.59	14.85	16.05	20.86	28.00	35.55	41.49	44.23	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m	283.93	286.88	279.45	263.65	243.69	224.94	212.41	209.47	216.89	232.70	252.65	271.40	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m	37.30	37.30	37.30	37.30	37.30	37.30	37.30	37.30	37.30	37.30	37.30	37.30	(69)

Pumps and fans gains (Table 5a)

(70)m	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	(70)

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

(71)m	-114.38	-114.38	-114.38	-114.38	-114.38	-114.38	-114.38	-114.38	-114.38	-114.38	-114.38	-114.38	(71)

Water heating gains (Table 5)

(72)m	182.14	179.65	174.48	167.45	162.89	156.47	151.01	158.00	160.49	167.76	175.97	179.66	(72)

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

(73)m	584.99	580.64	560.91	530.52	500.07	472.15	455.36	464.22	481.27	511.90	546.00	571.18	(73)

6. Solar gains

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

Rows (74) to (82) are used 12 times, one for each month, repeating as needed if there is more than one window type.

Details for month of January and annual totals are shown below:

	Access factor Table 6d		Area m²		Solar flux W/m²		g Specific data or Table 6b		FF Specific data or Table 6c		Gains (W)	
East	0.77	x	27.90	x	19.87	x 0.9 x	0.72	x	0.70	=	193.69	(76)

Solar gains in watts, calculated for each month ∑(74)m...(82)m

(83)m	193.69	375.42	600.04	890.92	1084.00	1131.09	1097.85	955.49	717.37	457.19	240.80	159.77	(83)

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

(84)m	778.68	956.06	1160.95	1421.44	1584.06	1603.25	1553.21	1419.71	1198.64	969.09	786.81	730.95	(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, η1,m (see Table 9a)													
(86)m	1.00	0.99	0.98	0.95	0.87	0.74	0.55	0.59	0.86	0.97	0.99	1.00	(86)
Mean internal temp of living area T1 (steps 3 to 7 in Table 9c)													
(87)m	18.83	19.05	19.47	19.96	20.48	20.81	20.95	20.94	20.65	20.02	19.28	18.88	(87)
Temperature during heating periods in the living area from Table 9, Th2(˚C)													
(88)m	19.33	19.34	19.34	19.37	19.39	19.40	19.40	19.40	19.39	19.37	19.36	19.34	(88)
Utilisation factor for gains for rest of dwelling η2,m (see Table 9a)													
(89)m	0.99	0.99	0.97	0.93	0.81	0.61	0.36	0.39	0.76	0.95	0.99	1.00	(89)
Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)													
(90)m	17.43	17.66	18.08	18.57	19.06	19.32	19.40	19.39	19.21	18.64	17.90	17.50	(90)

Living area fraction fLA 30.00 ÷ (4) = 0.25 (91)

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

(92)m	17.78	18.01	18.43	18.92	19.42	19.69	19.79	19.78	19.57	18.98	18.25	17.85	(92)

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

(93)m	17.78	18.01	18.43	18.92	19.42	19.69	19.79	19.78	19.57	18.98	18.25	17.85	(93)

8. Space heating requirement

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

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that tim = (93)m and recalculate the utilisation factor for gains using Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, ηm													
(94)m	0.99	0.99	0.97	0.92	0.81	0.64	0.41	0.44	0.78	0.95	0.99	0.99	(94)
Useful gains, ηmGm, W = (94)m x (84)m													
(95)m	773.01	942.54	1122.16	1308.37	1288.87	1020.78	634.37	627.83	931.20	917.40	777.16	726.22	(95)
Monthly average external temperature from Table 8													
(96)m	4.50	5.00	6.80	8.70	11.70	14.60	16.90	16.90	14.30	10.80	7.00	4.90	(96)
Heat loss rate for mean internal temperature, Lm, W													
(97)m	3189.51	3088.59	2760.75	2374.87	1769.48	1160.43	654.27	653.20	1212.34	1901.16	2640.84	3072.95	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m - (95)m] x (41)m													
(98)m	1797.88	1442.14	1219.11	767.88	357.57	0.00	0.00	0.00	0.00	731.91	1341.85	1745.97	

Total per year (kWh/year) = ∑(98)1...5, 10...12 =	9404.32	(98)
Space heating requirement in kWh/m²/year (98) ÷ (4)	79.01	(99)

9a. Energy Requirements - Individual heating systems including micro-CHP

Space heating:

Fraction of space heating from secondary/supplementary system (Table 11)	0.10	(201)
Fraction of space heating from main system(s) 1 - (201)	0.90	(202)
Fraction of main heating from main system 2	0.00	(203)
Fraction of total space heat from main system 1 (202) x [1 - (203)]	0.90	(204)
Fraction of total space heat from main system 2 (202) x (203)	0.00	(205)
Efficiency of main space heating system 1 (%)	78.90	(206)

(from database or Table 4a/4b, adjusted where appropriate by the amount shown in the 'space efficiency adjustment' column of Table 4c)

Efficiency of secondary/supplementary heating system, from Table 4a or Appendix E (%)	100.00	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement, kWh/month (as calculated above)												
(98)m	1797.88	1442.14	1219.11	767.88	357.57	0.00	0.00	0.00	0.00	731.91	1341.85	1745.97
Space heating fuel (main heating system 1), kWh/month = (98)m x (204) x 100 ÷ (206)												
(211)m	2050.81	1645.03	1390.62	875.91	407.88	0.00	0.00	0.00	0.00	834.88	1530.62	1991.60

Total per year (kWh/year) = ∑(211)1...5, 10...12 =	10727.37	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating fuel (secondary), kWh/month = (98)m x (201) x 100 ÷ (208)												
(215)m	179.79	144.21	121.91	76.79	35.76	0.00	0.00	0.00	0.00	73.19	134.18	174.60

Total per year (kWh/year) = ∑(215)1...5, 10...12 =	940.43	(215)

Water heating:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Output from water heater, kWh/month (calculated above)												
(64)m	272.09	240.73	254.96	231.52	229.03	207.73	202.44	218.10	216.44	239.93	249.97	266.55

∑(64)1...12 =	2829.51	(64)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Efficiency of water heater per month												
(217)m	77.27	77.13	76.77	76.10	74.36	68.80	68.80	68.80	68.80	75.92	76.96	77.26
Fuel for water heating, kWh/month = (64)m x 100 ÷ (217)m												
(219)m	352.15	312.12	332.09	304.25	308.00	301.94	294.25	317.00	314.60	316.01	324.80	345.02

Total per year (kWh/year) = ∑(219)1...12 =	3822.22	(219)

Annual Totals Summary:	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		10727.37	(211)
Space heating fuel used, secondary		940.43	(215)
Water heating fuel used		3822.22	(219)
Electricity for pumps, fans and electric keep-hot (Table 4f):			
mechanical ventilation fans - balanced, extract or positive input from outside	0.00		(230a)
warm air heating system fans	0.00		(230b)
central heating pump	130.00		(230c)
oil boiler pump	0.00		(230d)
boiler flue fan	45.00		(230e)
maintaining electric keep-hot facility for gas combi boiler	0.00		(230f)
pump for solar water heating	0.00		(230g)
Total electricity for the above	∑(230a)...(230g)	175.00	(231)
Electricity for lighting (calculated in Appendix L):		759.95	(232)

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

	Energy kWh/year	**Emissions Factor**	**Emissions (kgCO2/year)**

Space heating - main system 1	10727.37	x	0.194	=	2081.11	(261)
Space heating - secondary	940.43	x	0.422	=	396.86	(263)
Water heating	3822.22	x	0.194	=	741.51	(264)
Space and water heating			(261) + (262) + (263) + (264) =		3219.48	(265)
Pumps, fans and electric keep-hot	175.00	x	0.422	=	73.85	(267)
Lighting	759.95	x	0.422	=	320.70	(268)
Total carbon dioxide emissions			∑(261)...(271) =		3614.03	(272)

Emissions per m² for space and water heating	27.67	(272a)
Emissions per m² for lighting	2.69	(272b)

Target Carbon Dioxide Emissions Rate (TER)	[(27.67 × FF × EFA) + (2.69 × EFA)] × (0.6)	18.93	(273)

DER 2009 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	Mrs Farah Naz	Assessor number	1
Client		Last modified	21/02/2014
Address	1.7 Ste 01 1.7 Kiln Place, Camden, Camden, Gospel Oak London, UK, NW5		

1. Overall dwelling dimensions

		Area (m²)			Average storey height (m)			Volume (m³)	
Lowest occupied		44.87	(1a)	x	2.66	(2a)	=	119.35	(3a)
+1		38.00	(1b)	x	3.00	(2b)	=	114.00	(3b)
+2		36.15	(1c)	x	3.00	(2c)	=	108.45	(3c)
Total floor area	(1a) + (1b) + (1c) + (1d)...(1n) =	119.02	(4)						
Dwelling volume					(3a) + (3b) + (3c) + (3d)...(3n) =			341.80	(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		2.50	(17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)		0.12	(18)

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

Number of sides on which dwelling is sheltered		1	(19)
Shelter factor	1 - [0.075 x (19)] =	0.92	(20)
Adjusted infiltration rate	(18) x (20) =	0.12	(21)

Infiltration rate modified for monthly wind speed:

Monthly average wind speed from Table 7

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(22)m	5.40	5.10	5.10	4.50	4.10	3.90	3.70	3.70	4.20	4.50	4.80	5.10

∑(22)1...12 = 54.10 (22)

Wind Factor (22a)m = (22)m ÷ 4

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(22a)m	1.35	1.27	1.27	1.12	1.02	0.98	0.92	0.92	1.05	1.12	1.20	1.27

∑(22a)1...12 = 13.52 (22a)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(22b)m	0.16	0.15	0.15	0.13	0.12	0.11	0.11	0.11	0.12	0.13	0.14	0.15

∑(22b)1...12 = 1.56 (22b)

Calculate effective air change rate for the applicable case:

If mechanical ventilation: air change rate through system	0.50	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)), otherwise (23b) = (23a)	0.50	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	77.35	(23c)

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

(24a)m	0.27	0.26	0.26	0.24	0.23	0.23	0.22	0.22	0.23	0.24	0.25	0.26	(24a)

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

(25)m	0.27	0.26	0.26	0.24	0.23	0.23	0.22	0.22	0.23	0.24	0.25	0.26	(25)

3. Heat losses and heat loss parameter

The κ-value is the heat capacity per unit area, see Table 1e.

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	
Doors			4.40	x	1.00	=	4.40	N/A	N/A	(26)
Window*			20.52	x	0.96	=	19.73	N/A	N/A	(27)
Ground floor			42.69	x	0.10	=	4.27	N/A	N/A	(28a)
External wall			158.99	x	0.15	=	23.85	N/A	N/A	(29a)
Party Wall			29.34	x	0.00	=	0.00	N/A	N/A	(32)
Roof			48.69	x	0.10	=	4.87	N/A	N/A	(30)
Total area of external elements ∑A, m²			275.29	(31)						

** for windows and roof windows, effective window U-value is calculated using formula 1/[(1/UValue)+0.04] paragraph 3.2*

Fabric heat loss, W/K = ∑(A × U)	(26)...(30) + (32) =	57.12	(33)
Heat capacity Cm = ∑(A x κ)	(28)...(30) + (32) + (32a)...(32e) =	N/A	(34)
Thermal mass parameter (TMP) in kJ/m²K	Calculated separately =	285.00	(35)
Thermal bridges: ∑(L x Ψ) calculated using Appendix K		27.53	(36)

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

Total fabric heat loss	(33) + (36) =	84.64	(37)

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

(38)m	30.38	29.40	29.40	27.45	26.14	25.49	24.84	24.84	26.47	27.45	28.42	29.40	(38)

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

(39)m	115.03	114.05	114.05	112.09	110.79	110.13	109.48	109.48	111.11	112.09	113.07	114.05

Average = ∑(39)1...12/12 = 112.12 (39)

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

(40)m	0.97	0.96	0.96	0.94	0.93	0.93	0.92	0.92	0.93	0.94	0.95	0.96

Average = ∑(40)1...12/12 = 0.94 (40)

4. Water heating energy requirement

	kWh/year	
Assumed occupancy, N	2.86	(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	102.11	(43)

Annual average hot water usage has been reduced by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(44)m	112.32	108.24	104.15	100.07	95.99	91.90	91.90	95.99	100.07	104.15	108.24	112.32

∑(44)1...12 = 1225.34 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x Tm/3600 kWh/month (see Tables 1b, 1c 1d)

(45)m	166.97	146.03	150.69	131.38	126.06	108.78	100.80	115.67	117.05	136.41	148.91	161.70

∑(45)1...12 = 1610.46 (45)

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

For community heating include distribution loss whether or not hot water tank is present

Distribution loss 0.15 x (45)m

(46)m	25.05	21.90	22.60	19.71	18.91	16.32	15.12	17.35	17.56	20.46	22.34	24.26	(46)

Water storage loss:

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

Cylinder volume (litres) including any solar storage within same cylinder 250.00 (50)

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

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

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.01 (51)

If community heating see SAP 2009 section 4.3

Volume factor from Table 2a 0.78 (52)

Temperature factor from Table 2b 0.54 (53)

Energy lost from water storage, kWh/day (50) x (51) x (52) x (53) 0.91 (54)

Enter (49) or (54) in (55) 0.91 (55)

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

(56)m	28.09	25.37	28.09	27.18	28.09	27.18	28.09	28.09	27.18	28.09	27.18	28.09	(56)

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

(57)m	28.09	25.37	28.09	27.18	28.09	27.18	28.09	28.09	27.18	28.09	27.18	28.09	(57)

Primary circuit loss (annual) from Table 3 360.00 (58)

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

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

(59)m	30.58	27.62	30.58	29.59	30.58	29.59	30.58	30.58	29.59	30.58	29.59	30.58	(59)

Combi loss for each month from Table 3a, 3b or 3c (enter '0' if not a combi boiler)

(61)m	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 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m	225.63	199.02	209.36	188.15	184.72	165.55	159.46	174.33	173.82	195.07	205.68	220.36	(62)

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

(63)m	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)1...12 = 0.00 (63)

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

(64)m	225.63	199.02	209.36	188.15	184.72	165.55	159.46	174.33	173.82	195.07	205.68	220.36

∑(64)1...12 = 2301.16 (64)

if (64)m < 0 then set to 0

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

(65)m	79.98	70.65	74.57	67.35	66.38	59.84	57.98	62.92	62.59	69.82	73.18	78.23	(65)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	142.97	142.97	142.97	142.97	142.97	142.97	142.97	142.97	142.97	142.97	142.97	142.97	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m	25.55	22.69	18.45	13.97	10.44	8.82	9.53	12.38	16.62	21.10	24.63	26.26	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m	283.93	286.88	279.45	263.65	243.69	224.94	212.41	209.47	216.89	232.70	252.65	271.40	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m	37.30	37.30	37.30	37.30	37.30	37.30	37.30	37.30	37.30	37.30	37.30	37.30	(69)

Pumps and fans gains (Table 5a)

(70)m	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(70)

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

(71)m	-114.38	-114.38	-114.38	-114.38	-114.38	-114.38	-114.38	-114.38	-114.38	-114.38	-114.38	-114.38	(71)

Water heating gains (Table 5)

(72)m	107.50	105.13	100.22	93.55	89.21	83.11	77.93	84.57	86.93	93.84	101.64	105.14	(72)

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

(73)m	482.87	480.59	464.02	437.06	409.24	382.76	365.76	372.31	386.34	413.54	444.82	468.70	(73)

6. Solar gains

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

Rows (74) to (82) are used 12 times, one for each month, repeating as needed if there is more than one window type.

Details for month of January and annual totals are shown below:

	Access factor Table 6d		Area m²		Solar flux W/m²		g Specific data or Table 6b		FF Specific data or Table 6c		Gains (W)	
West	0.77	x	1.32	x	19.87	x 0.9 x	0.60	x	0.80	=	8.73	(80)
West	0.77	x	0.85	x	19.87	x 0.9 x	0.60	x	0.70	=	4.90	(80)
East	0.77	x	1.82	x	19.87	x 0.9 x	0.60	x	0.80	=	12.03	(76)
South	0.77	x	15.89	x	47.32	x 0.9 x	0.60	x	0.80	=	250.16	(78)
North	0.77	x	0.64	x	10.73	x 0.9 x	0.60	x	0.80	=	2.28	(74)

Solar gains in watts, calculated for each month ∑(74)m...(82)m

(83)m	278.09	462.06	584.76	685.28	733.39	743.36	728.59	688.79	632.32	516.70	331.10	239.22	(83)

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

(84)m	760.96	942.65	1048.78	1122.34	1142.64	1126.12	1094.35	1061.11	1018.66	930.24	775.91	707.91	(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, η1,m (see Table 9a)													
(86)m	1.00	0.99	0.98	0.94	0.82	0.62	0.41	0.42	0.70	0.94	1.00	1.00	(86)
Mean internal temp of living area T1 (steps 3 to 7 in Table 9c)													
(87)m	20.17	20.35	20.56	20.76	20.93	20.99	21.00	21.00	20.98	20.80	20.40	20.17	(87)
Temperature during heating periods in the living area from Table 9, Th2(˚C)													
(88)m	20.11	20.12	20.12	20.13	20.14	20.15	20.15	20.15	20.14	20.13	20.13	20.12	(88)
Utilisation factor for gains for rest of dwelling η2,m (see Table 9a)													
(89)m	1.00	0.99	0.97	0.92	0.77	0.54	0.33	0.34	0.63	0.91	0.99	1.00	(89)
Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)													
(90)m	19.00	19.27	19.58	19.86	20.08	20.14	20.15	20.15	20.13	19.92	19.36	19.01	(90)

Living area fraction fLA 30.00 ÷ (4) = 0.25 (91)

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

(92)m	19.29	19.54	19.83	20.09	20.30	20.36	20.37	20.37	20.34	20.14	19.62	19.31	(92)

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

(93)m	19.29	19.54	19.83	20.09	20.30	20.36	20.37	20.37	20.34	20.14	19.62	19.31	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that tim = (93)m and recalculate the utilisation factor for gains using Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, ηm													
(94)m	1.00	0.99	0.97	0.92	0.78	0.56	0.35	0.36	0.64	0.91	0.99	1.00	(94)
Useful gains, ηmGm, W = (94)m x (84)m													
(95)m	758.64	932.21	1014.30	1029.58	889.79	628.02	379.22	379.17	656.48	850.23	769.33	706.23	(95)
Monthly average external temperature from Table 8													
(96)m	4.50	5.00	6.80	8.70	11.70	14.60	16.90	16.90	14.30	10.80	7.00	4.90	(96)

Heat loss rate for mean internal temperature, Lm, W

(97)m	1701.75	1658.53	1485.93	1276.71	952.29	633.98	379.42	379.41	671.38	1047.36	1427.21	1642.96	(97)

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

(98)m	701.68	488.09	350.89	177.93	46.50	0.00	0.00	0.00	0.00	146.67	473.67	696.93	

Total per year (kWh/year) = ∑(98)1...5, 10...12 = 3082.35 (98)

Space heating requirement in kWh/m²/year (98) ÷ (4) 25.90 (99)

9a. Energy Requirements - Individual heating systems including micro-CHP

Space heating:

Fraction of space heating from secondary/supplementary system (Table 11)	0.00	(201)
Fraction of space heating from main system(s) 1 - (201)	1.00	(202)
Fraction of main heating from main system 2	0.00	(203)
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 space heating system 1 (%)	91.00	(206)

(from database or Table 4a/4b, adjusted where appropriate by the amount shown in the 'space efficiency adjustment' column of Table 4c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement, kWh/month (as calculated above)												
(98)m	701.68	488.09	350.89	177.93	46.50	0.00	0.00	0.00	0.00	146.67	473.67	696.93
Space heating fuel (main heating system 1), kWh/month = (98)m x (204) x 100 ÷ (206)												
(211)m	771.07	536.36	385.59	195.53	51.10	0.00	0.00	0.00	0.00	161.17	520.52	765.86

Total per year (kWh/year) = ∑(211)1...5, 10...12 = 3387.20 (211)

Water heating:

Output from water heater, kWh/month (calculated above)

(64)m	225.63	199.02	209.36	188.15	184.72	165.55	159.46	174.33	173.82	195.07	205.68	220.36

∑(64)1...12 = 2301.16 (64)

Efficiency of water heater per month

(217)m	88.14	87.62	86.68	85.17	82.24	80.30	80.30	80.30	80.30	84.57	87.47	88.18

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

(219)m	255.99	227.14	241.52	220.92	224.60	206.16	198.58	217.10	216.47	230.67	235.13	249.91

Total per year (kWh/year) = ∑(219)1...12 = 2724.19 (219)

Annual Totals Summary:		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			3387.20	(211)
Water heating fuel used			2724.19	(219)
Electricity for pumps, fans and electric keep-hot (Table 4f):				
mechanical ventilation fans - balanced, extract or positive input from outside		297.74		(230a)
warm air heating system fans		0.00		(230b)
central heating pump		130.00		(230c)
oil boiler pump		0.00		(230d)
boiler flue fan		0.00		(230e)
maintaining electric keep-hot facility for gas combi boiler		0.00		(230f)
pump for solar water heating		0.00		(230g)
Total electricity for the above	∑(230a)...(230g)		427.74	(231)
Electricity for lighting (calculated in Appendix L):			451.19	(232)

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

	Energy kWh/year		Emissions Factor		Emissions (kgCO2/year)	
Space heating - main system 1	3387.20	x	0.198	=	670.67	(261)

Water heating	2724.19	x	0.198	=	539.39	(264)
Space and water heating			(261) + (262) + (263) + (264) =		1210.06	(265)
Pumps, fans and electric keep-hot	427.74	x	0.517	=	221.14	(267)
Lighting	451.19	x	0.517	=	233.26	(268)
Total carbon dioxide emissions			∑(261)...(271) =		1664.46	(272)
Dwelling Carbon Dioxide Emissions Rate (DER)					13.98	(273)

TER 2009 Worksheet
Design - Draft

NHER

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	Mrs Farah Naz	Assessor number	1
Client		Last modified	21/02/2014
Address	2.2 Site 2 2.2 Kiln Place, Camden, Camden, Gospel Oak London, UK, NW5		

1. Overall dwelling dimensions

		Area (m²)			Average storey height (m)			Volume (m³)	
Lowest occupied		56.25	(1a)	x	2.66	(2a)	=	149.62	(3a)
+1		45.00	(1b)	x	3.00	(2b)	=	135.00	(3b)
Total floor area	(1a) + (1b) + (1c) + (1d)...(1n) =	101.25	(4)						
Dwelling volume							(3a) + (3b) + (3c) + (3d)...(3n) =	284.62	(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	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, fans, PSVs	(6a) + (6b) + (7a) + (7b) + (7c) =	30	÷ (5) =	0.11	(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		10.00	(17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)		0.61	(18)

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

Number of sides on which dwelling is sheltered		2	(19)
Shelter factor	1 - [0.075 x (19)] =	0.85	(20)
Adjusted infiltration rate	(18) x (20) =	0.51	(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	5.40	5.10	5.10	4.50	4.10	3.90	3.70	3.70	4.20	4.50	4.80	5.10

∑(22)1...12 = 54.10 (22)

Wind Factor (22a)m = (22)m ÷ 4

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(22a)m	1.35	1.27	1.27	1.12	1.02	0.98	0.92	0.92	1.05	1.12	1.20	1.27

∑(22a)1...12 = 13.52 (22a)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(22b)m	0.69	0.66	0.66	0.58	0.53	0.50	0.48	0.48	0.54	0.58	0.62	0.66

∑(22b)1...12 = 6.96 (22b)

Calculate effective air change rate for the applicable case:

If mechanical ventilation: air change rate through system N/A (23a)

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

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

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	0.74	0.72	0.72	0.67	0.64	0.63	0.61	0.61	0.65	0.67	0.69	0.72	(24d)

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

(25)m	0.74	0.72	0.72	0.67	0.64	0.63	0.61	0.61	0.65	0.67	0.69	0.72	(25)

3. Heat losses and heat loss parameter

The κ-value is the heat capacity per unit area, see Table 1e.

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	
Doors			1.85	x	2.00	=	3.70	N/A	N/A	(26)
Window*			23.46	x	1.85	=	43.45	N/A	N/A	(27)
Ground floor			56.25	x	0.25	=	14.06	N/A	N/A	(28a)
Party Wall			12.90	x	0.00	=	0.00	N/A	N/A	(32)
External wall			173.89	x	0.35	=	60.86	N/A	N/A	(29a)
Roof			45.00	x	0.16	=	7.20	N/A	N/A	(30)
Total area of external elements ∑A, m²			300.45	(31)						

** for windows and roof windows, effective window U-value is calculated using formula 1/[(1/UValue)+0.04] paragraph 3.2*

Fabric heat loss, W/K = ∑(A × U)	(26)...(30) + (32) =	129.27	(33)
Heat capacity Cm = ∑(A x κ)	(28)...(30) + (32) + (32a)...(32e) =	N/A	(34)
Thermal mass parameter (TMP) in kJ/m²K	Calculated separately =	250.00	(35)
Thermal bridges: ∑(L x Ψ) calculated using Appendix K		33.05	(36)

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

Total fabric heat loss	(33) + (36) =	162.32	(37)

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

(38)m	69.63	67.18	67.18	62.70	60.03	58.79	57.60	57.60	60.67	62.70	64.87	67.18	(38)

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

(39)m	231.95	229.50	229.50	225.02	222.35	221.11	219.93	219.93	223.00	225.02	227.19	229.50

Average = ∑(39)1...12/12 = | 225.33 | (39)

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

(40)m	2.29	2.27	2.27	2.22	2.20	2.18	2.17	2.17	2.20	2.22	2.24	2.27

Average = ∑(40)1...12/12 = | 2.23 | (40)

4. Water heating energy requirement

	kWh/year	
Assumed occupancy, N	2.75	(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	104.77	(43)

Annual average hot water usage has been reduced by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(44)m	115.25	111.06	106.87	102.67	98.48	94.29	94.29	98.48	102.67	106.87	111.06	115.25

∑(44)1...12 = | 1257.24 | (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x Tm/3600 kWh/month (see Tables 1b, 1c 1d)

(45)m	171.32	149.83	154.62	134.80	129.34	111.61	103.43	118.68	120.10	139.96	152.78	165.91

∑(45)1...12 = | 1652.38 | (45)

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

For community heating include distribution loss whether or not hot water tank is present

Distribution loss 0.15 x (45)m

(46)m	25.70	22.48	23.19	20.22	19.40	16.74	15.51	17.80	18.01	20.99	22.92	24.89	(46)

Water storage loss:

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

Cylinder volume (litres) including any solar storage within same cylinder	150.00	(50)
If community heating and no tank in dwelling, enter 110 litres in box (50)		
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in box (50)		
Hot water storage loss factor from Table 2 (kWh/litre/day)	0.02	(51)
If community heating see SAP 2009 section 4.3		
Volume factor from Table 2a	0.93	(52)
Temperature factor from Table 2b	0.54	(53)
Energy lost from water storage, kWh/day (50) x (51) x (52) x (53)	1.44	(54)
Enter (49) or (54) in (55)	1.44	(55)

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

(56)m	44.53	40.22	44.53	43.09	44.53	43.09	44.53	44.53	43.09	44.53	43.09	44.53	(56)

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

(57)m	44.53	40.22	44.53	43.09	44.53	43.09	44.53	44.53	43.09	44.53	43.09	44.53	(57)

Primary circuit loss (annual) from Table 3	610.00	(58)

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

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

(59)m	51.81	46.79	51.81	50.14	51.81	50.14	51.81	51.81	50.14	51.81	50.14	51.81	(59)

Combi loss for each month from Table 3a, 3b or 3c (enter '0' if not a combi boiler)

(61)m	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 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m	267.65	236.85	250.95	228.03	225.68	204.84	199.76	215.02	213.33	236.30	246.01	262.25	(62)

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

(63)m	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)1...12 = 0.00 (63)

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

(64)m	267.65	236.85	250.95	228.03	225.68	204.84	199.76	215.02	213.33	236.30	246.01	262.25	

∑(64)1...12 = 2786.67 (64)

if (64)m < 0 then set to 0

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

(65)m	134.03	119.43	128.48	119.40	120.08	111.69	111.46	116.53	114.52	123.61	125.38	132.23	(65)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	137.54	137.54	137.54	137.54	137.54	137.54	137.54	137.54	137.54	137.54	137.54	137.54	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m	39.15	34.77	28.28	21.41	16.00	13.51	14.60	18.98	25.47	32.34	37.75	40.24	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m	258.33	261.01	254.26	239.88	221.72	204.66	193.26	190.58	197.34	211.72	229.87	246.93	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m	36.75	36.75	36.75	36.75	36.75	36.75	36.75	36.75	36.75	36.75	36.75	36.75	(69)
Pumps and fans gains (Table 5a)													
(70)m	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	(70)

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

(71)m	-110.03	-110.03	-110.03	-110.03	-110.03	-110.03	-110.03	-110.03	-110.03	-110.03	-110.03	-110.03	(71)

Water heating gains (Table 5)

(72)m	180.15	177.72	172.69	165.84	161.39	155.13	149.81	156.63	159.05	166.14	174.14	177.73	(72)

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

(73)m	551.90	547.77	529.49	501.39	473.38	447.57	431.93	440.45	456.12	484.46	516.03	539.17	(73)

6. Solar gains

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

Rows (74) to (82) are used 12 times, one for each month, repeating as needed if there is more than one window type.

Details for month of January and annual totals are shown below:

	Access factor Table 6d		Area m²		Solar flux W/m²		g Specific data or Table 6b		FF Specific data or Table 6c		Gains (W)	
East	0.77	x	23.46	x	19.87	x 0.9 x	0.72	x	0.70	=	162.85	(76)

Solar gains in watts, calculated for each month ∑(74)m...(82)m

(83)m	162.85	315.65	504.51	749.08	911.42	951.02	923.08	803.37	603.17	384.41	202.47	134.34	(83)

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

(84)m	714.75	863.43	1034.00	1250.47	1384.80	1398.59	1355.01	1243.82	1059.29	868.87	718.49	673.51	(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, η1,m (see Table 9a)													
(86)m	0.99	0.99	0.98	0.95	0.88	0.76	0.59	0.63	0.87	0.97	0.99	1.00	(86)
Mean internal temp of living area T1 (steps 3 to 7 in Table 9c)													
(87)m	18.61	18.83	19.27	19.77	20.34	20.73	20.92	20.90	20.55	19.87	19.09	18.67	(87)
Temperature during heating periods in the living area from Table 9, Th2(˚C)													
(88)m	19.16	19.17	19.17	19.20	19.21	19.22	19.23	19.23	19.21	19.20	19.18	19.17	(88)
Utilisation factor for gains for rest of dwelling η2,m (see Table 9a)													
(89)m	0.99	0.99	0.97	0.93	0.82	0.63	0.37	0.40	0.77	0.95	0.99	0.99	(89)
Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)													
(90)m	17.09	17.32	17.75	18.27	18.80	19.11	19.22	19.21	18.99	18.37	17.59	17.16	(90)

Living area fraction fLA 30.00 ÷ (4) = 0.30 (91)

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

(92)m	17.54	17.77	18.20	18.71	19.26	19.59	19.72	19.71	19.45	18.82	18.04	17.61	(92)

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

(93)m	17.54	17.77	18.20	18.71	19.26	19.59	19.72	19.71	19.45	18.82	18.04	17.61	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that tim = (93)m and recalculate the utilisation factor for gains using Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, ηm													
(94)m	0.99	0.98	0.96	0.92	0.82	0.66	0.44	0.47	0.79	0.94	0.98	0.99	(94)
Useful gains, ηmGm, W = (94)m x (84)m													
(95)m	707.74	848.53	996.03	1150.88	1141.25	925.00	590.11	581.96	832.73	818.96	707.28	667.50	(95)
Monthly average external temperature from Table 8													
(96)m	4.50	5.00	6.80	8.70	11.70	14.60	16.90	16.90	14.30	10.80	7.00	4.90	(96)
Heat loss rate for mean internal temperature, Lm, W													
(97)m	3024.44	2930.10	2617.08	2253.07	1680.11	1103.18	620.46	619.00	1149.29	1803.67	2507.36	2916.51	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m - (95)m] x (41)m													
(98)m	1723.63	1398.82	1206.07	793.57	400.92	0.00	0.00	0.00	0.00	732.62	1296.06	1673.27	

Total per year (kWh/year) = ∑(98)1...5, 10...12 = 9224.94 (98)

Space heating requirement in kWh/m²/year	(98) ÷ (4)	91.11	(99)

9a. Energy Requirements - Individual heating systems including micro-CHP

Space heating:

Fraction of space heating from secondary/supplementary system (Table 11)	0.10	(201)
Fraction of space heating from main system(s) 1 - (201)	0.90	(202)
Fraction of main heating from main system 2	0.00	(203)
Fraction of total space heat from main system 1 (202) x [1 - (203)]	0.90	(204)
Fraction of total space heat from main system 2 (202) x (203)	0.00	(205)
Efficiency of main space heating system 1 (%)	78.90	(206)

(from database or Table 4a/4b, adjusted where appropriate by the amount shown in the 'space efficiency adjustment' column of Table 4c)

Efficiency of secondary/supplementary heating system, from Table 4a or Appendix E (%)	100.00	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement, kWh/month (as calculated above)												
(98)m	1723.63	1398.82	1206.07	793.57	400.92	0.00	0.00	0.00	0.00	732.62	1296.06	1673.27
Space heating fuel (main heating system 1), kWh/month = (98)m x (204) x 100 ÷ (206)												
(211)m	1966.11	1595.61	1375.74	905.21	457.32	0.00	0.00	0.00	0.00	835.69	1478.39	1908.67

Total per year (kWh/year) = ∑(211)1...5, 10...12 = 10522.74 (211)

Space heating fuel (secondary), kWh/month = (98)m x (201) x 100 ÷ (208)												
(215)m	172.36	139.88	120.61	79.36	40.09	0.00	0.00	0.00	0.00	73.26	129.61	167.33

Total per year (kWh/year) = ∑(215)1...5, 10...12 = 922.49 (215)

Water heating:

Output from water heater, kWh/month (calculated above)												
(64)m	267.65	236.85	250.95	228.03	225.68	204.84	199.76	215.02	213.33	236.30	246.01	262.25

∑(64)1...12 = 2786.67 (64)

Efficiency of water heater per month												
(217)m	77.23	77.11	76.78	76.19	74.68	68.80	68.80	68.80	68.80	75.96	76.93	77.22
Fuel for water heating, kWh/month = (64)m x 100 ÷ (217)m												
(219)m	346.56	307.17	326.83	299.27	302.19	297.73	290.35	312.53	310.07	311.09	319.77	339.62

Total per year (kWh/year) = ∑(219)1...12 = 3763.18 (219)

Annual Totals Summary:		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			10522.74	(211)
Space heating fuel used, secondary			922.49	(215)
Water heating fuel used			3763.18	(219)
Electricity for pumps, fans and electric keep-hot (Table 4f):				
mechanical ventilation fans - balanced, extract or positive input from outside		0.00		(230a)
warm air heating system fans		0.00		(230b)
central heating pump		130.00		(230c)
oil boiler pump		0.00		(230d)
boiler flue fan		45.00		(230e)
maintaining electric keep-hot facility for gas combi boiler		0.00		(230f)
pump for solar water heating		0.00		(230g)
Total electricity for the above	∑(230a)...(230g)		175.00	(231)
Electricity for lighting (calculated in Appendix L):			691.44	(232)

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

	Energy kWh/year		Emissions Factor		Emissions (kgCO2/year)	
Space heating - main system 1	10522.74	x	0.194	=	2041.41	(261)

Space heating - secondary	922.49	x	0.422	=	389.29	(263)
Water heating	3763.18	x	0.194	=	730.06	(264)
Space and water heating				(261) + (262) + (263) + (264) =	3160.76	(265)
Pumps, fans and electric keep-hot	175.00	x	0.422	=	73.85	(267)
Lighting	691.44	x	0.422	=	291.79	(268)
Total carbon dioxide emissions				∑(261)...(271) =	3526.40	(272)
Emissions per m² for space and water heating					31.95	(272a)
Emissions per m² for lighting					2.88	(272b)
Target Carbon Dioxide Emissions Rate (TER)				[(31.95 × FF × EFA) + (2.88 × EFA)] × (0.6)	21.68	(273)

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	Mrs Farah Naz	Assessor number	1
Client		Last modified	21/02/2014
Address	2.2 Site 2 2.2 Kiln Place, Camden, Camden, Gospel Oak London, UK, NW5		

1. Overall dwelling dimensions

		Area (m²)			Average storey height (m)			Volume (m³)	
Lowest occupied		56.25	(1a)	x	2.66	(2a)	=	149.62	(3a)
+1		45.00	(1b)	x	3.00	(2b)	=	135.00	(3b)
Total floor area	(1a) + (1b) + (1c) + (1d)...(1n) =	101.25	(4)						
Dwelling volume					(3a) + (3b) + (3c) + (3d)...(3n) =			284.62	(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		1.50	(17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)		0.08	(18)

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

Number of sides on which dwelling is sheltered		1	(19)
Shelter factor	1 - [0.075 x (19)] =	0.92	(20)
Adjusted infiltration rate	(18) x (20) =	0.07	(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	5.40	5.10	5.10	4.50	4.10	3.90	3.70	3.70	4.20	4.50	4.80	5.10

∑(22)1...12 = 54.10 (22)

Wind Factor (22a)m = (22)m ÷ 4

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(22a)m	1.35	1.27	1.27	1.12	1.02	0.98	0.92	0.92	1.05	1.12	1.20	1.27

∑(22a)1...12 = 13.52 (22a)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(22b)m	0.09	0.09	0.09	0.08	0.07	0.07	0.06	0.06	0.07	0.08	0.08	0.09

∑(22b)1...12 = 0.94 (22b)

Calculate effective air change rate for the applicable case:

If mechanical ventilation: air change rate through system 0.50 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)), otherwise (23b) = (23a) | 0.50 | (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = | 77.35 | (23c)

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

(24a)m	0.21	0.20	0.20	0.19	0.18	0.18	0.18	0.18	0.19	0.19	0.20	0.20	(24a)

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

(25)m	0.21	0.20	0.20	0.19	0.18	0.18	0.18	0.18	0.19	0.19	0.20	0.20	(25)

3. Heat losses and heat loss parameter

The κ-value is the heat capacity per unit area, see Table 1e.

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	
Doors			4.40	x	1.00	=	4.40	N/A	N/A	(26)
Window*			35.21	x	0.96	=	33.86	N/A	N/A	(27)
Ground floor			56.25	x	0.10	=	5.62	N/A	N/A	(28a)
External wall			159.59	x	0.15	=	23.94	N/A	N/A	(29a)
Party Wall			12.90	x	0.00	=	0.00	N/A	N/A	(32)
Roof			45.00	x	0.10	=	4.50	N/A	N/A	(30)
Total area of external elements ∑A, m²			300.45	(31)						

** for windows and roof windows, effective window U-value is calculated using formula 1/[(1/UValue)+0.04] paragraph 3.2*

Fabric heat loss, W/K = ∑(A × U)	(26)...(30) + (32) =	72.32	(33)
Heat capacity Cm = ∑(A x κ)	(28)...(30) + (32) + (32a)...(32e) =	N/A	(34)
Thermal mass parameter (TMP) in kJ/m²K	Calculated separately =	100.00	(35)
Thermal bridges: ∑(L x Ψ) calculated using Appendix K		30.04	(36)

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

Total fabric heat loss (33) + (36) = | 102.36 | (37)

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

(38)m	19.43	18.95	18.95	17.97	17.32	16.99	16.66	16.66	17.48	17.97	18.46	18.95	(38)

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

(39)m	121.80	121.31	121.31	120.33	119.68	119.35	119.03	119.03	119.84	120.33	120.82	121.31

Average = ∑(39)1...12/12 = | 120.35 | (39)

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

(40)m	1.20	1.20	1.20	1.19	1.18	1.18	1.18	1.18	1.18	1.19	1.19	1.20

Average = ∑(40)1...12/12 = | 1.19 | (40)

4. Water heating energy requirement

kWh/year

Assumed occupancy, N | 2.75 | (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 | 99.53 | (43)

Annual average hot water usage has been reduced by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(44)m	109.48	105.50	101.52	97.54	93.56	89.58	89.58	93.56	97.54	101.52	105.50	109.48

∑(44)1...12 = | 1194.38 | (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x Tm/3600 kWh/month (see Tables 1b, 1c 1d)

(45)m	162.75	142.34	146.89	128.06	122.87	106.03	98.25	112.75	114.09	132.97	145.14	157.62

∑(45)1...12 = | 1569.76 | (45)

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

For community heating include distribution loss whether or not hot water tank is present

Distribution loss 0.15 x (45)m

(46)m	24.41	21.35	22.03	19.21	18.43	15.90	14.74	16.91	17.11	19.94	21.77	23.64	(46)

Water storage loss:

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

Cylinder volume (litres) including any solar storage within same cylinder	250.00	(50)
If community heating and no tank in dwelling, enter 110 litres in box (50)		
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in box (50)		
Hot water storage loss factor from Table 2 (kWh/litre/day)	0.01	(51)
If community heating see SAP 2009 section 4.3		
Volume factor from Table 2a	0.78	(52)
Temperature factor from Table 2b	0.54	(53)
Energy lost from water storage, kWh/day (50) x (51) x (52) x (53)	0.91	(54)
Enter (49) or (54) in (55)	0.91	(55)

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

(56)m	28.09	25.37	28.09	27.18	28.09	27.18	28.09	28.09	27.18	28.09	27.18	28.09	(56)

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

(57)m	28.09	25.37	28.09	27.18	28.09	27.18	28.09	28.09	27.18	28.09	27.18	28.09	(57)

Primary circuit loss (annual) from Table 3	360.00	(58)

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

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

(59)m	30.58	27.62	30.58	29.59	30.58	29.59	30.58	30.58	29.59	30.58	29.59	30.58	(59)

Combi loss for each month from Table 3a, 3b or 3c (enter '0' if not a combi boiler)

(61)m	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 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m	221.41	195.33	205.55	184.83	181.54	162.80	156.92	171.41	170.86	191.63	201.91	216.28	(62)

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

(63)m	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)1...12 = 0.00 (63)

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

(64)m	221.41	195.33	205.55	184.83	181.54	162.80	156.92	171.41	170.86	191.63	201.91	216.28	

∑(64)1...12 = 2260.46 (64)

if (64)m < 0 then set to 0

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

(65)m	78.57	69.42	73.30	66.25	65.32	58.93	57.13	61.95	61.61	68.67	71.93	76.87	(65)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	137.54	137.54	137.54	137.54	137.54	137.54	137.54	137.54	137.54	137.54	137.54	137.54	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m	23.03	20.46	16.64	12.59	9.41	7.95	8.59	11.16	14.98	19.02	22.20	23.67	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m	258.33	261.01	254.26	239.88	221.72	204.66	193.26	190.58	197.34	211.72	229.87	246.93	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m	36.75	36.75	36.75	36.75	36.75	36.75	36.75	36.75	36.75	36.75	36.75	36.75	(69)
Pumps and fans gains (Table 5a)													
(70)m	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(70)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(71)m	-110.03	-110.03	-110.03	-110.03	-110.03	-110.03	-110.03	-110.03	-110.03	-110.03	-110.03	-110.03	(71)

Water heating gains (Table 5)

(72)m	105.61	103.31	98.52	92.01	87.79	81.84	76.79	83.26	85.57	92.30	99.90	103.32	(72)

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

(73)m	451.24	449.04	433.68	408.75	383.19	358.71	342.90	349.27	362.15	387.31	416.24	438.18	(73)

6. Solar gains

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

Rows (74) to (82) are used 12 times, one for each month, repeating as needed if there is more than one window type.

Details for month of January and annual totals are shown below:

	Access factor Table 6d		Area m²		Solar flux W/m²		g Specific data or Table 6b		FF Specific data or Table 6c		Gains (W)	
East	0.77	x	7.53	x	19.87	x 0.9 x	0.60	x	0.80	=	49.78	(76)
West	0.77	x	22.71	x	19.87	x 0.9 x	0.60	x	0.80	=	150.12	(80)
South	0.77	x	4.97	x	47.32	x 0.9 x	0.60	x	0.80	=	78.24	(78)

Solar gains in watts, calculated for each month ∑(74)m...(82)m

(83)m	278.13	515.06	775.10	1093.27	1298.22	1347.40	1310.19	1157.87	905.69	612.86	341.22	232.50	(83)

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

(84)m	729.37	964.10	1208.77	1502.02	1681.41	1706.12	1653.09	1507.15	1267.84	1000.17	757.46	670.68	(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, η1,m (see Table 9a)													
(86)m	0.95	0.91	0.83	0.71	0.56	0.41	0.29	0.31	0.54	0.79	0.92	0.96	(86)
Mean internal temp of living area T1 (steps 3 to 7 in Table 9c)													
(87)m	18.72	19.15	19.75	20.29	20.70	20.90	20.97	20.97	20.80	20.24	19.28	18.72	(87)
Temperature during heating periods in the living area from Table 9, Th2(˚C)													
(88)m	19.92	19.92	19.92	19.93	19.94	19.94	19.94	19.94	19.94	19.93	19.93	19.92	(88)
Utilisation factor for gains for rest of dwelling η2,m (see Table 9a)													
(89)m	0.94	0.89	0.81	0.68	0.51	0.35	0.22	0.24	0.48	0.75	0.91	0.95	(89)
Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)													
(90)m	16.90	17.51	18.36	19.09	19.63	19.86	19.93	19.92	19.76	19.05	17.71	16.91	(90)

Living area fraction fLA 30.00 ÷ (4) = 0.30 (91)

Mean internal temperature for the whole dwelling fLA x T1 +(1 - fLA) x T2													
(92)m	17.44	18.00	18.77	19.45	19.95	20.17	20.24	20.23	20.07	19.40	18.17	17.45	(92)
Apply adjustment to the mean internal temperature from Table 4e, where appropriate													
(93)m	17.44	18.00	18.77	19.45	19.95	20.17	20.24	20.23	20.07	19.40	18.17	17.45	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that tim = (93)m and recalculate the utilisation factor for gains using Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, ηm													
(94)m	0.92	0.87	0.78	0.66	0.51	0.37	0.24	0.26	0.49	0.73	0.88	0.93	(94)
Useful gains, ηmGm, W = (94)m x (84)m													
(95)m	670.10	834.36	943.26	996.24	864.74	627.09	389.52	387.26	616.11	731.19	670.18	621.40	(95)
Monthly average external temperature from Table 8													
(96)m	4.50	5.00	6.80	8.70	11.70	14.60	16.90	16.90	14.30	10.80	7.00	4.90	(96)
Heat loss rate for mean internal temperature, Lm, W													
(97)m	1575.79	1576.91	1452.49	1292.99	986.80	664.25	397.24	396.74	691.02	1034.75	1350.06	1521.98	(97)

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

(98)m	673.83	499.00	378.87	213.66	90.81	0.00	0.00	0.00	0.00	225.85	489.51	670.03

Total per year (kWh/year) = ∑(98)1...5, 10...12 = 3241.57 (98)

Space heating requirement in kWh/m²/year (98) ÷ (4) 32.02 (99)

9a. Energy Requirements - Individual heating systems including micro-CHP

Space heating:

Fraction of space heating from secondary/supplementary system (Table 11)	0.00	(201)
Fraction of space heating from main system(s) 1 - (201)	1.00	(202)
Fraction of main heating from main system 2	0.00	(203)
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 space heating system 1 (%)	91.00	(206)

(from database or Table 4a/4b, adjusted where appropriate by the amount shown in the 'space efficiency adjustment' column of Table 4c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement, kWh/month (as calculated above)												
(98)m	673.83	499.00	378.87	213.66	90.81	0.00	0.00	0.00	0.00	225.85	489.51	670.03
Space heating fuel (main heating system 1), kWh/month = (98)m x (204) x 100 ÷ (206)												
(211)m	740.48	548.35	416.34	234.79	99.79	0.00	0.00	0.00	0.00	248.19	537.93	736.30

Total per year (kWh/year) = ∑(211)1...5, 10...12 = 3562.16 (211)

Water heating:

Output from water heater, kWh/month (calculated above)												
(64)m	221.41	195.33	205.55	184.83	181.54	162.80	156.92	171.41	170.86	191.63	201.91	216.28

∑(64)1...12 = 2260.46 (64)

Efficiency of water heater per month												
(217)m	88.10	87.71	86.93	85.70	83.58	80.30	80.30	80.30	80.30	85.75	87.59	88.13
Fuel for water heating, kWh/month = (64)m x 100 ÷ (217)m												
(219)m	251.33	222.69	236.46	215.66	217.21	202.74	195.41	213.46	212.78	223.46	230.52	245.40

Total per year (kWh/year) = ∑(219)1...12 = 2667.12 (219)

Annual Totals Summary:	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		3562.16	(211)
Water heating fuel used		2667.12	(219)
Electricity for pumps, fans and electric keep-hot (Table 4f):			
mechanical ventilation fans - balanced, extract or positive input from outside	221.37		(230a)
warm air heating system fans	0.00		(230b)
central heating pump	130.00		(230c)
oil boiler pump	0.00		(230d)
boiler flue fan	0.00		(230e)
maintaining electric keep-hot facility for gas combi boiler	0.00		(230f)
pump for solar water heating	0.00		(230g)
Total electricity for the above	∑(230a)...(230g)	351.37	(231)
Electricity for lighting (calculated in Appendix L):		406.73	(232)

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

	Energy kWh/year		**Emissions Factor**		**Emissions (kgCO2/year)**	
Space heating - main system 1	3562.16	x	0.198	=	705.31	(261)
Water heating	2667.12	x	0.198	=	528.09	(264)
Space and water heating			(261) + (262) + (263) + (264) =		1233.40	(265)
Pumps, fans and electric keep-hot	351.37	x	0.517	=	181.66	(267)

Lighting	406.73	x	0.517	=	210.28	(268)
Total carbon dioxide emissions				∑(261)...(271) =	1625.33	(272)
Dwelling Carbon Dioxide Emissions Rate (DER)					16.05	(273)

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	Mrs Farah Naz	Assessor number	1
Client		Last modified	21/02/2014
Address	3 Site 3 3 Kiln Place, Camden, Camden, Gospel Oak London, UK, NW5		

1. Overall dwelling dimensions

		Area (m²)			Average storey height (m)			Volume (m³)	
Lowest occupied		27.00	(1a)	x	3.00	(2a)	=	81.00	(3a)
+1		37.00	(1b)	x	3.00	(2b)	=	111.00	(3b)
Total floor area	(1a) + (1b) + (1c) + (1d)...(1n) =	64.00	(4)						
Dwelling volume							(3a) + (3b) + (3c) + (3d)...(3n) =	192.00	(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		2	x 10 =	20	(7a)
Number of passive vents		0	x 10 =	0	(7b)
Number of flueless gas fires		0	x 40 =	0	(7c)
				Air changes per hour	
Infiltration due to chimneys, flues, fans, PSVs	(6a) + (6b) + (7a) + (7b) + (7c) =	20	÷ (5) =	0.10	(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		10.00	(17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)		0.60	(18)

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

Number of sides on which dwelling is sheltered		2	(19)
Shelter factor	1 - [0.075 x (19)] =	0.85	(20)
Adjusted infiltration rate	(18) x (20) =	0.51	(21)

Infiltration rate modified for monthly wind speed:

Monthly average wind speed from Table 7

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(22)m	5.40	5.10	5.10	4.50	4.10	3.90	3.70	3.70	4.20	4.50	4.80	5.10

∑(22)1...12 = 54.10 (22)

Wind Factor (22a)m = (22)m ÷ 4

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(22a)m	1.35	1.27	1.27	1.12	1.02	0.98	0.92	0.92	1.05	1.12	1.20	1.27

∑(22a)1...12 = 13.52 (22a)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(22b)m	0.69	0.65	0.65	0.58	0.53	0.50	0.48	0.48	0.54	0.58	0.62	0.65

∑(22b)1...12 = 6.95 (22b)

Calculate effective air change rate for the applicable case:

If mechanical ventilation: air change rate through system N/A (23a)

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

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

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	0.74	0.71	0.71	0.67	0.64	0.63	0.61	0.61	0.65	0.67	0.69	0.71	(24d)

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

(25)m	0.74	0.71	0.71	0.67	0.64	0.63	0.61	0.61	0.65	0.67	0.69	0.71	(25)

3. Heat losses and heat loss parameter

The κ-value is the heat capacity per unit area, see Table 1e.

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	
Doors			1.85	x	2.00	=	3.70	N/A	N/A	(26)
Window*			14.15	x	1.85	=	26.20	N/A	N/A	(27)
Exposed floor			27.00	x	0.25	=	6.75	N/A	N/A	(28b)
Party Wall			153.00	x	0.00	=	0.00	N/A	N/A	(32)
External wall			23.99	x	0.35	=	8.40	N/A	N/A	(29a)
Roof			37.00	x	0.16	=	5.92	N/A	N/A	(30)
Total area of external elements ∑A, m²			103.99	(31)						

** for windows and roof windows, effective window U-value is calculated using formula 1/[(1/UValue)+0.04] paragraph 3.2*

Fabric heat loss, W/K = ∑(A × U)	(26)...(30) + (32) =	50.97	(33)
Heat capacity Cm = ∑(A x κ)	(28)...(30) + (32) + (32a)...(32e) =	N/A	(34)
Thermal mass parameter (TMP) in kJ/m²K	Calculated separately =	250.00	(35)
Thermal bridges: ∑(L x Ψ) calculated using Appendix K		11.44	(36)

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

Total fabric heat loss | (33) + (36) = | 62.41 | (37)

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

(38)m	46.91	45.26	45.26	42.25	40.46	39.62	38.83	38.83	40.89	42.25	43.71	45.26	(38)

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

(39)m	109.32	107.67	107.67	104.66	102.87	102.03	101.24	101.24	103.30	104.66	106.12	107.67	

Average = ∑(39)1...12/12 = | 104.87 | (39)

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

(40)m	1.71	1.68	1.68	1.64	1.61	1.59	1.58	1.58	1.61	1.64	1.66	1.68

Average = ∑(40)1...12/12 = | 1.64 | (40)

4. Water heating energy requirement

kWh/year

Assumed occupancy, N | 2.09 | (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 | 88.30 | (43)

Annual average hot water usage has been reduced by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(44)m	97.13	93.60	90.07	86.54	83.01	79.47	79.47	83.01	86.54	90.07	93.60	97.13

∑(44)1...12 = | 1059.65 | (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x Tm/3600 kWh/month (see Tables 1b, 1c 1d)

(45)m	144.39	126.29	130.32	113.61	109.01	94.07	87.17	100.03	101.22	117.97	128.77	139.84

∑(45)1...12 = | 1392.70 | (45)

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

For community heating include distribution loss whether or not hot water tank is present

Distribution loss 0.15 x (45)m

(46)m	21.66	18.94	19.55	17.04	16.35	14.11	13.08	15.00	15.18	17.70	19.32	20.98	(46)

Water storage loss:

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

Cylinder volume (litres) including any solar storage within same cylinder	150.00	(50)
If community heating and no tank in dwelling, enter 110 litres in box (50)		
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in box (50)		
Hot water storage loss factor from Table 2 (kWh/litre/day)	0.02	(51)
If community heating see SAP 2009 section 4.3		
Volume factor from Table 2a	0.93	(52)
Temperature factor from Table 2b	0.54	(53)
Energy lost from water storage, kWh/day (50) x (51) x (52) x (53)	1.44	(54)
Enter (49) or (54) in (55)	1.44	(55)

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

(56)m	44.53	40.22	44.53	43.09	44.53	43.09	44.53	44.53	43.09	44.53	43.09	44.53	(56)

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

(57)m	44.53	40.22	44.53	43.09	44.53	43.09	44.53	44.53	43.09	44.53	43.09	44.53	(57)

Primary circuit loss (annual) from Table 3	610.00	(58)

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

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

(59)m	51.81	46.79	51.81	50.14	51.81	50.14	51.81	51.81	50.14	51.81	50.14	51.81	(59)

Combi loss for each month from Table 3a, 3b or 3c (enter '0' if not a combi boiler)

(61)m	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 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m	240.73	213.30	226.65	206.84	205.35	187.30	183.51	196.37	194.45	214.30	222.00	236.17	(62)

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

(63)m	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)1...12 =	0.00	(63)

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

(64)m	240.73	213.30	226.65	206.84	205.35	187.30	183.51	196.37	194.45	214.30	222.00	236.17	
											∑(64)1...12 =	2526.98	(64)

if (64)m < 0 then set to 0

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

(65)m	125.08	111.60	120.40	112.36	113.32	105.86	106.05	110.33	108.24	116.29	117.40	123.56	(65)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	104.61	104.61	104.61	104.61	104.61	104.61	104.61	104.61	104.61	104.61	104.61	104.61	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m	27.73	24.63	20.03	15.16	11.33	9.57	10.34	13.44	18.04	22.90	26.73	28.50	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m	182.91	184.81	180.03	169.84	156.99	144.91	136.84	134.94	139.72	149.91	162.76	174.84	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m	33.46	33.46	33.46	33.46	33.46	33.46	33.46	33.46	33.46	33.46	33.46	33.46	(69)
Pumps and fans gains (Table 5a)													
(70)m	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	(70)

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

(71)m	-83.69	-83.69	-83.69	-83.69	-83.69	-83.69	-83.69	-83.69	-83.69	-83.69	-83.69	-83.69	(71)

Water heating gains (Table 5)

(72)m	168.12	166.07	161.83	156.05	152.31	147.03	142.55	148.29	150.33	156.31	163.05	166.08	(72)

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

(73)m	443.14	439.89	426.26	405.44	385.01	365.89	354.11	361.05	372.48	393.50	416.93	433.80	(73)

6. Solar gains

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

Rows (74) to (82) are used 12 times, one for each month, repeating as needed if there is more than one window type.

Details for month of January and annual totals are shown below:

	Access factor Table 6d		Area m²		Solar flux W/m²		g Specific data or Table 6b		FF Specific data or Table 6c		Gains (W)	
East	0.77	x	14.15	x	19.87	x 0.9 x	0.72	x	0.70	=	98.21	(76)

Solar gains in watts, calculated for each month ∑(74)m...(82)m

(83)m	98.21	190.37	304.27	451.77	549.67	573.55	556.70	484.51	363.76	231.83	122.11	81.02	(83)

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

(84)m	541.35	630.26	730.53	857.21	934.68	939.44	910.80	845.56	736.24	625.33	539.03	514.82	(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, η1,m (see Table 9a)													
(86)m	0.99	0.99	0.97	0.92	0.80	0.63	0.44	0.48	0.77	0.94	0.99	0.99	(86)
Mean internal temp of living area T1 (steps 3 to 7 in Table 9c)													
(87)m	19.31	19.53	19.90	20.33	20.72	20.92	20.99	20.98	20.83	20.36	19.72	19.36	(87)
Temperature during heating periods in the living area from Table 9, Th2(˚C)													
(88)m	19.54	19.56	19.56	19.59	19.61	19.62	19.63	19.63	19.61	19.59	19.58	19.56	(88)
Utilisation factor for gains for rest of dwelling η2,m (see Table 9a)													
(89)m	0.99	0.98	0.95	0.89	0.74	0.52	0.30	0.32	0.66	0.91	0.98	0.99	(89)
Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)													
(90)m	18.06	18.29	18.65	19.08	19.44	19.59	19.63	19.63	19.53	19.12	18.49	18.13	(90)

Living area fraction fLA 41.00 ÷ (4) = 0.64 (91)

Mean internal temperature for the whole dwelling fLA x T1 +(1 - fLA) x T2													
(92)m	18.86	19.08	19.45	19.88	20.26	20.44	20.50	20.50	20.36	19.91	19.28	18.92	(92)
Apply adjustment to the mean internal temperature from Table 4e, where appropriate													
(93)m	18.86	19.08	19.45	19.88	20.26	20.44	20.50	20.50	20.36	19.91	19.28	18.92	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that tim = (93)m and recalculate the utilisation factor for gains using Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, ηm													
(94)m	0.99	0.98	0.95	0.90	0.77	0.59	0.39	0.42	0.73	0.92	0.98	0.99	(94)
Useful gains, ηmGm, W = (94)m x (84)m													
(95)m	534.48	616.37	696.04	767.69	720.50	554.83	358.20	356.28	534.45	576.19	527.75	508.79	(95)
Monthly average external temperature from Table 8													
(96)m	4.50	5.00	6.80	8.70	11.70	14.60	16.90	16.90	14.30	10.80	7.00	4.90	(96)
Heat loss rate for mean internal temperature, Lm, W													
(97)m	1570.17	1516.12	1362.16	1169.99	880.79	596.19	364.24	363.97	626.21	953.67	1302.96	1509.59	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m - (95)m] x (41)m													
(98)m	770.55	604.63	495.60	289.66	119.26	0.00	0.00	0.00	0.00	280.84	558.15	744.60	

Total per year (kWh/year) = ∑(98)1...5, 10...12 = 3863.29 (98)

Space heating requirement in kWh/m²/year	(98) ÷ (4)	60.36	(99)

9a. Energy Requirements - Individual heating systems including micro-CHP

Space heating:

Fraction of space heating from secondary/supplementary system (Table 11)	0.10	(201)
Fraction of space heating from main system(s) 1 - (201)	0.90	(202)
Fraction of main heating from main system 2	0.00	(203)
Fraction of total space heat from main system 1 (202) x [1 - (203)]	0.90	(204)
Fraction of total space heat from main system 2 (202) x (203)	0.00	(205)
Efficiency of main space heating system 1 (%)	78.90	(206)

(from database or Table 4a/4b, adjusted where appropriate by the amount shown in the 'space efficiency adjustment' column of Table 4c)

Efficiency of secondary/supplementary heating system, from Table 4a or Appendix E (%)	100.00	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement, kWh/month (as calculated above)												
(98)m	770.55	604.63	495.60	289.66	119.26	0.00	0.00	0.00	0.00	280.84	558.15	744.60
Space heating fuel (main heating system 1), kWh/month = (98)m x (204) x 100 ÷ (206)												
(211)m	878.95	689.70	565.32	330.41	136.04	0.00	0.00	0.00	0.00	320.36	636.68	849.35

Total per year (kWh/year) = ∑(211)1...5, 10...12 = 4406.80 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating fuel (secondary), kWh/month = (98)m x (201) x 100 ÷ (208)												
(215)m	77.05	60.46	49.56	28.97	11.93	0.00	0.00	0.00	0.00	28.08	55.82	74.46

Total per year (kWh/year) = ∑(215)1...5, 10...12 = 386.33 (215)

Water heating:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Output from water heater, kWh/month (calculated above)												
(64)m	240.73	213.30	226.65	206.84	205.35	187.30	183.51	196.37	194.45	214.30	222.00	236.17

∑(64)1...12 = 2526.98 (64)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Efficiency of water heater per month												
(217)m	76.02	75.77	75.18	74.09	71.96	68.80	68.80	68.80	68.80	73.92	75.50	75.99
Fuel for water heating, kWh/month = (64)m x 100 ÷ (217)m												
(219)m	316.65	281.52	301.48	279.18	285.36	272.24	266.73	285.42	282.64	289.91	294.03	310.78

Total per year (kWh/year) = ∑(219)1...12 = 3465.93 (219)

Annual Totals Summary:		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			4406.80	(211)
Space heating fuel used, secondary			386.33	(215)
Water heating fuel used			3465.93	(219)
Electricity for pumps, fans and electric keep-hot (Table 4f):				
mechanical ventilation fans - balanced, extract or positive input from outside		0.00		(230a)
warm air heating system fans		0.00		(230b)
central heating pump		130.00		(230c)
oil boiler pump		0.00		(230d)
boiler flue fan		45.00		(230e)
maintaining electric keep-hot facility for gas combi boiler		0.00		(230f)
pump for solar water heating		0.00		(230g)
Total electricity for the above	∑(230a)...(230g)		175.00	(231)
Electricity for lighting (calculated in Appendix L):			489.66	(232)

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

	Energy kWh/year		Emissions Factor		Emissions (kgCO2/year)	
Space heating - main system 1	4406.80	x	0.194	=	854.92	(261)

Space heating - secondary	386.33	x	0.422	=	163.03	(263)
Water heating	3465.93	x	0.194	=	672.39	(264)
Space and water heating			(261) + (262) + (263) + (264) =		1690.34	(265)
Pumps, fans and electric keep-hot	175.00	x	0.422	=	73.85	(267)
Lighting	489.66	x	0.422	=	206.64	(268)
Total carbon dioxide emissions			∑(261)...(271) =		1970.83	(272)
Emissions per m² for space and water heating					27.57	(272a)
Emissions per m² for lighting					3.23	(272b)
Target Carbon Dioxide Emissions Rate (TER)			[(27.57 × FF × EFA) + (3.23 × EFA)] × (0.6)		19.25	(273)

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	Mrs Farah Naz	Assessor number	1
Client		Last modified	21/02/2014
Address	3 Site 3 3 Kiln Place, Camden, Camden, Gospel Oak London, UK, NW5		

1. Overall dwelling dimensions

		Area (m²)			Average storey height (m)			Volume (m³)	
Lowest occupied		27.00	(1a)	x	3.00	(2a)	=	81.00	(3a)
+1		37.00	(1b)	x	3.00	(2b)	=	111.00	(3b)
Total floor area	(1a) + (1b) + (1c) + (1d)...(1n) =	64.00	(4)						
Dwelling volume					(3a) + (3b) + (3c) + (3d)...(3n) =			192.00	(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		2.00	(17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)		0.10	(18)

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

Number of sides on which dwelling is sheltered		1	(19)
Shelter factor	1 - [0.075 x (19)] =	0.92	(20)
Adjusted infiltration rate	(18) x (20) =	0.09	(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	5.40	5.10	5.10	4.50	4.10	3.90	3.70	3.70	4.20	4.50	4.80	5.10
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m	1.35	1.27	1.27	1.12	1.02	0.98	0.92	0.92	1.05	1.12	1.20	1.27
Adjusted infiltration rate (allowing for shelter and wind speed) = (21) × (22a)m												
(22b)m	0.12	0.12	0.12	0.10	0.09	0.09	0.09	0.09	0.10	0.10	0.11	0.12

∑(22)1...12 = 54.10 (22)

∑(22a)1...12 = 13.52 (22a)

∑(22b)1...12 = 1.25 (22b)

Calculate effective air change rate for the applicable case:

If mechanical ventilation: air change rate through system 0.50 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)), otherwise (23b) = (23a)	0.50	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	77.35	(23c)

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

(24a)m	0.24	0.23	0.23	0.22	0.21	0.20	0.20	0.20	0.21	0.22	0.22	0.23	(24a)

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

(25)m	0.24	0.23	0.23	0.22	0.21	0.20	0.20	0.20	0.21	0.22	0.22	0.23	(25)

3. Heat losses and heat loss parameter

The κ-value is the heat capacity per unit area, see Table 1e.

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	
Doors			4.40	x	1.00	=	4.40	N/A	N/A	(26)
Window*			19.64	x	0.96	=	18.88	N/A	N/A	(27)
Exposed floor			27.00	x	0.10	=	2.70	N/A	N/A	(28b)
External wall			15.95	x	0.10	=	1.60	N/A	N/A	(29a)
Party Wall			153.00	x	0.00	=	0.00	N/A	N/A	(32)
Roof			37.00	x	0.10	=	3.70	N/A	N/A	(30)
Total area of external elements ∑A, m²			103.99	(31)						

** for windows and roof windows, effective window U-value is calculated using formula 1/[(1/UValue)+0.04] paragraph 3.2*

Fabric heat loss, W/K = ∑(A × U)	(26)...(30) + (32) =	31.28	(33)
Heat capacity Cm = ∑(A x κ)	(28)...(30) + (32) + (32a)...(32e) =	N/A	(34)
Thermal mass parameter (TMP) in kJ/m²K	Calculated separately =	450.00	(35)
Thermal bridges: ∑(L x Ψ) calculated using Appendix K		10.40	(36)

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

Total fabric heat loss	(33) + (36) =	41.68	(37)

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

(38)m	15.09	14.65	14.65	13.77	13.18	12.89	12.60	12.60	13.33	13.77	14.21	14.65	(38)

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

(39)m	56.77	56.33	56.33	55.45	54.86	54.57	54.28	54.28	55.01	55.45	55.89	56.33

Average = ∑(39)1...12/12 = 55.46 (39)

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

(40)m	0.89	0.88	0.88	0.87	0.86	0.85	0.85	0.85	0.86	0.87	0.87	0.88

Average = ∑(40)1...12/12 = 0.87 (40)

4. Water heating energy requirement

kWh/year

Assumed occupancy, N — 2.09 (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 — 83.89 (43)

Annual average hot water usage has been reduced by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(44)m	92.28	88.92	85.57	82.21	78.86	75.50	75.50	78.86	82.21	85.57	88.92	92.28

∑(44)1...12 = 1006.67 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x Tm/3600 kWh/month (see Tables 1b, 1c 1d)

(45)m	137.17	119.97	123.80	107.93	103.56	89.37	82.81	95.03	96.16	112.07	122.33	132.85

∑(45)1...12 = 1323.06 (45)

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

For community heating include distribution loss whether or not hot water tank is present

Distribution loss 0.15 x (45)m

(46)m	20.58	18.00	18.57	16.19	15.53	13.41	12.42	14.25	14.42	16.81	18.35	19.93	(46)

Water storage loss:

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

Cylinder volume (litres) including any solar storage within same cylinder	250.00	(50)
If community heating and no tank in dwelling, enter 110 litres in box (50)		
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in box (50)		
Hot water storage loss factor from Table 2 (kWh/litre/day)	0.01	(51)
If community heating see SAP 2009 section 4.3		
Volume factor from Table 2a	0.78	(52)
Temperature factor from Table 2b	0.54	(53)
Energy lost from water storage, kWh/day (50) x (51) x (52) x (53)	0.91	(54)
Enter (49) or (54) in (55)	0.91	(55)

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

(56)m	28.09	25.37	28.09	27.18	28.09	27.18	28.09	28.09	27.18	28.09	27.18	28.09	(56)

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

(57)m	28.09	25.37	28.09	27.18	28.09	27.18	28.09	28.09	27.18	28.09	27.18	28.09	(57)

Primary circuit loss (annual) from Table 3	360.00	(58)

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

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

(59)m	30.58	27.62	30.58	29.59	30.58	29.59	30.58	30.58	29.59	30.58	29.59	30.58	(59)

Combi loss for each month from Table 3a, 3b or 3c (enter '0' if not a combi boiler)

(61)m	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 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m	195.84	172.96	182.46	164.70	162.23	146.14	141.47	153.69	152.93	170.73	179.10	191.51	(62)

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

(63)m	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)1...12 = 0.00 (63)

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

(64)m	195.84	172.96	182.46	164.70	162.23	146.14	141.47	153.69	152.93	170.73	179.10	191.51

∑(64)1...12 = 2013.76 (64)

if (64)m < 0 then set to 0

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

(65)m	70.07	61.98	65.62	59.56	58.90	53.39	52.00	56.06	55.65	61.72	64.35	68.63	(65)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	104.61	104.61	104.61	104.61	104.61	104.61	104.61	104.61	104.61	104.61	104.61	104.61	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m	16.31	14.48	11.78	8.92	6.67	5.63	6.08	7.90	10.61	13.47	15.72	16.76	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m	182.91	184.81	180.03	169.84	156.99	144.91	136.84	134.94	139.72	149.91	162.76	174.84	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m	33.46	33.46	33.46	33.46	33.46	33.46	33.46	33.46	33.46	33.46	33.46	33.46	(69)
Pumps and fans gains (Table 5a)													
(70)m	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(70)

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

(71)m	-83.69	-83.69	-83.69	-83.69	-83.69	-83.69	-83.69	-83.69	-83.69	-83.69	-83.69	-83.69	(71)

Water heating gains (Table 5)

(72)m	94.18	92.24	88.20	82.72	79.16	74.15	69.89	75.35	77.29	82.96	89.37	92.25	(72)

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

(73)m	347.78	345.91	334.39	315.86	297.20	279.07	267.19	272.57	282.00	300.72	322.23	338.23	(73)

6. Solar gains

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

Rows (74) to (82) are used 12 times, one for each month, repeating as needed if there is more than one window type.

Details for month of January and annual totals are shown below:

	Access factor Table 6d		Area m²		Solar flux W/m²		g Specific data or Table 6b		FF Specific data or Table 6c		Gains (W)	
East	0.77	x	17.88	x	19.87	x 0.9 x	0.60	x	0.80	=	118.19	(76)
North	0.77	x	1.76	x	10.73	x 0.9 x	0.60	x	0.80	=	6.28	(74)

Solar gains in watts, calculated for each month ∑(74)m...(82)m

(83)m	124.47	241.01	385.67	575.66	705.53	739.46	716.27	619.11	461.82	293.52	154.68	102.74	(83)

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

(84)m	472.25	586.93	720.06	891.52	1002.72	1018.53	983.46	891.69	743.82	594.24	476.92	440.96	(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, η1,m (see Table 9a)													
(86)m	1.00	1.00	0.95	0.75	0.51	0.34	0.23	0.25	0.50	0.89	1.00	1.00	(86)
Mean internal temp of living area T1 (steps 3 to 7 in Table 9c)													
(87)m	20.57	20.71	20.89	20.99	21.00	21.00	21.00	21.00	21.00	20.97	20.72	20.57	(87)
Temperature during heating periods in the living area from Table 9, Th2(˚C)													
(88)m	20.18	20.19	20.19	20.20	20.21	20.21	20.21	20.21	20.20	20.20	20.19	20.19	(88)
Utilisation factor for gains for rest of dwelling η2,m (see Table 9a)													
(89)m	1.00	0.99	0.93	0.71	0.47	0.30	0.18	0.20	0.44	0.84	1.00	1.00	(89)
Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)													
(90)m	19.61	19.82	20.07	20.19	20.21	20.21	20.21	20.21	20.20	20.17	19.84	19.62	(90)

Living area fraction fLA 41.00 ÷ (4) = 0.64 (91)

Mean internal temperature for the whole dwelling fLA x T1 +(1 - fLA) x T2													
(92)m	20.23	20.39	20.60	20.70	20.71	20.72	20.72	20.72	20.71	20.68	20.40	20.23	(92)
Apply adjustment to the mean internal temperature from Table 4e, where appropriate													
(93)m	20.23	20.39	20.60	20.70	20.71	20.72	20.72	20.72	20.71	20.68	20.40	20.23	(93)

8. Space heating requirement

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

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that tim = (93)m and recalculate the utilisation factor for gains using Table 9a)

Utilisation factor for gains, ηm													
(94)m	1.00	0.99	0.94	0.74	0.49	0.33	0.21	0.23	0.47	0.87	1.00	1.00	(94)
Useful gains, ηmGm, W = (94)m x (84)m													
(95)m	471.96	583.69	679.29	657.72	494.41	333.73	207.18	207.18	352.74	518.30	475.42	440.77	(95)
Monthly average external temperature from Table 8													
(96)m	4.50	5.00	6.80	8.70	11.70	14.60	16.90	16.90	14.30	10.80	7.00	4.90	(96)
Heat loss rate for mean internal temperature, Lm, W													
(97)m	892.70	866.68	777.27	665.55	494.53	333.73	207.18	207.18	352.80	547.80	748.85	863.24	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m - (95)m] x (41)m													
(98)m	313.03	190.17	72.90	5.64	0.10	0.00	0.00	0.00	0.00	21.95	196.87	314.32	

Total per year (kWh/year) = ∑(98)1...5, 10...12 =	1114.97	(98)
Space heating requirement in kWh/m²/year (98) ÷ (4)	17.42	(99)

9a. Energy Requirements - Individual heating systems including micro-CHP

Space heating:

Fraction of space heating from secondary/supplementary system (Table 11)	0.00	(201)
Fraction of space heating from main system(s) 1 - (201)	1.00	(202)
Fraction of main heating from main system 2	0.00	(203)
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 space heating system 1 (%)	91.00	(206)

(from database or Table 4a/4b, adjusted where appropriate by the amount shown in the 'space efficiency adjustment' column of Table 4c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement, kWh/month (as calculated above)												
(98)m	313.03	190.17	72.90	5.64	0.10	0.00	0.00	0.00	0.00	21.95	196.87	314.32
Space heating fuel (main heating system 1), kWh/month = (98)m x (204) x 100 ÷ (206)												
(211)m	343.99	208.98	80.11	6.20	0.10	0.00	0.00	0.00	0.00	24.12	216.34	345.40

Total per year (kWh/year) = ∑(211)1...5, 10...12 =	1225.25	(211)

Water heating:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Output from water heater, kWh/month (calculated above)												
(64)m	195.84	172.96	182.46	164.70	162.23	146.14	141.47	153.69	152.93	170.73	179.10	191.51

∑(64)1...12 =	2013.76	(64)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Efficiency of water heater per month												
(217)m	86.56	85.57	83.09	80.61	80.31	80.30	80.30	80.30	80.30	81.39	85.57	86.63
Fuel for water heating, kWh/month = (64)m x 100 ÷ (217)m												
(219)m	226.24	202.13	219.60	204.31	202.01	181.99	176.18	191.40	190.45	209.77	209.31	221.06

Total per year (kWh/year) = ∑(219)1...12 =	2434.44	(219)

Annual Totals Summary:		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			1225.25	(211)
Water heating fuel used			2434.44	(219)
Electricity for pumps, fans and electric keep-hot (Table 4f):				
mechanical ventilation fans - balanced, extract or positive input from outside		149.33		(230a)
warm air heating system fans		0.00		(230b)
central heating pump		130.00		(230c)
oil boiler pump		0.00		(230d)
boiler flue fan		0.00		(230e)
maintaining electric keep-hot facility for gas combi boiler		0.00		(230f)
pump for solar water heating		0.00		(230g)
Total electricity for the above	∑(230a)...(230g)		279.33	(231)
Electricity for lighting (calculated in Appendix L):			287.98	(232)
Energy saving/generation technologies (Appendices M, N and Q):				
Electricity generated by PVs (Appendix M) (negative quantity)			-223.18	(233)

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

	Energy kWh/year		Emissions Factor		Emissions (kgCO2/year)	
Space heating - main system 1	1225.25	x	0.198	=	242.60	(261)
Water heating	2434.44	x	0.198	=	482.02	(264)
Space and water heating			(261) + (262) + (263) + (264) =		724.62	(265)

Pumps, fans and electric keep-hot	279.33	x	0.517	=	144.41	(267)
Lighting	287.98	x	0.517	=	148.89	(268)
Energy saving/generation technologies:						
PV emission savings (negative quantity)	-223.18	x	0.529	=	-118.06	(269)
Total carbon dioxide emissions				∑(261)...(271) =	899.85	(272)
Dwelling Carbon Dioxide Emissions Rate (DER)					14.06	(273)

TER 2009 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	Mrs Farah Naz	Assessor number	1
Client		Last modified	21/02/2014
Address	5.3 Site 5 5.3 Kiln Place, Camden, Camden, Gospel Oak London, UK, NW5		

1. Overall dwelling dimensions

		Area (m²)			Average storey height (m)			Volume (m³)	
Lowest occupied		53.00	(1a)	x	3.00	(2a)	=	159.00	(3a)
Total floor area	(1a) + (1b) + (1c) + (1d)...(1n) =	53.00	(4)						
Dwelling volume					(3a) + (3b) + (3c) + (3d)...(3n) =			159.00	(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	2	x 10 =	20	(7a)
Number of passive vents	0	x 10 =	0	(7b)
Number of flueless gas fires	0	x 40 =	0	(7c)

				Air changes per hour	
Infiltration due to chimneys, flues, fans, PSVs	(6a) + (6b) + (7a) + (7b) + (7c) =	20	÷ (5) =	0.13	(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		10.00	(17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)		0.63	(18)

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

Number of sides on which dwelling is sheltered		2	(19)
Shelter factor	1 - [0.075 x (19)] =	0.85	(20)
Adjusted infiltration rate	(18) x (20) =	0.53	(21)

Infiltration rate modified for monthly wind speed:

Monthly average wind speed from Table 7

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(22)m	5.40	5.10	5.10	4.50	4.10	3.90	3.70	3.70	4.20	4.50	4.80	5.10

∑(22)1...12 = 54.10 (22)

Wind Factor (22a)m = (22)m ÷ 4

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(22a)m	1.35	1.27	1.27	1.12	1.02	0.98	0.92	0.92	1.05	1.12	1.20	1.27

∑(22a)1...12 = 13.52 (22a)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(22b)m	0.72	0.68	0.68	0.60	0.55	0.52	0.49	0.49	0.56	0.60	0.64	0.68

∑(22b)1...12 = 7.19 (22b)

Calculate effective air change rate for the applicable case:

If mechanical ventilation: air change rate through system	N/A	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)), otherwise (23b) = (23a)	N/A	(23b)

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

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	0.76	0.73	0.73	0.68	0.65	0.63	0.62	0.62	0.66	0.68	0.70	0.73	(24d)

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

(25)m	0.76	0.73	0.73	0.68	0.65	0.63	0.62	0.62	0.66	0.68	0.70	0.73	(25)

3. Heat losses and heat loss parameter

The κ-value is the heat capacity per unit area, see Table 1e.

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	
Doors			1.85	x	2.00	=	3.70	N/A	N/A	(26)
Window*			11.40	x	1.85	=	21.11	N/A	N/A	(27)
Ground floor			53.00	x	0.25	=	13.25	N/A	N/A	(28a)
External wall			77.47	x	0.35	=	27.11	N/A	N/A	(29a)
Roof			53.00	x	0.16	=	8.48	N/A	N/A	(30)
Total area of external elements ∑A, m²			196.72	(31)						

** for windows and roof windows, effective window U-value is calculated using formula 1/[(1/UValue)+0.04] paragraph 3.2*

Fabric heat loss, W/K = ∑(A × U) (26)...(30) + (32) = 73.66 (33)

Heat capacity Cm = ∑(A x κ) (28)...(30) + (32) + (32a)...(32e) = N/A (34)

Thermal mass parameter (TMP) in kJ/m²K Calculated separately = 250.00 (35)

Thermal bridges: ∑(L x Ψ) calculated using Appendix K 21.64 (36)

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

Total fabric heat loss (33) + (36) = 95.29 (37)

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

(38)m	39.76	38.30	38.30	35.63	34.03	33.29	32.59	32.59	34.42	35.63	36.92	38.30	(38)

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

(39)m	135.06	133.60	133.60	130.92	129.33	128.59	127.88	127.88	129.71	130.92	132.22	133.60

Average = ∑(39)1...12/12 = 131.11 (39)

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

(40)m	2.55	2.52	2.52	2.47	2.44	2.43	2.41	2.41	2.45	2.47	2.49	2.52

Average = ∑(40)1...12/12 = 2.47 (40)

4. Water heating energy requirement

kWh/year

Assumed occupancy, N 1.78 (42)

If TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA - 13.9)²)] + 0.0013 x (TFA - 13.9)

If TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 80.46 (43)

Annual average hot water usage has been reduced by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)												
(44)m	88.51	85.29	82.07	78.85	75.64	72.42	72.42	75.64	78.85	82.07	85.29	88.51

∑(44)1...12 = 965.57 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x Tm/3600 kWh/month (see Tables 1b, 1c 1d)

(45)m	131.57	115.07	118.75	103.53	99.34	85.72	79.43	91.15	92.24	107.49	117.34	127.42

∑(45)1...12 = 1269.04 (45)

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

For community heating include distribution loss whether or not hot water tank is present

Distribution loss 0.15 x (45)m

(46)m	19.74	17.26	17.81	15.53	14.90	12.86	11.91	13.67	13.84	16.12	17.60	19.11	(46)

Water storage loss:

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

Cylinder volume (litres) including any solar storage within same cylinder	150.00	(50)
If community heating and no tank in dwelling, enter 110 litres in box (50)		
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in box (50)		
Hot water storage loss factor from Table 2 (kWh/litre/day)	0.02	(51)
If community heating see SAP 2009 section 4.3		
Volume factor from Table 2a	0.93	(52)
Temperature factor from Table 2b	0.54	(53)
Energy lost from water storage, kWh/day (50) x (51) x (52) x (53)	1.44	(54)
Enter (49) or (54) in (55)	1.44	(55)

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

(56)m	44.53	40.22	44.53	43.09	44.53	43.09	44.53	44.53	43.09	44.53	43.09	44.53	(56)

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

(57)m	44.53	40.22	44.53	43.09	44.53	43.09	44.53	44.53	43.09	44.53	43.09	44.53	(57)

Primary circuit loss (annual) from Table 3	610.00	(58)

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

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

(59)m	51.81	46.79	51.81	50.14	51.81	50.14	51.81	51.81	50.14	51.81	50.14	51.81	(59)

Combi loss for each month from Table 3a, 3b or 3c (enter '0' if not a combi boiler)

(61)m	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 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m	227.91	202.09	215.08	196.75	195.67	178.95	175.77	187.48	185.47	203.83	210.57	223.76	(62)

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

(63)m	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)1...12 = 0.00 (63)

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

(64)m	227.91	202.09	215.08	196.75	195.67	178.95	175.77	187.48	185.47	203.83	210.57	223.76	

∑(64)1...12 = 2403.32 (64)

if (64)m < 0 then set to 0

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

(65)m	120.82	107.87	116.55	109.01	110.10	103.08	103.48	107.38	105.25	112.81	113.60	119.44	(65)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	88.93	88.93	88.93	88.93	88.93	88.93	88.93	88.93	88.93	88.93	88.93	88.93	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m	23.52	20.89	16.99	12.86	9.62	8.12	8.77	11.40	15.30	19.43	22.68	24.18	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m	155.02	156.63	152.57	143.94	133.05	122.81	115.97	114.36	118.42	127.05	137.94	148.18	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m	31.89	31.89	31.89	31.89	31.89	31.89	31.89	31.89	31.89	31.89	31.89	31.89	(69)
Pumps and fans gains (Table 5a)													
(70)m	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	(70)
Losses e.g. evaporation (negative values) (Table 5)													
(71)m	-71.14	-71.14	-71.14	-71.14	-71.14	-71.14	-71.14	-71.14	-71.14	-71.14	-71.14	-71.14	(71)

Water heating gains (Table 5)

(72)m	162.39	160.53	156.66	151.40	147.98	143.17	139.09	144.32	146.18	151.63	157.77	160.53	(72)

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

(73)m	400.61	397.72	385.90	367.88	350.33	333.78	323.51	329.77	339.58	357.78	378.07	392.57	(73)

6. Solar gains

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

Rows (74) to (82) are used 12 times, one for each month, repeating as needed if there is more than one window type.

Details for month of January and annual totals are shown below:

	Access factor Table 6d		Area m²		Solar flux W/m²		g Specific data or Table 6b		FF Specific data or Table 6c		Gains (W)	
East	0.77	x	11.40	x	19.87	x 0.9 x	0.72	x	0.70	=	79.13	(76)

Solar gains in watts, calculated for each month ∑(74)m...(82)m

(83)m	79.13	153.37	245.13	363.97	442.84	462.08	448.51	390.34	293.07	186.78	98.37	65.27	(83)

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

(84)m	479.74	551.09	631.03	731.85	793.17	795.87	772.01	720.11	632.65	544.56	476.45	457.84	(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, η1,m (see Table 9a)													
(86)m	0.99	0.98	0.97	0.94	0.87	0.76	0.59	0.62	0.85	0.95	0.98	0.99	(86)
Mean internal temp of living area T1 (steps 3 to 7 in Table 9c)													
(87)m	18.52	18.74	19.18	19.68	20.27	20.68	20.90	20.89	20.52	19.83	19.03	18.59	(87)
Temperature during heating periods in the living area from Table 9, Th2(˚C)													
(88)m	19.00	19.02	19.02	19.05	19.07	19.07	19.08	19.08	19.06	19.05	19.03	19.02	(88)
Utilisation factor for gains for rest of dwelling η2,m (see Table 9a)													
(89)m	0.99	0.98	0.96	0.91	0.81	0.61	0.35	0.37	0.73	0.93	0.98	0.99	(89)
Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)													
(90)m	16.90	17.13	17.56	18.07	18.62	18.95	19.07	19.07	18.84	18.23	17.43	16.98	(90)

Living area fraction fLA 27.00 ÷ (4) = 0.51 (91)

Mean internal temperature for the whole dwelling fLA x T1 +(1 - fLA) x T2													
(92)m	17.73	17.95	18.38	18.89	19.46	19.83	20.00	19.99	19.70	19.05	18.25	17.80	(92)
Apply adjustment to the mean internal temperature from Table 4e, where appropriate													
(93)m	17.73	17.95	18.38	18.89	19.46	19.83	20.00	19.99	19.70	19.05	18.25	17.80	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that tim = (93)m and recalculate the utilisation factor for gains using Table 9a)													
Utilisation factor for gains, ηm													
(94)m	0.98	0.97	0.95	0.91	0.82	0.68	0.48	0.50	0.78	0.93	0.97	0.98	(94)
Useful gains, ηmGm, W = (94)m x (84)m													
(95)m	471.03	536.27	600.73	666.67	653.01	540.21	366.81	361.25	493.11	503.93	463.74	449.97	(95)
Monthly average external temperature from Table 8													
(96)m	4.50	5.00	6.80	8.70	11.70	14.60	16.90	16.90	14.30	10.80	7.00	4.90	(96)
Heat loss rate for mean internal temperature, Lm, W													
(97)m	1786.73	1729.81	1547.71	1334.23	1003.36	672.83	396.61	395.55	700.20	1079.48	1487.16	1723.94	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m - (95)m] x (41)m													
(98)m	978.88	802.06	704.55	480.64	260.66	0.00	0.00	0.00	0.00	428.21	736.86	947.84	

Total per year (kWh/year) = ∑(98)1...5, 10...12 = 5339.70 (98)

Space heating requirement in kWh/m²/year (98) ÷ (4) 100.75 (99)

9a. Energy Requirements - Individual heating systems including micro-CHP

Space heating:

Fraction of space heating from secondary/supplementary system (Table 11)	0.10	(201)
Fraction of space heating from main system(s) 1 - (201)	0.90	(202)
Fraction of main heating from main system 2	0.00	(203)
Fraction of total space heat from main system 1 (202) x [1 - (203)]	0.90	(204)
Fraction of total space heat from main system 2 (202) x (203)	0.00	(205)
Efficiency of main space heating system 1 (%)	78.90	(206)

(from database or Table 4a/4b, adjusted where appropriate by the amount shown in the 'space efficiency adjustment' column of Table 4c)

Efficiency of secondary/supplementary heating system, from Table 4a or Appendix E (%)	100.00	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement, kWh/month (as calculated above) (98)m	978.88	802.06	704.55	480.64	260.66	0.00	0.00	0.00	0.00	428.21	736.86	947.84
Space heating fuel (main heating system 1), kWh/month = (98)m x (204) x 100 ÷ (206) (211)m	1116.59	914.90	803.67	548.26	297.34	0.00	0.00	0.00	0.00	488.45	840.52	1081.18

Total per year (kWh/year) = ∑(211)1...5, 10...12 = 6090.91 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating fuel (secondary), kWh/month = (98)m x (201) x 100 ÷ (208) (215)m	97.89	80.21	70.46	48.06	26.07	0.00	0.00	0.00	0.00	42.82	73.69	94.78

Total per year (kWh/year) = ∑(215)1...5, 10...12 = 533.97 (215)

Water heating:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Output from water heater, kWh/month (calculated above) (64)m	227.91	202.09	215.08	196.75	195.67	178.95	175.77	187.48	185.47	203.83	210.57	223.76

∑(64)1...12 = 2403.32 (64)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Efficiency of water heater per month (217)m	76.59	76.45	76.07	75.44	73.96	68.80	68.80	68.80	68.80	75.09	76.20	76.56
Fuel for water heating, kWh/month = (64)m x 100 ÷ (217)m (219)m	297.57	264.36	282.74	260.82	264.56	260.10	255.48	272.51	269.57	271.46	276.32	292.25

Total per year (kWh/year) = ∑(219)1...12 = 3267.72 (219)

Annual Totals Summary:		kWh/year	kWh/year	
Space heating fuel used, main system 1			6090.91	(211)
Space heating fuel used, secondary			533.97	(215)
Water heating fuel used			3267.72	(219)
Electricity for pumps, fans and electric keep-hot (Table 4f):				
mechanical ventilation fans - balanced, extract or positive input from outside		0.00		(230a)
warm air heating system fans		0.00		(230b)
central heating pump		130.00		(230c)
oil boiler pump		0.00		(230d)
boiler flue fan		45.00		(230e)
maintaining electric keep-hot facility for gas combi boiler		0.00		(230f)
pump for solar water heating		0.00		(230g)
Total electricity for the above	∑(230a)...(230g)		175.00	(231)
Electricity for lighting (calculated in Appendix L):			415.44	(232)

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

	Energy kWh/year		Emissions Factor		Emissions (kgCO2/year)	
Space heating - main system 1	6090.91	x	0.194	=	1181.64	(261)
Space heating - secondary	533.97	x	0.422	=	225.34	(263)

Water heating	3267.72	x	0.194	=	633.94	(264)
Space and water heating				(261) + (262) + (263) + (264) =	2040.91	(265)
Pumps, fans and electric keep-hot	175.00	x	0.422	=	73.85	(267)
Lighting	415.44	x	0.422	=	175.32	(268)
Total carbon dioxide emissions				∑(261)...(271) =	2290.08	(272)
Emissions per m² for space and water heating					39.90	(272a)
Emissions per m² for lighting					3.31	(272b)
Target Carbon Dioxide Emissions Rate (TER)				[(39.90 × FF × EFA) + (3.31 × EFA)] × (0.6)	26.87	(273)

DER 2009 Worksheet

Design - Draft

NHER

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	Mrs Farah Naz	Assessor number	1
Client		Last modified	21/02/2014
Address	5.3 Site 5 5.3 Kiln Place, Camden, Camden, Gospel Oak London, UK, NW5		

1. Overall dwelling dimensions

		Area (m²)			Average storey height (m)			Volume (m³)	
Lowest occupied		53.00	(1a)	x	3.00	(2a)	=	159.00	(3a)
Total floor area	(1a) + (1b) + (1c) + (1d)...(1n) =	53.00	(4)						
Dwelling volume					(3a) + (3b) + (3c) + (3d)...(3n) =			159.00	(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	2.00	(17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)	0.10	(18)

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

Number of sides on which dwelling is sheltered		1	(19)
Shelter factor	1 - [0.075 x (19)] =	0.92	(20)
Adjusted infiltration rate	(18) x (20) =	0.09	(21)

Infiltration rate modified for monthly wind speed:

Monthly average wind speed from Table 7

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(22)m	5.40	5.10	5.10	4.50	4.10	3.90	3.70	3.70	4.20	4.50	4.80	5.10

∑(22)1...12 = 54.10 (22)

Wind Factor (22a)m = (22)m ÷ 4

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(22a)m	1.35	1.27	1.27	1.12	1.02	0.98	0.92	0.92	1.05	1.12	1.20	1.27

∑(22a)1...12 = 13.52 (22a)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(22b)m	0.12	0.12	0.12	0.10	0.09	0.09	0.09	0.09	0.10	0.10	0.11	0.12

∑(22b)1...12 = 1.25 (22b)

Calculate effective air change rate for the applicable case:

If mechanical ventilation: air change rate through system	0.50	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)), otherwise (23b) = (23a)	0.50	(23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 77.35 (23c)

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

(24a)m	0.24	0.23	0.23	0.22	0.21	0.20	0.20	0.20	0.21	0.22	0.22	0.23	(24a)

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

(25)m	0.24	0.23	0.23	0.22	0.21	0.20	0.20	0.20	0.21	0.22	0.22	0.23	(25)

3. Heat losses and heat loss parameter

The κ-value is the heat capacity per unit area, see Table 1e.

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*			13.72	x	0.96	=	13.19	N/A	N/A	(27)
Ground floor			53.00	x	0.10	=	5.30	N/A	N/A	(28a)
External wall			77.00	x	0.15	=	11.55	N/A	N/A	(29a)
Roof			53.00	x	0.10	=	5.30	N/A	N/A	(30)
Total area of external elements ∑A, m²			196.72	(31)						

** for windows and roof windows, effective window U-value is calculated using formula 1/[(1/UValue)+0.04] paragraph 3.2*

Fabric heat loss, W/K = ∑(A × U) (26)...(30) + (32) = 35.34 (33)

Heat capacity Cm = ∑(A x κ) (28)...(30) + (32) + (32a)...(32e) = N/A (34)

Thermal mass parameter (TMP) in kJ/m²K Calculated separately = 450.00 (35)

Thermal bridges: ∑(L x Ψ) calculated using Appendix K 19.67 (36)

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

Total fabric heat loss (33) + (36) = 55.01 (37)

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

(38)m	12.49	12.13	12.13	11.40	10.92	10.67	10.43	10.43	11.04	11.40	11.77	12.13	(38)

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

(39)m	67.51	67.14	67.14	66.42	65.93	65.69	65.45	65.45	66.05	66.42	66.78	67.14

Average = ∑(39)1...12/12 = 66.43 (39)

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

(40)m	1.27	1.27	1.27	1.25	1.24	1.24	1.23	1.23	1.25	1.25	1.26	1.27

Average = ∑(40)1...12/12 = 1.25 (40)

4. Water heating energy requirement

kWh/year

Assumed occupancy, N 1.78 (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 76.44 (43)

Annual average hot water usage has been reduced by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m	84.08	81.03	77.97	74.91	71.85	68.80	68.80	71.85	74.91	77.97	81.03	84.08	

∑(44)1...12 = 917.29 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x Tm/3600 kWh/month (see Tables 1b, 1c 1d)

(45)m	124.99	109.32	112.81	98.35	94.37	81.43	75.46	86.59	87.63	102.12	111.47	121.05

∑(45)1...12 = 1205.59 (45)

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

For community heating include distribution loss whether or not hot water tank is present

Distribution loss 0.15 x (45)m

(46)m	18.75	16.40	16.92	14.75	14.16	12.21	11.32	12.99	13.14	15.32	16.72	18.16	(46)

Water storage loss:

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

Cylinder volume (litres) including any solar storage within same cylinder	250.00	(50)
If community heating and no tank in dwelling, enter 110 litres in box (50)		
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in box (50)		
Hot water storage loss factor from Table 2 (kWh/litre/day)	0.01	(51)
If community heating see SAP 2009 section 4.3		
Volume factor from Table 2a	0.78	(52)
Temperature factor from Table 2b	0.54	(53)
Energy lost from water storage, kWh/day (50) x (51) x (52) x (53)	0.91	(54)
Enter (49) or (54) in (55)	0.91	(55)

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

(56)m	28.09	25.37	28.09	27.18	28.09	27.18	28.09	28.09	27.18	28.09	27.18	28.09	(56)

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

(57)m	28.09	25.37	28.09	27.18	28.09	27.18	28.09	28.09	27.18	28.09	27.18	28.09	(57)

Primary circuit loss (annual) from Table 3 | 360.00 | (58)

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

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

(59)m	30.58	27.62	30.58	29.59	30.58	29.59	30.58	30.58	29.59	30.58	29.59	30.58	(59)

Combi loss for each month from Table 3a, 3b or 3c (enter '0' if not a combi boiler)

(61)m	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 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m	183.66	162.31	171.47	155.12	153.03	138.20	134.12	145.25	144.39	160.78	168.24	179.71	(62)

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

(63)m	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)1...12 = 0.00 (63)

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

(64)m	183.66	162.31	171.47	155.12	153.03	138.20	134.12	145.25	144.39	160.78	168.24	179.71	

∑(64)1...12 = 1896.28 (64)

if (64)m < 0 then set to 0

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

(65)m	66.02	58.44	61.97	56.37	55.84	50.75	49.55	53.25	52.81	58.41	60.74	64.71	(65)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	88.93	88.93	88.93	88.93	88.93	88.93	88.93	88.93	88.93	88.93	88.93	88.93	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m	13.82	12.27	9.98	7.56	5.65	4.77	5.15	6.70	8.99	11.42	13.32	14.20	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m	155.02	156.63	152.57	143.94	133.05	122.81	115.97	114.36	118.42	127.05	137.94	148.18	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m	31.89	31.89	31.89	31.89	31.89	31.89	31.89	31.89	31.89	31.89	31.89	31.89	(69)
Pumps and fans gains (Table 5a)													
(70)m	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(70)
Losses e.g. evaporation (negative values) (Table 5)													
(71)m	-71.14	-71.14	-71.14	-71.14	-71.14	-71.14	-71.14	-71.14	-71.14	-71.14	-71.14	-71.14	(71)
Water heating gains (Table 5)													
(72)m	88.74	86.97	83.29	78.30	75.05	70.48	66.60	71.57	73.34	78.51	84.35	86.97	(72)

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

(73)m	307.25	305.55	295.53	279.47	263.43	247.74	237.40	242.32	250.43	266.66	285.30	299.04	(73)

6. Solar gains

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

Rows (74) to (82) are used 12 times, one for each month, repeating as needed if there is more than one window type.

Details for month of January and annual totals are shown below:

	Access factor Table 6d		Area m²		Solar flux W/m²		g Specific data or Table 6b		FF Specific data or Table 6c		Gains (W)	
East	0.77	x	11.16	x	19.87	x 0.9 x	0.60	x	0.80	=	73.77	(76)
South	0.77	x	2.56	x	47.32	x 0.9 x	0.60	x	0.80	=	40.30	(78)

Solar gains in watts, calculated for each month ∑(74)m...(82)m

(83)m	114.07	208.72	308.80	428.85	505.31	523.55	509.39	452.39	358.38	246.77	139.46	95.68	(83)

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

(84)m	421.32	514.26	604.33	708.32	768.74	771.29	746.79	694.71	608.81	513.42	424.76	394.71	(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, η1,m (see Table 9a)													
(86)m	1.00	1.00	0.99	0.94	0.76	0.54	0.36	0.39	0.71	0.97	1.00	1.00	(86)
Mean internal temp of living area T1 (steps 3 to 7 in Table 9c)													
(87)m	20.26	20.40	20.62	20.84	20.97	21.00	21.00	21.00	20.99	20.81	20.45	20.26	(87)
Temperature during heating periods in the living area from Table 9, Th2(˚C)													
(88)m	19.86	19.87	19.87	19.88	19.89	19.89	19.89	19.89	19.89	19.88	19.87	19.87	(88)
Utilisation factor for gains for rest of dwelling η2,m (see Table 9a)													
(89)m	1.00	1.00	0.98	0.90	0.69	0.45	0.26	0.28	0.60	0.94	1.00	1.00	(89)
Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)													
(90)m	18.90	19.11	19.42	19.72	19.87	19.89	19.89	19.89	19.88	19.69	19.19	18.91	(90)

Living area fraction fLA 27.00 ÷ (4) = 0.51 (91)

Mean internal temperature for the whole dwelling fLA x T1 +(1 - fLA) x T2													
(92)m	19.59	19.77	20.03	20.29	20.43	20.45	20.46	20.46	20.44	20.26	19.83	19.60	(92)
Apply adjustment to the mean internal temperature from Table 4e, where appropriate													
(93)m	19.59	19.77	20.03	20.29	20.43	20.45	20.46	20.46	20.44	20.26	19.83	19.60	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that tim = (93)m and recalculate the utilisation factor for gains using Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, ηm													
(94)m	1.00	1.00	0.98	0.92	0.73	0.50	0.31	0.34	0.66	0.95	1.00	1.00	(94)
Useful gains, ηmGm, W = (94)m x (84)m													
(95)m	421.01	512.55	593.51	649.96	558.73	383.70	232.82	232.81	399.71	489.16	423.74	394.48	(95)
Monthly average external temperature from Table 8													
(96)m	4.50	5.00	6.80	8.70	11.70	14.60	16.90	16.90	14.30	10.80	7.00	4.90	(96)
Heat loss rate for mean internal temperature, Lm, W													
(97)m	1018.77	991.40	888.44	769.65	575.70	384.59	232.84	232.84	405.89	628.31	857.00	987.07	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m - (95)m] x (41)m													
(98)m	444.73	321.79	219.43	86.18	12.63	0.00	0.00	0.00	0.00	103.52	311.95	440.88	

Total per year (kWh/year) = ∑(98)1...5, 10...12 = 1941.12 (98)

Space heating requirement in kWh/m²/year (98) ÷ (4) 36.62 (99)

9a. Energy Requirements - Individual heating systems including micro-CHP

Space heating:

Fraction of space heating from secondary/supplementary system (Table 11)	0.00	(201)
Fraction of space heating from main system(s) 1 - (201)	1.00	(202)
Fraction of main heating from main system 2	0.00	(203)
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 space heating system 1 (%)	91.00	(206)

(from database or Table 4a/4b, adjusted where appropriate by the amount shown in the 'space efficiency adjustment' column of Table 4c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement, kWh/month (as calculated above)												
(98)m	444.73	321.79	219.43	86.18	12.63	0.00	0.00	0.00	0.00	103.52	311.95	440.88
Space heating fuel (main heating system 1), kWh/month = (98)m x (204) x 100 ÷ (206)												
(211)m	488.72	353.62	241.13	94.70	13.88	0.00	0.00	0.00	0.00	113.76	342.81	484.49

Total per year (kWh/year) = ∑(211)1...5, 10...12 = 2133.10 (211)

Water heating:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Output from water heater, kWh/month (calculated above)												
(64)m	183.66	162.31	171.47	155.12	153.03	138.20	134.12	145.25	144.39	160.78	168.24	179.71

∑(64)1...12 = 1896.28 (64)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Efficiency of water heater per month												
(217)m	87.59	87.11	85.97	83.82	81.03	80.30	80.30	80.30	80.30	84.18	86.94	87.62
Fuel for water heating, kWh/month = (64)m x 100 ÷ (217)m												
(219)m	209.68	186.33	199.44	185.06	188.86	172.11	167.03	180.89	179.82	191.00	193.51	205.11

Total per year (kWh/year) = ∑(219)1...12 = 2258.83 (219)

Annual Totals Summary:		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			2133.10	(211)
Water heating fuel used			2258.83	(219)
Electricity for pumps, fans and electric keep-hot (Table 4f):				
mechanical ventilation fans - balanced, extract or positive input from outside		123.66		(230a)
warm air heating system fans		0.00		(230b)
central heating pump		130.00		(230c)
oil boiler pump		0.00		(230d)
boiler flue fan		0.00		(230e)
maintaining electric keep-hot facility for gas combi boiler		0.00		(230f)
pump for solar water heating		0.00		(230g)
Total electricity for the above	∑(230a)...(230g)		253.66	(231)
Electricity for lighting (calculated in Appendix L):			244.06	(232)
Energy saving/generation technologies (Appendices M, N and Q):				
Electricity generated by PVs (Appendix M) (negative quantity)			-223.18	(233)

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

	Energy kWh/year		Emissions Factor		Emissions (kgCO2/year)	
Space heating - main system 1	2133.10	x	0.198	=	422.35	(261)
Water heating	2258.83	x	0.198	=	447.25	(264)
Space and water heating			(261) + (262) + (263) + (264) =		869.60	(265)
Pumps, fans and electric keep-hot	253.66	x	0.517	=	131.14	(267)
Lighting	244.06	x	0.517	=	126.18	(268)

Energy saving/generation technologies:

PV emission savings (negative quantity)	-223.18	x	0.529	=	-118.06	(269)
Total carbon dioxide emissions				∑(261)...(271) =	1008.86	(272)
Dwelling Carbon Dioxide Emissions Rate (DER)					19.04	(273)

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	Mrs Farah Naz	Assessor number	1
Client		Last modified	24/09/2014
Address	Unit 6 Unit 6 on Site 6 6 Kiln Place, Camden, Camden, Gospel Oak London, UK, NW5		

1. Overall dwelling dimensions

		Area (m^2)			Average storey height (m)			Volume (m^3)	
Lowest occupied		60.00	(1a)	x	2.66	(2a)	=	159.60	(3a)
Total floor area	(1a) + (1b) + (1c) + (1d)...(1n) =	60.00	(4)						
Dwelling volume							(3a) + (3b) + (3c) + (3d)...(3n) =	159.60	(5)

2. Ventilation rate

				m^3 per hour	
Number of chimneys		0	x 40 =	0	(6a)
Number of open flues		0	x 20 =	0	(6b)
Number of intermittent fans		2	x 10 =	20	(7a)
Number of passive vents		0	x 10 =	0	(7b)
Number of flueless gas fires		0	x 40 =	0	(7c)
				Air changes per hour	
Infiltration due to chimneys, flues, fans, PSVs	(6a) + (6b) + (7a) + (7b) + (7c) =	20	÷ (5) =	0.13	(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		10.00	(17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)		0.63	(18)

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

Number of sides on which dwelling is sheltered		2	(19)
Shelter factor	1 - [0.075 x (19)] =	0.85	(20)
Adjusted infiltration rate	(18) x (20) =	0.53	(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	5.40	5.10	5.10	4.50	4.10	3.90	3.70	3.70	4.20	4.50	4.80	5.10

∑(22)1...12 = 54.10 (22)

Wind Factor (22a)m = (22)m ÷ 4

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(22a)m	1.35	1.27	1.27	1.12	1.02	0.98	0.92	0.92	1.05	1.12	1.20	1.27

∑(22a)1...12 = 13.52 (22a)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(22b)m	0.72	0.68	0.68	0.60	0.54	0.52	0.49	0.49	0.56	0.60	0.64	0.68

∑(22b)1...12 = 7.19 (22b)

Calculate effective air change rate for the applicable case:

If mechanical ventilation: air change rate through system	N/A	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)), otherwise (23b) = (23a)	N/A	(23b)

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

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	0.76	0.73	0.73	0.68	0.65	0.63	0.62	0.62	0.66	0.68	0.70	0.73	(24d)

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

(25)m	0.76	0.73	0.73	0.68	0.65	0.63	0.62	0.62	0.66	0.68	0.70	0.73	(25)

3. Heat losses and heat loss parameter

The κ-value is the heat capacity per unit area, see Table 1e.

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	
Doors			1.85	x	2.00	=	3.70	N/A	N/A	(26)
Window*			13.15	x	1.85	=	24.35	N/A	N/A	(27)
Ground floor			60.00	x	0.25	=	15.00	N/A	N/A	(28a)
Party Wall			30.75	x	0.00	=	0.00	N/A	N/A	(32)
External wall			209.50	x	0.35	=	73.32	N/A	N/A	(29a)
Roof			60.00	x	0.16	=	9.60	N/A	N/A	(30)
Total area of external elements ∑A, m²			344.50	(31)						

** for windows and roof windows, effective window U-value is calculated using formula 1/[(1/UValue)+0.04] paragraph 3.2*

Fabric heat loss, W/K = ∑(A × U)	(26)...(30) + (32) =	125.98	(33)
Heat capacity Cm = ∑(A x κ)	(28)...(30) + (32) + (32a)...(32e) =	N/A	(34)
Thermal mass parameter (TMP) in kJ/m²K	Calculated separately =	250.00	(35)
Thermal bridges: ∑(L x Ψ) calculated using Appendix K		37.90	(36)

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

Total fabric heat loss (33) + (36) = 163.87 (37)

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

(38)m	39.89	38.43	38.43	35.75	34.15	33.41	32.70	32.70	34.54	35.75	37.05	38.43	(38)

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

(39)m	203.76	202.30	202.30	199.62	198.02	197.28	196.57	196.57	198.41	199.62	200.92	202.30

Average = ∑(39)1...12/12 = 199.81 (39)

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

(40)m	3.40	3.37	3.37	3.33	3.30	3.29	3.28	3.28	3.31	3.33	3.35	3.37

Average = ∑(40)1...12/12 = 3.33 (40)

4. Water heating energy requirement

kWh/year

Assumed occupancy, N 1.98 (42)

If TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA - 13.9)²)] + 0.0013 x (TFA - 13.9)

If TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 85.54 (43)

Annual average hot water usage has been reduced by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(44)m	94.09	90.67	87.25	83.83	80.41	76.99	76.99	80.41	83.83	87.25	90.67	94.09

∑(44)1...12 = 1026.49 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x Tm/3600 kWh/month (see Tables 1b, 1c 1d)

(45)m	139.87	122.33	126.24	110.06	105.60	91.13	84.44	96.90	98.06	114.28	124.74	135.46

∑(45)1...12 = 1349.11 (45)

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

For community heating include distribution loss whether or not hot water tank is present

Distribution loss 0.15 x (45)m

(46)m	20.98	18.35	18.94	16.51	15.84	13.67	12.67	14.53	14.71	17.14	18.71	20.32	(46)

Water storage loss:

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

Cylinder volume (litres) including any solar storage within same cylinder: 150.00 (50)

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

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

Hot water storage loss factor from Table 2 (kWh/litre/day): 0.02 (51)

If community heating see SAP 2009 section 4.3

Volume factor from Table 2a: 0.93 (52)

Temperature factor from Table 2b: 0.54 (53)

Energy lost from water storage, kWh/day (50) x (51) x (52) x (53): 1.44 (54)

Enter (49) or (54) in (55): 1.44 (55)

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

(56)m	44.53	40.22	44.53	43.09	44.53	43.09	44.53	44.53	43.09	44.53	43.09	44.53	(56)

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

(57)m	44.53	40.22	44.53	43.09	44.53	43.09	44.53	44.53	43.09	44.53	43.09	44.53	(57)

Primary circuit loss (annual) from Table 3: 610.00 (58)

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

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

(59)m	51.81	46.79	51.81	50.14	51.81	50.14	51.81	51.81	50.14	51.81	50.14	51.81	(59)

Combi loss for each month from Table 3a, 3b or 3c (enter '0' if not a combi boiler)

(61)m	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 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m	236.21	209.35	222.57	203.29	201.94	184.36	180.78	193.24	191.29	210.61	217.97	231.80	(62)

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

(63)m	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)1...12 = 0.00 (63)

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

(64)m	236.21	209.35	222.57	203.29	201.94	184.36	180.78	193.24	191.29	210.61	217.97	231.80

∑(64)1...12 = 2483.39 (64)

if (64)m < 0 then set to 0

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

(65)m	123.58	110.29	119.04	111.18	112.18	104.88	105.15	109.29	107.19	115.07	116.06	122.11	(65)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	99.08	99.08	99.08	99.08	99.08	99.08	99.08	99.08	99.08	99.08	99.08	99.08	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m	26.22	23.29	18.94	14.34	10.72	9.05	9.78	12.71	17.06	21.66	25.28	26.95	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m	172.95	174.74	170.22	160.59	148.44	137.02	129.38	127.59	132.11	141.74	153.89	165.32	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m	32.91	32.91	32.91	32.91	32.91	32.91	32.91	32.91	32.91	32.91	32.91	32.91	(69)
Pumps and fans gains (Table 5a)													
(70)m	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	(70)

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

(71)m	-79.27	-79.27	-79.27	-79.27	-79.27	-79.27	-79.27	-79.27	-79.27	-79.27	-79.27	-79.27	(71)

Water heating gains (Table 5)

(72)m	166.10	164.12	160.00	154.41	150.78	145.67	141.33	146.89	148.87	154.66	161.19	164.13	(72)

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

(73)m	427.99	424.88	411.89	392.07	372.66	354.46	343.21	349.92	360.77	380.79	403.09	419.12	(73)

6. Solar gains

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

Rows (74) to (82) are used 12 times, one for each month, repeating as needed if there is more than one window type.

Details for month of January and annual totals are shown below:

	Access factor Table 6d		Area m²		Solar flux W/m²		g Specific data or Table 6b		FF Specific data or Table 6c		Gains (W)	
East	0.77	x	13.15	x	19.87	x 0.9 x	0.72	x	0.70	=	91.27	(76)

Solar gains in watts, calculated for each month ∑(74)m...(82)m

(83)m	91.27	176.91	282.76	419.84	510.82	533.02	517.36	450.27	338.06	215.45	113.48	75.29	(83)

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

(84)m	519.27	601.79	694.65	811.91	883.49	887.48	860.57	800.18	698.82	596.23	516.57	494.41	(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, η1,m (see Table 9a)													
(86)m	0.99	0.98	0.97	0.95	0.90	0.82	0.68	0.71	0.89	0.96	0.99	0.99	(86)
Mean internal temp of living area T1 (steps 3 to 7 in Table 9c)													
(87)m	17.84	18.05	18.55	19.11	19.83	20.40	20.75	20.73	20.20	19.36	18.43	17.92	(87)
Temperature during heating periods in the living area from Table 9, Th2(˚C)													
(88)m	18.58	18.59	18.59	18.61	18.63	18.63	18.64	18.64	18.62	18.61	18.60	18.59	(88)
Utilisation factor for gains for rest of dwelling η2,m (see Table 9a)													
(89)m	0.99	0.98	0.96	0.93	0.84	0.67	0.37	0.39	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	15.96	16.19	16.68	17.24	17.92	18.40	18.61	18.61	18.27	17.49	16.56	16.05	(90)

Living area fraction — fLA 40.00 ÷ (4) = 0.67 (91)

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

(92)m	17.21	17.43	17.93	18.49	19.19	19.73	20.04	20.02	19.56	18.74	17.80	17.29	(92)

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

(93)m	17.21	17.43	17.93	18.49	19.19	19.73	20.04	20.02	19.56	18.74	17.80	17.29	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that tim = (93)m and recalculate the utilisation factor for gains using Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, ηm													
(94)m	0.98	0.97	0.96	0.92	0.86	0.75	0.58	0.61	0.83	0.94	0.97	0.98	(94)
Useful gains, ηmGm, W = (94)m x (84)m													
(95)m	509.92	586.29	664.60	750.71	759.31	666.91	501.82	487.23	580.24	558.96	503.60	485.95	(95)
Monthly average external temperature from Table 8													
(96)m	4.50	5.00	6.80	8.70	11.70	14.60	16.90	16.90	14.30	10.80	7.00	4.90	(96)
Heat loss rate for mean internal temperature, Lm, W													
(97)m	2590.33	2514.82	2251.27	1954.05	1483.20	1012.24	617.15	613.88	1042.99	1584.47	2170.84	2507.38	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m - (95)m] x (41)m													
(98)m	1547.83	1295.97	1180.49	866.41	538.58	0.00	0.00	0.00	0.00	762.98	1200.42	1503.94	

Total per year (kWh/year) = ∑(98)1...5, 10...12 = 8896.60 (98)

Space heating requirement in kWh/m²/year — (98) ÷ (4) 148.28 (99)

9a. Energy Requirements - Individual heating systems including micro-CHP

Space heating:

Fraction of space heating from secondary/supplementary system (Table 11)	0.10	(201)
Fraction of space heating from main system(s) 1 - (201)	0.90	(202)
Fraction of main heating from main system 2	0.00	(203)
Fraction of total space heat from main system 1 (202) x [1 - (203)]	0.90	(204)
Fraction of total space heat from main system 2 (202) x (203)	0.00	(205)
Efficiency of main space heating system 1 (%)	78.90	(206)

(from database or Table 4a/4b, adjusted where appropriate by the amount shown in the 'space efficiency adjustment' column of Table 4c)

Efficiency of secondary/supplementary heating system, from Table 4a or Appendix E (%)	100.00	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement, kWh/month (as calculated above) (98)m	1547.83	1295.97	1180.49	866.41	538.58	0.00	0.00	0.00	0.00	762.98	1200.42	1503.94
Space heating fuel (main heating system 1), kWh/month = (98)m x (204) x 100 ÷ (206) (211)m	1765.58	1478.29	1346.56	988.30	614.34	0.00	0.00	0.00	0.00	870.32	1369.30	1715.52

Total per year (kWh/year) = ∑(211)1...5, 10...12 = 10148.21 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating fuel (secondary), kWh/month = (98)m x (201) x 100 ÷ (208) (215)m	154.78	129.60	118.05	86.64	53.86	0.00	0.00	0.00	0.00	76.30	120.04	150.39

Total per year (kWh/year) = ∑(215)1...5, 10...12 = 889.66 (215)

Water heating:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Output from water heater, kWh/month (calculated above) (64)m	236.21	209.35	222.57	203.29	201.94	184.36	180.78	193.24	191.29	210.61	217.97	231.80

∑(64)1...12 = 2483.39 (64)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Efficiency of water heater per month (217)m	77.26	77.18	76.94	76.58	75.63	68.80	68.80	68.80	68.80	76.27	77.00	77.24
Fuel for water heating, kWh/month = (64)m x 100 ÷ (217)m (219)m	305.75	271.26	289.27	265.47	266.99	267.96	262.76	280.87	278.03	276.13	283.07	300.09

Total per year (kWh/year) = ∑(219)1...12 = 3347.66 (219)

Annual Totals Summary:	kWh/year	kWh/year	
Space heating fuel used, main system 1		10148.21	(211)
Space heating fuel used, secondary		889.66	(215)
Water heating fuel used		3347.66	(219)
Electricity for pumps, fans and electric keep-hot (Table 4f):			
mechanical ventilation fans - balanced, extract or positive input from outside	0.00		(230a)
warm air heating system fans	0.00		(230b)
central heating pump	130.00		(230c)
oil boiler pump	0.00		(230d)
boiler flue fan	45.00		(230e)
maintaining electric keep-hot facility for gas combi boiler	0.00		(230f)
pump for solar water heating	0.00		(230g)
Total electricity for the above	∑(230a)...(230g)	175.00	(231)
Electricity for lighting (calculated in Appendix L):		463.12	(232)

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

	Energy kWh/year		Emissions Factor		Emissions (kgCO2/year)	
Space heating - main system 1	10148.21	x	0.194	=	1968.75	(261)
Space heating - secondary	889.66	x	0.422	=	375.44	(263)

Water heating	3347.66	x	0.194	=	649.45	(264)
Space and water heating			(261) + (262) + (263) + (264) =		2993.64	(265)
Pumps, fans and electric keep-hot	175.00	x	0.422	=	73.85	(267)
Lighting	463.12	x	0.422	=	195.43	(268)
Total carbon dioxide emissions			∑(261)...(271) =		3262.92	(272)
Emissions per m² for space and water heating					51.12	(272a)
Emissions per m² for lighting					3.26	(272b)
Target Carbon Dioxide Emissions Rate (TER)			[(51.12 × FF × EFA) + (3.26 × EFA)] × (0.6)		33.70	(273)

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	Mrs Farah Naz	Assessor number	1
Client		Last modified	24/09/2014
Address	Unit 6 Unit 6 on Site 6 6 Kiln Place, Camden, Camden, Gospel Oak London, UK, NW5		

1. Overall dwelling dimensions

		Area (m²)			Average storey height (m)			Volume (m³)	
Lowest occupied		60.00	(1a)	x	2.66	(2a)	=	159.60	(3a)
Total floor area	(1a) + (1b) + (1c) + (1d)...(1n) =	60.00	(4)						
Dwelling volume							(3a) + (3b) + (3c) + (3d)...(3n) =	159.60	(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		3.00	(17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)		0.15	(18)

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

Number of sides on which dwelling is sheltered		2	(19)
Shelter factor	1 - [0.075 x (19)] =	0.85	(20)
Adjusted infiltration rate	(18) x (20) =	0.13	(21)

Infiltration rate modified for monthly wind speed:

Monthly average wind speed from Table 7

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(22)m	5.40	5.10	5.10	4.50	4.10	3.90	3.70	3.70	4.20	4.50	4.80	5.10

∑(22)1...12 = 54.10 (22)

Wind Factor (22a)m = (22)m ÷ 4

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(22a)m	1.35	1.27	1.27	1.12	1.02	0.98	0.92	0.92	1.05	1.12	1.20	1.27

∑(22a)1...12 = 13.52 (22a)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(22b)m	0.17	0.16	0.16	0.14	0.13	0.12	0.12	0.12	0.13	0.14	0.15	0.16

∑(22b)1...12 = 1.72 (22b)

Calculate effective air change rate for the applicable case:

If mechanical ventilation: air change rate through system	0.50	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)), otherwise (23b) = (23a)	0.50	(23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = | 80.75 | (23c)

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

(24a)m	0.27	0.26	0.26	0.24	0.23	0.22	0.21	0.21	0.23	0.24	0.25	0.26	(24a)

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

(25)m	0.27	0.26	0.26	0.24	0.23	0.22	0.21	0.21	0.23	0.24	0.25	0.26	(25)

3. Heat losses and heat loss parameter

The κ-value is the heat capacity per unit area, see Table 1e.

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*			22.40	x	0.96	=	21.54	N/A	N/A	(27)
Doors			2.20	x	1.00	=	2.20	N/A	N/A	(26)
Ground floor			60.00	x	0.10	=	6.00	N/A	N/A	(28a)
External wall			199.90	x	0.15	=	29.98	N/A	N/A	(29a)
Party Wall			30.75	x	0.00	=	0.00	N/A	N/A	(32)
Roof			60.00	x	0.10	=	6.00	N/A	N/A	(30)
Total area of external elements ∑A, m²			344.50	(31)						

** for windows and roof windows, effective window U-value is calculated using formula 1/[(1/UValue)+0.04] paragraph 3.2*

Fabric heat loss, W/K = ∑(A × U)	(26)...(30) + (32) =	65.73	(33)
Heat capacity Cm = ∑(A x κ)	(28)...(30) + (32) + (32a)...(32e) =	N/A	(34)
Thermal mass parameter (TMP) in kJ/m²K	Calculated separately =	285.00	(35)
Thermal bridges: ∑(L x Ψ) calculated using Appendix K		34.45	(36)

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

Total fabric heat loss (33) + (36) = | 100.18 | (37)

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

(38)m	14.13	13.63	13.63	12.62	11.95	11.62	11.28	11.28	12.12	12.62	13.13	13.63	(38)

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

(39)m	114.31	113.81	113.81	112.80	112.13	111.79	111.46	111.46	112.30	112.80	113.30	113.81	

Average = ∑(39)1...12/12 = | 112.81 | (39)

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

(40)m	1.91	1.90	1.90	1.88	1.87	1.86	1.86	1.86	1.87	1.88	1.89	1.90	

Average = ∑(40)1...12/12 = | 1.88 | (40)

4. Water heating energy requirement

kWh/year

Assumed occupancy, N | 1.98 | (42)

If TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA - 13.9)²)] + 0.0013 x (TFA - 13.9)

If TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 | 81.26 | (43)

Annual average hot water usage has been reduced by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m	89.39	86.14	82.89	79.64	76.39	73.14	73.14	76.39	79.64	82.89	86.14	89.39	

∑(44)1...12 = | 975.17 | (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x Tm/3600 kWh/month (see Tables 1b, 1c 1d)

(45)m	132.88	116.22	119.93	104.55	100.32	86.57	80.22	92.05	93.15	108.56	118.50	128.69	

∑(45)1...12 = | 1281.66 | (45)

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

For community heating include distribution loss whether or not hot water tank is present

Distribution loss 0.15 x (45)m

(46)m	19.93	17.43	17.99	15.68	15.05	12.99	12.03	13.81	13.97	16.28	17.78	19.30	(46)

Water storage loss:

Cylinder volume (litres) including any solar storage within same cylinder	0	(50)
Energy lost from water storage, kWh/day (50) x (51) x (52) x (53)	0.00	(54)
Enter (49) or (54) in (55)	0.00	(55)

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

(56)m	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(56)

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

(57)m	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(57)

Primary circuit loss (annual) from Table 3	0.00	(58)

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

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

(59)m	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(59)

Combi loss for each month from Table 3a, 3b or 3c (enter '0' if not a combi boiler)

(61)m	45.55	39.65	42.24	39.27	38.93	36.07	37.27	38.93	39.27	42.24	42.48	45.55	(61)

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

(62)m	178.43	155.87	162.17	143.83	139.25	122.64	117.49	130.98	132.43	150.80	160.98	174.24	(62)

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

(63)m	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)1...12 = 0.00 (63)

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

(64)m	178.43	155.87	162.17	143.83	139.25	122.64	117.49	130.98	132.43	150.80	160.98	174.24

∑(64)1...12 = 1769.10 (64)

if (64)m < 0 then set to 0

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

(65)m	55.57	48.55	50.44	44.58	43.09	37.80	35.99	40.34	40.79	46.66	50.02	54.18	(65)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	99.08	99.08	99.08	99.08	99.08	99.08	99.08	99.08	99.08	99.08	99.08	99.08	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m	15.42	13.69	11.14	8.43	6.30	5.32	5.75	7.47	10.03	12.74	14.87	15.85	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m	172.95	174.74	170.22	160.59	148.44	137.02	129.38	127.59	132.11	141.74	153.89	165.32	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m	32.91	32.91	32.91	32.91	32.91	32.91	32.91	32.91	32.91	32.91	32.91	32.91	(69)
Pumps and fans gains (Table 5a)													
(70)m	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	(70)
Losses e.g. evaporation (negative values) (Table 5)													
(71)m	-79.27	-79.27	-79.27	-79.27	-79.27	-79.27	-79.27	-79.27	-79.27	-79.27	-79.27	-79.27	(71)
Water heating gains (Table 5)													
(72)m	74.69	72.25	67.79	61.92	57.92	52.50	48.37	54.22	56.66	62.71	69.48	72.82	(72)
Total internal gains (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m													
(73)m	325.78	323.41	311.87	293.67	275.38	257.56	246.23	252.01	261.52	279.91	300.96	316.71	(73)

6. Solar gains

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

Rows (74) to (82) are used 12 times, one for each month, repeating as needed if there is more than one window type.

Details for month of January and annual totals are shown below:

	Access factor Table 6d		Area m²		Solar flux W/m²		g Specific data or Table 6b		FF Specific data or Table 6c		Gains (W)	
North	0.77	x	7.60	x	10.73	x 0.9 x	0.60	x	0.80	=	27.13	(74)
South	0.77	x	14.80	x	47.32	x 0.9 x	0.60	x	0.80	=	232.98	(78)

Solar gains in watts, calculated for each month ∑(74)m...(82)m

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

(83)m	260.11	431.48	548.24	655.70	724.66	748.82	727.58	667.15	596.19	482.67	309.47	223.93	(83)
(84)m	585.89	754.89	860.11	949.37	1000.04	1006.38	973.81	919.16	857.71	762.58	610.43	540.64	(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, η1,m (see Table 9a)													
(86)m	0.99	0.98	0.95	0.91	0.81	0.64	0.46	0.48	0.74	0.92	0.98	0.99	(86)
Mean internal temp of living area T1 (steps 3 to 7 in Table 9c)													
(87)m	19.36	19.64	20.00	20.34	20.71	20.91	20.98	20.98	20.85	20.43	19.76	19.37	(87)
Temperature during heating periods in the living area from Table 9, Th2(˚C)													
(88)m	19.40	19.41	19.41	19.42	19.43	19.43	19.44	19.44	19.43	19.42	19.41	19.41	(88)
Utilisation factor for gains for rest of dwelling η2,m (see Table 9a)													
(89)m	0.99	0.97	0.94	0.88	0.73	0.51	0.29	0.31	0.61	0.88	0.98	0.99	(89)
Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)													
(90)m	17.34	17.74	18.25	18.72	19.18	19.39	19.43	19.43	19.34	18.86	17.92	17.36	(90)

Living area fraction fLA 40.00 ÷ (4) = 0.67 (91)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Mean internal temperature for the whole dwelling fLA x T1 +(1 - fLA) x T2													
(92)m	18.69	19.01	19.42	19.80	20.20	20.40	20.47	20.46	20.35	19.91	19.15	18.70	(92)
Apply adjustment to the mean internal temperature from Table 4e, where appropriate													
(93)m	18.54	18.86	19.27	19.65	20.05	20.25	20.32	20.31	20.20	19.76	19.00	18.55	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that tim = (93)m and recalculate the utilisation factor for gains using Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, ηm													
(94)m	0.99	0.97	0.93	0.88	0.77	0.58	0.38	0.41	0.68	0.89	0.97	0.99	(94)
Useful gains, ηmGm, W = (94)m x (84)m													
(95)m	577.49	729.91	804.00	837.07	765.71	587.87	374.39	372.83	583.24	676.20	593.96	534.09	(95)
Monthly average external temperature from Table 8													
(96)m	4.50	5.00	6.80	8.70	11.70	14.60	16.90	16.90	14.30	10.80	7.00	4.90	(96)
Heat loss rate for mean internal temperature, Lm, W													
(97)m	1604.72	1577.14	1419.02	1235.49	935.95	632.09	380.74	380.47	662.01	1010.53	1359.38	1553.63	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m - (95)m] x (41)m													
(98)m	764.26	569.34	457.58	286.86	126.66	0.00	0.00	0.00	0.00	248.74	551.10	758.54	

Total per year (kWh/year) = ∑(98)1...5, 10...12 = 3763.08 (98)

Space heating requirement in kWh/m²/year (98) ÷ (4) 62.72 (99)

9a. Energy Requirements - Individual heating systems including micro-CHP

Space heating:

Fraction of space heating from secondary/supplementary system (Table 11)	0.00	(201)
Fraction of space heating from main system(s) 1 - (201)	1.00	(202)
Fraction of main heating from main system 2	0.00	(203)
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 space heating system 1 (%)	94.90	(206)

(from database or Table 4a/4b, adjusted where appropriate by the amount shown in the 'space efficiency adjustment' column of Table 4c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement, kWh/month (as calculated above)												
(98)m	764.26	569.34	457.58	286.86	126.66	0.00	0.00	0.00	0.00	248.74	551.10	758.54
Space heating fuel (main heating system 1), kWh/month = (98)m x (204) x 100 ÷ (206)												
(211)m	805.33	599.94	482.17	302.28	133.47	0.00	0.00	0.00	0.00	262.11	580.72	799.30

Total per year (kWh/year) = ∑(211)1...5, 10...12 = 3965.31 (211)

Water heating:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Output from water heater, kWh/month (calculated above)												
(64)m	178.43	155.87	162.17	143.83	139.25	122.64	117.49	130.98	132.43	150.80	160.98	174.24

∑(64)1...12 = 1769.10 (64)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Efficiency of water heater per month												
(217)m	92.81	92.53	92.03	91.27	89.33	84.80	84.80	84.80	84.80	90.82	92.41	92.83
Fuel for water heating, kWh/month = (64)m x 100 ÷ (217)m												
(219)m	192.26	168.45	176.21	157.59	155.88	144.62	138.55	154.46	156.16	166.05	174.20	187.69

Total per year (kWh/year) = ∑(219)1...12 = 1972.12 (219)

Annual Totals Summary:	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		3965.31	(211)
Water heating fuel used		1972.12	(219)
Electricity for pumps, fans and electric keep-hot (Table 4f):			
mechanical ventilation fans - balanced, extract or positive input from outside	129.00		(230a)
warm air heating system fans	0.00		(230b)
central heating pump	130.00		(230c)
oil boiler pump	0.00		(230d)
boiler flue fan	45.00		(230e)
maintaining electric keep-hot facility for gas combi boiler	0.00		(230f)
pump for solar water heating	0.00		(230g)
Total electricity for the above	∑(230a)...(230g)	304.00	(231)
Electricity for lighting (calculated in Appendix L):		272.29	(232)

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

	Energy kWh/year		Emissions Factor		Emissions (kgCO2/year)	
Space heating - main system 1	3965.31	x	0.198	=	785.13	(261)
Water heating	1972.12	x	0.198	=	390.48	(264)
Space and water heating			(261) + (262) + (263) + (264) =		1175.61	(265)
Pumps, fans and electric keep-hot	304.00	x	0.517	=	157.17	(267)
Lighting	272.29	x	0.517	=	140.78	(268)
Total carbon dioxide emissions			∑(261)...(271) =		1473.55	(272)
Dwelling Carbon Dioxide Emissions Rate (DER)					24.56	(273)

Appendix C: Code for Sustainable Homes Pre Assessment

Code for Sustainable Homes Pre-Assessment

THE CODE FOR SUSTAINABLE HOMES™

Project Name **Kiln Place**

Design Team:	Client	**Camden**	**Prepared by:**	**Farah Naz**
	Architect	**Peter BarberARCHITECTS**	**Checked by:**	
	Contractor	not known	**Date**	**26/09/2013**
	Developer	not known		
	M+E Engineer	**Ramboll UK**		
	Structural Engineer	**Ramboll UK**		
	Planning Consultant	**Quod**		
	Environmental Engineer	**Ramboll UK**		
	Acoustician	**Peter BarberARCHITECTS**		
	Ecologist	**Ramboll UK**		
	Landscape	**Peter BarberARCHITECTS**		
	Quantity Surveyor	**EC Harris**		

Difficulty of achieving credit - Traffic Light Approach

(green)	Credit straightforward to achieve
(orange)	Credit involves changes to the design and additional work
(red)	Credit difficult to achieve

		SUMMARY: Achieved Code Level including Mandatory Standards					
OPTION 1	Achieved?	1	2	3	4	5	6
69.0%		**YES**	**YES**	**YES**	**YES**	**NO**	**NO**

		SUMMARY: Achieved Code Level including Mandatory Standards					
OPTION 2	Achieved?	1	2	3	4	5	6
0.0%		**NO**	**NO**	**NO**	**NO**	**NO**	**NO**

		SUMMARY: Achieved Code Level including Mandatory Standards					
OPTION 3	Achieved?	1	2	3	4	5	6
0.0%		**NO**	**NO**	**NO**	**NO**	**NO**	**NO**

Code Level Benchmarks	
Level 1	**≥36**
Level 2	**≥48**
Level 3	**≥57**
Level 4	**≥68**
Level 5	**≥84**
Level 6	**≥90**

Category		Description	Number of credits available	Credits achieved - Option 1	Credits achieved - Option 2	Credits achieved - Option 3	Mandatory Standards Levels 1	2	3	4	5	6	Responsibility	Notes
Energy and CO_2 Emissions														
Ene 1	Dwelling and Emission Rate	Credits awarded based on percentage improvement of DER over TER using SAP 2009	10	3	0	0				3	9	10	Accredited Energy Assessor / M+E Engineer	Aim for 28% improvement to achieve 3credits to onatin Code Level 4. Part L 2010 improved U values, whole house ventilation, Accrediated Construction Details, Airtightness ranges from 1.5 to 2.5m³/h.m²@50PA) , Please refer to the DER worksheet for details.Confirmed by the Architects.
Ene 2	Building Fabric	Credits are awarded based on the Fabric Energy Efficiency (kWh/m2/yr) of the dwelling. Minimum standards apply at Code levels 5 and 6. The FEE value is taken from the SAP 2009 worksheet.	9	5	0	0	3+	3+	3+	3+	7	7	Accredited Energy Assessor / Architect	**(FEE) Fabric Energy Efficiency** Energy demand for space heating and cooling expressed in kilowatt-hours of energy demand per square metre per year (kWh/m2/year). Fabric energy efficiency is calculated according to the conditions defined in Section 11 of SAP. The type of dwelling under assessment determines the applicable FEE and credit scale. The FEE scale of ≤48 kWh/m2/year to ≤32 kWh/m2/year is applicable to: • Apartment blocks • Mid-terrace houses / bungalows The FEE scale of ≤60 kWh/m2/year to ≤38 kWh/m2/year is applicable to: • End terrace houses / bungalows • Semi-detached houses / bungalows • Detached houses / bungalows. Energy averaging For all apartment blocks, it is acceptable to assess this issue based on the area weighted average FEE performance of all dwellings within the building. The area weighted average FEE performance must be calculated in accordance with methodology defined in clause 4.6 of AD L1A. In Kiln place the average FEE is 52.28 approx based on the sampled modelled dwellings.
Ene 3	Energy Display Devices	Credits are awarded where a correctly specified Energy Display Device is installed monitoring electricity and/or primary heating fuel consumption.	2	2	0	0							Developer / M+E Engineer	1 credit - Where current electricity OR primary heating fuel consumption data are displayed to occupants by a correctly specified energy display device. 2 credits - Where current electricity AND primary heating fuel consumption data are displayed to occupants by a correctly specified energy display device. Default case (2 credits): Where electricity is the primary heating fuel and current electricity consumption data are displayed to occupants by a correctly specified energy display device.
Ene 4	Drying Space	Credit awarded for providing internal or external secure drying space with posts and fittings, or fixings capable of holding 4m+ for 1-2 bed dwellings or 6m+ for 3+ bed dwellings	1	1	0	0							Architect	The ecological value before and after development is measured, and the overall change in species per hectare is: 1 credit: Minor negative change: between –9 and less than or equal to –3 2 credits: Neutral: greater than –3 and less than or equal to +3 3 cr
Ene 5	Energy Labelled White Goods	Credits are awarded where each dwelling is provided with either information about the EU Energy Labelling Scheme, White Goods with ratings ranging from A+ to B or a combination of the previous according to the technical guide.	2	2	0	0							Camden/ Client	1st credit - A+ rated fridges and freezers or fridge-freezers 2nd credit - A-rated washing machine and dishwasher AND EITHER B-rated washer-dryer or tubledryer OR info on dryers OR 1 credit - Where no white goods are provided but EU Energy Efficiency Labelling Scheme Information is provided to each dwelling Camden to Confirm this credit.
Ene 6	External Lighting	Credits are awarded based on the provision of space lighting with dedicated energy efficient fittings and security lighting fittings with appropriate control gear.	2	2	0	0							M+E Engineer	1st credit - Where all external space lighting, including lighting in common areas, is provided by dedicated energy efficient fittings with appropriate control systems. 2nd credit - Where all security lighting is designed for energy efficiency and is adequately controlled such that: All burglar security lights have a maximum wattage of 150 W and Movement detecting control devices (PIR) and Daylight cut-off sensors All other security lighting is provided by dedicated energy efficient fittings and is fitted with daylight cut-off sensors / time switch Default cases: - If no security lighting is installed credit is awarded by defaul providing requirements related to space lighting have been met - Dual lamp luminaires with both space and security lamps can be awarded both credits provided they meet the criteria for energy efficiency

Ene 7	Low or Zero Carbon Energy Technologies	Credits are awarded where there is a 10% or 15% reduction in CO2 emissions resulting from the use of low or zero carbon technologies.	2	0	0	0	Accredited Energy Assessor / M&E Engineer	1 credit - 10% of demand or greater 2 credits - 15% of demand or greater A copy of calculations required to determine compliance - based on design stage SAP outputs Accredited External Renewables (off site) will comply with these credits which: • Are Renewable Energy Guarantee of Origin (REGO) certified • Create new installed generation capacity designed to meet the demand of the dwelling • Are additional to capacity already required under the Renewables Obligation SAP modellling was undertaken. The development achive the 26% onsite savings from Energy efficiency measures based on passive and active design improvements. Some dwelling require renewbale technology eg: PV to obtain the 25% reduction for Code level 4 (2010). The dwellings on Site 3, 4 and 5 requires PV and the total no required is 24kWp which equates to a 3% onsite savings from this technology. Thus this credit is not achievable.
Ene 8	Cycle Storage	Credits are awarded where adequate, safe, secure and weather proof cycle storage is provided according to the Code requirements.	2	1	0	0		Where individual or communal cycle storage is provided, that is adequately sized, secure and convenient, for the following number of cycles: 1 credit requirement: Studios or 1 bedroom dwellings – storage for 1 cycle for every two dwellings 2 and 3 bedroom dwellings –- storage for 1 cycle per dwelling 4 bedrooms and above –- storage for 2 cycles per dwelling 2 credits requirement: Studios or 1 bedroom dwellings – storage for 1 cycle per dwelling 2 and 3 bedroom dwellings – storage for 2 cycles per dwelling 4 bedrooms and above – storage for 4 cycles per dwelling Communal storage should be located within 100 m of the front door or the main entrance to the block of flats. Lighting should comply with ENE 6 Credit. Entrance must be secure door set and have no windows. To be Confirmed. Few flats might not achieve this credit. Architect will confirm.
Ene 9	Home Office	A credit is awarded for the provision of space for a home office. The location, space and services provided must meet the Code requirements.	1	1	0	0	Architect / M+E Engineer	See requirements for ventilation, daylight, services, space and proposed room dimensions. Note. each flat requires individual assessment - is considered a low cost option for those that can achieve it. Documentry evidence required of the following: - socket location, telephone points, ventilation and average daylight factor of min 1.5%. One of the following: -cable connection, Broadband connection and double telephone points. SPACE REQUIREMENT: Min size 1.8 m wall length to allow space for, desk, chair and filing cabinet. For a studio, 1 or 2 bed room flat, suitable room is the living area. 3+ bedroom, a suitable room is other than the bedroom, bathroom, living and kitchen. Confimed by the design team. Will be progressed further in next design stage.
Total Credits for Section			**31**	**17**	**0**	**0**		
Indicative Section Score				**19.89%**	**0.00%**	**0.00%**		

Water														
Wat 1	Internal Potable Water Use	Credits are awarded based on the predicted average household water consumption, calculated using the Code Water Calculator Tool. Minimum standards for each code level apply.	**5**	**4**	**0**	**0**	1	1	3	3	5	5	Architect / M+E Engineer	≤ 120 l/p/day 1 credit (Levels 1 and 2) ≤ 110 l/p/day 2 credits ≤ 105 l/p/day 3 credits (Levels 3 and 4) ≤ 90 l/p/day 4 credits ≤ 80 l/p/day 5 credits (Levels 5 and 6) **London Plan 2011, Policy 5.15 water use and Supplies:** Minimum water usage would meet a target of 105l/p/day or less. Need to specify flow rate for WCs, bathroom and kitchen taps, bath, shower, washing machine, dishwasher and water softener. Note. Rainwater / Greywater recycling systems will improve score but are not required for Code Level 4 compliance. Confirmed by the architect at Code workshop at Ramboll offices on 1010/2013 , that 4 credit would be achievable.
Wat 2	External Water Use	A credit is awarded where a compliant system is specified for collecting rainwater for external irrigation purposes. Where no outdoor space is provided the credit can be achieved by default.	**1**	**1**	**0**	**0**							Architect / M+E Engineer	1 credit - where a correctly specified and sufficient sized system to collect rainwater for external/internal irrigation/use has been provided to a dwelling with a garden, patio or communal garden space. Examples of such systems include rainwater butts and central rainwater collection systems **Sufficient Size/ Storage Volume:** - Terrace and patios- 100 litres min - 1- 2 bed room home with private garden - 150 litres min - 3+ bedroom hoem with private garden - 200 litres min **For Houses:** - with front or reargarden , a rainwater collector is required only in the larger garden, but must meet the capacity requirement above. **Size requirements for communal gardens:** • 1 litre/m2 of land allocated to the dwelling with a minimum of 200 litres per communal garden. Where the communal garden is allocated to more than 6 dwellings, a maximum of 30 litres per dwelling can be applied. **Default Cases** If no individual or communal garden spaces are specified or if only balconies are provided, the credit can be awarded by default For hard surfaces the volume requirements is halved. Provisionally confirmed by the design team.
Total Credits for Section			**6**	**5**	**0**	**0**								
Indicative Section Score				**7.50%**	**0.00%**	**0.00%**								
Materials														
Mat 1	Environmental Impact of Materials	Mandatory Requirement: At least three of the five key building elements must achieve a Green Guide 2008 Rating of A+ to D. Tradable Credits: Points are awarded on a scale based on the Green Guide Rating of the specifications. The Code Materials Calculator can be used to predict a potential score.	**15**	**8**	**0**	**0**	3+	3+	3+	3+	3+	3+	Architect / Structural Engineer	Building elements assessed using 2008 Green Guide. CfSH materials calculator used to estimate credits. Where at least three of the following five key elements of the building envelope achieve a rating of A+ to D : • Roof • External walls • Internal walls (including separating walls) • Upper and ground floors (including separating floors) • Windows Mixed use development: -Dwelling located over non domestic accomodation(eg. retail, parking), the lowest residential floor is considered as ground floor. - If external wall, windows, internal walls are located above non domestic, only those related to the dwellings needs to be assessed. - Where a non domestic is located between the dwellings and the roof, the roof is assessed as it is protecting the dwellings below.If the roof is directly above a commercial use property, the equivalent commercial rating for the roof must be used as opposed to the ratings of a domestic roofs.Roof areas to the part of the dwelling,not containing a dwelling should be omitted. Note. Developer can specify requirement when procuring Contractors services. May push up price. To be confirmed by the architects. Camden Material Policy: Policy 8.16, Pg 63: 8.16 In new-build and development projects with either - 500sq m of any floorspace or more or 5 dwellings or more - you should seek to achieve an area weighted average of A+ to B for the major building elements (roof, external walls, floor finishes, internal partitions and windows) in accordance with the BRE Green Guide to Specification.

Mat 2	Responsible Sourcing of Materials - Basic Building Elements	Credits are awarded where materials used in the basic building elements are responsibly sourced. The Code Materials Calculator can be used to predict a potential score.	6	4	0	0	Archiytect	6 credits available where 80% of the following Building Elements are responsibly sourced: a) Frame b) Ground floor c) Upper floors (including separating floors) d) Roof e) External walls f) Internal walls (including separating walls) g) Foundation/substructure (excluding sub-base materials) h) Staircase Additionally, 100% of any timber in these elements must be legally sourced These credits are difficult to achieve as limits suppliers which can have knock on effect to cost. Note. Developer can specify requirement when procuring Contractors services. May push up price. Camden Material Policy: Policy 8.17, Pg 63: Responsible Sourcing Responsible Sourcing 8.17 You should specify materials from suppliers who participate in responsible sourcing schemes such as the BRE BES 6001:2008 Responsible Sourcing Standard. All timber specified should be sourced from schemes supported by the Central Point of Expertise for Timber Procurement such as Forest Stewardship Council (FSC) accreditation (which ensures that the harvest of timber and non-timber products maintains the forest's ecology and its long-term viability). The use of Camden Planning Guidance | Sustainability | Materials 64 responsible sourcing can contribute towards attaining the BREEAM/Code credits but a clear audit trail will need to be provided to gain these credits. For further guidance on responsible sourcing of materials: http://www.bre.co.uk/
Mat 3	Responsible Sourcing of Materials - Finishing Elements	Credits are awarded where materials used in the finishing elements are responsibly sourced. The Code Materials Calculator can be used to predict a potential score.	3	2	0	0	Architect	3 credits available where 80% of the following materials are responsibly sourced: a) Stair b) Window c) External & internal door d) Skirting (timber) e) Panelling (very difficult) f) Furniture - (might not be provided) g) Fascias (very difficult) h) Any other significant use Additionally, 100% of any timber in these elements must be legally sourced Has been confirmed by the architect.
Total Credits for Section			**24**	**14**	**0**	**0**		
Indicative Section Score				**4.20%**	**0.00%**	**0.00%**		

Surface Water Run-off

Sur 1	Reduction of Surface Water Run-off from Site	Mandatory Requirement: Peak rate of run-off into watercourses is no greater for the developed site than it was for the predevelopment site and that the additional predicted volume of rainwater discharge caused by the new development is entirely reduced as far as possible in accordance with the assessment criteria. Designing the drainage system to be able to cope with local drainage system failure. Tradable Credits: Where SUDS are used to improve water quality of the rainwater discharged or for protecting the quality of the receiving waters.	**2**	**1**	**0**	**0**							Environmental Scientist	Credits are available where SUDS are used to improve the water quality of discharged water: 1st credit - ensuring there is no discharge from the developed site for rainfall depths up to 5 mm (see Calculation Procedures). 2nd credit - the run-off from all hard surfaces shall receive an appropriate level of treatment in accordance with The SuDS Manual to minimise the risk of pollution. Default Cases: The mandatory criteria can be deemed to be met by default if the site discharges rainwater directly to a tidal estuary or the sea. Credits cannot be awarded unless the relevant water quality criteria are met. Note: This section will be revised when the National Standards for Sustainable Drainage and associated regulations come into force.
Sur 2	Flood Risk	Credits are awarded where developments are located in areas of low flood risk or where in areas of medium or high flood risk appropriate measures are taken to prevent damage to the property and its contents in accordance with the Code criteria in the technical guide.	**2**	**2**	**0**	**0**							Environmental Scientist	2 credits: for developments situated in Zone 1 – low annual probability of flooding (as defined in PPS25 Development and Flood Risk) and where the site-specific Flood Risk Assessment (FRA) indicates that there is low risk of flooding from all sources. 1 credit: for developments situated in Zones 2 and 3a – medium and high annual probability of flooding where the finished ground floor level of all habitable parts of dwellings and access routes to the ground level and the site, are placed at least 600 mm above the design flood level of the flood zone. The Flood Risk Assessment accompanying the planning application must demonstrate to the satisfaction of the local planning authority and statutory body that the development is appropriately flood resilient and resistant, including safe access and escape routes where required, and that any residual risk can be safely managed.
SUR 1 **Mandatory Requirement**	Peak Rate of Run-off is No Greater for the Developed Site than the Pre-Development Site		**YES = 1**	**1**	**0**	**0**	**1**	**1**	**1**	**1**	**1**	**1**	Environmental Scientist	Mandatory requirements for peak rate of run-off and additional volume of run-off.
Total Credits for Section			**4**	**3**	**0**	**0**								
Indicative Section Score				**1.65%**	**0.00%**	**0.00%**								

Waste														
Was 1	Household Waste Storage and Recycling Facilities	Mandatory Requirement: The space provided for waste storage should be sized to hold the larger of either all external containers provided by the Local Authority or the min capacity calculated from BS 5906. Tradable Credits are awarded for adequate internal and/ or external recycling facilities.	**4**	**4**	**0**	**0**							Architect & Camden	Mandatory standard: An adequate external space should be allocated for waste storage and sized to accommodate containers according to the largest of the following two volumes: • The minimum volume recommended by British Standard 5906 (British Standards Institution, 2005) based on a maximum collection frequency of once per week. This volume is 100 litres for a single bedroom dwelling, with a further 70 litres for each additional bedroom (e.g. 1bed – 100l, 2bed – 170l, 3bed – 240l, 4bed – 310l) • The total volume of the external waste containers provided by the Local Authority. Storage space must provide inclusive access and usability (Checklist IDP). Containers must not be stacked. Credits available for the provision of recycling facilities. 2 credits - dedicated internal storage for recyclable household waste where there is no (or insufficient) dedicated external storage capacity for recyclable material and no Local Authority collection scheme. 4 credits - a combination of internal storage capacity provided in an adequate internal space, with either a Local Authority collection scheme or adequate external storage capacity. For flats, a private recycling scheme operator must be appointed to maintain bins and collect recyclable waste regularly if there is no LA collection scheme. Be located in an adequate extrenal soace, sized according to frequency of collection, based on guidance from the recycling scheme operator and store at least three types of recyclable waste in identifiabley dfferent bins. Note: 4 credits awarded based on confirmation by Camden Council and the Architect.
Was 2	Construction Site Waste Management	A credit is awarded where a compliant SWMP is provided with targets and procedures to minimise construction waste. Credits are available where the SWMP include procedures and commitments for diverting either 50% or 85% of waste generated from landfill.	**3**	**2**	**0**	**0**							Contractor / Environmental Scientist	1 credit: SWMP with targets and procedures to minimise waste 2 credits: SWMP with procedures to divert 50% of waste 3 credits: SWMP with procedures to divert 85% of waste Note: 2 Credits awarded based on confirmation by Camden Council and the Architect.
Was 3	Composting	A credit is awarded where individual home composting facilities are provided, or where a community/ communal composting service, either run by the Local Authority or overseen by a management plan is in operation.	**1**	**1**	**0**	**0**							Architect / Developer	• Individual home composting facilities. OR • A local communal or community composting service, which the Local Authority runs or where there is a management plan in place. OR • A Local Authority green/kitchen waste collection system (this can include an automated waste collection system). All facilities must also: • be in a dedicated position • provide inclusive access and usability (Checklist IDP) • have a supporting information leaflet provided to each dwelling
WAS 1 **Mandatory Requirement**	Space Provided for Waste Storage Should be Sized to Hold the Larger of a) All External Storage Containers Provided by the LA or b) The Minimum Capacity of Waste Storage as Calculated from BS 5906		**YES = 1**	**1**	**0**	**0**	**1**	**1**	**1**	**1**	**1**	**1**		
Total Credits for Section			**8**	**7**	**0**	**0**								
Indicative Section Score				**5.60%**	**0.00%**	**0.00%**								
Pollution														
Pol 1	Global Warming Potential of Insulants	A credit is awarded where all insulating materials only use substances (in manufacture AND installation) that have a GWP of less than 5.	**1**	**1**	**0**	**0**							Architect / M+E Engineer	Credits are awarded where all insulating materials in the elements of the dwelling listed below only use substances that have a GWP < 5 (in manufacture AND installation): • Roofs: including loft access • Walls: internal and external including lintels and all acoustic insulation • Floors: including ground and upper floors • Hot water cylinder: pipe insulation and other thermal stores • Cold water storage tanks: where provided • External doors Note. Non-foamed insulation such as mineral wool, recycled newspaper or cork complies.
Pol 2	NOx emissions from heating source	Credits are awarded on the basis of NOx emissions arising from the operation of the space and water heating system within the dwelling.	**3**	**3**	**0**	**0**							M+E Engineer	Dry NOX levels (mg/kWh) 1 credit - NOX levels <100 / boiler class 4 2 credits - NOX levels <70 / boiler class 5 3 credits - NOX levels <40 Note. Can depend on renewable solution e.g. CHP scores well, GSHP scores poorly Default case: Where all space heating and hot water energy requirements are fully met by systems which do not produce NOX emissions.
Total Credits for Section			**4**	**4**	**0**	**0**								
Indicative Section Score				**2.80%**	**0.00%**	**0.00%**								

Health and Wellbeing														
Hea 1	Daylighting	Credits are awarded for ensuring key rooms in the dwelling have high daylight factors (DF) and a view of the sky.	**3**	**0**	**0**	**0**							M+E Engineer / Architect	1 credit - Kitchens must achieve a minimum average daylight factor of at least 2% 1 credit - All living rooms, dining rooms and studies (including any room designated as a home office under Ene 9 – Home Office) must achieve a minimum average daylight factor of at least 1.5% 1 credit - 80% of the working plane in each kitchen, living room, dining room and study (including any room designated as a home offi ce under Ene 9 – Home Office) must receive direct light fromthe sky . Note: This credit is not targetted.
Hea 2	Sound Insulation	Credits are awarded where performance standards exceed those required in Building Regulations Part E. This can be demonstrated by carrying out pre-completion testing or through the use of Robust Details Limited.	**4**	**3**	**0**	**0**							Acoustician	Credits available where sound insulation achieves higher performance than the standards set out in the Building Regulations approved for England and Wales, Approved Document E (2003 Edition, with amendments 2004). 1 credit • airborne sound insulation values are at least 3dB higher • impact sound insulation values are at least 3dB lower 3 credits • airborne sound insulation values are at least 5dB higher • impact sound insulation values are at least 5dB lower 4 credits • airborne sound insulation values are at least 8dB higher • impact sound insulation values are at least 8dB lower This must be demonstrated through either a programme of pre-completion testing, or specifying Robust Details. All relevant dwellings must be registered with RDL. Default cases: Detached dwellings (4 credits) Attached dwellings where separating walls or floors occur only between non-habitable rooms (3 credits) Note. Part E is already challenging, higher levels of sound insulation will require larger build up of walls therefore impact on available floor area. See default case for flats for 3 credits. Note: Provisionally confirmed by the design team. Will be developed further in next design stage.
Hea 3	Private Space	A credit is awarded for the provision of an outdoor space that is at least partially private. The space must allow easy access to all occupants.	**1**	**1**	**0**	**0**							Architect	Where outdoor space (private or semi-private) has been provided that is: • Of a minimum size that allows all occupants to use the space. • Provided with inclusive access and usability • Accessible only to occupants of designated dwellings. Minimum space requirements: • Private space: 1.5 m2 per bedroom • Shared space: minimum 1 m2 per bedroom. Note. Balconies easy way to achieve credit. Juliet balcony, conservatory and other encosed spaces donot comply. Winter Gradens will comply with the criteria only if at least one side can be fully opened to the exterior (shutters, sliding wall, wings or terraced doors) Without this feaure, winter gardens are regarded as conservatories and donot comply with the criteria)
Hea 4	Lifetime Homes	Mandatory Requirement: Lifetime Homes is mandatory when a dwelling is to achieve Code Level 6. Tradable credits: Credits are awarded where the developer has implemented all of the principles of the Lifetime Homes scheme.	**4**	**4**	**0**	**0**	0	0	0	0	0	4	Developer / Architect	4 credits - where all principles of Lifetime Homes, applicable to the dwelling being assessed, have been complied with. 3 credits - where an exemption from Lifetime Homes criteria 2 and/or 3 is applied to selected pathways subject to a steeply sloping plot gradient, but all other principles of Lifetime Homes, applicable to the dwelling being assessed, have been complied with. Note:Confirmed by Architects.
Total Credits for Section			**12**	**8**	**0**	**0**								
Indicative Section Score				**9.36%**	**0.00%**	**0.00%**								

Management

Man 1	Home User Guide	Credits are awarded where a simple guide is provided to each dwelling covering information relevant to the 'non-technical' home occupier, in accordance with the Code requirements.	**3**	**3**	**0**	**0**	Developer / Architect / M+E Engineer	2 credits: A Home User Guide, compiled using Checklist Man 1 Part 1 together with information that the guide is available in alternative accessible formats Extra credit: Where the guide also covers information relating to the site and its surroundings, compiled using Checklist Man 1 Part 2 Confirmed by the Architect.
Man 2	Considerate Constructors Scheme	Credits are awarded where there is a commitment to comply with best practice site management principles using either the Considerate Constructors Scheme or an alternative locally/ nationally recognised scheme.	**2**	**2**	**0**	**0**	Contractor / Developer	1 credit: commitment to meet Best Practice under a nationally or locally recognised certification scheme such as the Considerate Constructors Scheme (score 24 - 31.5) 2 credits: commitment to go significantly beyond Best Practice (score 32 - 40) under nationally or localy recognised certification scheme such as , considerate constructors scheme. Note. Developer can specify requirement when procuring Contractors services. May push up price.
Man 3	Construction Site Impacts	Credits are awarded where there is a commitment and strategy to operate site management procedures on site	**2**	**2**	**0**	**0**	Contractor / Developer	1 credit where there are procedures that cover 2 or more of the following items: 2 credits where there are procedures that cover 4 or more of the following items: - Monitor, report and set targets for CO2 production or energy use arising from site activities - Monitor and report CO2 or energy use arising from commercial transport to and from site - Monitor, report and set targets for water consumption from site activities - Adopt best practice policies in respect of air (dust) pollution arising from site activities - Adopt best practice policies in respect of water (ground and surface) pollution occurring on the site - 80% of site timber is reclaimed, re-used or responsibly sourced Note. As above.
Man 4	Security	Credits are awarded for complying with Section 2 - Physical Security from Secured by Design - New Homes. An Architectural Liaison Officer (ALO), or alternative, needs to be appointed early in the design process and their recommendations incorporated.	**2**	**2**	**0**	**0**	Architect	Credits awarded where an Architectural Liaison Officer (ALO) or Crime Prevention Design Advisor (CPDA) from the local police force is consulted at the design stage and their recommendations are incorporated into the design of the dwelling. AND Section 2 – Physical Security from 'Secured by Design – New Homes' is complied with (Secured by Design certification is not required).
Total Credits for Section			**9**	**9**	**0**	**0**		

Indicative Section Score				**9.99%**	**0.00%**	**0.00%**		
Ecology								
Eco 1	Ecological Value of Site	One credit is awarded for developing land of inherently low value.	**1**	**1**		**0**	Environmental Scientist	1 credit where the development site is confirmed as land of inherently low ecological value EITHER By meeting the criteria for low ecological value OR By being confirmed by a Suitably Qualified Ecologist OR Where an independent ecological report of the site, prepared by a Suitably Qualified Ecologist confirms that the construction zone is of low or insignificant ecological value AND Any land of ecological value outside the construction zone but within the development site will remain undisturbed by the construction works. Note: Suitably Qualified Ecologist have been appointed. The site has been identified as a low ecological value.
Eco 2	Ecological Enhancement	A credit is awarded where there is a commitment to enhance the ecological value of the development site.	**1**	**0**	**0**	**0**	Suitably Qualified Ecologist / Developer	1 credit where a Suitably Qualified Ecologist has been appointed to recommend appropriate ecological features that will positively enhance the ecology of the site. AND Where the developer adopts all key recommendations and 30% of additional recommendations. It is recommended the Ecologit's report is prepared using the 'Code for Sustainable Homes Ecology Report Template', and it is carried out at RIBA Stage B Note: Recommandations have been made for mitigation but enhancement, so credit cannot be targetted.
Eco 3	Protection of Ecological Features	A credit is awarded where there is a commitment to maintain and adequately protect features of ecological value.	**1**	**1**	**0**	**0**	Suitably Qualified Ecologist / Contractor	1 credit - where all existing features of ecological value potentially affected by the works are maintained and adequately protected during site clearance, preparation and construction works. Default Cases The credit can be awarded by default where the site has been classified as having low ecological value in accordance with Eco 1 and no features of ecological value have been identified. If a suitably qualified ecologist has confirmed a feature can be removed because of its insignificant ecological value or where an arboriculturalist has confirmed a feature can be removed owing to poor health/condition (e.g. diseased trees which require felling for health and safety and/or conservation reasons), the credit can be achieved provided all other features are adequately protected in accordance with the ecologist's recommendations. Note: Credit has been confirmed by the qualified ecologist.
Eco 4	Change of Ecological Value of Site	Credits are awarded where the change in ecological value has been calculated in accordance with the Code requirements	**4**	**4**	**0**	**0**	Environmental Scientist / Developer	The ecological value before and after development is measured, and the overall change in species per hectare is: 1 credit: Minor negative change: between –9 and less than or equal to –3 2 credits: Neutral: greater than –3 and less than or equal to +3 3 credits: Minor enhancement: greater than 3 and less than or equal to 9 4 credits: Major enhancement: greater than +9 Note: Credit has been confirmed by the qualified ecologist based on the information to date. Wiil be confirmed in the next design stage.
Eco 5	Building Footprint	Credits are awarded depending on the ratio of combined floor area of all dwellings on the site to their footprint	**2**	**0**	**0**	**0**	Architect	1 credit - For blocks of flats, where the Net Internal Floor Area: Net Internal Ground Floor Area is greater than or equal to 3:1 2 credits - For block of flats, where the Net Internal Floor Area: Net Internal Ground Floor Area is greater than or equal to 4:1 Has been confirmed by the Architects.
Total Credits for Section			**9**	**6**	**0**	**0**		
Indicative Section Score				**7.98%**	**0.00%**	**0.00%**		