TER Worksheet Design - Draft



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

Assessor name		tan Parand						sessor num		4550		
Client	London E	Borough of	Camden				La	st modified	l	18/11	/2014	
Address	CREC Cro	gsland Roa	ad, Camde	n, London, I	NW1 8AY							
1. Overall dwelling dimens	sions											
				А	area (m²)			age storey eight (m)		Vo	olume (m³)	
Lowest occupied					55.30	<mark>](1a)</mark> x		2.85] (2a) =		157.61	(3a)
Total floor area	(1a)	+ (1b) + (1	c) + (1d)	(1n) =	55.30	(4)						
Dwelling volume							(3a)	+ (3b) + (3	c) + (3d)(3	n) =	157.61	(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 fan	s							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 pe hour	r
Infiltration due to chimneys	, flues, fans	s, PSVs		(6a)) + (6b) + (7	a) + (7b) + (7c) =	20	÷ (5) =		0.13	(8)
If a pressurisation test has b	been carried	d out or is i	ntended, p	proceed to (17), otherw	vise continu	e from (9) t	o (16)				
Air permeability value, q50,	expressed	in cubic m	etres per h	nour per squ	uare metre	of envelope	e area				5.00	(17)
If based on air permeability	value, ther	n (18) = [(1 ⁻	7) ÷ 20] + (8), otherwi	se (18) = (1	6)					0.38	(18)
Number of sides on which t	he dwelling	g is sheltere	ed								2	(19)
Shelter factor	-							1 -	[0.075 x (19	9)] =	0.85	(20)
Infiltration rate incorporatir	ng shelter fa	actor							(18) x (2	:0) =	0.32	(21)
Infiltration rate modified fo	r monthly v	wind speed	l:									_
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Monthly average wind spee	d from Tab	ole U2										
5.10	5.00	4.90	4.40	4.30	3.80	3.80	3.70	4.00	4.30	4.50	4.70	(22)
Wind factor (22)m ÷ 4												
1.28	1.25	1.23	1.10	1.08	0.95	0.95	0.93	1.00	1.08	1.13	1.18	(22a)
Adjusted infiltration rate (al	llowing for	shelter and	d wind fact	or) (21) x (2	22a)m							
0.41	0.40	0.39	0.35	0.34	0.30	0.30	0.30	0.32	0.34	0.36	0.38	(22b)
Calculate effective air chang	ge rate for t	the applica	ble case:									
If mechanical ventilation	1: air chang	e rate thro	ugh systen	n							N/A	(23a)
If balanced with heat red	covery: effic	ciency in %	allowing f	or in-use fa	ctor from T	able 4h					N/A	(23c)
d) natural ventilation or	whole hou	se positive	input vent	tilation fron	n loft							
0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.56	0.57	(24d)
Effective air change rate - e	nter (24a) o	or (24b) or	(24c) or (2	4d) in (25)								
0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.56	0.57	(25)
												-

3. Heat losses	and heat lo	ss paramet	er:										
Element				Gross rea, m²	Openings m ²		area m²	U-value W/m²K	A x U \	•	value, I/m².K	Ахк, kJ/K	
Door						2.	20 x	1.00	= 2.20)			(26)
Window						11	.62 x	1.33	= 15.4	1			(27)
External wall						27	.79 x	0.18	= 5.00)			(29a)
Party wall						49	.02 x	0.00	= 0.00)			(32)
Total area of ext	ternal eleme	ents ∑A, m²	2			41	61						(31)
Fabric heat loss,	W/K = ∑(A	× U)							(2	26)(30) + ((32) =	22.61	(33)
Heat capacity C	m = ∑(А x к)							(28)	.(30) + (32)	+ (32a)(3	2e) =	N/A	(34)
Thermal mass p	arameter (T	MP) in kJ/r	m²K									250.00	(35)
Thermal bridges	s: Σ(L x Ψ) ca	alculated u	sing Appen	dix K								2.78	(36)
Total fabric heat	t loss									(33) +	(36) =	25.39	(37)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ventilation heat	loss calcula	ted month	ily 0.33 x (2	25)m x (5)									
	30.34	30.18	30.01	29.23	29.09	28.41	28.41	28.29	28.67	29.09	29.38	29.69	(38)
Heat transfer co	efficient, W	//K (37)m +	+ (38)m										
	55.73	55.57	55.40	54.62	54.48	53.80	53.80	53.68	54.06	54.48	54.77	55.08	
									Average =	∑(39)112	/12 =	54.62	(39)
Heat loss param	eter (HLP),	W/m²K (39	∋)m ÷ (4)										
	1.01	1.00	1.00	0.99	0.99	0.97	0.97	0.97	0.98	0.99	0.99	1.00	
									Average =	∑(40)112	/12 =	0.99	(40)
Number of days	in month (1	Fable 1a)											
	31.00	28.00	31.00	30.00	31.00	30.00	31.00	31.00	30.00	31.00	30.00	31.00	(40)
4. Water heati	ng energy r	equiremen	+										
Assumed occup		equinemen										1.85	(42)
Annual average		isage in litr	es ner dav '	Vd average	= (25 x N) +	36						78.05	(43)
, and a verage	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage	e in litres pe	r day for ea	ach month '			le 1c x (43	3)	U	•				
	85.85	82.73	79.61	76.49	73.36	70.24	70.24	73.36	76.49	79.61	82.73	85.85	7
		1							-	Σ(44)1.	-	936.55	(44)
Energy content	of hot wate	r used = 4.:	18 x Vd,m x	nm x Tm/3	3600 kWh/m	onth (see	Tables 1b	o, 1c 1d)		2. /			• •
	127.31	111.35	114.90	100.17	96.12	82.94	76.86	88.20	89.25	104.01	113.54	123.30	
										Σ(45)1.	12 =	1227.97	(45)
Distribution loss	5 0.15 x (45))m											
	19.10	16.70	17.24	15.03	14.42	12.44	11.53	13.23	13.39	15.60	17.03	18.49	(46)
Storage volume	(litres) inclu	uding any s	olar or WW	/HRS storag	e within sam	ne vessel						150.00	(47)
Water storage lo	oss:												
a) If manufactur	er's declare	d loss facto	or is known	(kWh/day)								1.39	(48)
Temperature	e factor fron	n Table 2b										0.54	(49)
Energy lost f	rom water s	torage (kW	/h/day) (48	3) x (49)								0.75	(50)
Enter (50) or (54	1) in (55)											0.75	(55)
Water storage le	oss calculate	ed for each	month (55	5) x (41)m									
	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)
If the vessel con	tains dedica	ated solar s	torage or d	ledicated W	/WHRS (56)n	n x [(47) -	Vs] ÷ (47)	, else (56)					
	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)
	20.00		20.00	22.50	25.55	22.50	25.55	25.55			22.50	23.33	1 1

													()
	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)
Combi loss for e	ach month	from Table 3	3a, 3b or 3	C									
	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 requi	red for wate	er heating ca	alculated for	or each mo	nth 0.85 x	(45)m + (46	6)m + (57)r	n + (59)m +	- (61)m				
	173.91	153.44	161.50	145.27	142.72	128.04	123.46	134.79	134.34	150.61	158.63	169.89	(62)
Solar DHW input	t calculated	using Appe	ndix G or A	ppendix H									
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(63)
Output from wa	ter heater f	or each mor	nth (kWh/r	nonth) (62	2)m + (63)m	י <u></u> ו							
·	173.91	153.44	161.50	145.27	142.72	128.04	123.46	134.79	134.34	150.61	158.63	169.89	
	175.51	133.44	101.50	145.27	172.72	120.04	125.40	154.75	134.34				(CA)
							[(46)			∑(64)1	12 = 1	.//0.58	(64)
Heat gains from		- ·			(45)m + (61	-	[(46)m + (,	
	79.61	70.69	75.48	69.38	69.24	63.65	62.83	66.60	65.75	71.86	73.83	78.27	(65)
5. Internal gain) C												
5. Internal gain		Fab	Max	A	Maria	1	Int	A	Com	Ort	Neu	Dee	
	Jan	Feb	Mar	Apr	Мау	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains	(Table 5)								1				
	92.31	92.31	92.31	92.31	92.31	92.31	92.31	92.31	92.31	92.31	92.31	92.31	(66)
Lighting gains (c	alculated in	Appendix L	, equation	L9 or L9a),	also see Ta	able 5							
	14.39	12.78	10.39	7.87	5.88	4.97	5.37	6.97	9.36	11.89	13.87	14.79	(67)
Appliance gains	(calculated	in Appendix	L, equatio	n L13 or L1	l3a), also se	ee Table 5							
	160.96	162.63	158.42	149.46	138.15	127.52	120.42	118.75	122.95	131.92	143.23	153.86	(68)
Cooking gains (c	alculated in	Appendix L	, equation	L15 or L15	a), also see	Table 5							
	32.23	32.23	32.23	32.23	32.23	32.23	32.23	32.23	32.23	32.23	32.23	32.23	(69)
Pump and fan ga			52.25	52.25	52.25	52.25	52.25	52.25	52.25	52.25	52.25	52.25	(03)
		· · · · ·	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	(70)
	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	(70)
Losses e.g. evap								1					
	-73.85	-73.85	-73.85	-73.85	-73.85	-73.85	-73.85	-73.85	-73.85	-73.85	-73.85	-73.85	(71)
Water heating g	ains (Table	5)											
	107.00	105.20	101.45	96.36	93.06	88.41	84.45	89.52	91.32	96.59	102.54	105.20	(72)
Total internal ga	ins (66)m +	+ (67)m + (68	8)m + (69)r	n + (70)m -	+ (71)m + (7	72)m							
	336.04	334.30	323.96	307.38	290.78	274.58	263.92	268.93	277.33	294.08	313.33	327.54	(73)
6. Solar gains													
			Access f		Area		ar flux		g	FF		Gains	
			Table	6d	m²	w	//m²	•	ific data able 6b	specific d or Table		W	
				r		- —							
East			0.77	7 X	1.94				0.63 x		= [(76)
West			0.77	7 X	9.68	x 19	9.64 x	0.9 x 0	0.63 x	0.70	=	58.10	(80)
Solar gains in wa	atts ∑(74)m	(82)m											
	69.75	136.44	224.70	327.71	401.62	411.13	391.41	336.22	261.33	161.90	86.97	57.36	(83)
Total gains - inte	ernal and so	lar (73)m +	(83)m										
	405.79	470.74	548.65	635.09	692.40	685.71	655.33	605.15	538.66	455.98	400.29	384.90	(84)
		· · · ·										·	
7. Mean intern	al tempera	ture (heatin	g season)										
Temperature du	ring heating	g periods in	the living a	irea from T	able 9, Th1	.(°C)						21.00	(85)
	Jan	Feb	Mar	Apr	Мау	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation facto	r for gains f	or living area	a n1,m (se	e Table 9a)									

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1.00

(86)

0.50

0.36

0.41

0.66

0.93

0.99

0.99

0.99

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

0.96

0.87

0.69

	20.08	20.25	20.52	20.81	20.95	20.99	21.00	21.00	20.97	20.75	20.36	20.05	(87)
Temperature du	uring heating	g periods in	the rest of	dwelling fi	rom Table 9	ə, Th2(°C)							
	20.08	20.08	20.08	20.09	20.10	20.11	20.11	20.11	20.10	20.10	20.09	20.09	(88)
Utilisation facto	r for gains for	or rest of d	welling n2,	n	1						1	1	_ • •
	0.99	0.98	0.95	0.83	0.64	0.43	0.29	0.33	0.59	0.90	0.98	0.99	(89)
Mean internal to		in the rest	of dwelling		steps 3 to	7 in Table 9	e)	1			1	1	_ • •
	18.86	19.11	19.49	19.88	20.06	20.10	20.11	20.11	20.08	19.82	19.28	18.83	(90)
Living area fract	ion				I					ving area ÷	(4) =	0.47	(91)
Mean internal to	emperature	for the wh	ole dwellin	g fLA x T1 +	-(1 - fLA) x 1	F2							_
	19.43	19.64	19.97	20.32	20.48	20.52	20.53	20.53	20.50	20.26	19.79	19.40	(92)
Apply adjustme	nt to the me	an interna	l temperatu	ire from Ta	ble 4e whe	re appropr	iate						
	19.43	19.64	19.97	20.32	20.48	20.52	20.53	20.53	20.50	20.26	19.79	19.40	(93)
					•					•			
8. Space heating	ng requirem	ent							-				
	Jan	Feb	Mar	Apr	Мау	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation facto	r for gains, r	յՠ											-
	0.99	0.98	0.95	0.84	0.66	0.46	0.32	0.37	0.62	0.90	0.98	0.99	(94)
Useful gains, ηn	nGm, W (94)m x (84)m			1							1	-
	402.24	461.54	519.02	535.15	458.64	316.54	211.01	221.07	335.80	412.34	392.68	382.30	(95)
Monthly averag		-								1	1	1	-
	4.30	4.90	6.50	8.90	11.70	14.60	16.60	16.40	14.10	10.60	7.10	4.20	(96)
Heat loss rate fo		-								1			7
	843.49	819.26	746.33	623.69	478.23	318.62	211.22	221.50	346.11	526.06	694.84	837.40	(97)
Space heating re										1		1	7
	328.29	240.39	169.12	63.75	14.58	0.00	0.00	0.00	0.00	84.61	217.56	338.59	
											- [
									Σ(98	8)15, 10		1456.87	_] (98)
Space heating re	equirement	kWh/m²/ye	ear						∑(98	8)15, 10 (98)		1456.87 26.34] (98)] (99)
Space heating re 9a. Energy req		-		stems inclu	Iding micro	-CHP			Σ(ð8				-
		-		stems inclu	iding micro	-CHP			∑(98				-
9a. Energy req	uirements -	individual	heating sys						∑(98				-
9a. Energy req Space heating	uirements - e heat from	individual secondary	heating sys /supplement						∑(98		÷ (4)	26.34] (99)
9a. Energy req Space heating Fraction of space	uirements - e heat from e heat from	individual secondary main syste	heating sys /supplementer em(s)						∑(98	(98)	÷ (4)	0.00] (99)] (201)
9a. Energy req Space heating Fraction of spac Fraction of spac	uirements - e heat from e heat from e heat from	individual secondary, main syste main syste	heating sys /supplemen em(s) em 2							(98)	÷ (4)	26.34 0.00 1.00] (99)] (201)] (202)
9a. Energy req Space heating Fraction of spac Fraction of spac Fraction of spac	uirements - e heat from e heat from e heat from I space heat	individual secondary, main syste main syste from main	heating sys /supplemen em(s) em 2 system 1							(98) 1 - (20	÷ (4)	26.34 0.00 1.00 0.00] (99)] (201)] (202)] (202)
9a. Energy req Space heating Fraction of space Fraction of space Fraction of space Fraction of total	uirements - e heat from e heat from e heat from l space heat	individual secondary main syste main syste from main from main	heating sys /supplemen em(s) em 2 system 1							(98) 1 - (2()2) x [1- (20	÷ (4)	26.34 0.00 1.00 0.00 1.00] (99)] (201)] (202)] (202)] (202)] (204)
9a. Energy req Space heating Fraction of space Fraction of space Fraction of space Fraction of total Fraction of total	uirements - e heat from e heat from e heat from l space heat	individual secondary main syste main syste from main from main	heating sys /supplemen em(s) em 2 system 1				Jul	Aug		(98) 1 - (2()2) x [1- (20	÷ (4)	26.34 0.00 1.00 0.00 1.00 0.00] (99)] (201)] (202)] (202)] (204)] (205)
9a. Energy req Space heating Fraction of space Fraction of space Fraction of space Fraction of total Fraction of total	uirements - e heat from e heat from e heat from space heat ispace heat in system 1 Jan	individual secondary, main syste main syste from main from main (%) Feb	heating sys /supplemen em(s) em 2 system 1 system 2 Mar	ntary system	m (table 11)	Jul	Aug	(20	(98) 1 - (20)2) x [1- (20 (202) x (20	÷ (4)	26.34 0.00 1.00 0.00 1.00 0.00 93.50] (99)] (201)] (202)] (202)] (204)] (205)
9a. Energy req Space heating Fraction of space Fraction of space Fraction of space Fraction of total Fraction of total Efficiency of ma	uirements - e heat from e heat from e heat from space heat ispace heat in system 1 Jan	individual secondary, main syste main syste from main from main (%) Feb	heating sys /supplemen em(s) em 2 system 1 system 2 Mar	ntary system	m (table 11)	Jul 0.00	Aug 0.00	(20	(98) 1 - (20)2) x [1- (20 (202) x (20	÷ (4)	26.34 0.00 1.00 0.00 1.00 0.00 93.50] (99)] (201)] (202)] (202)] (204)] (205)
9a. Energy req Space heating Fraction of space Fraction of space Fraction of space Fraction of total Fraction of total Efficiency of ma	uirements - e heat from e heat from l space heat l space heat in system 1 Jan uel (main sys	individual secondary main syste main syste from main from main (%) Feb stem 1), kW	heating sys /supplemen em(s) em 2 system 1 system 2 Mar Vh/month	ntary system	m (table 11 May) Jun		-	(20 Sep 0.00	(98) 1 - (20)2) x [1- (20 (202) x (20 Oct	÷ (4) (1) = (3)] = (1) = (3) = Nov 232.68	26.34 0.00 1.00 0.00 1.00 0.00 93.50 Dec] (99)] (201)] (202)] (202)] (204)] (205)
9a. Energy req Space heating Fraction of space Fraction of space Fraction of space Fraction of total Fraction of total Efficiency of ma	uirements - e heat from e heat from l space heat l space heat in system 1 Jan uel (main sys	individual secondary main syste main syste from main from main (%) Feb stem 1), kW	heating sys /supplemen em(s) em 2 system 1 system 2 Mar Vh/month	ntary system	m (table 11 May) Jun		-	(20 Sep 0.00	(98) 1 - (20)2) x [1- (20 (202) x (20 Oct 90.49	÷ (4) (1) = (3)] = (1) = (3) = Nov 232.68	26.34 0.00 1.00 0.00 1.00 93.50 Dec 362.13] (99)] (201)] (202)] (202)] (204)] (205)] (206)
9a. Energy req Space heating Fraction of space Fraction of space Fraction of space Fraction of total Fraction of total Efficiency of ma Space heating for	uirements - e heat from e heat from e heat from space heat space heat in system 1 Jan uel (main sys 351.11	individual secondary main syste main syste from main from main (%) Feb stem 1), kW	heating sys /supplemen em(s) em 2 system 1 system 2 Mar Vh/month	ntary system	m (table 11 May) Jun		-	(20 Sep 0.00	(98) 1 - (20)2) x [1- (20 (202) x (20 Oct 90.49	÷ (4) (1) = (3)] = (1) = (3) = Nov 232.68	26.34 0.00 1.00 0.00 1.00 93.50 Dec 362.13] (99)] (201)] (202)] (202)] (204)] (205)] (206)
9a. Energy req Space heating Fraction of space Fraction of space Fraction of space Fraction of total Fraction of total Efficiency of ma Space heating for Water heating	uirements - e heat from e heat from e heat from space heat space heat in system 1 Jan uel (main sys 351.11	individual secondary main syste main syste from main from main (%) Feb stem 1), kW	heating sys /supplemen em(s) em 2 system 1 system 2 Mar Vh/month	ntary system	m (table 11 May) Jun		-	(20 Sep 0.00	(98) 1 - (20)2) x [1- (20 (202) x (20 Oct 90.49	÷ (4) (1) = (3)] = (1) = (3) = Nov 232.68	26.34 0.00 1.00 0.00 1.00 93.50 Dec 362.13] (99)] (201)] (202)] (202)] (204)] (205)] (206)
9a. Energy req Space heating Fraction of space Fraction of space Fraction of space Fraction of total Fraction of total Efficiency of ma Space heating for Water heating	uirements - e heat from e heat from e heat from I space heat I space heat in system 1 Jan uel (main sys 351.11 ter heater 86.48	individual secondary, main syste from main from main (%) Feb stem 1), kW 257.10	heating sys /supplemen em(s) em 2 system 1 system 2 Mar Vh/month 180.87	Apr 68.18	m (table 11 May 15.59) Jun 0.00	0.00	0.00	(20 Sep 0.00 Σ(21:	(98) 1 - (20)2) × [1- (20 (202) × (20 Oct 90.49 1)15, 10	÷ (4)	26.34 0.00 1.00 0.00 1.00 0.00 93.50 Dec 362.13 1558.15] (99)] (201)] (202)] (202)] (204)] (205)] (206)] (211)
9a. Energy req Space heating Fraction of space Fraction of space Fraction of space Fraction of total Fraction of total Efficiency of ma Space heating for Water heating Efficiency of war	uirements - e heat from e heat from e heat from I space heat I space heat in system 1 Jan uel (main sys 351.11 ter heater 86.48	individual secondary, main syste from main from main (%) Feb stem 1), kW 257.10	heating sys /supplemen em(s) em 2 system 1 system 2 Mar Vh/month 180.87	Apr 68.18	m (table 11 May 15.59) Jun 0.00	0.00	0.00	(20 Sep 0.00 Σ(21:	(98) 1 - (20)2) × [1- (20 (202) × (20 Oct 90.49 1)15, 10	÷ (4)	26.34 0.00 1.00 0.00 1.00 0.00 93.50 Dec 362.13 1558.15] (99)] (201)] (202)] (202)] (204)] (205)] (206)] (211)
9a. Energy req Space heating Fraction of space Fraction of space Fraction of space Fraction of total Fraction of total Efficiency of ma Space heating for Water heating Efficiency of war	uirements - e heat from e heat from e heat from l space heat l space heat in system 1 Jan uel (main sys 351.11 ter heater 86.48 uel, kWh/ma	individual secondary, main syste main syste from main from main (%) Feb stem 1), kW 257.10 86.01 onth	heating sys /supplemen em(s) em 2 system 1 system 2 Mar Vh/month 180.87	Apr 68.18 82.79	m (table 11 May 15.59 80.68) Jun 0.00 79.80	0.00 79.80	0.00	(20 Sep 0.00 Σ(21: 79.80	(98) 1 - (20)2) × [1- (20 (202) × (20 Oct 90.49 1)15, 10 83.34	÷ (4) D1) = 3)] = 3)] = 03) = Nov 232.68 12 =1 85.66 185.19	26.34 0.00 1.00 0.00 1.00 93.50 Dec 362.13 1558.15 86.62] (99)] (201)] (202)] (202)] (204)] (205)] (206)] (211)
9a. Energy req Space heating Fraction of space Fraction of space Fraction of space Fraction of total Fraction of total Efficiency of ma Space heating for Water heating Efficiency of war	uirements - e heat from e heat from e heat from l space heat l space heat in system 1 Jan uel (main sys 351.11 ter heater 86.48 uel, kWh/ma	individual secondary, main syste main syste from main from main (%) Feb stem 1), kW 257.10 86.01 onth	heating sys /supplemen em(s) em 2 system 1 system 2 Mar Vh/month 180.87	Apr 68.18 82.79	m (table 11 May 15.59 80.68) Jun 0.00 79.80	0.00 79.80	0.00	(20 Sep 0.00 Σ(21: 79.80	(98) 1 - (20)2) x [1- (20 (202) x (20 Oct 90.49 1)15, 10 83.34 180.71	÷ (4) D1) = 3)] = 3)] = 03) = Nov 232.68 12 =1 85.66 185.19	26.34 0.00 1.00 0.00 93.50 Dec 362.13 1558.15 86.62 196.14] (99)] (201)] (202)] (202)] (204)] (205)] (206)] (206)] (211)] (217)
9a. Energy req Space heating Fraction of space Fraction of space Fraction of space Fraction of total Fraction of total Efficiency of ma Space heating for Water heating Efficiency of wa	uirements - e heat from e heat from e heat from l space heat l space heat in system 1 Jan Jel (main sys 351.11 ter heater 86.48 uel, kWh/me 201.09	individual secondary main syste from main from main (%) Feb stem 1), kW 257.10 86.01 0nth 178.40	heating sys /supplemen em(s) em 2 system 1 system 2 Mar Vh/month 180.87	Apr 68.18 82.79	m (table 11 May 15.59 80.68) Jun 0.00 79.80	0.00 79.80	0.00	(20 Sep 0.00 Σ(21: 79.80	(98) 1 - (20)2) x [1- (20 (202) x (20 Oct 90.49 1)15, 10 83.34 180.71	÷ (4)	26.34 0.00 1.00 0.00 93.50 Dec 362.13 1558.15 86.62 196.14] (99)] (201)] (202)] (202)] (204)] (205)] (206)] (206)] (211)] (217)

					-
Water heating fuel	-			2136.43	
Electricity for pumps, fans and electric keep-hot (Table 4)					
central heating pump or water pump within warm air	heating unit		30.00		(230c
boiler flue fan			45.00		(230e
Total electricity for the above, kWh/year				75.00	(231)
Electricity for lighting (Appendix L)				254.10	(232)
Total delivered energy for all uses		(21	11)(221) + (231) + (232)(237b	= 4023.69	(238)
10a. Fuel costs - individual heating systems including m	nicro-CHP		_		
	Fuel kWh/year		Fuel price	Fuel cost £/year	
Space heating - main system 1	1558.15	х	3.48 x 0.01 =	54.22	(240)
Water heating	2136.43	x	3.48 x 0.01 =	74.35	(247)
Pumps and fans	75.00	x	13.19 x 0.01 =	9.89	(249)
Electricity for lighting	254.10	x	13.19 x 0.01 =	33.52	(250)
Additional standing charges				120.00	(251)
Total energy cost			(240)(242) + (245)(254	= 291.98	(255)
11a. SAP rating - individual heating systems including n	nicro-CHP				
Energy cost deflator (Table 12)				0.42	(256)
Energy cost factor (ECF)				1.22	(257)
SAP value				82.94	
SAP rating (section 13)				83	(258)
SAP band				В	
12a. CO ₂ emissions - individual heating systems includi	ng micro-CHP				
	Energy		Emission factor	Emissions	
	kWh/year		kg CO₂/kWh	kg CO₂/year	
Space heating - main system 1	1558.15	х	0.22 =	336.56	(261)
Water heating	2136.43	x	0.22 =	461.47	(264)
Space and water heating			(261) + (262) + (263) + (264) = 798.03	(265)
Pumps and fans	75.00	×	0.52		(267)
Electricity for lighting			0.52 =	38.93	
	254.10	x	0.52 =	38.93 131.88	(268)
Total CO ₂ , kg/year	254.10	х		131.88	
	254.10	x	0.52 =	131.88) = 968.83	(268)
Total CO ₂ , kg/year Dwelling CO ₂ emission rate El value	254.10	x	0.52 = (265)(271	131.88) = 968.83	(268) (272)
Dwelling CO ₂ emission rate	254.10	x	0.52 = (265)(271	131.88) = 968.83) = 17.52	(268) (272)
Dwelling CO ₂ emission rate El value	254.10	x	0.52 = (265)(271	131.88 968.83 17.52 87.06	(268) (272) (273)
Dwelling CO ₂ emission rate El value El rating (section 14)		x	0.52 = (265)(271	$ \begin{array}{c} 131.88 \\ 968.83 \\ 17.52 \\ \overline{87.06} \\ \overline{87} \\ \end{array} $	(268) (272) (273)
Dwelling CO ₂ emission rate El value El rating (section 14) El band		x	0.52 = (265)(271	$ \begin{array}{c} 131.88 \\ 968.83 \\ 17.52 \\ \overline{87.06} \\ \overline{87} \\ \end{array} $	(268) (272) (273) (273)
Dwelling CO ₂ emission rate El value El rating (section 14) El band 13a. Primary energy - individual heating systems incluc	Sing micro-CHP Energy	x	0.52 = (265)(271 (272) ÷ (4	131.88 968.83 17.52 87.06 87 B Primary Energy	(268) (272) (273) (273)
Dwelling CO ₂ emission rate El value El rating (section 14) El band	ding micro-CHP Energy kWh/year		0.52 = (265)(271 (272) ÷ (4	131.88 968.83 = 968.83 = 17.52 87.06 87 B Primary Energ kWh/year	(268) (272) (273) (274)
Dwelling CO ₂ emission rate El value El rating (section 14) El band 13a. Primary energy - individual heating systems incluc Space heating - main system 1	Sing micro-CHP Energy kWh/year 1558.15	x	0.52 = (265)(271 (272) ÷ (4 Primary factor 1.22 =	<pre>131.88 131.88 968.83 17.52 87.06 87 87 B Primary Energ kWh/year 1900.95 2606.45</pre>	(268) (272) (273) (274) (274)
Dwelling CO ₂ emission rate El value El rating (section 14) El band 13a. Primary energy - individual heating systems incluc Space heating - main system 1 Water heating Space and water heating	Sing micro-CHP Energy kWh/year 1558.15	x	0.52 = (265)(271 (272) ÷ (4) Primary factor 1.22 = 1.22 =	<pre>131.88 131.88 968.83 17.52 87.06 87 87 B Primary Energ kWh/year 1900.95 2606.45</pre>	(268) (272) (273) (273) (274) (274) (261) (264)
Dwelling CO ₂ emission rate El value El rating (section 14) El band 13a. Primary energy - individual heating systems includ Space heating - main system 1 Water heating	ting micro-CHP Energy kWh/year 1558.15 2136.43	x x	$0.52 = (265)(271) (272) \div (4)$ Primary factor $1.22 = (261) + (262) + (263) + (264)$	131.88 131.88 968.83 17.52 87.06 87 B Primary Energ kWh/year 1900.95 2606.45 4507.39	(268) (272) (273) (273) (274) (274) (261) (264) (265)
Dwelling CO ₂ emission rate El value El rating (section 14) El band 13a. Primary energy - individual heating systems includ Space heating - main system 1 Water heating Space and water heating Pumps and fans	ding micro-CHP Energy kWh/year 1558.15 2136.43 75.00	x x x	$\begin{array}{c} \hline 0.52 & = \\ (265)(271) \\ (272) \div (4) \\ \hline \end{array}$ $\begin{array}{c} \mathbf{Primary factor} \\ \hline 1.22 & = \\ \hline 1.22 & = \\ (261) + (262) + (263) + (264) \\ \hline 3.07 & = \end{array}$	131.88 131.88 968.83 17.52 87.06 87 B Primary Energ kWh/year 1900.95 2606.45 4507.39 230.25	(268) (272) (273) (273) (274) (274) (261) (264) (265) (265) (267)

DER Worksheet Design - Draft



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

Assessor name	Dr Forouta	n Parand					As	sessor num	iber	4550		
Client	London Bo	rough of (Camden				Las	st modified		18/11	/2014	
Address	CREC Crogs	land Road	d, Camde	n, London,	NW1 8AY							
1. Overall dwelling dimens	sions							_				
				Δ	area (m²)			age storey ight (m)		Vo	lume (m³)	
Lowest occupied					55.30	<mark>](1a)</mark> x		2.85] (2a) =		157.61	(3a)
Total floor area	(1a) +	(1b) + (1c) + (1d)	(1n) =	55.30] (4)						
Dwelling volume							(3a)	+ (3b) + (3	c) + (3d)(3	n) =	157.61	(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 fan	S							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 pe	r
Infiltration due to chimneys	fluor fans l			160	(ch) , (7	a) + (7b) + (7c) -	0	÷ (5) =		hour	(8)
If a pressurisation test has b			tondod r				· .	-] - (5) =		0.00	_ (8)
Air permeability value, q50,								0 (10)			3.00	(17)
If based on air permeability											0.15	(18)
Number of sides on which the				(8), 0therwi	se (10) – (1	0)					2	(18)
Shelter factor	ne uwening is	shellere	u					1	[0.075 x (19))] _ [0.85	
	a chaltar fac	tor						1-				(20)
Infiltration rate incorporatin									(18) x (2	.0) =	0.13	(21)
Infiltration rate modified for				Mari	lum	11	A	Som	Oct	Nov	Dee	
Jan Monthly average wind spee	Feb	Mar	Apr	Мау	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
5.10		4.90	4.40	4.20	2.80	2.90	2 70	4.00	4.20	4 5 0	4.70	(22)
	5.00	4.90	4.40	4.30	3.80	3.80	3.70	4.00	4.30	4.50	4.70	(22)
Wind factor (22)m ÷ 4	1.25	1 22	1 10	1.09	0.05	0.05	0.02	1.00	1.00	1 1 2	1 1 0] (22a)
1.28 Adjusted infiltration rate (al	1.25	1.23	1.10	1.08	0.95	0.95	0.93	1.00	1.08	1.13	1.18	(22a)
	-				-	0.12	0.12	0.12	0.14	0.14	0.15	(22k)
0.16 Calculate effective air chang	0.16 ge rate for the	0.16 e applicab	0.14 ole case:	0.14	0.12	0.12	0.12	0.13	0.14	0.14	0.15	(22b)
If mechanical ventilation				n							0.50	(23a)
If balanced with heat rec	-				ctor from T	able 4h					68.85	(23a)
a) If balanced mechanica		-	-				r) ÷ 1001				00.05	
0.32	0.32	0.31	0.30	0.29	0.28	0.28	0.27	0.28	0.29	0.30	0.31	(24a)
Effective air change rate - ei	I				0.28	0.28	0.27	0.28	0.29	0.50	0.31	_ (24d)
-				1	0.20	0.20	0.27	0.20	0.20	0 20	0.21	() [)
0.32	0.32	0.31	0.30	0.29	0.28	0.28	0.27	0.28	0.29	0.30	0.31	(25)



3. Heat losses a	and heat lo	ss paramet	er										
Element				Gross rea, m²	Openings m ²	Net A,		U-value W/m²K	A x U W	-	value, /m².K	Ахк, kJ/K	
Door						2.2	20 x	1.00	= 2.20				(26)
Window						16.	.71 x	1.33	= 22.15				(27)
External wall						22.	.70 x	0.18	= 4.09				(29a)
Party wall						49.	.02 x	0.00	= 0.00				(32)
Total area of ext	ternal eleme	ents ∑A, m²				41.	.61						(31)
Fabric heat loss,	W/K = ∑(A	× U)							(26	5)(30) + (1	32) =	28.44	(33)
Heat capacity Cr	m = ∑(А x к)							(28)	.(30) + (32) -	+ (32a)(3	2e) =	N/A	(34)
Thermal mass pa	arameter (T	MP) in kJ/n	n²K									100.00	(35)
Thermal bridges	::Σ(L x Ψ) ca	alculated us	ing Append	dix K								5.76	(36)
Total fabric heat	t loss									(33) + (36) = 🗌	34.20	(37)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ventilation heat	loss calcula	ited month	ly 0.33 x (2	25)m x (5)									
	16.56	16.39	16.22	15.39	15.23	14.40	14.40	14.23	14.73	15.23	15.56	15.89	(38)
Heat transfer co	efficient, W	/K (37)m +	(38)m										
	50.76	50.59	50.43	49.60	49.43	48.60	48.60	48.44	48.94	49.43	49.76	50.10	
Heat loss param	eter (HLP).	W/m²K (39))m ÷ (4)						Average = 2	(39)112,	/12 =	49.56	(39)
	0.92	0.91	0.91	0.90	0.89	0.88	0.88	0.88	0.88	0.89	0.90	0.91	٦
	0.51	0.01	0.01	0.00		0.00	0.00	1 0.00	Average = 2		·	0.90	(40)
Number of days	in month (1	Table 1a)							2	_(· · · / _ · · · /			
	31.00	28.00	31.00	30.00	31.00	30.00	31.00	31.00	30.00	31.00	30.00	31.00	(40)
4. Water heati	ng energy r	equiremen	t										
Assumed occupa	ancy, N											1.85	(42)
Annual average	hot water u	sage in litre	es per day \	Vd,average	= (25 x N) +	36						78.05	(43)
	Jan	Feb	Mar	Apr	Мау	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage	e in litres pe	r day for ea	ich month '	Vd,m = fact	or from Tab	le 1c x (43)						
	85.85	82.73	79.61	76.49	73.36	70.24	70.24	73.36	76.49	79.61	82.73	85.85]
										∑(44)1	.12 =	936.55	(44)
Energy content	of hot wate	r used = 4.1	.8 x Vd,m x	nm x Tm/3	3600 kWh/m	onth (see	Tables 1k	o, 1c 1d)					
	127.31	111.35	114.90	100.17	96.12	82.94	76.86	88.20	89.25	104.01	113.54	123.30	
Distribution loss	0.15 x (45)	Im								∑(45)1	.12 =	1227.97	(45)
	19.10	16.70	17.24	15.03	14.42	12.44	11.53	13.23	13.39	15.60	17.03	18.49	(46)
Storage volume	(litres) inclu	iding any so	olar or WW	'HRS storag	e within sam	ne vessel						110.00	(47)
Water storage lo	oss:												_
b) Manufacture	r's declared	loss factor	is not knov	vn									_
Hot water sto	-		Table 2 (kW	h/litre/day	y)							0.02	(51)
Volume facto												1.03	(52)
Temperature												0.60	(53)
Energy lost fi		torage (kW	'h/day) (47	7) x (51) x (5	52) x (53)							1.03	(54)
Enter (50) or (54												1.03	(55)
Water storage lo			-	1						.	<u> </u>		٦
	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

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

	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)
Primary circuit l	oss for each	month fro	m Table 3										
	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)
Combi loss for e	each month	from Table	3a, 3b or 3	с									
	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 requi	ired for wate	er heating o	alculated f	or each mo	onth 0.85 x	(45)m + (4	6)m + (57)r	n + (59)m +	- (61)m				
	182.59	161.28	170.18	153.67	151.40	136.44	132.14	143.48	142.75	159.29	167.03	178.57	(62)
Solar DHW inpu	t calculated	using Appe	endix G or A	Appendix H									
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(63)
Output from wa	ater heater f	or each mo	onth (kWh/i	month) (62	2)m + (63)m	1							
	182.59	161.28	170.18	153.67	151.40	136.44	132.14	143.48	142.75	159.29	167.03	178.57]
										∑(64)1	12 = 1	.878.81	(64)
Heat gains from	water heat	ing (kWh/n	nonth) 0.25	5 × [0.85 ×	(45)m + (61)m] + 0.8 ×	: [(46)m + (!	57)m + (59)	m]				
	86.55	76.97	82.43	76.10	76.18	70.37	69.78	73.55	72.47	78.81	80.55	85.22	(65)
5. Internal gain				-					-	-		_	
	Jan	Feb	Mar	Apr	Мау	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains	. ,		[~	1	-
	92.31	92.31	92.31	92.31	92.31	92.31	92.31	92.31	92.31	92.31	92.31	92.31	(66)
Lighting gains (o			-						1		F		-
	14.35	12.75	10.37	7.85	5.87	4.95	5.35	6.96	9.34	11.85	13.83	14.75	(67)
Appliance gains	(calculated	in Appendi	x L, equatio	on L13 or L:	13a), also se	ee Table 5							-
	160.96	162.63	158.42	149.46	138.15	127.52	120.42	118.75	122.95	131.92	143.23	153.86	(68)
Cooking gains (o	calculated in	Appendix	L, equation	L15 or L15	a), also see	Table 5							_
	32.23	32.23	32.23	32.23	32.23	32.23	32.23	32.23	32.23	32.23	32.23	32.23	(69)
Pump and fan g	ains (Table 5	5a)											-
	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. evap	•												_
	-73.85	-73.85	-73.85	-73.85	-73.85	-73.85	-73.85	-73.85	-73.85	-73.85	-73.85	-73.85	(71)
Water heating g	gains (Table	5)											_
	116.34	114.53	110.79	105.70	102.39	97.74	93.79	98.85	100.65	105.92	111.87	114.54	(72)
Total internal ga	ains (66)m +	+ (67)m + (6	58)m + (69)	m + (70)m	+ (71)m + (7	72)m							
	342.34	340.60	330.27	313.70	297.10	280.90	270.25	275.25	283.64	300.38	319.62	333.84	(73)
6. Solar gains													
			Access f	iactor	Area	Sol	ar flux		a	FF		Gains	
			Table		m²		V/m²	•	g ific data	specific d		W	
								or T	able 6b	or Table	6c		_
East			0.7	7 X	2.79	x 1	9.64 x	0.9 x 🛛 (D.65 x	0.75	=	18.51	(76)
West			0.7	7 X	13.92	x 1	9.64 x	0.9 x 0	D.65 x	0.75	=	92.36	(80)
Solar gains in w	atts ∑(74)m	(82)m											
	110.87	216.89	357.19	520.95	638.44	653.56	622.21	534.47	415.43	257.36	138.25	91.18	(83)
Total gains - inte	ernal and so	lar (73)m +	(83)m										
	453.21	557.49	687.46	834.64	935.54	934.46	892.46	809.72	699.07	557.75	457.87	425.01	(84)
7 Maan intern		turo (beeti											
7. Mean interr						(°C)						21.00	
Temperature du			-				11	۸	for	Oct		21.00	(85)
I Itilication fast-	Jan	Feb	Mar	Apr	Мау	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation facto	n for gains fo	or living are	:a 111,111 (Se	e Table 9a)	1								

	0.92	0.87	0.77	0.62	0.46	0.33	0.24	0.27	0.46	0.72	0.88	0.93	(86)
Mean internal to	emp of livin	g area T1 (s	steps 3 to 7	in Table 9c	:)								
	19.49	19.84	20.30	20.71	20.90	20.98	20.99	20.99	20.93	20.61	19.98	19.43	(87)
Temperature du	uring heating	g periods ir	the rest of	f dwelling fi	rom Table !	9, Th2(°C)	•	•	•		•		-
	20.15	20.15	20.16	20.17	20.17	20.19	20.19	20.19	20.18	20.17	20.17	20.16	(88)
Utilisation facto	r for gains f	1	welling n2,	m	1		1	1	1	1	1	1], ,
	0.91	0.86	0.75	0.59	0.43	0.29	0.19	0.22	0.41	0.69	0.87	0.93	(89)
Mean internal to					1] (,
	18.14	18.64	19.27	19.82	20.07	20.16	20.18	20.18	20.11	19.71	18.85	18.06	(90)
Living area fract		10.04	15.27	15.02	20.07	20.10	20.10	20.10		ving area ÷	·	0.47	(91)
Mean internal to		for the wh	ole dwellin	α fl Λ v T1 μ	L(1 _ fl A) v	тэ			Ľ		(4) -	0.47] (91)
	18.78	19.21	19.76	20.24	20.46	20.55	20.56	20.56	20.50	20.13	19.38	18.71	(92)
Apply adjustma					I		1	20.56	20.50	20.13	19.38	18.71] (92)
Apply adjustme	r	1	1	1		1		20.50	20.50	20.42	10.20	40.74	
	18.78	19.21	19.76	20.24	20.46	20.55	20.56	20.56	20.50	20.13	19.38	18.71	(93)
8. Space heating	ng requirem	ent											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation facto	r for gains,	ŋm		•	•								
	0.90	. 0.84	0.74	0.59	0.44	0.30	0.21	0.25	0.43	0.69	0.85	0.91	(94)
Useful gains, ηn				0.00	0	0.00	0.11	0.20	0110	0.00	0.00	0.51] (0 .)
6 6 6 7 1 1 1 6 7 1 1 1 1 1 1 1 1 1 1 1 1	406.04	468.06	509.61	493.88	410.18	283.72	191.32	199.55	298.14	383.52	389.10	386.10	(95)
Monthly averag		1		1	410.10	205.72	151.52	155.55	250.14	505.52	565.10	500.10] (33)
	4.30	4.90	6.50	8.90	11.70	14.60	16.60	16.40	14.10	10.60	7 10	4.20	
Heat loss rate fo							10.00	10.40	14.10	10.60	7.10	4.20	(96)
Heat loss rate fo			i		1		402.64	204.55	242.42	474.00	644.22	726 70	1 (07)
	734.88	723.87	668.49	562.31	432.99	288.97	192.61	201.55	313.12	471.23	611.33	726.70	(97)
Space heating re		1	1										1
	244.66	171.91	118.21	49.27	16.97	0.00	0.00	0.00	0.00	65.26	160.01	253.41]
									∑(98	3)15, 10		1079.69] (98)]
Space heating re	equirement	kWh/m²/y	ear							(98)	÷ (4)	19.52	(99)
9b. Energy req	uirements -	communit	ty heating s	cheme									
Fraction of spac	e heat from	secondarv	/suppleme	ntarv svste	m (table 11	L)				'0' if r	none	0.00	(301)
Fraction of spac				. , . ,		,				1 - (30		1.00	(302)
Fraction of com										- (-		1.00	(303a)
Fraction of total	-			ers						(302) x (303	3a) =	1.00	(304a)
Factor for contr			-		munity sn	ace heating				(302) x (30		1.00	(305)
Factor for charg												1.00	(305a)
Distribution loss	-											1.00	(306)
Distribution loss		120/101	community	rieating sy	stem							1.05] (300)
Cuese heating													
Space heating									070.00	1			(00)
Annual space he		rement							079.69] (205) (20		400.67	(98)
Space heat from	1 bollers							(98	s) x (304a) x	k (305) x (30	J6) = <u> </u>	133.67	(307a)
Water heating								r		1			1
Annual water he		rement							878.81]			(64)
Water heat from										(305a) x (30		1972.75	(310a)
Electricity used							0.01	. × [(307a)	.(307e) + (3	310a)(310	e)] = [31.06	(313)
Electricity for pu	umps, fans a	ind electric	keep-hot (Table 4f)									

mechanical ventilation fans - balanced, extract or positive input from outside

187.47

(330a)

Total electricity for the above, kWh/year Electricity for lighting (Appendix L)

Total delivered energy for all uses

187.47 (331) 253.42 (332) 3547.31 (338) (307) + (309) + (310) + (312) + (315) + (331) + (332)...(337b) =

10b. Fuel costs - community heating scheme						
	Fuel kWh/year		Fuel price		Fuel cost £/year	
Space heating from boilers	1133.67	x	4.24	x 0.01 =	48.07	(340a)
Water heating from boilers	1972.75	x	4.24	x 0.01 =	83.64	(342a)
Pumps and fans	187.47	х	13.19	x 0.01 =	24.73	(349)
Electricity for lighting	253.42	х	13.19	x 0.01 =	33.43	(350)
Additional standing charges					120.00	(351)
Total energy cost			(340a)(342e) +	(345)(354) =	309.87	(355)
11b. SAP rating - community heating scheme						
Energy cost deflator (Table 12)					0.42	(356)
Energy cost factor (ECF)					1.30	(357)
SAP value					81.90	
SAP rating (section 13)					82	(358)
SAP band					В	

12b. CO₂ emissions - community heating scheme

12b. CO ₂ emissions - commun	inty neating scheme						
		Energy kWh/year		Emission factor		Emissions (kg/year)	
Emissions from other sources (space heating)						
Efficiency of boilers		94.00					(367a)
CO2 emissions from boilers	[(307a)+(310a)] x 100 ÷ (367a) =	3304.70	x	0.216	=	713.81	(367)
Electrical energy for communit	y heat distribution	31.06	х	0.52	=	16.12	(372)
Total CO2 associated with com	munity systems					729.94	(373)
Total CO2 associated with space	e and water heating					729.94	(376)
Pumps and fans		187.47	x	0.52	=	97.30	(378)
Electricity for lighting		253.42	х	0.52	=	131.52	(379)
Total CO₂, kg/year					(376)(382) =	958.76	(383)
Dwelling CO ₂ emission rate					(383) ÷ (4) =	17.34	(384)
El value						87.19]
El rating (section 14)						87	(385)
El band						В]
13b. Primary energy - commu	unity heating scheme						
		Energy kWh/year		Primary factor		Primary energy (kWh/year)	,
Primary energy from other sou	rces (space heating)						
Efficiency of boilers		94.00					(367a)
Primary energy from boilers	[(307a)+(310a)] x 100 ÷ (367a) =	3304.70	x	1.22	=	4031.73	(367)
Electrical energy for communit	y heat distribution	31.06	x	3.07	=	95.37	(372)
Total primary energy associate	d with community systems					4127.10	(373)
Total primary energy associate	d with space and water heating					4127.10	(376)

		Energy kWh/year		Primary factor		Primary energy (kWh/year)	
Primary energy from other sou	rces (space heating)						
Efficiency of boilers		94.00					(367a)
Primary energy from boilers	[(307a)+(310a)] x 100 ÷ (367a) =	3304.70	х	1.22	=	4031.73	(367)
Electrical energy for community	y heat distribution	31.06	х	3.07	=	95.37	(372)
Total primary energy associated	d with community systems					4127.10	(373)
Total primary energy associated	d with space and water heating					4127.10	(376)
Pumps and fans		187.47	х	3.07	=	575.54	(378)
Electricity for lighting		253.42	х	3.07	=	777.99	(379)
						LIRN: 5 y	version 1

Primary energy kWh/year

Dwelling primary energy rate kWh/m2/year

5480.63	(383)
99.11	(384)

DER Worksheet Design - Draft



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

Assessor name		ino Saporit					As	sessor num	ber	5798		
Client	London B	orough of	Camden				La	st modified		27/01	/2015	
Address	CREC Cro	gsland Roa	d, Camde	n, London,	NW1 8AY							
1. Overall dwelling dimen	sions							_				
				4	Area (m²)			age storey eight (m)		Vo	olume (m³)	
Lowest occupied					55.30](1a) x		2.85	(2a) =		157.61	(3a)
Total floor area (1a) + (1b) + (1c) + (1d)(1n) = 55.30 (4)												
Dwelling volume $(3a) + (3b) + (3c) + (3d)(3n) = 157.61$ (5)										(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 fan	S							0	x 10 =	=	0	(7a)
Number of passive vents								0	x 10 =	=	0	(7b)
Number of flueless gas fires	5							0	x 40 =	-	0	(7c)
										Air	changes pe hour	
Infiltration due to chimneys	s. flues. fans	. PSVs		(6a)) + (6b) + (7a	a) + (7b) + (7c) =	0	÷ (5) :	=	0.00	(8)
If a pressurisation test has l			ntended, p					o (16)	(-)			
Air permeability value, q50,	, expressed	in cubic me	etres per l	nour per sq	uare metre	of envelope	e area				3.00	(17)
If based on air permeability value, then $(18) = [(17) \div 20] + (8)$, otherwise $(18) = (16)$ (18)											0.15	
Number of sides on which t				(a), otherwi	se (18) = (1	6)					0.15	
				(o), otherwi	ise (18) = (10	6)		1 -	[0.075 x (1	.9)] =		(18)
Number of sides on which t	he dwelling	is sheltere		a, otherwi	ise (18) = (10	6)		1-	[0.075 x (1 (18) x (1		2] (18)] (19)
Number of sides on which t Shelter factor	he dwelling ng shelter fa	is sheltere	d	(a), otherwi	ise (18) = (10	6)		1 -			2 0.85	(18) (19) (20)
Number of sides on which t Shelter factor Infiltration rate incorporation	he dwelling ng shelter fa	is sheltere	d	May	ise (18) = (10 Jun	6) Jul	Aug	1 - Sep			2 0.85	(18) (19) (20)
Number of sides on which t Shelter factor Infiltration rate incorporation Infiltration rate modified for	he dwelling ng shelter fa r monthly w Feb	is sheltere actor vind speed Mar	d				Aug		(18) x (20) =	2 0.85 0.13	(18) (19) (20)
Number of sides on which t Shelter factor Infiltration rate incorporation Infiltration rate modified for Jan	he dwelling ng shelter fa r monthly w Feb	is sheltere actor vind speed Mar	d				Aug 3.70		(18) x (20) =	2 0.85 0.13	(18) (19) (20)
Number of sides on which t Shelter factor Infiltration rate incorporation Infiltration rate modified for Jan Monthly average wind spee	he dwelling ng shelter fa r monthly w Feb ed from Tabl	; is sheltere actor vind speed Mar le U2	d Apr	Мау	Jun	lut		Sep	(18) x (Oct	20) = Nov	2 0.85 0.13 Dec] (18)] (19)] (20)] (21)
Number of sides on which t Shelter factor Infiltration rate incorporation Infiltration rate modified for Jan Monthly average wind spect 5.10	he dwelling ng shelter fa r monthly w Feb ed from Tabl	; is sheltere actor vind speed Mar le U2	d Apr	Мау	Jun	lut		Sep	(18) x (Oct	20) = Nov	2 0.85 0.13 Dec] (18)] (19)] (20)] (21)
Number of sides on which t Shelter factor Infiltration rate incorporation Infiltration rate modified for Jan Monthly average wind spect 5.10 Wind factor (22)m ÷ 4	he dwelling ng shelter fa r monthly w Feb ed from Tabl 5.00	is sheltere actor vind speed Mar le U2 4.90 1.23	Apr 4.40	May 4.30	Jun 3.80 0.95	Jul 3.80	3.70	Sep	(18) x (Oct 4.30	20) = Nov 4.50	2 0.85 0.13 Dec 4.70] (18)] (19)] (20)] (21)] (22)
Number of sides on which t Shelter factor Infiltration rate incorporation Infiltration rate modified for Jan Monthly average wind speet 5.10 Wind factor (22)m ÷ 4 1.28	he dwelling ng shelter fa r monthly w Feb ed from Tabl 5.00	is sheltere actor vind speed Mar le U2 4.90 1.23	Apr 4.40	May 4.30	Jun 3.80 0.95	Jul 3.80	3.70	Sep	(18) x (Oct 4.30	20) = Nov 4.50	2 0.85 0.13 Dec 4.70] (18)] (19)] (20)] (21)] (22)
Number of sides on which t Shelter factor Infiltration rate incorporation Infiltration rate modified for Jan Monthly average wind spect 5.10 Wind factor (22)m ÷ 4 1.28 Adjusted infiltration rate (a	he dwelling ng shelter fa r monthly w Feb ed from Tabl 5.00 1.25 Ilowing for s	is sheltere actor vind speed Mar le U2 4.90 1.23 shelter and 0.16	4.40 1.10 wind fact	May 4.30 1.08 tor) (21) x (2	Jun 3.80 0.95 22a)m	Jul 3.80 0.95	3.70 0.93	Sep 4.00 1.00	(18) x (Oct 4.30	20) = Nov 4.50	2 0.85 0.13 Dec 4.70) (18) (19) (20) (21)) (22)) (22a)
Number of sides on which t Shelter factor Infiltration rate incorporation Infiltration rate modified for Jan Monthly average wind spece 5.10 Wind factor (22)m ÷ 4 1.28 Adjusted infiltration rate (a 0.16	the dwelling ng shelter fa r monthly w Feb ed from Tabl 5.00 1.25 Ilowing for s 0.16 ge rate for t	is sheltere actor vind speed Mar le U2 4.90 1.23 shelter and 0.16 he applical	4.40 1.10 wind fact 0.14 ble case:	May 4.30 1.08 tor) (21) x (2 0.14	Jun 3.80 0.95 22a)m	Jul 3.80 0.95	3.70 0.93	Sep 4.00 1.00	(18) x (Oct 4.30	20) = Nov 4.50	2 0.85 0.13 Dec 4.70) (18) (19) (20) (21)) (22)) (22a)
Number of sides on which t Shelter factor Infiltration rate incorporation Infiltration rate modified for Jan Monthly average wind speet 5.10 Wind factor (22)m ÷ 4 1.28 Adjusted infiltration rate (a 0.16 Calculate effective air changed)	the dwelling ng shelter fa r monthly w Feb ed from Tabl 5.00 1.25 Ilowing for s 0.16 ge rate for t n: air change	is sheltere actor vind speed Mar le U2 4.90 1.23 shelter and 0.16 he applicate e rate throu	Apr 4.40 1.10 wind fact 0.14 ole case: ugh syster	May 4.30 1.08 tor) (21) x (2 0.14	Jun 3.80 0.95 22a)m 0.12	Jul 3.80 0.95 0.12	3.70 0.93	Sep 4.00 1.00	(18) x (Oct 4.30	20) = Nov 4.50	2 0.85 0.13 Dec 4.70 1.18 0.15) (18) (19) (20) (21)) (22)) (22)) (22a)) (22b)
Number of sides on which t Shelter factor Infiltration rate incorporation Infiltration rate modified for Jan Monthly average wind spece 5.10 Wind factor (22)m ÷ 4 1.28 Adjusted infiltration rate (a 0.16 Calculate effective air changed) If mechanical ventilation	the dwelling ng shelter fa r monthly w Feb ed from Tabl 5.00 1.25 Ilowing for s 0.16 ge rate for t n: air change covery: effic	is sheltere actor vind speed Mar le U2 4.90 1.23 shelter and 0.16 he applicate e rate throus ciency in %	Apr 4.40 1.10 wind fact 0.14 ole case: ugh syster allowing f	May 4.30 1.08 tor) (21) x (2 0.14 n for in-use fa	Jun 3.80 0.95 22a)m 0.12 actor from T	Jul 3.80 0.95 0.12	0.93 0.12	Sep 4.00 1.00	(18) x (Oct 4.30	20) = Nov 4.50	2 0.85 0.13 Dec 4.70 1.18 0.15) (18) (19) (20) (21)) (22)) (22)) (22a)) (22a)) (22b)) (23a)
Number of sides on which t Shelter factor Infiltration rate incorporation Infiltration rate modified for Jan Monthly average wind speet 5.10 Wind factor (22)m ÷ 4 1.28 Adjusted infiltration rate (a 0.16 Calculate effective air changed If mechanical ventilation If balanced with heat res	the dwelling ng shelter fa r monthly w Feb ed from Tabl 5.00 1.25 Ilowing for s 0.16 ge rate for t n: air change covery: effic	is sheltere actor vind speed Mar le U2 4.90 1.23 shelter and 0.16 he applicate e rate throus ciency in %	Apr 4.40 1.10 wind fact 0.14 ole case: ugh syster allowing f	May 4.30 1.08 tor) (21) x (2 0.14 n for in-use fa	Jun 3.80 0.95 22a)m 0.12 actor from T	Jul 3.80 0.95 0.12	0.93 0.12	Sep 4.00 1.00	(18) x (Oct 4.30	20) = Nov 4.50	2 0.85 0.13 Dec 4.70 1.18 0.15) (18) (19) (20) (21)) (22)) (22)) (22a)) (22a)) (22b)) (23a)
Number of sides on which t Shelter factor Infiltration rate incorporation Infiltration rate modified for Jan Monthly average wind spece 5.10 Wind factor (22)m ÷ 4 1.28 Adjusted infiltration rate (a 0.16 Calculate effective air changed If mechanical ventilation If balanced with heat re- a) If balanced mechanica	he dwelling ng shelter fa r monthly w Feb ed from Tabl 5.00 1.25 Ilowing for s 0.16 ge rate for t n: air change covery: effic al ventilation 0.32	is sheltere actor vind speed Mar le U2 4.90 1.23 shelter and 0.16 the applical e rate throus ciency in % n with hea 0.31	Apr Apr 4.40 1.10 wind fact 0.14 ole case: ugh syster allowing f t recovery 0.30	May 4.30 1.08 tor) (21) x (2 0.14 n for in-use fa for in-use fa (MVHR) (2 0.29	Jun 3.80 0.95 22a)m 0.12 actor from T 2b)m + (23k	Jul 3.80 0.95 0.12 able 4h b) x [1 - (23)	3.70 0.93 0.12 c) ÷ 100]	Sep 4.00 1.00 0.13	(18) x (Oct 4.30 1.08	20) = Nov 4.50 1.13 0.14	2 0.85 0.13 Dec 4.70 1.18 0.15 0.50 68.85) (18) (19) (20) (21)) (21)) (22)) (22a)) (22a)) (22b)) (22b)) (23a)] (23c)



3. Heat losses a	and heat lo	ss paramet	er.										
Element			а	Gross rea, m²	Openings m ²		area m²	U-value W/m²K	A x U W	•	value, /m².K	Ахк, kJ/K	
Door						2.	20 x	1.00	= 2.20				(26)
Window						16	.71 x	1.33	= 22.15	5			(27)
External wall						22	.70 x	0.18	= 4.09				(2 9a
Party wall						49	.02 x	0.00	= 0.00				(32)
Total area of ext	ternal eleme	ents ∑A, m ²	2			41	.61						(31)
Fabric heat loss,	W/K = ∑(A	× U)							(2	6)(30) + (32) =	28.44	(33)
Heat capacity Cr	m = ∑(А x к)							(28)	.(30) + (32)	+ (32a)(3	2e) =	N/A	(34)
Thermal mass p	arameter (T	·MP) in kJ/r	m²K									100.00	(35)
Thermal bridges	s: Σ(L x Ψ) ca	alculated u	sing Appen	dix K								5.76	(36)
Total fabric heat										(33) + (36) =	34.20	(37)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ventilation heat	loss calcula	ited month	ily 0.33 x (2	25)m x (5)									
	16.56	16.39	16.22	15.39	15.23	14.40	14.40	14.23	14.73	15.23	15.56	15.89	(38)
Heat transfer co													
	50.76	50.59	50.43	49.60	49.43	48.60	48.60	48.44	48.94	49.43	49.76	50.10	7
									Average =		·	49.56	 (39)
Heat loss param	eter (HLP),	W/m²K (39	9)m ÷ (4)							2()			
·	0.92	0.91	0.91	0.90	0.89	0.88	0.88	0.88	0.88	0.89	0.90	0.91	7
								1	Average =)		·	0.90	(40)
Number of days	in month (1	Fable 1a)								2()			
,	31.00	28.00	31.00	30.00	31.00	30.00	31.00	31.00	30.00	31.00	30.00	31.00	(40)
											1	1	
4. Water heati	ng energy r	equiremen	it										
Assumed occupa	ancy, N											1.85	(42)
Annual average	hot water u	isage in litr	es per day '	Vd,average	= (25 x N) +	36						78.05	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage	e in litres pe	r day for ea	ach month	Vd,m = fact	or from Tabl	le 1c x (43)						
	85.85	82.73	79.61	76.49	73.36	70.24	70.24	73.36	76.49	79.61	82.73	85.85	
										∑(44)1	.12 =	936.55	(44)
Energy content	of hot wate	r used = 4.:	18 x Vd,m x	nm x Tm/3	8600 kWh/m	onth (see	Tables 1b	, 1c 1d)					
	127.31	111.35	114.90	100.17	96.12	82.94	76.86	88.20	89.25	104.01	113.54	123.30	
										∑(45)1	.12 =	1227.97	(45)
Distribution loss	6 0.15 x (45))m											
	19.10	16.70	17.24	15.03	14.42	12.44	11.53	13.23	13.39	15.60	17.03	18.49	(46)
Storage volume	(litres) inclu	uding any s	olar or WW	'HRS storag	e within sam	ne vessel						110.00	(47)
Water storage lo	oss:												
b) Manufacture	r's declared	loss factor	is not know	vn									
Hot water sto	orage loss fa	actor from	Table 2 (kV	h/litre/day	y)							0.02	(51)
Volume facto	or from Tab	le 2a										1.03	(52)
													7,
Temperature	e factor fron	n Table 2b										0.60	(53)
			/h/day) (47	7) x (51) x (5	52) x (53)							0.60	(53) (54)
Temperature	rom water s		/h/day) (47	7) x (51) x (5	52) x (53)								
Temperature Energy lost fi	rom water s 1) in (55)	torage (kW			52) x (53)							1.03	(54)
Temperature Energy lost fi Enter (50) or (54	rom water s 1) in (55)	torage (kW			52) x (53) 32.01	30.98	32.01	32.01	30.98	32.01	30.98	1.03	(54)

	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)
Primary circuit l	loss for each	month fro	m Table 3										
	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)
Combi loss for e	each month	from Table	3a, 3b or 3	с									
	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 requi	ired for wate	er heating o	calculated f	or each mo	onth 0.85 x	(45)m + (4	6)m + (57)r	n + (59)m +	- (61)m				
	182.59	161.28	170.18	153.67	151.40	136.44	132.14	143.48	142.75	159.29	167.03	178.57	(62)
Solar DHW inpu	it calculated	using Appe	endix G or A	Appendix H									
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(63)
Output from wa	ater heater f	or each mo	onth (kWh/	month) (62	2)m + (63)m	1							
	182.59	161.28	170.18	153.67	151.40	136.44	132.14	143.48	142.75	159.29	167.03	178.57]
										∑(64)1	12 = 1	.878.81	(64)
Heat gains from	n water heat	ing (kWh/n	nonth) 0.2	5 × [0.85 ×	(45)m + (61)m] + 0.8 ×	: [(46)m + (!	57)m + (59)	m]				
	86.55	76.97	82.43	76.10	76.18	70.37	69.78	73.55	72.47	78.81	80.55	85.22	(65)
5. Internal gain				-				-	-			_	
	Jan	Feb	Mar	Apr	Мау	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains	, ,											1	-
	92.31	92.31	92.31	92.31	92.31	92.31	92.31	92.31	92.31	92.31	92.31	92.31	(66)
Lighting gains (o	r		-								. <u> </u>		-
	14.35	12.75	10.37	7.85	5.87	4.95	5.35	6.96	9.34	11.85	13.83	14.75	(67)
Appliance gains			-	1				_					٦
	160.96	162.63	158.42	149.46	138.15	127.52	120.42	118.75	122.95	131.92	143.23	153.86	(68)
Cooking gains (o	calculated in	Appendix	L, equation	1	a), also see								-
	32.23	32.23	32.23	32.23	32.23	32.23	32.23	32.23	32.23	32.23	32.23	32.23	(69)
Pump and fan g	ains (Table 5	5a)											-
	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. evap	•												_
	-73.85	-73.85	-73.85	-73.85	-73.85	-73.85	-73.85	-73.85	-73.85	-73.85	-73.85	-73.85	(71)
Water heating g	gains (Table	5)											_
	116.34	114.53	110.79	105.70	102.39	97.74	93.79	98.85	100.65	105.92	111.87	114.54	(72)
Total internal ga	ains (66)m +	- (67)m + (6	68)m + (69)	m + (70)m	+ (71)m + (7	72)m							_
	342.34	340.60	330.27	313.70	297.10	280.90	270.25	275.25	283.64	300.38	319.62	333.84	(73)
6. Solar gains													
0. 50101 80113			Access	actor	Area	Sol	ar flux		g	FF		Gains	
			Table		m ²		V/m²	spec	б ific data	specific d	lata	W	
								or T	able 6b	or Table	6c		
East			0.7	7 X	2.79	x 1	9.64 x	0.9 x 0).65 x	0.75	=	18.51	(76)
West			0.7	7 X	13.92	x 1	9.64 x	0.9 x 🚺).65 x	0.75	=	92.36	(80)
Solar gains in w	atts ∑(74)m	(82)m											
	110.87	216.89	357.19	520.95	638.44	653.56	622.21	534.47	415.43	257.36	138.25	91.18	(83)
Total gains - inte	ernal and so	lar (73)m +	(83)m										
	453.21	557.49	687.46	834.64	935.54	934.46	892.46	809.72	699.07	557.75	457.87	425.01	(84)
7.00													
7. Mean interr	-					(° 0)							7,
Temperature du			•					_	<u> </u>	c :		21.00	(85)
	Jan	Feb	Mar	Apr	Мау	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation facto	or tor gains f	or living are	ea n1,m (se	e Table 9a)	1								

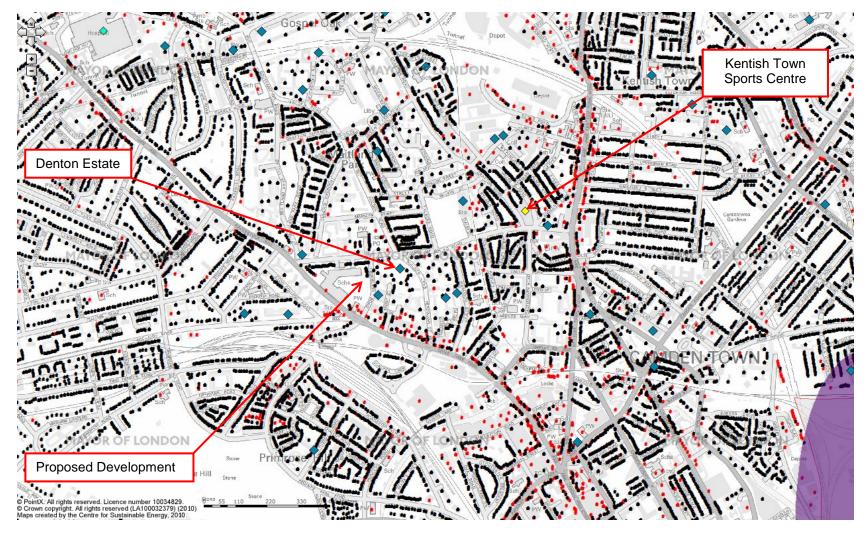
	0.92	0.87	0.77	0.62	0.46	0.33	0.24	0.27	0.46	0.72	0.88	0.93	(86)
Mean internal t	emp of livin	g area T1 (s	steps 3 to 7	' in Table 9d	c)								
	19.49	19.84	20.30	20.71	20.90	20.98	20.99	20.99	20.93	20.61	19.98	19.43	(87)
Temperature du	uring heating	g periods ir	n the rest of	f dwelling f	rom Table !	9, Th2(°C)	•	•	•		•		-
	20.15	20.15	20.16	20.17	20.17	20.19	20.19	20.19	20.18	20.17	20.17	20.16	(88)
Utilisation facto	or for gains f	1	welling n2,	m			1	1		1	1	4], ,
	0.91	0.86	0.75	0.59	0.43	0.29	0.19	0.22	0.41	0.69	0.87	0.93	(89)
Mean internal t					1			0.22	0.11	0.05	0.07	0.55] (03)
	18.14	18.64	19.27	19.82	20.07	20.16	20.18	20.18	20.11	19.71	18.85	18.06	(90)
Living and fur of		10.04	19.27	19.02	20.07	20.10	20.18	20.18			·		ייב ר
Living area fract		for the same	- I	- (1 A T4	(4 fl A)	.			Lr	ving area ÷	(4) =	0.47	(91)
Mean internal t	-		1	-	1	1	0.00				10.00		1 (00)
	18.78	19.21	19.76	20.24	20.46	20.55	20.56	20.56	20.50	20.13	19.38	18.71	(92)
Apply adjustme		1	1	1		1					1		1
	18.78	19.21	19.76	20.24	20.46	20.55	20.56	20.56	20.50	20.13	19.38	18.71	(93)
8. Space heati	ng requirem	ent											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation facto			With		Ividy	Jun	501	Aug	Jep	000		Dec	
	,		0.74	0.50	0.44	0.20	0.21	0.25	0.42	0.00	0.05	0.01	
	0.90	0.84	0.74	0.59	0.44	0.30	0.21	0.25	0.43	0.69	0.85	0.91	(94)
Useful gains, ηn			1					1 100 77		000 -0			1 (0-1)
	406.04	468.06	509.61	493.88	410.18	283.72	191.32	199.55	298.14	383.52	389.10	386.10	(95)
Monthly averag		-	1	1				_					-
	4.30	4.90	6.50	8.90	11.70	14.60	16.60	16.40	14.10	10.60	7.10	4.20	(96)
Heat loss rate for	or mean inte	ernal tempe	erature, Lm	, W [(39)m	ı x [(93)m -	(96)m]							_
	734.88	723.87	668.49	562.31	432.99	288.97	192.61	201.55	313.12	471.23	611.33	726.70	(97)
Space heating re	equirement	, kWh/mon	th 0.024 x	[(97)m - (9	5)m] x (41)	m							
	244.66	171.91	118.21	49.27	16.97	0.00	0.00	0.00	0.00	65.26	160.01	253.41]
									Σ(98	3)15, 10	.12 = 1	L079.69	(98)
Space heating re	equirement	kWh/m²/y	ear							(98)	÷ (4)	19.52	(99)
			_		_								
9b. Energy req													1
Fraction of space				ntary syste	m (table 11	L)				'0' if r		0.00	(301)
Fraction of space	e heat from	communit	y system							1 - (30	01) =	1.00	(302)
Fraction of com	munity heat	from boile	ers									1.00	(303a)
Fraction of total	l space heat	from com	nunity boil	ers						(302) x (303	3a) =	1.00	(304a)
Factor for contr	ol and charg	ging metho	d (Table 4c	(3)) for com	nmunity spa	ace heating						1.00	(305)
Factor for charg	ing method	(Table 4c(3	3)) for com	munity wat	er heating							1.00	(305a)
Distribution loss	s factor (Tab	le 12c) for	community	/ heating sy	vstem							1.05	(306)
Space heating													
Annual space he	eating requi	rement						1	.079.69]			(98)
Space heat from	n boilers							(98	3) x (304a) x	- k (305) x (30	06) = 1	1133.67	(307a)
													-
Water heating													
Annual water he	eating requi	rement						1	878.81	1			(64)
Water heat from) (305a) x (30)6) = 1	1972.75	(310a)
Electricity used		tribution					0.01	(04) L × [(307a)				31.06	(313)
Electricity for pu			keen-hot (Table 4f)			0.01				-/1	- 2.00] (313)
				. usic fij									

mechanical ventilation fans - balanced, extract or positive inpu	It from outside	187.47	(330a)
Total electricity for the above, kWh/year			187.47 (331)
Electricity for lighting (Appendix L)			253.42 (332)
Energy saving/generation technologies			
electricity generated by PV (Appendix M)			-608.39 (333)
Total delivered energy for all uses	(307) + (309) + (310) + (312	2) + (315) + (331) + (332)(337b) =	
	(307) + (303) + (310) + (312	-/ * (313) * (331) * (332)(3376) -	2550.51 (550)
10b. Fuel costs - community heating scheme			
	Fuel kWh/year	Fuel price	Fuel cost £/year
Space heating from boilers	1133.67 x	4.24 x 0.01 =	48.07 (340a)
Water heating from boilers	1972.75 x	4.24 x 0.01 =	83.64 (342a)
Pumps and fans	187.47 x	13.19 x 0.01 =	24.73 (349)
Electricity for lighting	253.42 x	13.19 × 0.01 =	33.43 (350)
Additional standing charges	X	X 0.01 -	120.00 (351)
			120.00 (551)
Energy saving/generation technologies			
pv savings	-608.39 x	$13.19 \times 0.01 = (212) \times (212)$	0.00 (352)
Total energy cost		(340a)(342e) + (345)(354) =	309.87 (355)
11b. SAP rating - community heating scheme			
Energy cost deflator (Table 12)			0.42 (356)
Energy cost factor (ECF)			1.30 (357)
SAP value			81.90
SAP rating (section 13)			82 (<mark>358)</mark>
SAP band			В
12b. CO ₂ emissions - community heating scheme			
120. Coz emissions - community neating scheme	Energy	Emission factor	Emissions
12b. Co ₂ emissions - community neating scheme	Energy kWh/year	Emission factor	Emissions (kg/year)
Emissions from other sources (space heating)		Emission factor	
		Emission factor	
Emissions from other sources (space heating)	kWh/year	Emission factor	(kg/year)
Emissions from other sources (space heating) Efficiency of boilers	kWh/year 94.00		(kg/year) (367a)
Emissions from other sources (space heating) Efficiency of boilers CO2 emissions from boilers [(307a)+(310a)] x 100 ÷ (367a) =	kWh/year 94.00 3304.70 x	0.216 =	(kg/year) (367a) 713.81 (367)
Emissions from other sources (space heating) Efficiency of boilers CO2 emissions from boilers [(307a)+(310a)] x 100 ÷ (367a) = Electrical energy for community heat distribution	kWh/year 94.00 3304.70 x	0.216 =	(kg/year) (367a) 713.81 (367) 16.12 (372)
Emissions from other sources (space heating) Efficiency of boilers CO2 emissions from boilers [(307a)+(310a)] x 100 ÷ (367a) = Electrical energy for community heat distribution Total CO2 associated with community systems	kWh/year 94.00 3304.70 x	0.216 =	(kg/year) (367a) 713.81 (367) 16.12 (372) 729.94 (373)
Emissions from other sources (space heating) Efficiency of boilers CO2 emissions from boilers [(307a)+(310a)] x 100 ÷ (367a) = Electrical energy for community heat distribution Total CO2 associated with community systems Total CO2 associated with space and water heating	kWh/year 94.00 3304.70 x 31.06 x	0.216 = 0.52 =	(kg/year) (367a) 713.81 (367) 16.12 (372) 729.94 (373) 729.94 (376)
Emissions from other sources (space heating) Efficiency of boilers CO2 emissions from boilers [(307a)+(310a)] x 100 ÷ (367a) = Electrical energy for community heat distribution Total CO2 associated with community systems Total CO2 associated with space and water heating Pumps and fans	kWh/year 94.00 3304.70 x 31.06 x 187.47 x	0.216 = 0.52 =	(kg/year) (367a) 713.81 (367) 16.12 (372) 729.94 (373) 729.94 (376) 97.30 (378)
Emissions from other sources (space heating) Efficiency of boilers CO2 emissions from boilers [(307a)+(310a)] x 100 ÷ (367a) = Electrical energy for community heat distribution Total CO2 associated with community systems Total CO2 associated with space and water heating Pumps and fans Electricity for lighting	kWh/year 94.00 3304.70 x 31.06 x 187.47 x	0.216 = 0.52 =	(kg/year) (367a) 713.81 (367) 16.12 (372) 729.94 (373) 729.94 (376) 97.30 (378)
Emissions from other sources (space heating) Efficiency of boilers CO2 emissions from boilers [(307a)+(310a)] x 100 ÷ (367a) = Electrical energy for community heat distribution Total CO2 associated with community systems Total CO2 associated with space and water heating Pumps and fans Electricity for lighting Energy saving/generation technologies pv savings	wwh/year 94.00 3304.70 x 31.06 x 187.47 x 253.42 x	$\begin{array}{ c c c c c c c c c c c c c c c c c c c$	(kg/year) (367a) 713.81 (367) 16.12 (372) 729.94 (373) 729.94 (376) 97.30 (378) 131.52 (379) -315.76 (380)
Emissions from other sources (space heating) Efficiency of boilers CO2 emissions from boilers [(307a)+(310a)] x 100 ÷ (367a) = Electrical energy for community heat distribution Total CO2 associated with community systems Total CO2 associated with space and water heating Pumps and fans Electricity for lighting Energy saving/generation technologies pv savings Total CO ₂ , kg/year	wwh/year 94.00 3304.70 x 31.06 x 187.47 x 253.42 x	0.216 = 0.52 = 0.52 = 0.52 = 0.52 = 0.52 = (376)(382) =	(kg/year) (367a) 713.81 (367) 16.12 (372) 729.94 (373) 729.94 (376) 97.30 (378) 131.52 (379) -315.76 (380) 643.00 (383)
Emissions from other sources (space heating) Efficiency of boilers CO2 emissions from boilers [(307a)+(310a)] x 100 ÷ (367a) = Electrical energy for community heat distribution Total CO2 associated with community systems Total CO2 associated with space and water heating Pumps and fans Electricity for lighting Energy saving/generation technologies pv savings Total CO ₂ , kg/year Dwelling CO ₂ emission rate	wwh/year 94.00 3304.70 x 31.06 x 187.47 x 253.42 x	$\begin{array}{ c c c c c c c c c c c c c c c c c c c$	(kg/year) (367a) 713.81 (367) 16.12 (372) 729.94 (373) 729.94 (376) 97.30 (378) 131.52 (379) -315.76 (380) 643.00 (383) 11.63 (384)
Emissions from other sources (space heating) Efficiency of boilers CO2 emissions from boilers [(307a)+(310a)] x 100 ÷ (367a) = Electrical energy for community heat distribution Total CO2 associated with community systems Total CO2 associated with space and water heating Pumps and fans Electricity for lighting Energy saving/generation technologies pv savings Total CO ₂ , kg/year Dwelling CO ₂ emission rate El value	wwh/year 94.00 3304.70 x 31.06 x 187.47 x 253.42 x	0.216 = 0.52 = 0.52 = 0.52 = 0.52 = 0.52 = (376)(382) =	(kg/year) (367a) 713.81 (367) 16.12 (372) 729.94 (373) 729.94 (376) 97.30 (378) 131.52 (379) -315.76 (380) -315.76 (380) 4 643.00 (383) 11.63 (384) 91.41
Emissions from other sources (space heating) Efficiency of boilers CO2 emissions from boilers [(307a)+(310a)] x 100 ÷ (367a) = Electrical energy for community heat distribution Total CO2 associated with community systems Total CO2 associated with space and water heating Pumps and fans Electricity for lighting Energy saving/generation technologies pv savings Total CO ₂ , kg/year Dwelling CO ₂ emission rate	wwh/year 94.00 3304.70 x 31.06 x 187.47 x 253.42 x	0.216 = 0.52 = 0.52 = 0.52 = 0.52 = 0.52 = (376)(382) =	(kg/year) (367a) 713.81 (367) 16.12 (372) 729.94 (373) 729.94 (376) 97.30 (378) 131.52 (379) -315.76 (380) 643.00 (383) 11.63 (384)
Emissions from other sources (space heating) Efficiency of boilers CO2 emissions from boilers [(307a)+(310a)] x 100 ÷ (367a) = Electrical energy for community heat distribution Total CO2 associated with community systems Total CO2 associated with space and water heating Pumps and fans Electricity for lighting Energy saving/generation technologies pv savings Total CO ₂ , kg/year Dwelling CO ₂ emission rate El value El rating (section 14) El band	wwh/year 94.00 3304.70 x 31.06 x 187.47 x 253.42 x	0.216 = 0.52 = 0.52 = 0.52 = 0.52 = 0.52 = (376)(382) =	(kg/year) (367a) 713.81 (367) 16.12 (372) 729.94 (373) 729.94 (376) 97.30 (378) 131.52 (379) -315.76 (380) 643.00 (383) 11.63 (384) 91.41 91 (385)
Emissions from other sources (space heating) Efficiency of boilers CO2 emissions from boilers [(307a)+(310a)] x 100 ÷ (367a) = Electrical energy for community heat distribution Total CO2 associated with community systems Total CO2 associated with space and water heating Pumps and fans Electricity for lighting Energy saving/generation technologies pv savings Total CO ₂ , kg/year Dwelling CO ₂ emission rate El value El rating (section 14)	kWh/year 94.00 3304.70 x 31.06 x 187.47 x 253.42 x -608.39 x	$\begin{array}{c} 0.216 \\ = \\ 0.52 \\ = \\ \hline 0.52 \\ = \\ \hline 0.52 \\ = \\ \hline 0.52 \\ = \\ (376)(382) \\ = \\ (383) \div (4) \\ = \\ \end{array}$	(kg/year) (367a) 713.81 (367) 16.12 (372) 729.94 (373) 729.94 (373) 729.94 (376) 97.30 (378) 131.52 (379) -315.76 (380) 643.00 (383) 11.63 (384) 91.41 91 (385) B
Emissions from other sources (space heating) Efficiency of boilers CO2 emissions from boilers [(307a)+(310a)] x 100 ÷ (367a) = Electrical energy for community heat distribution Total CO2 associated with community systems Total CO2 associated with space and water heating Pumps and fans Electricity for lighting Energy saving/generation technologies pv savings Total CO ₂ , kg/year Dwelling CO ₂ emission rate El value El rating (section 14) El band	wwh/year 94.00 3304.70 x 31.06 x 187.47 x 253.42 x	0.216 = 0.52 = 0.52 = 0.52 = 0.52 = 0.52 = (376)(382) =	(kg/year) (367a) 713.81 (367) 16.12 (372) 729.94 (373) 729.94 (376) 97.30 (378) 131.52 (379) -315.76 (380) 643.00 (383) 11.63 (384) 91.41 91 (385)
Emissions from other sources (space heating) Efficiency of boilers CO2 emissions from boilers [(307a)+(310a)] × 100 ÷ (367a) = Electrical energy for community heat distribution Total CO2 associated with community systems Total CO2 associated with space and water heating Pumps and fans Electricity for lighting Energy saving/generation technologies pv savings Total CO ₂ , kg/year Dwelling CO ₂ emission rate El value El rating (section 14) El band 13b. Primary energy - community heating scheme	kWh/year 94.00 3304.70 x 31.06 x 187.47 x 253.42 x -608.39 x	$\begin{array}{c} 0.216 \\ = \\ 0.52 \\ = \\ \hline 0.52 \\ = \\ \hline 0.52 \\ = \\ \hline 0.52 \\ = \\ (376)(382) \\ = \\ (383) \div (4) \\ = \\ \end{array}$	(kg/year) (367a) 713.81 (367) 16.12 (372) 729.94 (373) 729.94 (373) 729.94 (376) 97.30 (378) 131.52 (379) -315.76 (380) 643.00 (383) 11.63 (384) 91.41 91 (385) B
Emissions from other sources (space heating) Efficiency of boilers CO2 emissions from boilers [(307a)+(310a)] x 100 ÷ (367a) = Electrical energy for community heat distribution Total CO2 associated with community systems Total CO2 associated with space and water heating Pumps and fans Electricity for lighting Energy saving/generation technologies pv savings Total CO ₂ , kg/year Dwelling CO ₂ emission rate El value El rating (section 14) El band 13b. Primary energy - community heating scheme Primary energy from other sources (space heating)	94.00 3304.70 x 31.06 x 187.47 x 253.42 x -608.39 x	$\begin{array}{c} 0.216 \\ = \\ 0.52 \\ = \\ \hline 0.52 \\ = \\ \hline 0.52 \\ = \\ \hline 0.52 \\ = \\ (376)(382) \\ = \\ (383) \div (4) \\ = \\ \end{array}$	(kg/year) (367a) 713.81 (367) 16.12 (372) 729.94 (373) 729.94 (376) 97.30 (378) 131.52 (379) -315.76 (380) -315.76 (380) 383) 11.63 (384) 91.41 (384) 91.41 91 (385) B
Emissions from other sources (space heating) Efficiency of boilers CO2 emissions from boilers [(307a)+(310a)] x 100 ÷ (367a) = Electrical energy for community heat distribution Total CO2 associated with community systems Total CO2 associated with space and water heating Pumps and fans Electricity for lighting Energy saving/generation technologies pv savings Total CO ₂ , kg/year Dwelling CO ₂ emission rate El value El rating (section 14) El band 13b. Primary energy - community heating scheme Primary energy from other sources (space heating) Efficiency of boilers	kWh/year 94.00 3304.70 x 31.06 x 187.47 x 253.42 x -608.39 x	$\begin{array}{c} 0.216 \\ = \\ 0.52 \\ = \\ \hline 0.52 \\ = \\ \hline 0.52 \\ = \\ \hline 0.52 \\ = \\ (376)(382) \\ = \\ (383) \div (4) \\ = \\ \end{array}$	(kg/year) (367a) 713.81 (367) 16.12 (372) 729.94 (373) 729.94 (373) 729.94 (376) 97.30 (378) 131.52 (379) -315.76 (380) 643.00 (383) 11.63 (384) 91.41 91 (385) B
Emissions from other sources (space heating) Efficiency of boilers CO2 emissions from boilers [(307a)+(310a)] x 100 ÷ (367a) = Electrical energy for community heat distribution Total CO2 associated with community systems Total CO2 associated with space and water heating Pumps and fans Electricity for lighting Energy saving/generation technologies pv savings Total CO ₂ , kg/year Dwelling CO ₂ emission rate El value El rating (section 14) El band 13b. Primary energy - community heating scheme Primary energy from other sources (space heating)	94.00 3304.70 x 31.06 x 187.47 x 253.42 x -608.39 x	$\begin{array}{c} 0.216 \\ = \\ 0.52 \\ = \\ \hline 0.52 \\ = \\ \hline 0.52 \\ = \\ \hline 0.52 \\ = \\ (376)(382) \\ = \\ (383) \div (4) \\ = \\ \end{array}$	(kg/year) (367a) 713.81 (367) 16.12 (372) 729.94 (373) 729.94 (376) 97.30 (378) 131.52 (379) -315.76 (380) -315.76 (380) 383) 11.63 (384) 91.41 (384) 91.41 91 (385) B

Primary energy from boilers	3304.70	х	1.22	=	4031.73	(367)
Electrical energy for community heat distribution	31.06	х	3.07	=	95.37	(372)
Total primary energy associated with community systems					4127.10	(373)
Total primary energy associated with space and water heating					4127.10	(376)
Pumps and fans	187.47	х	3.07	=	575.54	(378)
Electricity for lighting	253.42	х	3.07	=	777.99	(379)
Energy saving/generation technologies						
Electricity generated - PVs	-608.39	х	3.07	=	-1867.77	(380)
Primary energy kWh/year					3612.86	(383)
Dwelling primary energy rate kWh/m2/year					65.33	(384)

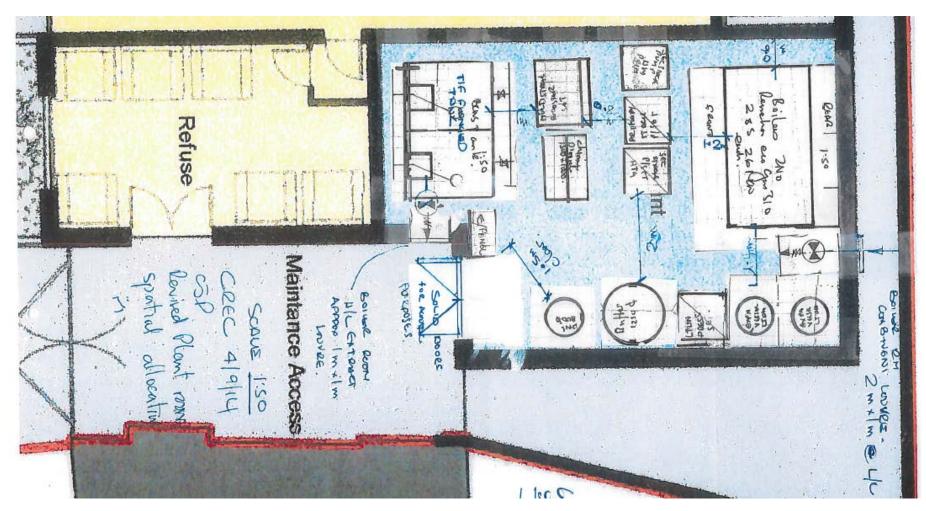


APPENDIX B – LONDON HEAT MAP





APPENDIX C – PLANT ROOM LAYOUT





APPENDIX D – APPRAISAL OF RENEWABLE ENERGY TECHNOLOGIES NOT FEASIBLE FOR THE SCHEME

In line with the Mayor's Energy Hierarchy the feasibility of renewable energy technologies has been carried out for the Proposed Development. Overall, there are a number of constraints associated with the application site when considering their installation. Please refer to Section 8 and the table below.

The following table presents a summary of the technologies considered unsuitable for the site. The technologies have been considered as:

- H High feasibility;
- M Medium feasibility; significant issues would need to be addressed; and

L – Low feasibility; development site not suitable to support the technology.

Technology	Fea	asibi	lity	Comments
	н	м	L	
1. Solar Hot Water (SHW) Systems		>		Active solar hot water technology uses the Sun's energy to heat fluid passing through a collector in an active process. For the Proposed Development, space implications associated with the installation of hot water storage tanks in the basement level plant room or the individual units, as well as the complexity and increased cost resulting from the pipe and plumbing connection, make the SHW system unviable for the scheme. In addition, the roof will be fully utilized from the PV panels and therefore there will be no additional roof area available for further solar technologies'
				installation. Therefore a solar hot water system is not considered feasible for the site.



Technology	Fe	Feasibility		Comments
	н	м	L	
2. Ground Source Heat Pump (GSHP)			~	GSHP technology exploits seasonal temperature differences between ground and air temperatures to provide heating in the winter and air conditioning in the summer.
				GSHP systems use some electricity to run the heat pump, but as most of the energy for heating is taken from the ground, they produce less greenhouse gas than conventional heating systems.
				Pipe work is placed either horizontally or vertically in the ground. Fluid pumped through the pipes takes up heat which is then extracted by the heat pump and released at a higher temperature to drive a space heating system.
				Horizontal systems are considered most suitable for large open-space developments and are therefore not appropriate for the Proposed Development.
				Vertical systems are considered most appropriate for developments with site area restrictions. Typical vertical systems, utilising flow-return water closed-loop configurations, can achieve outputs of approximately 50W/m depth. The Proposed Development could accommodate pile depths of circa 20m each, resulting in around 1kW output per pile.
				Appropriate spacing arrangements should be made between piles to ensure thermal breakthrough is prevented. Such spacing at the Proposed Development suggests that a maximum of 4 piles could be supported onsite, making the maximum output of the system as a whole to be approximately 4kW.
				The expected 3,000 hour heating season means 12MWh of heat could be extracted annually. Typical GSHP seasonal efficiencies of around 350%, displacing currently proposed heating systems, would therefore result in CO_2 savings of approximately 1 tonne per year. These modest CO_2 savings should be balanced against the significant cost implications and design coordination complications of its adoption – it is considered an unviable solution for the Proposed Development, particularly in light of the modest savings that its implementation would achieve.
				Additionally, a GSHP system will not be compatible with any future connection to a DH network, which is being safeguarded onsite.
				Furthermore, a detailed geological survey, including test boreholes, would be required to verify the suitability of ground conditions and accurately estimate the potential capacity of GSHP scheme.
				Due to the constraints mentioned above and due to the increased installation and connection costs, GSHP technology is not considered suitable for this site.



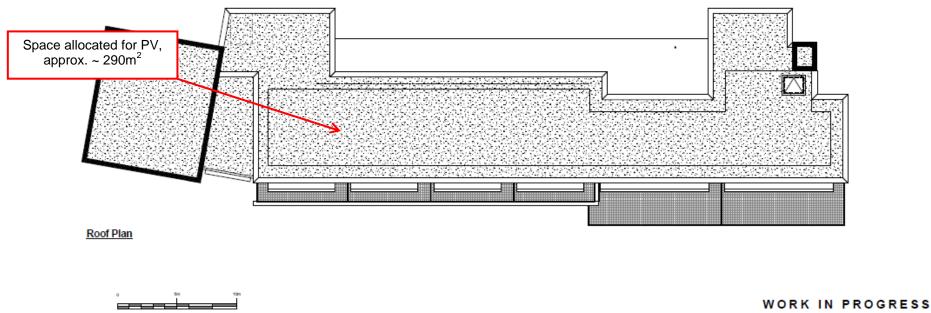
Technology	Fea	Feasibility		Comments
	н	м	L	
3. Wind Power			>	Micro wind turbines can be fitted to the roof of any selected building (given appropriate structural measures). Mast-mounted wind turbines can be located in an open area away from obstructions such as buildings and tall trees.
				A report by BRE^4 highlighted inherent problems and the poor performance to date of urban micro wind installations. Both technologies are considered marginally viable in built environments by the majority of small wind turbine manufacturers ⁵ due to the relatively low (and turbulent) wind speed prevailing in an urban environment. The DECC database indicates a predicted wind speed of 4.9 m/s @ 10m above ground level at nearest postcode.
				Hence, due to the relatively low wind speed and lack of suitable space in this built environment, the use of these technologies is not considered feasible.
4. Biomass Heating			~	Biomass boilers work on the principle that the combustion of wood chip or pellets can create heat for space heating and hot water loads.
				 There are several factors that strongly disadvantage this technology, namely: On-site fuel storage space requirements; The impact on local air quality (concerns exist over the level of Nitrogen dioxide (NO₂) and particulate matter PM₁₀ emissions from biomass boiler installations, particularly in air quality management areas); Fuel sourcing and the cost of fuel; Traffic movement and access arrangements for regular fuel deliveries; and Regular ash removal and maintenance requirements. Biomass boilers are therefore not further considered for the Proposed Development.
5. Energy from Waste			`	Methane gas from sewage or waste can be captured and used for firing boilers. The Proposed Development will not generate sufficient waste to make this option worthwhile. Moreover plant space requirements and emissions (air quality and odour) would be an issue. This option is therefore not considered feasible.

⁴ Micro wind turbine in urban environments, Richard Phillips, Paul Blackmore, Jane Anderson, Michael Clift, Antonio Aguiló-Rullán and Steve Pester, BRE 2007 ISBN 978-1-84806-021-0.

⁵ A report by Poyry on behalf of *Department for Energy and Climate Change* concludes that a wind system of 1.5-15 kW would require an average wind speed of 5.5 m/s to achieve circa 7% load factor.



APPENDIX E – ROOF LAYOUT





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