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Assessor name	Mr Will Belfield	Assessor number	129
Client		Last modified	23/10/2019
Address	Manor Road Richmond Block E, Richmond, TW9		

1. Overall dwelling dimensions

	Area (m ²)	Average storey height (m)	Volume (m ³)
Lowest occupied	<input type="text" value="89.40"/> (1a)	<input type="text" value="2.65"/> (2a)	<input type="text" value="236.91"/> (3a)
Total floor area	(1a) + (1b) + (1c) + (1d)...(1n) =		<input type="text" value="89.40"/> (4)
Dwelling volume	(3a) + (3b) + (3c) + (3d)...(3n) =		<input type="text" value="236.91"/> (5)

2. Ventilation rate

		m ³ per hour
Number of chimneys	<input type="text" value="0"/>	<input type="text" value="0"/> (6a)
Number of open flues	<input type="text" value="0"/>	<input type="text" value="0"/> (6b)
Number of intermittent fans	<input type="text" value="0"/>	<input type="text" value="0"/> (7a)
Number of passive vents	<input type="text" value="0"/>	<input type="text" value="0"/> (7b)
Number of flueless gas fires	<input type="text" value="0"/>	<input type="text" value="0"/> (7c)

	Air changes per hour
Infiltration due to chimneys, flues, fans, PSVs	<input type="text" value="0"/> (8)

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

Air permeability value, q ₅₀ , expressed in cubic metres per hour per square metre of envelope area	<input type="text" value="3.00"/> (17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)	<input type="text" value="0.15"/> (18)
Number of sides on which the dwelling is sheltered	<input type="text" value="2"/> (19)
Shelter factor	<input type="text" value="0.85"/> (20)
Infiltration rate incorporating shelter factor	<input type="text" value="0.13"/> (21)

Infiltration rate modified for monthly wind speed:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table U2	<input type="text" value="5.10"/>	<input type="text" value="5.00"/>	<input type="text" value="4.90"/>	<input type="text" value="4.40"/>	<input type="text" value="4.30"/>	<input type="text" value="3.80"/>	<input type="text" value="3.80"/>	<input type="text" value="3.70"/>	<input type="text" value="4.00"/>	<input type="text" value="4.30"/>	<input type="text" value="4.50"/>	<input type="text" value="4.70"/> (22)

Wind factor (22)m ÷ 4

	<input type="text" value="1.28"/>	<input type="text" value="1.25"/>	<input type="text" value="1.23"/>	<input type="text" value="1.10"/>	<input type="text" value="1.08"/>	<input type="text" value="0.95"/>	<input type="text" value="0.95"/>	<input type="text" value="0.93"/>	<input type="text" value="1.00"/>	<input type="text" value="1.08"/>	<input type="text" value="1.13"/>	<input type="text" value="1.18"/> (22a)
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Adjusted infiltration rate (allowing for shelter and wind factor) (21) x (22a)m

	<input type="text" value="0.16"/>	<input type="text" value="0.16"/>	<input type="text" value="0.16"/>	<input type="text" value="0.14"/>	<input type="text" value="0.14"/>	<input type="text" value="0.12"/>	<input type="text" value="0.12"/>	<input type="text" value="0.12"/>	<input type="text" value="0.13"/>	<input type="text" value="0.14"/>	<input type="text" value="0.14"/>	<input type="text" value="0.15"/> (22b)
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Calculate effective air change rate for the applicable case:

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

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

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

	<input type="text" value="0.28"/>	<input type="text" value="0.28"/>	<input type="text" value="0.27"/>	<input type="text" value="0.26"/>	<input type="text" value="0.25"/>	<input type="text" value="0.24"/>	<input type="text" value="0.24"/>	<input type="text" value="0.24"/>	<input type="text" value="0.25"/>	<input type="text" value="0.25"/>	<input type="text" value="0.26"/>	<input type="text" value="0.27"/> (24a)
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Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in (25)

	<input type="text" value="0.28"/>	<input type="text" value="0.28"/>	<input type="text" value="0.27"/>	<input type="text" value="0.26"/>	<input type="text" value="0.25"/>	<input type="text" value="0.24"/>	<input type="text" value="0.24"/>	<input type="text" value="0.24"/>	<input type="text" value="0.25"/>	<input type="text" value="0.25"/>	<input type="text" value="0.26"/>	<input type="text" value="0.27"/> (25)
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3. Heat losses and heat loss parameter

Element	Gross area, m ²	Openings m ²	Net area A, m ²	U-value W/m ² K	A x U W/K	κ-value, kJ/m ² .K	A x κ, kJ/K					
Window			19.43	1.33	25.76		(27)					
External wall			50.75	0.15	7.61		(29a)					
External wall			20.00	0.01	0.20		(29a)					
Party wall			23.78	0.00	0.00		(32)					
Total area of external elements ΣA, m ²			90.18				(31)					
Fabric heat loss, W/K = Σ(A x U)					(26)...(30) + (32) =	33.57	(33)					
Heat capacity Cm = Σ(A x κ)					(28)...(30) + (32) + (32a)...(32e) =	N/A	(34)					
Thermal mass parameter (TMP) in kJ/m ² K						100.00	(35)					
Thermal bridges: Σ(L x Ψ) calculated using Appendix K						13.89	(36)					
Total fabric heat loss						(33) + (36) =	47.46 (37)					
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ventilation heat loss calculated monthly 0.33 x (25)m x (5)	21.90	21.65	21.40	20.15	19.90	18.66	18.66	18.41	19.15	19.90	20.40	20.90
Heat transfer coefficient, W/K (37)m + (38)m	69.36	69.11	68.86	67.61	67.36	66.12	66.12	65.87	66.61	67.36	67.86	68.36
	Average = Σ(39)1...12/12 =											67.55 (39)
Heat loss parameter (HLP), W/m ² K (39)m ÷ (4)	0.78	0.77	0.77	0.76	0.75	0.74	0.74	0.74	0.75	0.75	0.76	0.76
	Average = Σ(40)1...12/12 =											0.76 (40)
Number of days in month (Table 1a)	31.00	28.00	31.00	30.00	31.00	30.00	31.00	31.00	30.00	31.00	30.00	31.00

4. Water heating energy requirement

Assumed occupancy, N												2.62	(42)	
Annual average hot water usage in litres per day Vd,average = (25 x N) + 36													96.36	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)	106.00	102.15	98.29	94.44	90.58	86.73	86.73	90.58	94.44	98.29	102.15	106.00		
	Σ(44)1...12 =											1156.36 (44)		
Energy content of hot water used = 4.18 x Vd,m x nm x Tm/3600 kWh/month (see Tables 1b, 1c 1d)	157.20	137.48	141.87	123.69	118.68	102.41	94.90	108.90	110.20	128.43	140.19	152.23		
	Σ(45)1...12 =											1516.18 (45)		
Distribution loss 0.15 x (45)m	23.58	20.62	21.28	18.55	17.80	15.36	14.23	16.33	16.53	19.26	21.03	22.84		
Storage volume (litres) including any solar or WWHRS storage within same vessel													194.00	(47)
Water storage loss:														
a) If manufacturer's declared loss factor is known (kWh/day)													1.61	(48)
Temperature factor from Table 2b													0.60	(49)
Energy lost from water storage (kWh/day) (48) x (49)													0.97	(50)
Enter (50) or (54) in (55)													0.97	(55)
Water storage loss calculated for each month (55) x (41)m	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95		
If the vessel contains dedicated solar storage or dedicated WWHRS (56)m x [(47) - Vs] ÷ (47), else (56)	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95		
													(57)	
Primary circuit loss for each month from Table 3														

23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)
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Combi loss for each month from Table 3a, 3b or 3c

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(61)
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Total heat required for water heating calculated for each month $0.85 \times (45)m + (46)m + (57)m + (59)m + (61)m$

210.40	185.54	195.08	175.18	171.89	153.90	148.11	162.11	161.69	181.64	191.68	205.44	(62)
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Solar DHW input calculated using Appendix G or Appendix H

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(63)
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Output from water heater for each month (kWh/month) (62)m + (63)m

210.40	185.54	195.08	175.18	171.89	153.90	148.11	162.11	161.69	181.64	191.68	205.44	
$\Sigma(64)1...12 =$											2142.66	(64)

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

94.83	84.16	89.74	82.32	82.03	75.25	74.12	78.78	77.83	85.27	87.81	93.18	(65)
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5. Internal gains

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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Metabolic gains (Table 5)

130.87	130.87	130.87	130.87	130.87	130.87	130.87	130.87	130.87	130.87	130.87	130.87	(66)
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Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

21.22	18.84	15.32	11.60	8.67	7.32	7.91	10.28	13.80	17.52	20.45	21.80	(67)
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Appliance gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

237.97	240.44	234.22	220.97	204.25	188.53	178.03	175.56	181.78	195.03	211.75	227.47	(68)
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Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

36.09	36.09	36.09	36.09	36.09	36.09	36.09	36.09	36.09	36.09	36.09	36.09	(69)
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Pump and fan gains (Table 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)
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Losses e.g. evaporation (Table 5)

-104.70	-104.70	-104.70	-104.70	-104.70	-104.70	-104.70	-104.70	-104.70	-104.70	-104.70	-104.70	(71)
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Water heating gains (Table 5)

127.47	125.24	120.62	114.33	110.25	104.51	99.62	105.88	108.10	114.61	121.95	125.25	(72)
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Total internal gains (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

448.91	446.78	432.42	409.16	385.43	362.62	347.83	353.99	365.95	389.42	416.42	436.78	(73)
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6. Solar gains

	Access factor Table 6d	Area m ²	Solar flux W/m ²	g specific data or Table 6b	FF specific data or Table 6c	Gains W	
SouthWest	0.77	13.13	36.79	0.9	0.40	0.90	120.52 (79)
NorthWest	0.77	6.30	11.28	0.9	0.40	0.90	17.73 (81)

Solar gains in watts $\Sigma(74)m...(82)m$

138.26	241.40	345.93	454.85	533.41	540.08	516.32	456.10	383.40	271.01	166.67	117.63	(83)
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Total gains - internal and solar (73)m + (83)m

587.17	688.18	778.35	864.02	918.84	902.70	864.14	810.08	749.35	660.44	583.10	554.41	(84)
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7. Mean internal temperature (heating season)

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

21.00	(85)
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Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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Utilisation factor for gains for living area n1,m (see Table 9a)

0.95	0.92	0.86	0.75	0.61	0.45	0.33	0.37	0.56	0.80	0.92	0.96	(86)
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Mean internal temp of living area T1 (steps 3 to 7 in Table 9c)

19.62	19.89	20.24	20.61	20.85	20.96	20.99	20.99	20.92	20.60	20.06	19.57	(87)
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Temperature during heating periods in the rest of dwelling from Table 9, Th2(°C)

20.27	20.28	20.28	20.29	20.29	20.31	20.31	20.31	20.30	20.29	20.29	20.28	(88)
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Utilisation factor for gains for rest of dwelling n2,m

0.94	0.91	0.84	0.73	0.58	0.41	0.28	0.31	0.52	0.77	0.91	0.95	(89)
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Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

18.41	18.80	19.29	19.82	20.13	20.27	20.30	20.30	20.22	19.81	19.05	18.35	(90)
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Living area fraction

Living area ÷ (4) = (91)

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

19.02	19.35	19.77	20.22	20.49	20.62	20.65	20.65	20.57	20.21	19.56	18.97	(92)
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Apply adjustment to the mean internal temperature from Table 4e where appropriate

19.02	19.35	19.77	20.22	20.49	20.62	20.65	20.65	20.57	20.21	19.56	18.97	(93)
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8. Space heating requirement

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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Utilisation factor for gains, ηm

0.93	0.89	0.83	0.73	0.59	0.43	0.31	0.34	0.54	0.77	0.89	0.94	(94)
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Useful gains, ηmGm, W (94)m x (84)m

545.15	613.16	646.50	627.36	538.58	385.11	264.65	275.29	401.94	507.04	520.69	519.82	(95)
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Monthly average external temperature from Table U1

4.30	4.90	6.50	8.90	11.70	14.60	16.60	16.40	14.10	10.60	7.10	4.20	(96)
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Heat loss rate for mean internal temperature, Lm, W [(39)m x ((93)m - (96)m)]

1021.01	998.64	913.88	765.33	592.27	398.06	267.70	279.70	431.02	647.18	845.44	1009.60	(97)
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Space heating requirement, kWh/month 0.024 x ((97)m - (95)m) x (41)m

354.03	259.04	198.93	99.34	39.95	0.00	0.00	0.00	0.00	104.26	233.82	364.40	(98)
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Σ(98)1...5, 10...12 = (98)

Space heating requirement kWh/m²/year

(98) ÷ (4) = (99)

8c. Space cooling requirement

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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Heat loss rate Lm

0.00	0.00	0.00	0.00	0.00	621.49	489.26	500.58	0.00	0.00	0.00	0.00	(100)
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Utilisation factor for loss ηm

0.00	0.00	0.00	0.00	0.00	0.94	0.97	0.96	0.00	0.00	0.00	0.00	(101)
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Useful loss ηmLm (watts) (100)m x (101)m

0.00	0.00	0.00	0.00	0.00	585.50	472.70	479.51	0.00	0.00	0.00	0.00	(102)
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Gains

0.00	0.00	0.00	0.00	0.00	1141.13	1094.27	1032.39	0.00	0.00	0.00	0.00	(103)
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Space cooling requirement, whole dwelling, continuous (kWh) 0.024 x ((103)m - (102)m) x (41)m

0.00	0.00	0.00	0.00	0.00	400.06	462.45	411.34	0.00	0.00	0.00	0.00	(104)
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Σ(104)6...8 = (104)

Cooled fraction

cooled area ÷ (4) = (105)

Intermittency factor (Table 10)

0.00	0.00	0.00	0.00	0.00	0.25	0.25	0.25	0.00	0.00	0.00	0.00	(106)
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Σ(106)6...8 = (106)

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

0.00	0.00	0.00	0.00	0.00	50.68	58.58	52.11	0.00	0.00	0.00	0.00	(107)
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Σ(107)6...8 = (107)

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

9b. Energy requirements - community heating scheme

Fraction of space heat from secondary/supplementary system (table 11)	'0' if none	<input type="text" value="0.00"/>	(301)
Fraction of space heat from community system	1 - (301) =	<input type="text" value="1.00"/>	(302)
Fraction of community heat from boilers		<input type="text" value="1.00"/>	(303a)
Fraction of total space heat from community boilers	(302) x (303a) =	<input type="text" value="1.00"/>	(304a)
Factor for control and charging method (Table 4c(3)) for community space heating		<input type="text" value="1.00"/>	(305)
Factor for charging method (Table 4c(3)) for community water heating		<input type="text" value="1.00"/>	(305a)
Distribution loss factor (Table 12c) for community heating system		<input type="text" value="1.05"/>	(306)

Space heating

Annual space heating requirement	<input type="text" value="1653.78"/>	(98)
Space heat from boilers	(98) x (304a) x (305) x (306) =	<input type="text" value="1736.47"/> (307a)

Water heating

Annual water heating requirement	<input type="text" value="2142.66"/>	(64)
Water heat from boilers	(64) x (303a) x (305a) x (306) =	<input type="text" value="2249.80"/> (310a)
Electricity used for heat distribution	0.01 x [(307a)...(307e) + (310a)...(310e)] =	<input type="text" value="39.86"/> (313)

Cooling System Energy Efficiency Ratio	<input type="text" value="4.05"/>	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	(107) ÷ (314)	<input type="text" value="39.84"/> (315)
Electricity for pumps, fans and electric keep-hot (Table 4f)		
mechanical ventilation fans - balanced, extract or positive input from outside	<input type="text" value="222.55"/>	(330a)
Total electricity for the above, kWh/year	<input type="text" value="222.55"/>	(331)
Electricity for lighting (Appendix L)	<input type="text" value="374.67"/>	(332)
Total delivered energy for all uses	(307) + (309) + (310) + (312) + (315) + (331) + (332)...(337b) =	<input type="text" value="4623.33"/> (338)

10b. Fuel costs - community heating scheme

	Fuel kWh/year		Fuel price		Fuel cost £/year	
Space heating from boilers	<input type="text" value="1736.47"/>	x	<input type="text" value="4.24"/>	x 0.01 =	<input type="text" value="73.63"/>	(340a)
Water heating from boilers	<input type="text" value="2249.80"/>	x	<input type="text" value="4.24"/>	x 0.01 =	<input type="text" value="95.39"/>	(342a)
Space cooling	<input type="text" value="39.84"/>	x	<input type="text" value="13.19"/>	x 0.01 =	<input type="text" value="5.26"/>	(348)
Pumps and fans	<input type="text" value="222.55"/>	x	<input type="text" value="13.19"/>	x 0.01 =	<input type="text" value="29.35"/>	(349)
Electricity for lighting	<input type="text" value="374.67"/>	x	<input type="text" value="13.19"/>	x 0.01 =	<input type="text" value="49.42"/>	(350)
Additional standing charges					<input type="text" value="120.00"/>	(351)
Total energy cost				(340a)...(342e) + (345)...(354) =	<input type="text" value="373.05"/>	(355)

11b. SAP rating - community heating scheme

Energy cost deflator (Table 12)	<input type="text" value="0.42"/>	(356)
Energy cost factor (ECF)	<input type="text" value="1.17"/>	(357)
SAP value	<input type="text" value="83.74"/>	
SAP rating (section 13)	<input type="text" value="84"/>	(358)
SAP band	<input type="text" value="B"/>	

12b. CO₂ emissions - community heating scheme

	Energy kWh/year	Emission factor	Emissions (kg/year)
Emissions from other sources (space heating)			

Efficiency of boilers	89.50								(367a)
CO2 emissions from boilers	$[(307a)+(310a)] \times 100 \div (367a) =$	4453.92	x	0.216	=	962.05			(367)
Electrical energy for community heat distribution		39.86	x	0.519	=	20.69			(372)
Total CO2 associated with community systems						982.74			(373)
Total CO2 associated with space and water heating						982.74			(376)
Space cooling		39.84	x	0.519	=	20.68			(377)
Pumps and fans		222.55	x	0.519	=	115.51			(378)
Electricity for lighting		374.67	x	0.519	=	194.45			(379)
Total CO ₂ , kg/year							(376)..(382) =	1313.37	(383)
Dwelling CO ₂ emission rate							(383) ÷ (4) =	14.69	(384)
El value								86.91	
El rating (section 14)								87	(385)
El band								B	

13b. Primary energy - community heating scheme

	Energy kWh/year		Primary factor		Primary energy (kWh/year)		
Primary energy from other sources (space heating)							
Efficiency of boilers	89.50					(367a)	
Primary energy from boilers	$[(307a)+(310a)] \times 100 \div (367a) =$	4453.92	x	1.22	=	5433.79	(367)
Electrical energy for community heat distribution		39.86	x	3.07	=	122.38	(372)
Total primary energy associated with community systems						5556.17	(373)
Total primary energy associated with space and water heating						5556.17	(376)
Space cooling		39.84	x	3.07	=	122.32	(377)
Pumps and fans		222.55	x	3.07	=	683.24	(378)
Electricity for lighting		374.67	x	3.07	=	1150.23	(379)
Primary energy kWh/year						7511.95	(383)
Dwelling primary energy rate kWh/m ² /year						84.03	(384)