9.0 APPENDIX 2: DETAILS OF ENERGY STUDY

All suitable renewable energy options and low carbon emission technologies are reviewed here to identify those best suited to this development. While some technologies are intrinsically ill suited to this project, others are possible and a calculation of their possible contribution has been made.

Biomass Combustion

Description	**Combustion of plant material as an alternative to gas for firing boilers. Including the growth stage of the total plant cycle, this is a nearly carbon neutral option.**
Visual Impact	**Minimal, though local air quality pollution is an issue.**
Maintenance	**Significant – There are increased requirements for maintenance compared to traditional gas powered boiler plant.**
Feasibility	**A base load biomass boiler could only be used to heat the development. There are concerns in regard to the supply and cost stability of the fuel source and the maintenance requirements of such a system.** **Possible but not practical for this development**

Ground Heating and Cooling Energy Transfer
(Open loop and closed loop systems)

Description	Open loop borehole wells sunk down to the ground water for cooling and/or heating via water cooled chillers and heat pumps. Closed loop systems use coiled underground tube or vertical 'energy piles' to transfer heat between the building and the earth. The higher efficiency attained by this method of heat transfer (compared to traditional air to air systems) can be considered a renewable energy contribution.
Possible Contribution	The ground works and system complication required for these systems are not possible for this development.
Visual Impact	Minimal – this technology is very low profile as the bores and other equipment are in plant areas within the building or underground outside the
Maintenance	Moderate – There is a limited life for the open loop bore holes before they calcify up to a point that they are no longer effective. Filtration of the ground water is required to minimize maintenance requirements due to blockage. Licences issued by the Environmental Agency are at present valid until 2013.
Feasibility	For a simple development, the improvement offered does not justify the complication of expense of the required system and ground works. **Not feasible**

Wind Turbine

Description	Electro-Mechanical device that affects a momentum transfer to convert kinetic energy from a body of moving air into electrical energy for use on site.
Possible Contribution	Less than 1%
Visual Impact	Large – the scale of a turbine installation that would be required to generate any useful amount of power would be highly visible in a sensitive city area.
Maintenance	Moderate. Design also needs to consider vibration and noise.
Specifications	Direct drive, mechanically integrated, weather sealed 10kW permanent magnet generator
Feasibility	**Not practical.**

Photo-Voltaic Solar Energy (PV)

Description	Solar Collectors that convert the electromagnetic radiant energy from the sun into electrical energy.
Possible Contribution	Minimal - A significant renewable energy contribution would require a large and expensive panel array. If a similar area of PVs was installed to the solar thermal design, less than half a percent Carbon reduction is possible.
Capital Repayment Period	Each 1kW peak collector plate could provide 700-750 kWh/yr of power if optimally installed. These units cost £6000 installed. Financial payback periods of photovoltaic installations can be significant and often lay beyond the lifetime of the plant.
Available Grants	The support for photovoltaic systems has been directed toward a small number of high profile demonstration schemes rather than being a guaranteed subsidy to encourage the wide spread implementation of this technology.
Visual Impact	This is minimal for a roof installation.
Maintenance	No maintenance required
Feasibility	Financial payback performance and capital outlay required are prohibitive. **Not feasible**

Solar Water Heating (SWH)

Description	Arrangements of collector units absorb radiant energy from the sun for the purpose of heating hot water.
Possible Contribution	Over 6% of dwelling emissions can be abated by a roof top installation of solar hot water. The limitation for this in the commercial office unit is the low hot water demand.
Capital Repayment Period	Although there are various options of different collector types, a repayment period around 5 years makes this the best option from a cost effectiveness point of view.
Visual Impact	The angled panels on the roof have a minimal visual impact.
Maintenance	Low
Feasibility	The limitation on this type of scheme is the hot water demand. The relatively low cost of the systems allows a fast payback of the additional capital expense. **Feasible, practical and cost effective**

Combined Heat and Power (CHP)

Combined Heat and Power (CHP) is the generation of power on site, with use of the waste heat. If all waste heat can be used, overall efficiencies of up to 85% of input fuel (typically gas) may be obtained, compared to the overall efficiency of centrally generated and distributed power where much waste heat is dumped via cooling towers.

Where there is a large requirement on site for heat, it is cost or Carbon effective to operate a CHP system. It should be noted that any heat that is dumped lowers the overall efficiency of the system in operation and reduces energy cost savings.

Large scale commercial developments can implement an absorption (heat driven) chiller as part of a trigeneration system (gas in, power, coolth and heat out). This makes use of the waste heat from power production to meet the cooling demands of the office.

This development is suitable for onsite power production by CHP as there is sufficient heat demand to make use of waste heat.

10.0 APPENDIX 3: PART L1 COMPLIANCE: DWELLINGS

SAP CALCULATION OF ENERGY RATINGS (ACTUAL BUILDING) SAP 2005 (worksheet version - 9.80) – created by IES <VE> v5.9.2

Project: Residential, 08 June 09, 15:53

Dwelling as designed

1. Overall dwelling dimensions

	Area (m²)			Average storey height (m)		Volume (m³)	
Ground floor	32.25	(1a)	×	3.16	=	101.88	(1)
Other floors	56.16	(2a..4a)	×	2.46	=	138.17	(2 .. 4)
Total floor area (1a) + (2a .. 4a) =	88.41	(5)					
Dwelling volume					(1) + (2) + (3) + (4) =	240.05	(6)

2. Ventilation rate

			m³ per hour	
Number of chimneys	0	× 40 =	0	(7)
Number of open flues	0	× 20 =	0	(8)
Number of intermittent fans or passive vents	0	× 10 =	0	(9)
Number of flueless gas fires	0	× 40 =	0	(9a)

Air changes per hour

Infiltration due to chimneys, flues and fans (7)+(8)+(9)+(9a) = 0 ÷ (6) = box 0.00 (10)

If a pressurisation test has been carried out, proceed to box (19)

Number of storeys in the dwelling 0 (11)

Additional infiltration [(11) - 1] × 0.1 = 0.0 (12)

Structural infiltration: *0.25 for steel or timber frame or 0.35 for masonry construction* 0.00 (13)

If suspended wooden floor, *enter 0.2 (unsealed) or 0.1 (sealed)*, else enter 0 0.0 (14)

If no draught lobby, enter 0.05, else enter 0 0.00 (15)

Percentage of windows and doors draught stripped 0.00 (16)

Enter 100 in box (16) for new dwellings which are to comply with Building Regulations

Window infiltration 0.25 - [0.2 × (16) ÷ 100] = 0.00 (17)

Infiltration rate (10) + (12) + (13) + (14) + (15) + (17) = 0.00 (18)

If based on air permeability value, then [q_{50} ÷ 20]+(10) in box (19), otherwise (19) = (18) 0.25 (19)

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

Number of sides on which sheltered 3 (20)

(Enter 2 in box (20) for new dwellings where location is not shown)

Shelter factor 1 - [0.075 × (20)] = 0.77 (21)

Adjusted infiltration rate (19) × (21) = 0.19 (22)

Calculate effective air change rate for the applicable case

a) If balanced whole house mechanical ventilation with heat recovery (22) + 0.17 = 0.00 (23)

b) If balanced whole house mechanical ventilation without heat recovery (22) + 0.5 = 0.00 (23a)

c) If whole house extract ventilation or positive input ventilation from outside *if (22) < 0.25, then (23b) = 0.5; otherwise (23b) = 0.25 + (22)* 0.00 (23b)

d) If natural ventilation or whole house positive input ventilation from loft *if (22) $\geq$ 1, then (24) = (22); otherwise (24) = 0.5 + [$(22)^2 \times 0.5$]* 0.52 (24)

Effective air change rate - enter (23) or (23a) or (23b) or (24) in box (25) 0.52 (25)

4. Water heating energy requirements

Energy content of hot water used from Table 1 column (b)

Distribution loss from Table 1 column (c)

If instantaneous water heating at point of use, enter "0" in boxes (40) to (45)

For community heating use Table 1 (c) whether or not hot water tank is present

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day):

Temperature factor from Table 2b

Energy lost from water storage, kWh/year (41) × (41a) × 365 =

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

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

If community heating and no tank in dwelling, enter 110 litres in box (43)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in box (43)

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

If community heating and no tank in dwelling, use cylinder loss from Table 2 for 50 mm factory insulatic

Volume factor from Table 2a

Temperature factor from Table 2b

Energy lost from water storage, kWh/year (43) × (44)× (44a) × (44b) × 365

Enter (42) or (45) in box (46)

If cylinder contains dedicated solar storage, box (47) = (46) × [(43) – (H11)] / (43), else (47) = (46)

Primary circuit loss from Table 3

Combi loss from Table 3a (enter "0" if not a combi boiler)

Solar DHW input calculated using Appendix H (enter "0" if no solar collector)

Output from water heater, kWh/year

– (50) =

Heat gains from water heating, kWh/year 0

[(

include (47) in calculation of (52) only if cylinder is in the dwelling or hot water is from community heatir

3. Heat losses and heat loss parameters

ELEMENT	Area (m²)		U-value		A×U (W/K)	
Doors	1.60	×	2.19	=	3.51	(26)
Windows (type 1)*	16.05	×	(1.98) 1.83	=	29.41	(27)
Windows (other types)*	0.00	×	(0.00) 0.00	=	0.00	(27a)
Rooflights*	9.22	×	(2.10) 1.94	=	17.88	(27b)
Ground floor	33.12	×	0.25	=	8.28	(28)
Walls (type 1) *excluding windows and doors*	60.28	×	0.35	=	21.07	(29)
Walls (type 2) *excluding windows and doors*	0.00	×	0.00	=	0.00	(29a)
Roof (type 1) *excluding rooflights*	27.06	×	0.25	=	6.76	(30)
Roof (type 2) *excluding rooflights*	0.00	×	0.00	=	0.00	(30a)
Other	0.00	×	0.00	=	0.00	(31)
Total area of elements ΣA, m²	147.33	(32)				

**for windows and rooflights, use effective window U-value calculated as given in paragraph 3.2*

Fabric heat loss, W/K (26)+(27)+(27a)+(27b)+(28)+(29)+(29a)+(30)+(30a)+(31) = 86.91 (33)

Thermal bridges - Σ (l×Ψ) calculated using Appendix K 11.79 (34)

if details of thermal bridging are not known calculate y×(32) [see Appendix K] and enter in box (34)

Total fabric heat loss (33) + (34) = 98.69 (35)

Ventilation heat loss (25) × 0.33 × (6) = 41.09 (36)

Heat loss coefficient, W/K (35) + (36) = 139.79 (37)

Heat loss parameter (HLP), W/m²K (37) ÷ (5) = 1.58 (38)

4. Water heating energy requirements

	kWh/year	
Energy content of hot water used from Table 1 column (b)	1956	(39)
Distribution loss from Table 1 column (c)	345	(40)

If instantaneous water heating at point of use, enter "0" in boxes (40) to (45)

For community heating use Table 1 (c) whether or not hot water tank is present

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0.00 (41)

Temperature factor from Table 2b 0.00 (41a)

Energy lost from water storage, kWh/year (41) × (41a) × 365 = 0 (42)

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

Cylinder volume (litres) including any solar storage within same cylinder 100 (43)

If community heating and no tank in dwelling, enter 110 litres in box (43)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in box (43)

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.0152 (44)

If community heating and no tank in dwelling, use cylinder loss from Table 2 for 50 mm factory insulation in box (44)

Volume factor from Table 2a 1.063 (44a)

Temperature factor from Table 2b 0.54 (44b)

Energy lost from water storage, kWh/year (43) × (44)× (44a) × (44b) × 365 318 (45)

Enter (42) or (45) in box (46) 318 (46)

If cylinder contains dedicated solar storage, box (47) = (46) × [(43) - (H11)] / (43), else (47) = (46) 318 (47)

Primary circuit loss from Table 3 360 (48)

Combi loss from Table 3a (enter "0" if not a combi boiler) 0 (49)

Solar DHW input calculated using Appendix H (enter "0" if no solar collector) 1125 (50)

Output from water heater, kWh/year (39)+(40)+(47)+(48)+(49) - (50) = 1854 (51)

Heat gains from water heating, kWh/year 0.25 × [(39)+(49)]+0.8 × [(40)+(47)+(48)] = 1053 (52)

include (47) in calculation of (52) only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains

		Watts	
Lights, appliances, cooking and metabolic (Table 5)		520	(53)
Reduction of internal gains due to low energy lighting (calculated in Appendix L)		59	(53a)
Additional gains from Table 5a		0	(53b)
Water heating	(52) ÷ 8.76 =	120	(54)
Total internal gains	(53) + (53b) + (54) - (53a) =	581	(55)

6. Solar gains

	Access factor Table 6d		Area m²		Flux Table 6a		$g_\perp$ Table 6b		FF Table 6c		Gains (W)	
North	(0.00)	×	0.00	×	29	× 0.9 ×	(0.00)	×	(0.00)	=	0	(56)
Northeast	(0.77)	×	16.05	×	34	× 0.9 ×	(0.72)	×	(0.80)	=	218	(57)
East	(0.00)	×	0.00	×	48	× 0.9 ×	(0.00)	×	(0.00)	=	0	(58)
Southeast	(0.00)	×	0.00	×	64	× 0.9 ×	(0.00)	×	(0.00)	=	0	(59)
South	(0.00)	×	0.00	×	72	× 0.9 ×	(0.00)	×	(0.00)	=	0	(60)
Southwest	(0.00)	×	0.00	×	64	× 0.9 ×	(0.00)	×	(0.00)	=	0	(61)
West	(0.00)	×	0.00	×	48	× 0.9 ×	(0.00)	×	(0.00)	=	0	(62)
Northwest	(0.00)	×	0.00	×	34	× 0.9 ×	(0.00)	×	(0.00)	=	0	(63)
Rooflights	(1.00)	×	9.22	×	75	× 0.	(0.72)	×	(0.8	=	342	(64)

			9 ×	0)	

Total solar gains:	[(56) + ... + (64)] =	560	(65)

Note: for new dwellings where overshading is not known, the solar access factor is '0.77'

Total gains, W	(55) + (65) =	1142	(66)
Gain/loss ratio (GLR)	(66) ÷ (37) =	8.17	(67)
Utilisation factor (Table 7, using GLR in box (67)		0.89 0	(68)
Useful gains, W	(66) × (68) =	1016	(69)

7. Mean internal temperature

		°C	
Mean internal temperature of the living area (Table 8)		18.88	(70)
Temperature adjustment from Table 4e, where appropriate		0.00	(71)
Adjustment for gains	{[(69) ÷ (37)] - 4.0} × 0.2 × R =	0.65	(72)
R is obtained from the 'responsiveness' column of Table 4a or Table 4d			
Adjusted living room temperature	(70) + (71) + (72) =	19.53	(73)
Temperature difference between zones (Table 9)		1.50	(74)
Living area fraction (0 to 1.0) **living room area ÷ (5)**	=	0.318	(75)
Rest-of -house fraction	1 - (75) =	0.682	(76)
Mean internal temperature	(73) - [(74) × (76)] =	18.50	(77)

8. Degree days

Temperature rise from gains	(69) ÷ (37) =	7.27	(78)
Base temperature	(77) - (78) =	11.24	(79)
Degree-days, *use box (79) and Table 10*		1187.4	(80)

9. Space heating requirement

Space heating requirement (useful), kWh/year	0.024 × (80) × (37) =	3984	(81)

For range cooker boilers where efficiency is obtained from the Boiler Efficiency Database or manufacturer's declared value, multiply the result in box (81) by (1 – Φ_{case}/Φ_{water}) where Φ_{case} is the heat emission from the case of the range cooker at full load (in kW); and Φ_{water} is the heat transferred to water at full load (in kW). Φ_{case} and Φ_{water} are obtained from the database record for the range cooker boiler or manufacturer's declared value.

9b. Energy requirements - Community heating scheme

This page should used when space and water heating is provided by community heating only, with or without CHP or heat recovered from power stations. If CHP is not involved enter "0" on box (83*), and "1.0" in box (84*)

Overall system efficiency of the heating plant 100.0 (82*)

(100 % minus the amount shown in the 'efficiency adjustment' column of Table 4c(3) where appropriate)

Fraction of heat from CHP unit or fraction of heat recovered from power station 0.50 (83*)

(from operational records or the plant design specification)

Fraction of heat from boilers 1 - (83*) = 0.50 (84*)

Distribution loss factor (Table 12c) 1.05 (85*)

kWh/year

Space heating from CHP or recovered heat, kWh/year [(81) × (83*) × 100] ÷ (82*) × (85*) = 2091 (86*)

Space heating from boilers, kWh/year [(81) × (84*) × 100] ÷ (82*) × (85*) = 2091 (87*)

Water heated by CHP or recovered heat [(51) × (83*) × 100] ÷ (82*) × (85*) = 973 (87a*)

Water heated by boilers [(51) × (84*) × 100] ÷ (82*) × (85*) = 973 (87b*)

Electricity for pumps and fans: from Table 4f for dwellings with mechanical ventilation, otherwise enter "0" 0 (88*)

10b. Fuel costs - Community heating scheme

	Fuel required kWh/year	×	Fuel price (Table 12)		=	Fuel cost £/year	
Space heating							
Space heating (CHP or from power stations)	(86*)	×	1.39	× 0.01 =		29.07	(89*)

For CHP price from Table 12 is irrespective of fuel used by CHP

Space heating (community boilers)	(87*)	×	1.99	× 0.01 =	41.62	(90*)

Water heating

		Fuel price			
Water heated by CHP or recovered heat	(87a*) ×	1.39	× 0.01 =	13.53	(91*)
Water heated by boilers	(87b*) ×	1.99	× 0.01 =	19.37	(92*)

Water heated by immersion heater only; *if not heated by immersion heater, go to box (94*)*

On-peak fraction (Table 13) 1.00 (93*)

Off-peak fraction 1.0 - (93*) = 0.00 (93a*)

	Fuel price			
On-peak cost (51) × (93*) ×	0.00	× 0.01 =	0.00	(93b*)

Off-peak cost (51) × (93a*) ×		0.00	× 0.01 =	0.00	(93c*)
Pump and fan energy cost	(88*) ×	7.12	× 0.01 =	0.00	(94*)
Energy for lighting (calculated in Appendix L)	395 ×	7.12	× 0.01 =	28.10	(94a*)
Additional standing charges (Table 12)				34.00	(94b*)
Renewable and energy-saving technologies (Appendices M and Q)					
PV Energy produced or saved, kWh/year	0	(pv95*)			
Cost of PV energy produced or saved, £/year	(pv95*) ×	0.00	× 0.01 =	0.00	(pv95a*)
Other Energy produced or saved, kWh/year	0	(95*)			
Cost of other energy produced or saved, £/year	(95*) ×	1.63	× 0.01 =	0.00	(95a*)
Energy consumed by the technology, kWh/year	0	(96*)			
Cost of energy consumed, £/year	(96*) ×	1.63	× 0.01 =	0.00	(96a*)
Total heating (89*)+(90*)+(91*)+(92*)+(93b*)+(93c*)+(94*)+(94a*)+(94b*)-(95a*)-(pv95a*) +(96a*)=				165.69	(97*)

11b. SAP rating - Community heating scheme

Energy cost deflator (Table 12)		0.91	(98*)
Energy cost factor (ECF)	{[(97*) × (98*)] - 30.0} ÷ {(5) + 45} =	0.91	(99*)
SAP rating (Table 14)		87	(100*)
SAP band (Table 15)		B	

12b. Dwelling CO_2 Emission Rate (DER) for community heating schemes with CHP or heat recovered from power stations

(for community schemes that recover heat from power stations refer to C2 in Appendix C and omit (101) to (106*))*

	Energy kWh/year		Emission factor kg CO_2/kWh		Emissions (kg CO_2/year)	
Electrical efficiency of CHP unit (e.g. 30%) *from operational records or the CHP design specification*					30	(101*)
Heat efficiency of CHP unit (e.g. 50%) *from operational records or the CHP design specification*					50	(102*)
CO_2 emission factor for the CHP fuel from Table 12			0.194	(103*)		
CO_2 emission factor for electricity generated by CHP (from Table 12)			0.568	(104*)		
CO_2 emitted by CHP per kWh of generated electricity			(103*) ÷ (101*) × 100 =		1	(105*)
Heat to Power ratio *enter if known, otherwise* *(102*) ÷ (101*)*					2	(106*)
CO_2 emission factor for heat			[(105*) - (104*)] / (106*) =		0	(107*)

Note: with CHP the value in box (107) can be negative;*

with heat recovered from power stations enter emission factor for waste heat from Table 12 in box (107)*

	Energy		Emission factor:		Emissions	
Water heated by CHP or recovered heat from power station:	(87a*)	×	(107*)	=	46	(108*)

Energy for water heated by CHP or recovered heat from power stations = (51) × (83) × (85*)*

Efficiency of community boilers % 75.0000 (109*)

use actual efficiency if known, or value in Table 4a

Water heated by boilers:	(87b*) × 100 ÷ (109*)	×	0.194	Table 12 =	252	(110*)
If water heated by immersion heater, box	(51)	×	0.422	Table 12 =	0	(111*)
Space heating from CHP or recovered heat , box	(86*)	×	(107*)	=	99	(112*)
Space heating from boilers	(87*) × 100 ÷ (109*)	×	0.194	Table 12 =	541	(113*)
Electricity for pumps and fans, box	(88*)	×	0.422	Table 12 =	0	(114*)
Total CO_2 associated with boilers, CHP or recovered heat *If negative, enter "1" in box (115*)*			[(108*) + (110*) + ... + (114*)]	=	937	(115*)
Energy for lighting from Appendix L	395	×	0.422	Table 12 =	167	(116*)
Energy produced or saved in dwelling	(95*)	×	0.194	Table 12 =	0	(117*)
Energy consumed by the above technology	(96*)	×	0.194	Table 12 =	0	(118*)
Total CO_2, kg/year			(115*) + (116*) - (117*) + (118*)	=	1104	**(119*)**
Dwelling CO_2 Emission Rate			(119*) ÷ (5)	=	**12.49**	**(120*)**
EI value					88.91	
EI rating					**89**	
EI band					**B**	

13b. Primary energy

(for community schemes that recover heat from power stations refer to C2 in Appendix C and omit (101) to (106*))*

	Energy kWh/year	Primary factor (Table 12)		P.Energy kWh/year	
Electrical efficiency of CHP unit (e.g. 30%) *from operational records or the CHP design specification*				30	(101*)
Heat efficiency of CHP unit (e.g. 50%) *from operational records or the CHP design specification*				50	(102*)
Primary factor for the CHP fuel from Table 12		1.15	(103*)		
Primary factor for electricity generated by CHP (from Table 12)		2.80	(104*)		
Primary energy used by CHP per kWh of generated electricity		(103*) ÷ (101*) × 100 =		4	(105*)
Heat to Power ratio *enter if known, otherwise* *(102*) ÷ (101*)*				2	(106*)

Primary factor for heat	[(105*) - (104*)] / (106*) =				1	(107*)
Note: with CHP the value in box (107) can be negative;* *with heat recovered from power stations enter emission factor for waste heat from Table 12 in box (107*)*						
	Energy		Primary factor:		P.Energy	
Water heated by CHP or recovered heat from power station:	(87a*)	×	(107*)	=	603	(108*)
Energy for water heated by CHP or recovered heat from power stations = (51) × (83) × (85*)*						
Efficiency of community boilers %	75.0000	(109*)				
use actual efficiency if known, or value in Table 4a						
Water heated by boilers:	(87b*) × 100 ÷ (109*)	×	1.15	Table 12 =	1492	(110*)
If water heated by immersion heater, box	(51)	×	2.80	Table 12 =	0	(111*)
Space heating from CHP or recovered heat , box	(86*)	×	(107*)	=	1297	(112*)
Space heating from boilers	(87*) × 100 ÷ (109*)	×	1.15	Table 12 =	3207	(113*)
Electricity for pumps and fans, box	(88*)	×	2.80	Table 12 =	0	(114*)
Total for boilers, CHP or recovered heat	[(108*) + (110*) + ... + (114*)] =				6600	(115*)
If negative, enter "1" in box (115)*						
Energy for lighting from Appendix L	395	×	2.80	Table 12 =	1105	(116*)
Energy produced or saved in dwelling	(95*)	×	1.15	Table 12 =	0	(117*)
Energy consumed by the above technology	(96*)	×	1.15	Table 12 =	0	(118*)
Primary energy, kWh/year	(115*) + (116*) - (117*) + (118*) =				7705	**(119*)**
Primary energy kWh/m^2/year	(119*) ÷ (5) =				**87**	**(120*)**

Summary (SAP 2005):			
	SAP Rating:	**B 87**	
	Emissions:	**B 89**	**1.1 tonnes/year**
	Primary energy:		**87 kWh/m^2/year**

Note: The results of the calculation should not be accepted without first checking the input data.

11.0 APPENDIX 4: PART L2 COMPLIANCE: COMMERCIAL

See included document Commercial_brukl.

12.0 APPENDIX 5: EXAMPLE EPC: COMMERCIAL

See included document Commercial_epc[epc].