**ENERGY STATEMENT REPORT**

**MECHANICAL ENGINEERING SERVICES**

**AT**

**HOLLY LODGE ESTATE PHASE 2**

**FOR**

Camden

**LONDON BOROUGH OF CAMDEN**

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## REVISION HISTORY

| Version No. | Version Date | Summary of Changes | Changes Marked |
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## DISTRIBUTION

This document has been distributed to:

| Name | Title |
|---|---|
| Amanda Peck | Planning Officer – London Borough of Camden |
| | |

## APPROVALS

This document requires the following approvals.

| Name | Title |
|---|---|
| Rolfe Jackson | Director |
| | |

## CONTENTS

## 1.0 EXECUTIVE SUMMARY

The Energy Statement has been prepared to support a combined planning application for the former 85 - 112, 57-84 Makepeace Mansions and 28-54, 89-122 Holly Lodge Mansions.

The site proposal comprises of 39 residential dwellings. The Site has been identified as best served from a Community Gas fired boiler system and a CHP unit which received consent in the Phase 1B application in order to achieved the renewable energy policy.

The following tables provide a comparison of the carbon emissions between the "regulated" and the total emissions. The "regulated" emissions excludes occupational energy use due to such items as computers, washing machines, TV's etc. These summary tables are in the format required by Appendix D of the London Plan Supplementary Planning Guidance. (Sustainable Design and Construction).

The dwellings have demonstrated a carbon emission reduction equal to or more than the required to achieve Eco Homes 'Very Good'.

The team is committing to Eco Homes 'Very Good'; the detailed design and material selections are still to be undertaken and tested for affordability.

Table 1. CO2 comparison Table:

| Block 4 Dwelling Reference | Estimated Existing Building CO2 kg/year | Proposed Building CO2 kg/year | Percentage of improvement | Environmental Impact CO2 Rating |
|---|---|---|---|---|
| **Unit 1** | 4,367 | 2,218.26 | 49 | C |
| **Unit 6** | 3,789 | 1,818.84 | 52 | B |
| **Unit 7** | 3,523 | 1,796.79 | 49 | B |

Table 2. CO2 comparison Table:

| Block 5 Dwelling Reference | Estimated Existing Building CO2 kg/year | Proposed Building CO2 kg/year | Percentage of improvement | Environmental Impact CO2 Rating |
|---|---|---|---|---|
| **Unit 2** | 3,600 | 1,688.50 | 53 | B |
| **Unit 5** | 3,504 | 1,517.25 | 57 | B |
| **Unit 8** | 3,887 | 1,927.80 | 50 | B |

Table 3. CO2 comparison Table:

| Block 6 Dwelling Reference | Estimated Existing Building CO2 kg/year | Proposed Building CO2 kg/year | Percentage of improvement | Environmental Impact CO2 Rating |
|---|---|---|---|---|
| **Unit 2** | 5,598 | 1,903.25 | 66 | C |
| **Unit 7** | 2,416 | 1,227.42 | 49 | B |
| **Unit 8** | 2,520 | 1,249.95 | 50 | B |

Table 4. $CO_2$ comparison Table:

| Block 7 Dwelling Reference | Estimated Existing Building CO2 kg/year | Proposed Building CO2 kg/year | Percentage of improvement | Environmental Impact CO2 Rating |
|---|---|---|---|---|
| **Unit 1** | 3,148 | 1,249.95 | 60 | C |
| **Unit 9** | 2,214 | 1,062.78 | 52 | B |
| **Unit 13** | 3,158 | 1,481.23 | 53 | B |

The dwelling U values have been made low in order to reduce the emissions from the dwellings as detailed below:

Table 5. U-values:

| Element | Part L | This Development | Percentage improvements |
|---|---|---|---|
| **Walls** | 0.30 | 0.22 | 9.1% |
| **Windows** | 2.00 | 1.60 | 20% |
| **External doors** | 2.00 | 1.60 | 20% |
| **Roof** | 0.20 | 0.25 | N/A (existing) |
| **Floor** | 0.25 | 0.70 | N/A (existing) |
| **Air permeability Test** | 10.00 ($m^3/m^2h$ @ 50 Pa) | 5 ($m^3/m^2/hr$ @ 50 Pa) | 50% |

## 2.0 INTRODUCTION

This report has been prepared to provide an outline of the proposed energy strategy for the site proposal at Holly Lodge Estate, Phase 2.

This report has been prepared by Julia Cid, a registered low carbon consultant, with registration number LCC 101780; employed by McBains Cooper.

The Sap calculations have been produced by Stroma **FSAP 2009 program**, version: 1.3.0.39

The proposal for Makepeace site comprises of a conversion of 117 non self contained HMO units (sui generis) into 10 (1 bed), 23 (2 bed) and 6 (3 bed) self contained flats (Class 3) and replacement of existing single glazed windows with double glazed windows.

The client London Borough of Camden has asked for this project to be assessed by EcoHomes certification.

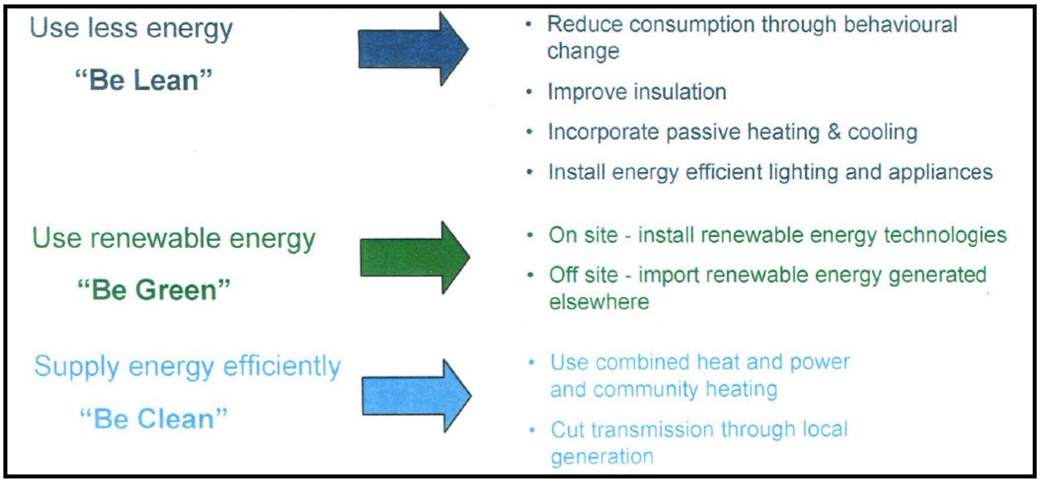
The development comprises of the renovation of 4 apartment blocks to provide 39 No 1, 2 and 3 bed units, which is required to achieve an EcoHomes very good' rating.

The energy statement standard methodologies described within the GLA Toolkit and sustainable design and construction "The London Plan Supplementary Planning Guidance". The energy has been assessed using **FSAP 2009 program**, version: 1.3.0.39 energy modelling procedure with 9.82 update April 2009. The energy attributed to occupation has been separately calculated using the BRE domestic energy model formula described within the Code for Sustainable Homes Guidance Document.

The calculation methods out lined in the Low or Zero Carbon Energy Sources Strategic Guide (NBS May 2010), has been used to estimate the potential contribution from renewable energy sources.

The energy profiles have been reviewed to determine the viability of each renewable energy option. The results are then compared to determine which options offer the best carbon savings for increased cost.

This report will demonstrate how the design has been optimised to reduce energy before considering renewable energy options, inline within the three-step approach:



# 3.0 ENERGY DEMAND ASSESSMENT

## 3.1 Method Adopted

The development has been modelled using the **FSAP 2009 program, version: 1.3.0.39** energy assessment model for domestic dwellings and the additional energy from equipment and occupational use has been estimated using the BRE Domestic Energy Model Formula 12.

Unregulated Energy:

**BREDEM 12 Code for Sustainable Homes guidance documents**

$$kgCO_2 = 99.9(TFA \times N)^{0.4714} - (3.267 \times TFA) + (32.23 \times N) + 72.6$$

$$where$$

$$N = 2.84\left[1 - e^{(-0.000391 \times TFA^2}\right]$$

Where TFA is the Total Floor Area and N is the Number of Occupants.

For TFA < 43m2; N = 1.46.

For full details of the typical dwelling modelled, see the SAP Report in the Appendix 01.

Table 6. Emission Factors:

| Emission Factors | |
|---|---|
| **GAS** | 0.194 $kgCO_2/kWh$ |
| **Electricity** | 0.422 $kgCO_2/kWh$ |
| **Offset Electricity** | 0.568 $kgCO_2/kWh$ |

## 3.2 Energy Breakdown

The energy calculations for each site have been undertaken for the base case, the improved case and the proposed design using the total energy for the sites.

**Base**

The notional energy calculations have been adjusted to represent improved U-values for a building that just passes the building regulations. The emissions from the regulated energy for the base case are on average 3,477 $kgCO_2/m^2$ year. These benchmarks are for a building just passing the current regulations.

**Improved**

The improved model uses the design air permeability rate and U-values from the actual design proposal. The energy from space heating and hot water are the primary energy requirements without the improved boiler efficiencies. This determines the improvement due to energy efficiency without renewable elements.

**Design**

This is the improved case with the adjustments made for the use of an existing community boiler system and domestic hot water heat exchangers.

These calculations have been undertaken using the total estimated energy consumption of the building. The calculation methods are the same as those described with the SAP 2009 guidance documents and the Low or Zero Carbon Technologies Strategic Guide, NBS May 2010.

### 3.3 Site

The following table for Site provides the summary of the SAP calculations and demonstrates the compliance with Eco Homes – Very Good rating.

Table 7. $CO_2$ emissions comparison Table:

| Block 4 Dwelling Reference | Estimated Existing Building CO2 Kg/year | Proposed Building CO2 Kg/year | Percentage of improvement | Environmental Impact CO2 Rating |
|---|---|---|---|---|
| **Unit 1** | 4,367 | 2,218.26 | 49 | C |
| **Unit 6** | 3,789 | 1,818.84 | 52 | B |
| **Unit 7** | 3,523 | 1,796.79 | 49 | B |

Table 8. $CO_2$ emissions comparison Table:

| Block 5 Dwelling Reference | Estimated Existing Building CO2 Kg/year | Proposed Building CO2 Kg/year | Percentage of improvement | Environmental Impact CO2 Rating |
|---|---|---|---|---|
| **Unit 2** | 3,600 | 1,688.50 | 53 | B |
| **Unit 5** | 3,504 | 1,517.25 | 57 | B |
| **Unit 8** | 3,887 | 1,927.80 | 50 | B |

Table 9. $CO_2$ emissions comparison Table:

| Block 6 Dwelling Reference | Estimated Existing Building CO2 Kg/year | Proposed Building CO2 Kg/year | Percentage of improvement | Environmental Impact CO2 Rating |
|---|---|---|---|---|
| **Unit 2** | 5,598 | 1,903.25 | 66 | C |
| **Unit 7** | 2,416 | 1,227.42 | 49 | B |
| **Unit 8** | 2,520 | 1,249.95 | 50 | B |

Table 10. $CO_2$ emissions comparison Table:

| Block 7 Dwelling Reference | Estimated Existing Building CO2 Kg/year | Proposed Building CO2 Kg/year | Percentage of improvement | Environmental Impact CO2 Rating |
|---|---|---|---|---|
| **Unit 1** | 3,148 | 1,249.95 | 60 | C |
| **Unit 9** | 2,214 | 1,062.78 | 52 | B |
| **Unit 13** | 3,158 | 1,481.23 | 53 | B |

The system parameters used in the energy assessment:-

Ventilation efficiency: 93%
Community Hot Water efficiency: 90%

# 4.0 ENERGY EFFICIENT DESIGN

## 4.1 General Principles

The design adopts the principles of passive design before renewable energy options. Passive measures provide savings for the lifetime of the building.

The building therefore is designed to exceed Part L requirements in the following ways:-

- Improved fabric U-Values.
- Reduced air loss through managed ventilation.
- Reduced solar gains.
- Low energy lighting
- Lighting controls
- Optimised window design to limit heat losses whilst achieving improved day-lighting.

## 4.2 Fabric

The external walls, windows and external doors are all designed to exceed Part L 1A requirements.

Table 11. U-values:

| Element | Part L Requirements ($W/m^2K$) | Proposed Values ($W/m^2K$) | Percentage improvements |
|---|---|---|---|
| **Walls** | 0.30 | 0.22 | 9.1% |
| **Windows** | 2.00 | 1.60 | 20% |
| **External doors** | 2.00 | 1.60 | 20% |
| **Roof** | 0.20 | 0.25 | N/A (existing) |
| **Floor** | 0.25 | 0.70 | N/A (existing) |
| **Air permeability Test** | 10.00 ($m^3/m^2h$ @ 50 Pa) | 5 ($m^3/m^2/hr$ @ 50 Pa) | 50% |

Holly Lodge Estate is located in a conservation area.

In assessing reasonable provision for energy efficiency improvement for historic buildings, it is important that the Building Control Body (BCB) takes into account the advice of the Local Authority's Conservation Officer.

The design team is in discussions with Building Control and Camden Council on the U-values shown above.

These improved U-Values will be achieved by using the following details.

## 4.3 Walls

The existing wall consists of a 360mm of brick wall and achieves a U-value of 1.49 $W/m^2K$. It has been proposed to add a 90 mm Gyproc Thermaline super board incorporating a vapour barrier which achieves a U-value of 0.22 $W/m^2K$.

### 4.4 Doors

The external doors will be designed to meet a U-value of 1.6 W/n²K. The external doors will consist of glazing sealed double glazed unit with clear low E glass outer and clear toughened glass inner.

### 4.5 Floor & Roofs

The construction of these elements will be designed to reduce thermal bridging losses at the intersections and junctions of walls and roofs. These elements will be detailed so that the Builder can achieve the required air permeability.

The roof will retain the existing asphalt roof on 150mmmm concrete (clinker) slab with 80mm Celotex FR4080 with a R-value of 3.60 m²K/W and a suspended ceiling of 15mm Soundbloc on MF system.

The Floor will consist of 150mm concrete (clinker) SLAB WITH 25mm Celotex FR4025 with an R-value of 1.10 m²K/W, raised timber floor on battens (void for Under Floor Heating UFH) and 20mm engineered floorboard

The construction of these elements will be designed to reduce thermal bridging losses at the intersections and junctions of walls and roofs. These elements will be detailed so that the Builder can achieve the required air permeability.

### 4.6 Windows

Modern double glazed window units will reduce the thermal losses and solar gains of the room. This is achieved by using composite frames and glazing sealed double glazed unit with clear low E glass outer and clear toughened glass inner giving the window an overall U-Value of 1.6 W/m$^2$k, the choice of solar reducing outer glass and thermal inner glass benefits by reducing solar gains in the room without compromising the loss of light.

Modern window frames are double sealed so that they do not compromise air permeability to the room in the winter. This helps with reducing heat loss from uncontrolled ventilation.

### 4.7 Ventilation

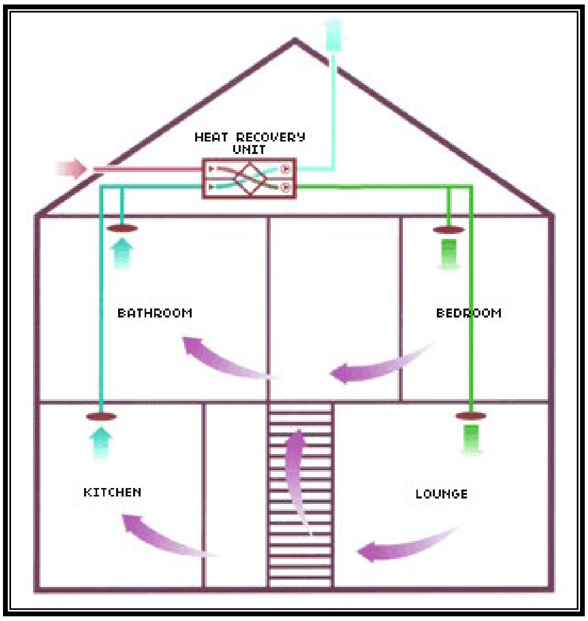
Losses through ventilation have been reduced through the improved air tightness testing, with the design intent to meet 10m$^3$/m$^2$/hr @ 50 Pa, complying with Part L regulations.

This will be achieved by specifying high performing walls, windows and door systems that limit air loss from the apartments. Background ventilation rates will be designed to meet with approved documents Part F.

The ventilation system shall be a continuous Mechanical Extract and Supply Ventilation with Heat Recovery.

The fan motors used in the ventilation system will be 93% efficient. The system used is “System 4 from Greenwood Air Management HRV2”; this system complies with Part L1A and is SAP Appendix Q eligible which helps to reduce ‘Dwelling Emission Rate’ (DER) in SAP.

Wet rooms will be provided with intermittent extract fans controlled by humidity sensors. This will reduce the risk of condensation on any cold surfaces due to the humidity in the air leaving the bathroom or kitchen areas.




Pic 1. Mechanical Ventilation with Heat Recovery

An Independently vented cooker hood extract unit will improve the ventilation of the kitchen and stop smell spreading into the living areas.

The ventilation rates will be designed according to Part F requirements ensuring the dwellings remain fresh and comfortable in winter.

Large window openings provide the means through which summer temperatures can be controlled.

## 4.8 Daylight

Large windows and careful selection of glass type will be undertaken to reduce internal heat gains without reducing daylight. This helps to reduce lighting energy in the summer months.

SAP calculations take into account energy saving due to daylight within the dwelling and the window sizes have been selected to balance the heat loss, purge ventilation, daylight and solar gains.

To address the daylighting section of the Code for Sustainable Homes, the design team will seek to design the key rooms to have average daylight factors of 1.5% and sky views, where possible.

## 4.9 Water Reduction

The dwellings are designed to meet 105 litres per person/day. This reduces the impact of the development on the waste water systems.

Table 12:

| INSTALLATION | DESCRIPTION | WATER USE |
|---|---|---|
| **WC** | DUAL FLUSH CISTERN USING RECOVERED RAINWATER | 6/4 LITRES |
| **WASH HAND BASIN** | LOW FLOW REGULATORS OR AIRATING TAPS | 3.5 LITRES/MIN |
| **BATH** | STANDARD | 135 LITRES |
| **SHOWER** | LOW FLOW RATE BETWEEN | 6 TO 10 LITRES/MIN |
| **KITCHEN SINK** | STANDARD MONOBLOCK | 3.5 LITRES/MIN |
| **WASHING MACHINE*** | BEST PRACTICE | 49 LITRES |
| **DISH WASHER*** | BEST PRACTICE | 16 LITRES |

Sustainable drainage systems will be employed to limit surface water run-off rates and reduce the demand on the local drainage systems.

## 5.0 HEATING SYSTEM

### 5.1 Dwelling Heating Proposals

There is an existing community boiler system with spare capacity from which the proposed building will be connected. This is being upgraded to a more efficient community gas fired boiler system with CHP.

The heating will be distributed to the space via underfloor heating fitted with thermostatic valves.

## 6.0 RENEWABLE ENERGY TECHNOLOGIES

### 6.1 General

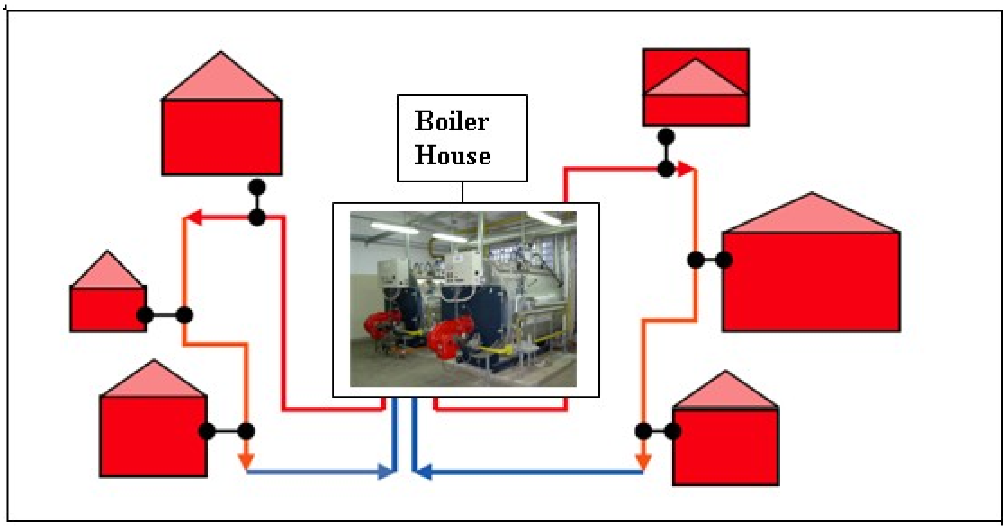
A range of renewable technologies have been considered for this project and are summarised below:-

### 6.2 Central Boiler House

Consideration has been given to maintaining and upgrading the central boiler house which provides heating and domestic hot water to the dwellings through the existing community boiler system.

Each property would have an individual meter which will monitor the heat used for individual billing.

Heat Exchangers would be fitted in each property and connected to the heat main, ensuring that the primary water is re-circulated back to the boiler room. Heat is extracted from the main via the heat exchangers and transferred into the heating systems within individual properties.




Pic. 2. Boiler House Schematic

Some of the benefits of community and district heating systems are:

>Huge environmental gain from lower carbon emissions and higher energy conversion rate
>Provides cheaper heating and hot water for residents
>Creates more usable space within each property
>Reduces maintenance costs
>Reliability delivery by system back up.

### 6.3 Ground Source Heat Pumps

Ground source heat pumps use the refrigeration cycle to take low grade heat from the ground (a renewable source) and deliver it as higher grade heat to a building.

Ground source heat pumps again are considered an inappropriate technology for this site.

The Site is located in central London within a conservation area and it is unsuitable for accommodating the extent of ground loops that will be required and therefore ground source heat pumps will not be used at the Site.

### 6.4 Water heating

Solar water heating utilises solar radiation to heat water for use in domestic hot water heating systems serving the building.
Due to the age and location of the building solar water systems have been discarded. The fitting of this system will affect the overall look of the building and this will have an impact on the conservation.

However the production of domestic hot water will be done via a heat exchanger. This system will extract heat from the heating circuit and will produce hot water to serve the dwellings.

### 6.5 Photovoltaic Panels

Photovoltaic (PV) systems convert energy from the sun into electricity through semi conductor.

For the same reason explained above the fitting of PV systems will affect the overall look of the building; this will have an impact on the conservation.

### 6.6 Wind Turbines

Urban buildings suffer from turbulent air conditions, which reduce the efficiency of Wind Turbines. Average urban wind speeds are lower than usually experienced in a rural site, which will increase the size of the rotor required.

The most common small scale wind turbines range in size between 5kW to 20kW and still require a relatively large rotor and mast which may not be suitable for all locations. Wind turbines put a considerable structural load on to the building which also has to be accommodated.

The roof areas of the development are used by the occupants, and this limits the location and size of the turbine. Wind turbines are not considered to be an inappropriate technology to generate renewable electricity in this site.

### 6.7 Combined Heat & Power (CHP)

The Mayor of London has an expectation for new developments to include combined heat and power (CHP). The (CHP) provision is attractive because the thermo dynamics involved in the generation of the electricity releases a significant amount of heat energy.

Traditionally, the national grid power stations have been located remotely from areas with continuous heating demands and the heat has been allowed to be released to the atmosphere in the very large cooling towers that are a familiar feature of a power station. Generating electricity locally on site can make available the consequentially produced heat for use within the development which makes more efficient use of the embedded energy in the fuel being used.

The proposed building has the benefit from an existing community boiler system therefore CHP has been considered as an appropriate technology for this site.

### 6.8 Biomass

Biomass heating provides the greatest emission reduction when analysed mathematically. A recent code for sustainable homes briefing document has suggested that biomass boilers provide the most cost effective route to achieving code level 4 emission reductions.

Due to the existence of a community gas boiler with spare capacity. This technology is therefore considered to be unsuitable for this particular urban development.

## 7.0 CONCLUSION

A sustainable building must follow three basic principles, Be Lean, Be Clean, Be Green.

- ***Lean***
  Energy efficiency measures; improve building fabric, lighting controls and use

- ***Clean***
  Use of energy efficient heat recovery system for ventilation and heat exchangers for domestic hot water production.

- ***Green***
  Inclusion of Combined Heat and Power (CHP) to produce electricity on-site with virtually no distribution losses and use of 'waste heat' to further reduce use of gas/ electricity.

As the target of the team is to achieve a highly energy efficient dwelling with local equipment sized to deal with the local and orientated heat losses.

Further sustainability features have been considered, but these have been deemed as inappropriate for this site and application as the use. However heat recovery systems have been deemed as suitable for the application and to be cost effective for this development.

The $CO_2$ reduction achieved by the installation is demonstrated below as the Dwelling Emission Rate is between 49% to 66% below the existing emission rate.

Table 13. $CO_2$ emissions comparison Table:

| Block 4 Dwelling Reference | Estimated Existing Building kgCO2/year | Proposed Building kgCO2/year | Percentage of improvement | Environmental Impact CO2 Rating |
|---|---|---|---|---|
| **Unit 1** | 4,367 | 2,218.26 | 49 | C |
| **Unit 6** | 3,789 | 1,818.84 | 52 | B |
| **Unit 7** | 3,523 | 1,796.79 | 49 | B |

Table 14. CO2 emissions comparison Table:

| Block 5 Dwelling Reference | Estimated Existing Building kgCO2/year | Proposed Building kgCO2/year | Percentage of improvement | Environmental Impact CO2 Rating |
|---|---|---|---|---|
| **Unit 2** | 3,600 | 1,688.50 | 53 | B |
| **Unit 5** | 3,504 | 1,517.25 | 57 | B |
| **Unit 8** | 3,887 | 1,927.80 | 50 | B |

Table 15. CO2 emissions comparison Table:

| Block 6 Dwelling Reference | Estimated Existing Building kgCO2/year | Proposed Building kgCO2/year | Percentage of improvement | Environmental Impact CO2 Rating |
|---|---|---|---|---|
| **Unit 2** | 5,598 | 1,903.25 | 66 | C |
| **Unit 7** | 2,416 | 1,227.42 | 49 | B |
| **Unit 8** | 2,520 | 1,249.95 | 50 | B |

Table 16. CO2 emissions comparison Table:

| Block 7 Dwelling Reference | Estimated Existing Building kgCO2/year | Proposed Building kgCO2/year | Percentage of improvement | Environmental Impact CO2 Rating |
|---|---|---|---|---|
| **Unit 1** | 3,148 | 1,249.95 | 60 | C |
| **Unit 9** | 2,214 | 1,062.78 | 52 | B |
| **Unit 13** | 3,158 | 1,481.23 | 53 | B |

The estimated annual consumption of the four blocks is 315,244.2 kWh; this is without including the unregulated loads for such items as TVs, computers, etc

The estimated annual CO2 emissions from regulated uses for the four blocks of flats are 54,778.60 kg of CO2. the expected contribution of the CHP will be a saving of 26,617.14 kgCO2/annum amounting to over 48%.

| Summary of CO2 figures for 4No. Blocks of the Proposed Development | |
|---|---|
| **Regulated CO2 emissions (kgCO2/annum)** | 54,778.60 |
| **CHP saving (kgCO2/annum)** | 26,617.14 |
| **Percentage improvement** | 48% |

**Summary**

The buildings have the benefit from an existing community boiler system and an upgrade to CHP has been proposed as an appropriate technology for this site saving 26,617.14 kgCO2/annum amounting to over 48%.