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# Energy Assessment 124-134 Clerkenwell Road

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## Contents:

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# Executive Summary
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|---|---|
| Introduction: | The proposed commercial scheme comprises of the refurbishment of existing offices to a new 43 bedroom hotel. The proposed development is required by the London Borough of Islington to make carbon emission reductions in accordance with the London Plan's energy hierarchy and meet a 40% carbon emissions reduction over Part L minimum requirements. |
| Aim of this study: | The aim of this study is to assess feasible carbon emissions reductions through zero carbon technologies. This report demonstrates how the site has followed the London Plan's energy hierarchy by reducing energy demand through passive design, energy efficiency measures, generating heat in a clean and efficient system and by using on-site renewable energy systems to further reduce the overall carbon emissions of the development. |
| Methodology: | The methodology followed in this report follows the guidance set out by the Greater London Authority (GLA) for developing energy strategies as detailed in the London Plan 2011, with update from October 2013.<br><br>Energy consumption figures, for the hotel are based on SBEM modelling data produced under Design Builder Building Regulations compliant software.<br><br>These findings are subject to detailed analysis from a services engineer and quantity surveyor. |
| Site description: | The proposed scheme comprises a new 43 bedroom hotel.<br><br>The total Gross Internal Area is approximately 1,527m$^2$ of hotel. |

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# Executive Summary
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**Recommendation:**

The proposed scheme will implement significant energy efficiency measures as well as air source heat pump systems to achieve carbon emission reductions. The measures within this report have followed the GLA's Energy Hierarchy and meet a 46.92% carbon emissions saving through energy efficiency measures alone and a further 9.82% saving through the implementation of the renewable technologies.

The development will meet the mandatory requirement from the London Plan 2011 (with 2013 updates) by achieving a 52.04% improvement in $CO_2$ emissions over Building Regulations minimum requirements.

The baseline carbon emissions for the scheme are 256,422 $kgCO_2/yr$ for space heating, domestic hot water, lighting and auxiliary. Following implementation of measures within this report a total saving of 137,788 $kgCO_2/yr$ will be made. These measures include:

- Be Lean (46.82% savings over baseline): Energy efficiency measures to improve the building fabric and services: high performance U-Values (0.28 for walls, 0.18 for roof, 0.25 for the ground floor and 1.8 for windows in $W/m^2K$), good air tightness (maximum of 10 $m^3/m^2/hr$ at 50 Pa).
- Be Clean (0% savings over the Lean case): No actions will be taken for the Be Clean stage.
- Be Green (9.82% savings over Clean case): Green energy generation to include air source heat pump systems to provide Domestic Hot Water, cooling and space heating.

The energy efficiency measures included within this report represent current best practice and the use of an air source heat pump system has been maximised.

At this stage, the current system is the optimal means of achieving the 40% target. With the implemented measures the scheme has a predicted energy performance 12.04% better than the new GLA targets.

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# Executive Summary
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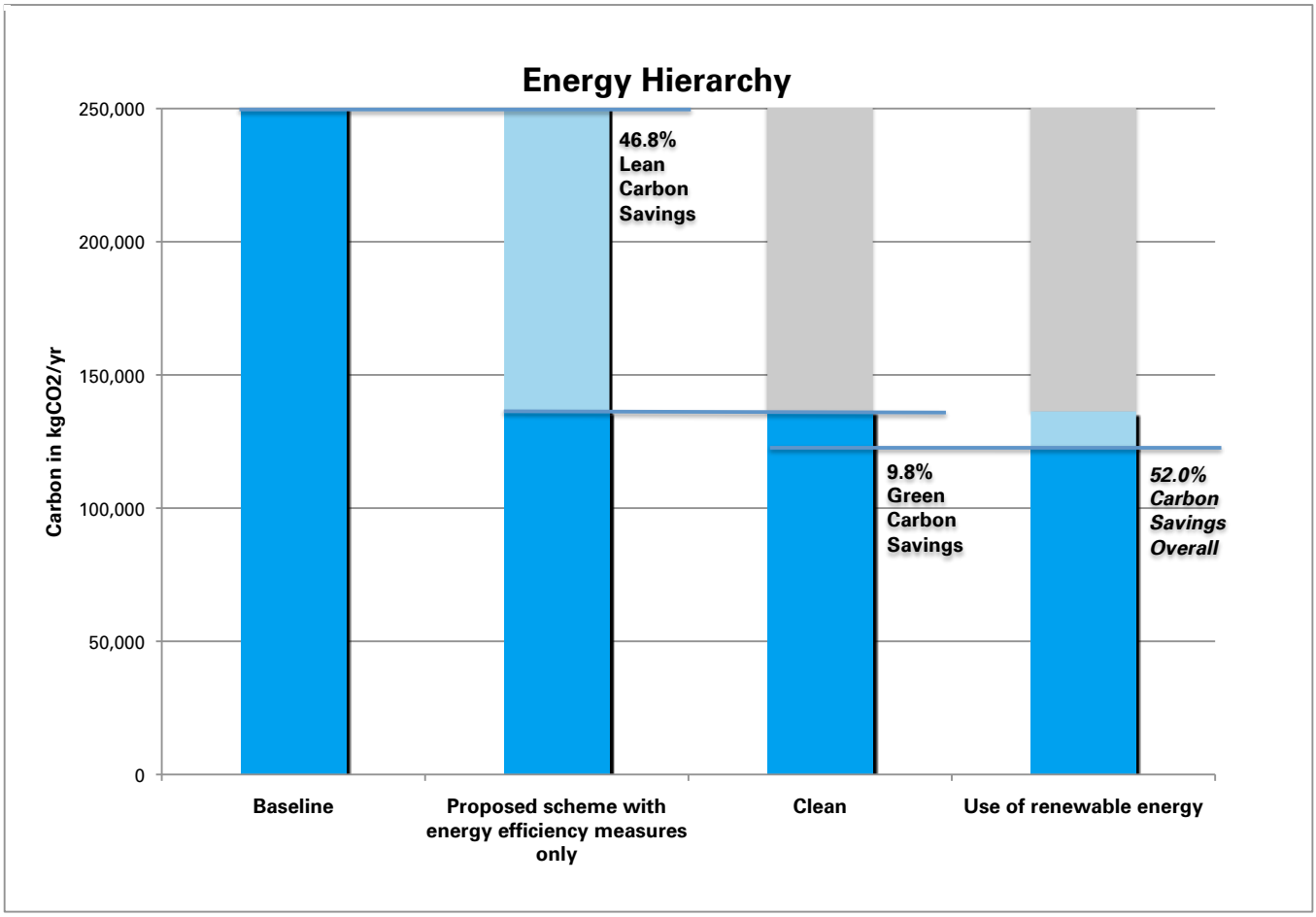
| GLA's Energy Hierarchy | | | |
|---|---|---|---|
| | Baseline | Be Lean: Energy Efficiency Measures | Be Green: Renewable |
| Carbon emissions in $kgCO_2/yr$ | 256,422 | 136,365 | 122,976 |
| Carbon emission savings in $kgCO_2/yr$ | - | 120,057 | 13,389 |
| Percentage reduction in carbon emissions over the previous stage | - | 46.82% | 9.82% |



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# Planning Requirement
## Energy Assessment
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|---|---|
| Planning Requirement: | The London Borough of Islington provides guidance stating that all new developments should be able to demonstrate compliance with the prevailing energy reduction requirements set out in the London Plan. |
| Energy Statements: | Applications for major developments should be accompanied by an energy statement, which provides information as set out below:<br>- A calculation of the baseline energy requirements and $CO_2$ emissions including regulated emissions (i.e. space heating, hot water, fixed electricity).<br>- Baseline regulated emissions should equal the Part L Target Emissions Rate (TER) and were calculated using the following methodology: Commercial: SBEM (Simplified Building Energy Model).<br>- A demonstration of how the Mayor's energy hierarchy has been followed (i.e being 'lean, clean, green') including consideration of passive design and decentralised energy options (including CHP/CCHP). Description of proposed energy efficiency measures including details of these measures (e.g. U-values, air permeability, percentage of energy efficient light fittings, heating efficiencies, etc).<br>- Calculation of the 'energy efficient' baseline (i.e. the reduced energy demand and $CO_2$ emissions after the application of energy efficient measures and decentralised energy provision) and predicted target for $CO_2$ reduction through renewables.<br>- An assessment of the feasibility of different renewable technologies on the site and the potential contribution to CO2 reduction from each option, explaining which technologies have been investigated and why any technologies have been ruled out, (i.e. technical limitations, costs, etc). |
| Remit of this report: | This report aims to provide cost-effective options to meet carbon emission reductions for the building, through renewable sources. Calculations were carried out using Design Builder, which is a software Building Regulations compliant software. |

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# Energy Hierarchy
## Energy Assessment
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**London Plan Energy Hierarchy**
Taken from GLA Energy Team Guidance on Planning Energy Assessments, Version 1, 2011

The London Plan's energy hierarchy takes a 'whole energy' approach and addresses energy efficiency use, energy supply efficiency and use of renewable energy. The purpose is to demonstrate that climate change mitigation measures are integral to the scheme's design and evolution, and that they are appropriate to the context of the development.

**Baseline calculations**
Section 5.3

The baseline calculations are taken from the Target Emission Rating (TER) worksheet from the SBEM modelling. Following the London Plan guidance, the baseline has been created with a gas boiler. However, the scheme will include an air source heat pump (fed by electricity). In order to compare the two systems, the base line has been adjusted with a correction factor as specified under the Building Regulations Approved document Part L2A.

This has identified the building to have the energy profile outlined in the following pages.

**Be Lean**
Section 5.3

Demand reduction (Be Lean) measures specific to the scheme are encouraged at the earliest design stage of a development and aim to reduce the demand for energy. Measures typically include passive design: both architectural and building fabric measures, and active design: energy efficient services. It is possible to exceed Building Regulations requirements (Part L 2010) through demand reduction (Be Lean) measures alone.

**Be Clean**
Section 5.6

A 'clean' energy supply refers to the energy efficiency of heating, cooling and power systems. Planning applications should demonstrate how the heating, cooling and power systems have been selected to minimise $CO_2$ emissions in accordance with the order of preference in Policy 5.6, such as through high-efficiency low $NO_x$ gas boilers.

**Be Green**
Section 5.7

Use of renewable energy in developments is encouraged at the 'Be Green' third stage. Each renewable energy technology in Policy 5.7 of the London Plan is technically feasible in London and each should be considered in the Energy Assessment. An assessment of what is achievable and compatible with the measures implemented in Be Lean and Be Clean is also required.

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# Energy Profile
## Energy Assessment
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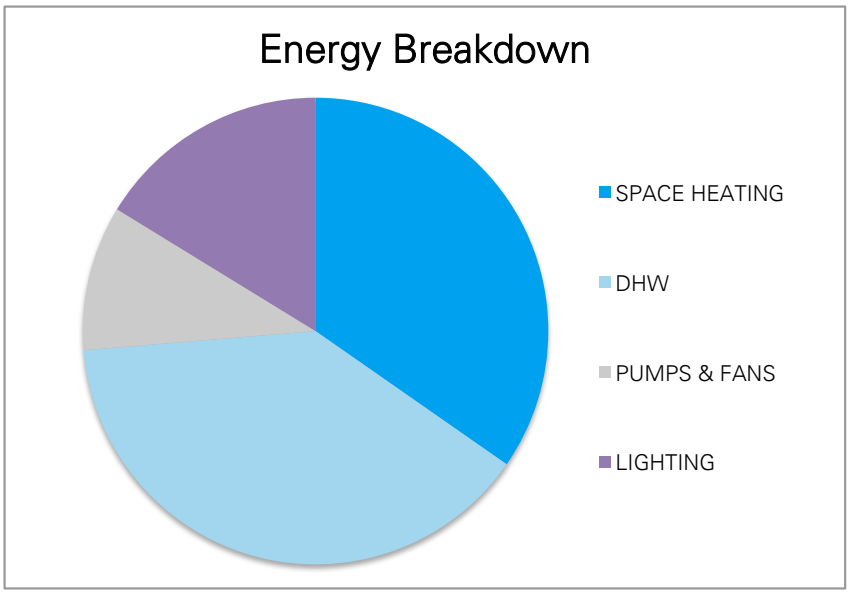
### Introduction:

Energy modelling allows designers to explore the performance of a scheme in terms of the likely energy usage and related carbon emissions. Through this understanding it is possible to reduce energy usage, use renewable energy and supply energy efficiently.

The scheme comprises of a new 43 bedroom hotel. The modelling of the units has been undertaken with Design Builder software to estimate the likely energy demands and carbon emissions of the proposed scheme.

| Carbon Emissions in $kgCO_2/yr$ | Heating | Cooling | Hot Water | Fans and Pumps | Lighting |
|---|---|---|---|---|---|
| Baseline | 82,108 | 19,604 | 92,394 | 23,812 | 38,504 |

Graph showing the site's carbon emissions breakdown in terms of heating, hot water, cooling and lighting, fans and appliances over the course of a year



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# ‘Be Lean’: Energy Efficiency Measures

## Energy Assessment

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**Energy efficiency targets:**

Energy efficiency measures such as optimising the building fabric will be incorporated to reduce the energy demand and carbon footprint of the proposed scheme. The measures outlined below result in an annual carbon emission saving of 46.82% or 137,788 kg$CO_2$/yr over baseline.

**U-values modelled:**

| Element | Part L2 B minimum U-Value (W/m$^2$K) | Proposed U-Value (W/m$^2$K) Indicative build-up |
|---|---|---|
| Roof | 0.18 | 0.15 |
| Walls | 0.35 | 0.28 |
| Floors | 0.25 | 0.25 |
| Windows | 1.80 | 1.60 |

**Air-Tightness:**

A high performance building with good air tightness levels is to be achieved so that the proposed scheme does not exceed an air permeability level of 10 m$^3$/hr/m$^2$ at 50 pascal during testing. This will be achieved through ensuring that sensitive areas are accounted for in the design and construction phases to make certain that a tightly sealed building is constructed and all punctures through the seal are air-tight. In particular, attention will be paid to major openings as well as minor openings such as services.

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# ‘Be Lean’: Energy Efficiency Measures

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|---|---|
| Cooling: | Cooling will be provided throughout the development. Air conditioning with a Seasonal Energy Efficiency Ratio of 3 and a nominal Energy Efficiency Ratio of 3.82 . |
| Heating: | An efficient condensing gas boiler, with a seasonal efficiency of 92% will provide space heating. Space heating will be provided by a radiator system, and will be controlled by a central control as well as local time and temperature controls in each Bedroom. |
| Domestic Hot water: | A gas-fired water heater with an efficiency of 92% will provide domestic hot water. |
| Ventilation: | The toilets will have a mechanical extract with a specific fan power of 0.6 W/l/s, with an extract rate of 10 Ach. The ACLI offices will have a mechanical supply and extract with a specific fan power of 1.5, with a flow rate of 8 l per person.The bedrooms extract rate will have a specific fan power of 0.6 W/l/s with an extract rate of 12 l/s. |
| Lighting: | The lighting system will be LED lamps with a lamp efficacy of 75 lumens/W and a Light Output Ratio of 0.8 and will be controlled by passive infrared sensors (PIR). |

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# ‘Be Clean’: Use of Combined Heat and Power

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**Use of Combined Heat and Power:**

The inclusion of gas combined heat and power (CHP) within the energy strategy has been considered. This section demonstrates how decentralised energy generation has been considered in accordance with the Mayor’s London Plan section 4A.1. The following guidance hierarchy was followed:

**Option One - Connection to existing CCHP/CHP networks**
This option is not deemed feasible in this instance due to the lack of an existing CCHP/CHP network in the vicinity of the proposed development.

**Option Two – Site-wide CCHP/CHP generation powered by renewables**
CCHP/CHP generation powered through renewables such as biomass is not considered feasible in this instance due to issues relating to air quality.

**Option Three - Gas CCHP/CHP accompanied by renewables**
A communal heating and hot water system will not be provided in this scheme. Carbon emissions reductions will be achieved with individual systems.

**Site-wide Combined Heat and Power (CHP) generation:**

A communal heating and hot water system that serves the dwellings will not be provided in this scheme. Carbon emissions reductions will be achieved with individual systems.

The load profile of the dwellings is not suitable enough for the CHP. CHP systems are best utilised where there is a consistent and high demand for heat. With the implemented fabric improvements from the ‘Be Lean’ scenario the energy demand is too low at times of relatively limited space heating, therefore if CHP system was to serve the hotel it would be somewhat oversized, less efficient and therefore less economic.

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# ‘Be Green’ Feasible Renewable Energy Technologies

## Energy Assessment

## 124-134 Clerkenwell Road

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|---|---|
| Feasible renewable energy technologies: | A reduction in carbon emissions through the use of on-site renewable energy can be achieved through several technologies that generate either heat or power. Following the analysis of the carbon emissions related to the scheme, the objective of this section is to determine the feasible renewable energy options that provide cost effective and practical emissions reductions. The renewable energy options for the proposed scheme are provided in the table below. Each technology is also assessed as either feasible or rejected based on its implications for the scheme in terms of their implementation, cost-effectiveness, site-related constraints, planning issues or other issues. The following sections will explore the feasible technologies in depth and explain why certain technologies have been rejected.<br><br>The following analysis will be reviewed at detailed design. This may result in a change of technologies. Currently air source heat pumps is the optimal system. |

| Technology and feasibility | Rationale |
|---|---|
| Biomass:<br>Rejected | This technology would have a significant impact on local air quality and large deliveries of fuel are required which may cause disruption to daily site operations. Storage space and delivery space will also be required. |
| Ground Source Heat Pump (GSHP):<br>Rejected | A ground source heat pump could supply heating and hot water to the proposed scheme. However, there is insufficient room to allow for horizontal closed loop pipes; therefore, additional boreholes would be required at a depth of approximately 50-100m. This option is capital intensive and is subject to uncertainty with regards to the ground conditions. |
| Photovoltaic (PV):<br>Rejected | PV units could be installed to reduce the energy demand of the development, however this system will be capital intensive with a long payback period. Due to this there are other options that are more cost effective in achieving the required 40% target. |
| Air Source Heat Pump (ASHP)<br>Feasible | Air source heat pump can supply domestic hot water, heating and cooling to the proposed scheme. Air Source Heat Pumps use the vapour compression cycle to efficiently extract heat from one place and transfer it to another. The air source heat pumps extract heat from external air, and transfer this heat to water, which is then used for the domestic hot water, space heating and cooling. |
| Solar Hot Water (SHW):<br>Rejected | Roof-mounted SHW units could be located on the roof space. However, this technology will not contribute significantly to carbon reductions as a stand-alone. |
| Wind Turbine:<br>Rejected | Due to the development’s location in London, this technology will not be suitable as turbulence created from surrounding buildings make this an inefficient solution. |

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# Air Source Heat Pump

## Energy Assessment

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### Air Source Heat Pump

Air source heat pumps use the vapour compression cycle to efficiently extract heat from one place and transfer it to another. The air source heat pumps extract heat from external air, and transfer this heat to water, which is then used for the heating.

Direct hot water will be provided by two calorifiers heated by an exhaust air heat pump with a heat recovery unit and continuous mechanical ventilation (CMV), an efficient gas boiler (92%) will be installed as backup. The system will have a COP of 3.47 with a thermal storage losses of 2,000MJ/ month.

System description:

VRF system is a form of air source heat pump that consists of a number of ceiling mounted indoor units connected to a common outdoor unit by refrigerant pipework.

Space heating and cooling will be provided via the VRF system, and will serve a fan coil system to the bedrooms  with a COP of 4.00.

The outside unit will generate little noise; therefore this will have a minimal impact on the noise level for the occupants of the building.

### Site-specific considerations

The outside units will be located on the roof of the building.

There are no planning requirements for the installation of the above system and the noise from the outside units would not have an impact on the surroundings.

### Ventilation

The toilets will have a mechanical extract with a specific fan power of 0.60 W/l-s, with an extract rate of 10 Ach.

The ACLI offices will have a mechanical supply and extract with a specific fan power of 1.5 W/l/s, with a flow rate of 8 l/per person, and a heat recovery unit with an efficiency of 65%.

The bedroom extracts will have a specific fan power of 0.6 W/l/s with an extract rate of 12 l/per person, and a heat recovery unit with an efficiency of 65% on two of the ground floor bedrooms.

The living room, foyer and reception area extracts will have a specific fan power of 1.5 W/l/s .

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# Summary of Applicable Renewable Technologies

## Energy Assessment

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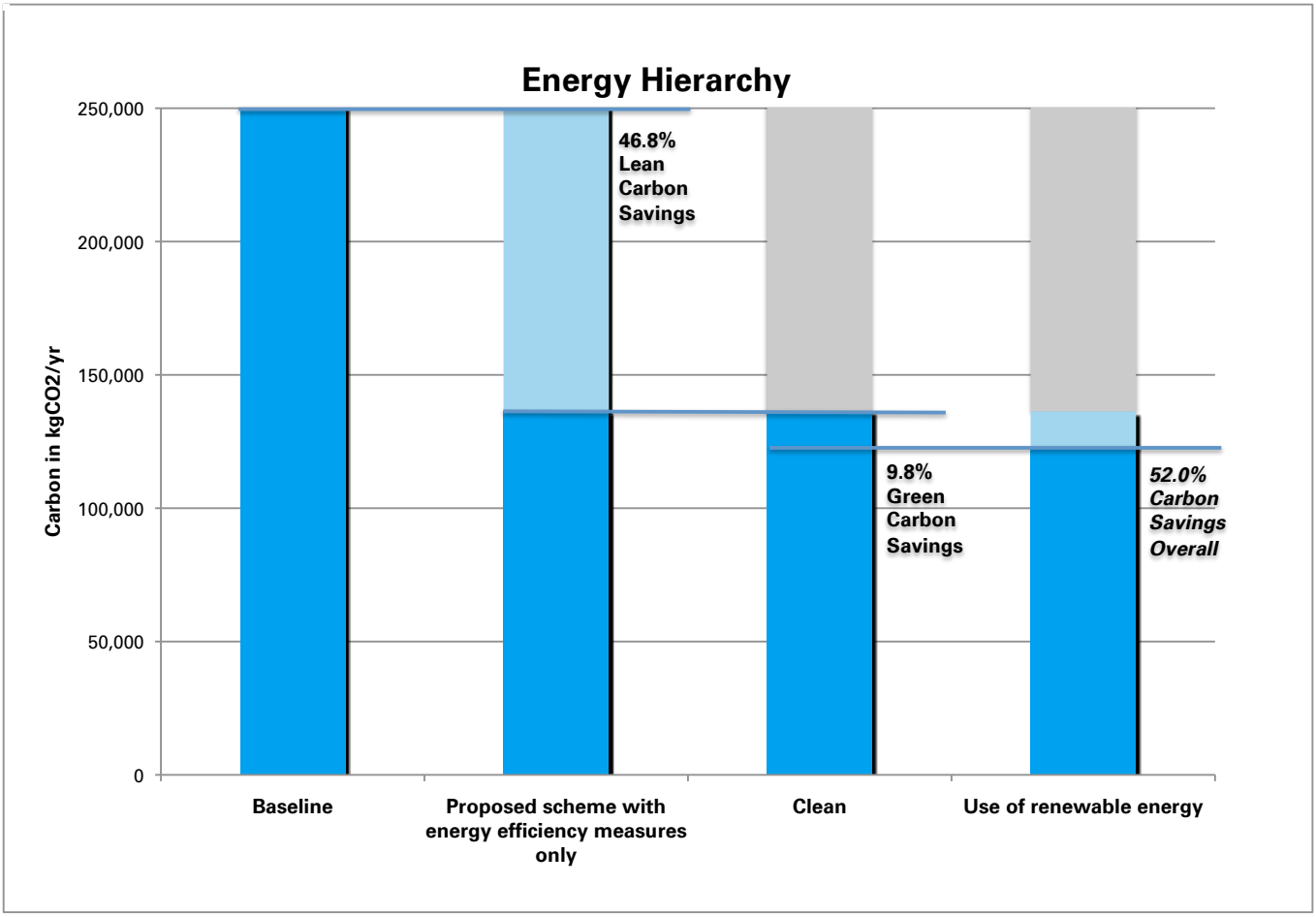
Explanation of applicable renewable technology options:

The following graph demonstrates the carbon savings achievable through renewable energy technologies applicable to this scheme following implementation of energy efficiency measures.

The air source heat pump system provides an additional 9.82% carbon reduction across the site.



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# Conclusion
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Recommendation:

The proposed scheme will implement significant energy efficiency measures as well as an air source heat pump system to achieve carbon emission reductions. The measures within this report have followed the GLA's Energy Hierarchy and meet a 46.82% carbon emissions saving through energy efficiency measures alone and a further 9.82% saving through the implementation of the renewable technologies.

The development will meet the mandatory requirement from the London Plan 2011 (with 2013 updates) by achieving a 52.04% improvement in $CO_2$ emissions over Building Regulations minimum requirements.

The baseline carbon emissions for the scheme are 256,422 $kgCO_2/yr$ for space heating, domestic hot water, lighting and auxiliary. Following implementation of measures within this report a total saving of 137,788 $kgCO_2/yr$ will be made. These measures include:

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The energy efficiency measures included within this report represent current best practice and the use of an air source heat pump system has been maximised.

At this stage, the current system is the optimal means of achieving the 40% target. With the implemented measures the scheme has a predicted energy performance 9.82% better than the new GLA targets.

GLA's Energy Hierarchy

| | Baseline | Be Lean: Energy Efficiency Measures | Be Green: Renewable |
|---|---|---|---|
| Carbon emissions in $kgCO_2/yr$ | 256,422 | 136,365 | 122,976 |
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