HILSON MORAN

24-28 WARNER STREET – ENERGY STRATEGY

FOR KARL & KEVAN WOODHOUSE

Date: 18th March 2011

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1. EXECUTIVE SUMMARY

This document lays out the Energy Assessment and Strategy for the 24 - 28 Warner Street development as a response to the current planning requirements for buildings to be designed to reduce the impacts on the local and global environment of their construction and operation. The aims of the Mayor's Energy Hierarchy, the London Plan, The London Renewables Toolkit and the Approved Document L2 2010 of the Building Regulations have all been addressed.

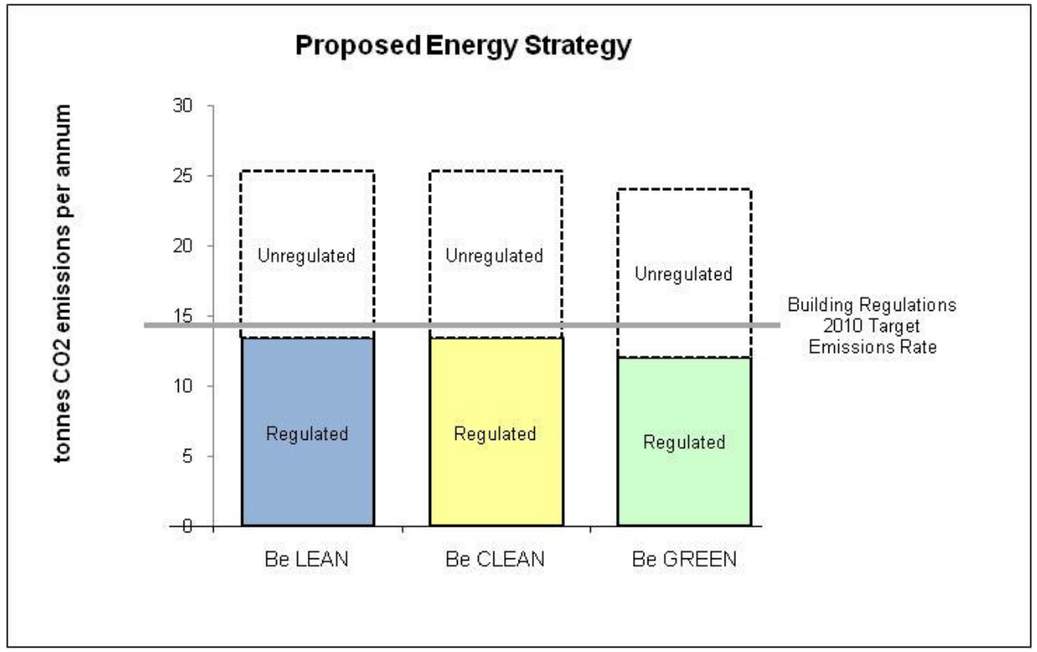
The development is located within the London Borough of Camden. The site is approximately 300 sq m in size and is located less than 1.5km to the north east of Farringdon tube station in Camden. The site is flanked by a 6 storey building separated by an access road on its right and adjoined to a 3 storey building on its left (viewed from Warner Street). It is proposed to demolish the existing timber yard buildings and form 12 dwellings.

The scheme will incorporate passive design features and along with best practice energy efficient plant and equipment that is commercially viable and proven.

Use		Target Emission Rate ($kgCO_2$ /m^2/annum)	Building Emission Rate ($kgCO_2$ /m^2/annum)	Part L % improvement
Residential	SAP 2009	17.05	15.94	6.5%

KEY FEATURES

- Code for Sustainable Homes Level 3 (52.5% of energy credits targeted)
- High levels of Passive design & Energy efficiency incorporated into the scheme
- Green roof
- PV array to roof of building
- Enhanced u values and air permeability
- Triple glazing to all vision glass
- Mechanical ventilation with heat recovery for background ventilation
- Opening windows for rapid ventilation
- 100% low energy lighting
- Presence detection controls to lighting in communal corridors.
- Low water use taps / showers to reduce hot water demand



	CO_2 savings (tonnes CO_2)		CO_2 savings (%)	
	Regulated	**Total**	**Regulated**	**Total**
Be Lean savings	0.9	0.9	6.5%	3.5%
Be Clean savings	0.0	0.0	0.0%	0.0%
Be Green savings	1.3	1.3	9.9%	5.2%
Total cumulative savings			**15.8%**	**8.6%**

2. INTRODUCTION

2.1. Background

Hilson Moran has been commissioned by Karl & Kevan Woodhouse to prepare an Energy Strategy Assessment to support their planning application for the proposed residential development at 24 - 28 Warner Street, London. The development is located within the London Borough of Camden. The site is approximately 300 sq m in size and is located less than 1.5km to the north east of Farringdon tube station in Camden. The site is flanked by a 6 storey building separated by an access road on its right and adjoined to a 3 storey building on its left (viewed from Warner Street). It is proposed to demolish the existing timber yard buildings and form 12 dwellings.

Figure 2.1 Location of the proposed development

2.2. Purpose

This Energy Strategy Assessment for the proposed development has been produced to provide an analysis of the development's CO_2 footprint, contribution of CO_2 reduction from passive building design, energy efficient enhancements of building services, Low Carbon Technologies and renewable energy systems. Furthermore, this document aims to show compliance with the London Borough of Camden and Greater London Authority Planning policies and associated guidance.

The application is accompanied by a Code for Sustainable Homes pre assessment which provides detailed analyses of the development's effects in terms of other related environmental issues.

2.3. Scope

This Energy Strategy relates to the proposed mixed use development at 24 - 28 Warner Street. A detailed assessment of the development's energy consumption and CO_2 emissions has been undertaken as well as determining the estimated savings from low and zero carbon energy systems.

2.4. Structure

The introductory section is followed by a comprehensive review of national, strategic and local planning policy on sustainability. Section 4 provides a detailed assessment of development energy and CO_2 emissions. Section 5 details the low and zero carbon technologies which are applicable to the scheme. Section 6 provides a summary and proposes the Energy Strategy for the scheme.

3. POLICY AND GOOD PRACTICE REVIEW

3.1. National Policy

3.1.1. National Sustainable Development Strategy

Sustainable Development policy as a subject separate from other environmental and socio-economic considerations started to develop in the late 1990s in the United Kingdom. The Sustainable Development Commission (SDC) is the Government's independent adviser in sustainable development.

The first sustainable development strategy for the UK, titled "A better quality of life" was issued in 1999, supported by a baseline assessment of quality of life indicators in "Quality of life counts".

"A better quality of life" outlines UK priorities for the future:

- more investment in people and equipment for a competitive economy;
- reducing the level of social exclusion;
- promoting a transport system which provides choice, and also minimises environmental harm and reduces congestion;
- improving the larger towns and cities to make them better places to live and work;
- directing development and promoting agricultural practices to protect and enhance the countryside and wildlife;
- improving energy efficiency and tackling waste; and
- working with others to achieve sustainable development internationally.

In addition, the document above outlines the definition of sustainable development policy in the UK, as reflecting the interaction of five principles, illustrated in Figure 3a.

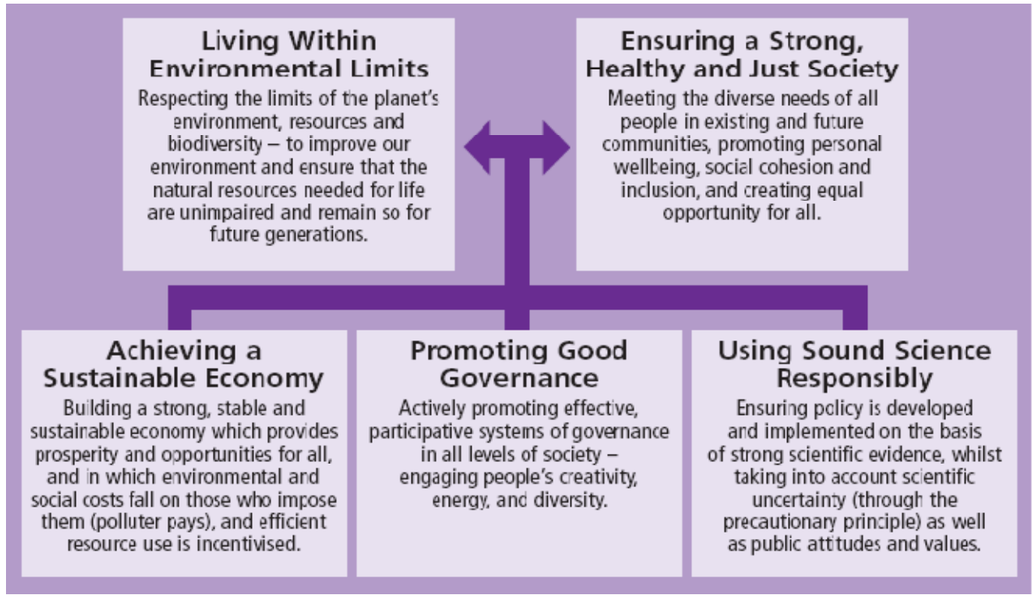


Figure 3.1 Shared principles of UK sustainable development policy

A revised sustainable development strategy, applicable only in England was produced in 2005 with an update of the UK Government Strategy Indicators. These documents group indicators into four key areas:

- Sustainable consumption and production;
- Climate change and energy;
- Protecting natural resources and enhancing the environment; and
- Creating sustainable communities and a fairer world.

This document concerns itself primarily with the first principle in Figure 3a – "Living within Environmental Limits".

3.1.2. Planning Policy Instruments

In addition, there are a range of policy instruments governing the delivery of sustainable development, including

- Planning Policy Statement 1: Delivering Sustainable Development;

- Planning Policy Statement 22: Renewable Energy.

Planning Policy Statement 1 sets out the government's general planning policies in the context of sustainable development, based on the 1999 strategy. It considers social cohesion and inclusion, protection and enhancement of the environment, prudent use of natural resources, sustainable economic development, and integrating sustainable development in development plans.

Planning Policy Statement 22 – Renewable Energy is intended to encourage the appropriate development of further renewable energy schemes, throughout England, including schemes in urban as well as rural locations, ranging in size from the domestic to the commercial scale. PPS 22 follows the guidance set out in the government's Energy White Paper, published in 2003 pursuing a 10% renewable energy target by the year 2010.

3.1.3. Greater London Policy

The Mayor of London's adopted 'spatial development strategy', the London Plan 2008 is a London-wide plan that provides the regional context for local borough planning frameworks.

The London Plan treats sustainable development as a major objective. The principal sections relating to environmental sustainability are detailed in the following box:

Policy 4A.1 Tackling climate change

The Mayor will, and boroughs should, in their DPDs require developments to make the fullest contribution to the mitigation of and adaptation to climate change and to minimise emissions of carbon dioxide. The following hierarchy will be used to assess applications:

- *Using less energy, in particular by adopting sustainable design and construction measures (Policy 4A.3)*
- *Supplying energy efficiently, in particular by prioritising decentralised energy generation (Policy 4A.6),*
- *Using renewable energy (Policy 4A.7).*

Policy 4A.3 Sustainable design and construction

The Mayor will, and boroughs should, ensure future developments meet the highest standards of sustainable design and construction and reflect this principle in DPD policies.

These will include measures to:

- *make most effective use of land and existing buildings*
- *reduce carbon dioxide and other emissions that contribute to climate change*
- *design new buildings for flexible use throughout their lifetime*
- *avoid internal overheating and excessive heat generation*
- *make most effective and sustainable use of water, aggregates and other resources*
- *minimise energy use, including by passive solar design, natural ventilation, and vegetation on buildings*
- *supply energy efficiently and incorporate decentralised energy systems (Policy 4A.6), and use renewable energy where feasible (Policy 4A.7)*
- *minimise light lost to the sky, particularly from street lights*
- *procure materials sustainably using local suppliers wherever possible*
- *ensure designs make the most of natural systems both within and around the building*
- *reduce air and water pollution*
- *manage flood risk, including through sustainable drainage systems (SUDS) and flood resilient design for infrastructure and property*
- *ensure developments are comfortable and secure for users*
- *conserve and enhance the natural environment, particularly in relation to biodiversity, and enable easy access to open spaces*
- *avoid creation of adverse local climatic conditions*
- *promote sustainable waste behaviour in new and existing developments, including support for local integrated recycling schemes, CHP and CCHP schemes and other treatment options*
- *encourage major developments to incorporate living roofs and walls where feasible (Policy 4A.11)*
- *reduce adverse noise impacts.*

The Mayor will and the boroughs should require all applications for major developments to include a statement on the potential implications of the development on sustainable design and construction principles. This statement should address demolition, construction and long-term management. Boroughs should ensure that the same sustainability principles are used to assess other planning applications.

Policy 4A.4 Energy assessment

The Mayor will, and boroughs should, support the Mayor's Energy Strategy and its objectives of improving energy efficiency and increasing the proportion of energy used generated from renewable sources. The Mayor will, and boroughs should, require an assessment of the energy demand and carbon dioxide emissions from proposed major developments, which should demonstrate the expected energy and carbon dioxide emission savings from the energy efficiency and renewable energy measures incorporated in the development, including the feasibility of CHP/CCHP and community heating systems. The assessment should include:

- *Calculation of baseline energy demand and carbon dioxide emissions*
- *Proposals for the reduction of energy demand and carbon dioxide emissions from heating, cooling and electrical power (Policy 4A.6)*
- *Proposals for meeting residual energy demands through sustainable energy measures (Policies 4A.7 and 4A.8)*
- *Calculation of the remaining energy demand and carbon dioxide emissions.*

This assessment should form part of the sustainable design and construction statement (Policy 4A.3).

Policy 4A.5 Provision of heating and cooling networks

Boroughs should ensure that all DPDs identify and safeguard existing heating and cooling networks and maximise the opportunities for providing new networks that are supplied by decentralised energy.

Boroughs should ensure that all new development is designed to connect to the heating and cooling network. The Mayor will and boroughs should work in partnership to identify and to establish network opportunities, to ensure the delivery of these networks and to maximise the potential for existing developments to connect to them.

Policy 4A.6 Decentralised Energy: Heating, Cooling and Power

The Mayor will and boroughs should in their DPDs require all developments to demonstrate that their heating, cooling and power systems have been selected to minimise carbon dioxide emissions.

The need for active cooling systems should be reduced as far as possible through passive design including ventilation, appropriate use of thermal mass, external summer shading and vegetation on and adjacent to developments. The heating and cooling infrastructure should be designed to allow the use of decentralised energy (including renewable generation) and for it to be maximised in the future.

Developments should evaluate combined cooling, heat, and power (CCHP) and combined heat and power (CHP) systems and where a new CCHP/CHP system is installed as part of a new development, examine opportunities to extend the scheme beyond the site boundary to adjacent areas.

The Mayor will expect all major developments to demonstrate that the proposed heating and cooling systems have been selected in accordance with the following order of preference:

- *connection to existing CCHP/CHP distribution networks*
- *site-wide CCHP/CHP powered by renewable energy*
- *gas-fired CCHP/CHP or hydrogen fuel cells, both accompanied by renewables*
- *communal heating and cooling fuelled by renewable sources of energy*
- *gas fired communal heating and cooling.*

Policy 4A.7 Renewable Energy

The Mayor will, and boroughs should, in their DPDs adopt a presumption that developments will achieve a reduction in carbon dioxide emissions of 20% from on site renewable energy generation (which can include sources of decentralised renewable energy) unless it can be demonstrated that such provision is not feasible. This will support the Mayor's Climate Change Mitigation and Energy Strategy and its objectives of increasing the proportion of energy used generated from renewable sources by:

- *Requiring the inclusion of renewable energy technology and design, including: biomass fuelled heating, cooling and electricity generating photovoltaics, solar water heating, wind, hydrogen fuel cells, and ground coupled heating and cooling in new developments wherever feasible*
- *Facilitating and encouraging the use of all forms of renewable energy where appropriate, and giving consideration to the impact of new development on existing renewable energy*

schemes.

Policy 4A.8 Hydrogen Economy

The Mayor will work with the London Hydrogen Partnership, the London Climate Change Agency, boroughs and others to support and encourage the more widespread use of hydrogen as an alternative to fossil fuels by:

- *Planning hydrogen supply and distribution infrastructures*
- *Supporting and developing renewable sources of hydrogen*
- *Maximising the uptake of hydrogen and fuel cell vehicles (see Chapter 3C)*
- *Maximising the adoption of fuel cell combined heat and power in developments.*

Policy 4A.9 Adaptation to Climate Change

The Mayor will, and other agencies should, promote and support the most effective adaptation to climate change, including:

- *Minimising overheating and contribution to heat island effects(Policy 4A.10)*
- *Minimising solar gain in summer (Policy 4A.10)*
- *Contributing to reducing flood risk including applying principles of sustainable urban drainage (Policies 4A.13 and 4A.14)*
- *Minimising water use (Policy 4A.16) and protecting and enhancing green infrastructure.*

Policy 4A.10 Overheating

The Mayor will, and boroughs should, strongly encourage development that avoids internal overheating and excessive heat generation and contributes to the prevention of further over-heating, especially where the urban heat island is most intense. Developers should demonstrate how development could be made heat resilient in design, construction and operation. The Mayor will work with partners to reduce the heat island effect through energy efficiency and appropriate design.

Policy 4A.19 Improving air quality

The Mayor will, and boroughs should, implement the Mayor's Air Quality Strategy and achieve reductions in pollutant emissions and public exposure to pollution by:

- *Improving the integration of land use and transport policy and reducing the need to travel, especially by car (see Policy 3C.1)*
- *Promoting sustainable design and construction (Policy 4A.3)*
- *Promoting sustainable construction to reduce emissions from the demolition and construction of buildings (Policy 4A.22)*
- *Ensuring at the planning application stage, that air quality is taken into account along with other material considerations, and that formal air quality assessments are undertaken where appropriate, particularly in designated Air Quality Management Areas*
- *Seeking to reduce the environmental impacts of transport activities by supporting the increased provision of cleaner transport fuels, including hydrogen, particularly with respect to the refuelling infrastructure*
- *Working in partnership with relevant organisations, taking appropriate steps to achieve an integrated approach to air quality management and to achieve emissions reductions through improved energy efficiency and energy use (Policy 4A.7).*

3.1.4. GLA Supplementary Planning Guidance

The London Plan is supported by a number of Supplementary Planning Guidance and Best Practice Guidance documents. Of these documents the Supplementary Planning Guidance on Sustainable Design and Construction (SPG) relates specifically to sustainability concerns that should be addressed during the design phase of a development.

The Supplementary Planning Guidance on Sustainable Design and Construction (May 2006) sets out essential requirements and the Mayor's preferred standard for new development. The document addresses a wide range of sustainability topics including land use, reuse of existing buildings, urban design, adaptation to climate change, energy consumption, materials use, water use, noise and air pollution, water pollution and flooding, microclimate, indoor comfort, security, open space, waste, biodiversity and inclusive environments. While the list is not comprehensive, this document is the only one apart from voluntary green building rating systems that provides specific technical detail on how to interpret sustainability in an urban built environment.

It is worth noting that the Mayor of London is planning to issue a draft Supplementary Planning Guidance on Renewable Energy. At the moment, no information on this planned SPG is available; however a toolkit on renewable energy, issued in 2004 has been used to address requirements on renewable and low and zero carbon technologies and to prepare an energy statement for this development.

Adapting to Climate Change

Mayor's essential standard:

- *"Buildings provide for flexibility of uses during their projected operational lives."*
- *"Buildings adapt to and mitigate for the effects of the urban heat island and the expected increases in hot dry summers and wet mild winters."*
- *"Design in facilities for bicycles and electric vehicles."*

The Greater London Authority has prepared a checklist to help developers plan for the foreseeable consequences of climate change. This document considers the following areas to be crucial for successful adaptation to climate change:

Location

- *Flooding*
- *Higher temperatures*
- *Water resources*
- *Subsidence*
- *Coastal erosion*

Site layout

- *Flooding*
- *Heat gain*
- *Outdoor spaces*
- *Subsidence*

Structure

- *Wind speeds*
- *Soils*
- *High temperatures*
- *Heat loss and gain*
- *Rainfall*
- *Air tightness*

Energy

Mayor's essential standard:

- *"Carry out an energy demand assessment."*
- *"Maximise energy efficiency."*
- *"Major commercial and residential developments to demonstrate that consideration has been given to the following ranking method for heating and where necessary cooling systems:*
- *Passive design*
- *Solar water heating; then*
- *Combined heat and power for heating and cooling (i.e. trigeneration), preferably fuelled by renewables; then*
- *Community heating and cooling; then*
- *Heat pumps; and then*
- *Gas condensing boilers."*
- *"Wherever on site outdoor lighting is proposed as part of a development it should be energy efficient, minimising light lost to sky."*
- *"Carbon emissions from the total energy needs (heat, cooling and power) of the development should be reduced by at least 10% by the onsite generation of renewable energy."*

Mayor's preferred standard:

- *"All developments to demonstrate that consideration has been given to the following ranking method for heating and where necessary for cooling systems and should incorporate the highest feasible of the following options:*
- *Solar water heating; then*
- *Combined heat and power/trigeneration, preferably fuelled by renewables; then*
- *Community heating.*
- *New developments should always be connected to existing community heating networks preferably fuelled by renewables* where feasible."
- "*Wherever outdoor lighting or other electrically powered street furniture is proposed on site, it should be solar powered and minimise light lost to the sky."*
- *"Lighting, heating and cooling controls should enable services to operate efficiently under different loadings and allow for localised control."*
- *Major developments should be zero carbon emission developments (ZEDs)."*
- *"Major developments should make a contribution to London's hydrogen economy through the adoption of hydrogen and/or fuel cell technologies and infrastructure."*

3.1.5. London Borough of Camden

The following is an extract from the London Borough of Camden Development Policies:

DP22 – Promoting sustainable design and construction

The Council will require development to incorporate sustainable design and construction measures. Schemes must:

a) demonstrate how sustainable development principles, including the relevant measures set out in paragraph 22.5 below, have been incorporated into the design and proposed implementation; and

b) incorporate green or brown roofs and green walls wherever suitable.

The Council will promote and measure sustainable design and construction by:

c) expecting new build housing to meet Code for Sustainable Homes Level 3 by 2010 and Code Level 4 by 2013 and encouraging Code Level 6 (zero carbon) by 2016.;

d) expecting developments (except new build) of 500 sq m of residential floorspace or above or 5 or more dwellings to achieve "very good" in EcoHomes assessments prior to 2013 and encouraging "excellent" from 2013;

e) expecting non-domestic developments of 500sqm of floorspace or above to achieve "very good" in BREEAM assessments and "excellent" from 2016 and encouraging zero carbon from 2019.

The Council will require development to be resilient to climate change by ensuring schemes include appropriate climate change adaptation measures, such as:

f) summer shading and planting;

g) limiting run-off;

h) reducing water consumption;

i) reducing air pollution; and

j) not locating vulnerable uses in basements in flood-prone areas.

The Following section is an extract taken from the Pre-Application Meeting Report received following a meeting with Camden Council to discuss the proposals in September 2010:

'*Policy DP22 of the LDF is of relevance in a development of this type and scale. You are advised that all new residential schemes will be required to meet with a minimum Level 3 rating (Code for Sustainable Homes) using he appraisal. In addition to this overall target, minimum scores of a least 50% of the available credits should be scored in each of the Energy, Water and Materials sub-categories. An assessment should be submitted as part of any application submission, with a post construction review to be carried out as part of the legal agreement of any approval [S106 agreement].*

Turning to renewable energy matters, as the proposals will be above the 1,000sqm threshold, provision must be made for renewable energy on site. You are advised that the provision of 10% of energy requirement of any new development to be provided through renewable energy sources has been superseded by further amendments to the London Plan in February 2008. This has specified that new developments should aspire to meet a 20% target. If the 20% target is not met, you must produce a robust justification statement to explain why this is not practicable.

If any renewable energy technology is proposed you should make sure you have followed the Mayor's energy hierarchy (1. use less energy, 2. use renewable energy and 3. supply energy efficiently) to show that renewable energy is not just an 'add-on'.

3.2. Emerging Policy

3.2.1. Building Regulations

The 2013 Part L Approved Documents are due for release in April 2013. The Government has announced that the Part 2013 consultation will take place in December 2011.

The updated Part L documents correspond with a reduction in the Target Emission Rate, driving design energy consumption downwards. In this way the design of the scheme should be considered in terms of projected domestic emissions pass margins as follows:

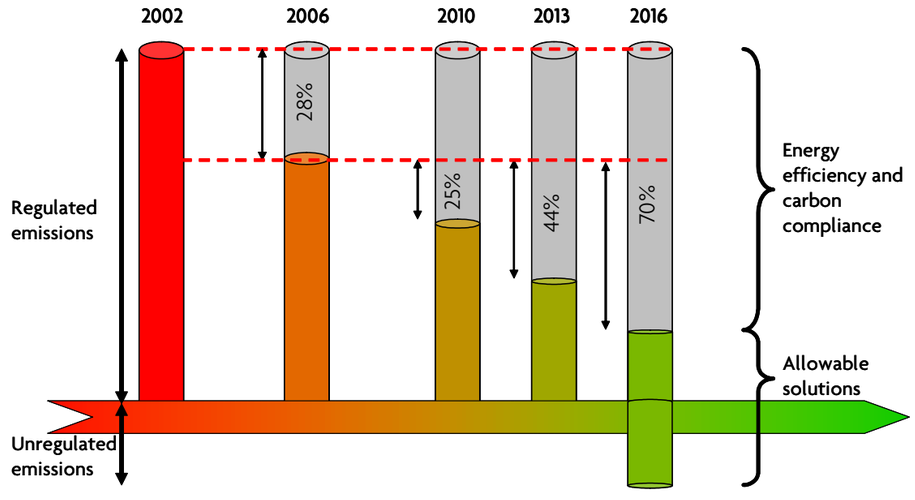


Figure 3.2 Proposed emissions reduction targets (dwellings).

The scheme design will target being ‘future-proofed’ to ensure Building Regulations compliance of the current regulations at the completion of the scheme.

Ongoing advancements with commercially available building elements and plant efficiencies will be continually monitored in order to integrate higher performance products, where appropriate, at the detailed design stage.

3.2.2. The draft London Plan 2011.

The Mayor of London is in the process of replacing the London Plan. The plan was consulted upon in October-December 2009 and was considered at an Examination in Public during the Summer/Autumn 2010 with a proposed adoption in 2011. The Mayor has advised the new London Plan will be more concise, contain fewer policies and be at a more strategic level. It will provide the framework for the development of London over the next 20-25 years.

London’s response to climate change will be targeting the following approached and policies:

- The Mayor seeks to reduce London’s carbon dioxide emissions by 60% by 2025 (reference 1990 levels).
- Retaining the ‘Be Lean, Be Clean, Be Green’ energy hierarchy approach to development’s design
- Targeting the highest levels of sustainable design and construction
- Highlighting the need to address sustainability in refitting and refurbishments
- Prioritising the development of new heating and cooling networks
- Retention of decentralised energy feasibility analysis
- Increase in the proportion of renewable energy targets.
- Encouraging the use of innovative energy technologies.
- Avoiding overheating and the urban heat island effect.
- Promote and support urban greening.

Local Authorities are directed to adopt appropriate policies to support the new London Plan.

4. TECHNICAL APPRAISAL & PERFORMANCE

A comprehensive energy and CO_2 emissions assessment has been carried out for the development. The environmental performance of the scheme has being comprehensively analysed and evaluated to achieve an optimum balance between environmental, social and economic sustainability criteria. This analysis has included:

- Part L1a 2010 (SAP 2009) CO_2 assessment for the residential blocks
- An energy demand assessment of the proposed scheme & CO_2 emissions calculations
- Low and Zero Carbon energy system studies

These analyses will be used to ensure that the building will achieve a higher level of energy performance than that required by the 2010 Building Regulations. Energy consumption figures and carbon dioxide emissions calculations including potential savings against the 2010 Building Regulations standards are given in Section 4.3.

The proposed Energy Strategy has, as its first priority, minimised energy consumption through the design of the building envelope, (shading / glass type / green roofs, etc) and energy efficient plant, equipment and systems. This is referred to as ‘Be lean’ within the London Plan.

Having achieved a high level of energy efficiency through ‘passive’ measures to reduce heating, cooling and lighting demands, the second stage of the strategy is to supply energy in an efficient manner, using high-efficiency decentralised systems where technically feasible.

The third stage is to ensure that the remaining demand uses renewable energy to meet a proportion of these residual demands by integrating appropriate renewable technologies within the scheme.

The Energy Strategy for the development therefore reflects the “energy hierarchy” set out in The London Plan 2008 and The Mayor’s Energy Strategy document of 2004, and is shown in Figure 4.1.

Table 4.1 shows the fuel CO_2 intensity factors which have been used within this report. These are in accordance with the 2010 Building Regulations. This table also shows the 2006 fuel CO_2 intensity factors as a comparison.

Fuel	**2006 $kgCO_2/kWh$**	**2010 $kgCO_2/kWh$**
Natural Gas	0.194	0.198
Biofuel – Wood chip	0.025	0.015
Biofuel – Wood pellets		0.037
Biofuel – bio-diesel		0.047
Grid Supplied Electricity	0.422	0.517
Grid Displaced Electricity	0.568	0.529

Table 4.1 Fuel CO_2 Intensity Data

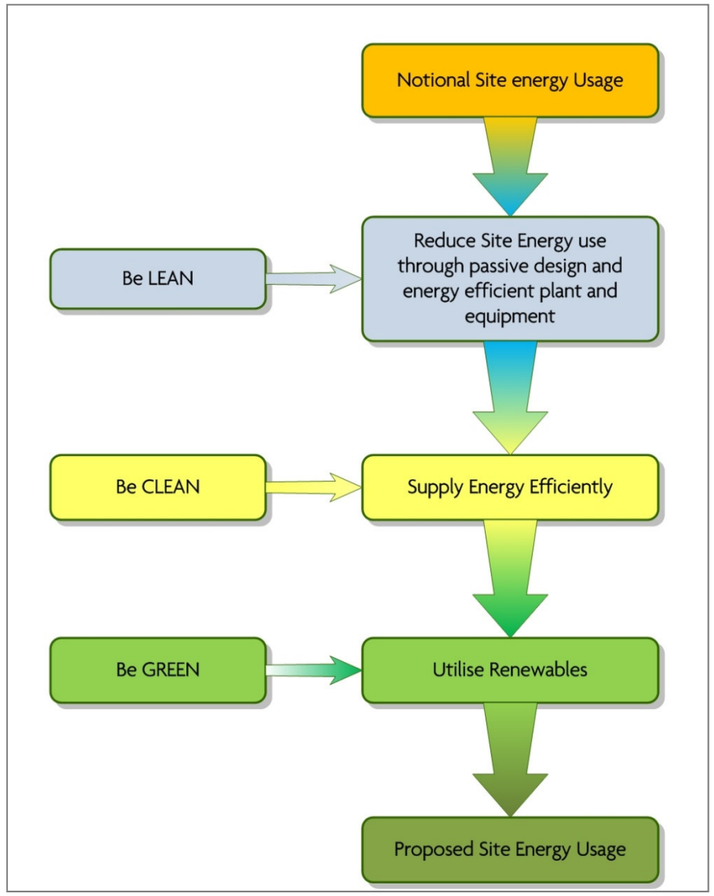


Figure 4.1 Proposed Energy Strategy

4.1. Site Environmental Factors

The following image, Figure 4.2, shows the environmental factors associated with the site.

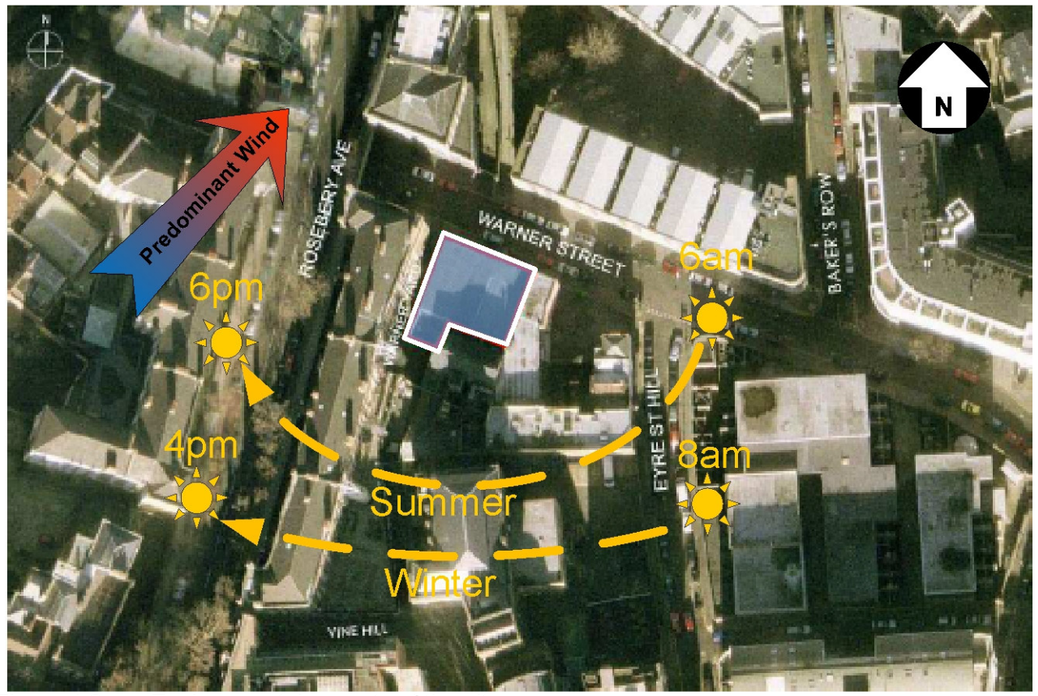


Figure 4.2 Environmental aspects of the site

The above analysis and impact on the development is discussed in section 4.6.

4.1. Energy Supply

The development will be supplied with mains electricity and mains gas.

4.2. Energy Conservation Measures – 'Be Lean'

The building design and building services systems will be selected to meet or better the following standards:

- Residential blocks – at least 5% improvement over Part L 2010.

It is proposed for each dwelling to have a wall hung gas combi boiler to provide heating and domestic hot water. The current proposed fabric U values and air permeability are set out in Table 4.2.

	Part L1a 2010	Proposed
Wall U Value	0.30 w/m²K	**0.15 w/m²K**
Floor U value	0.2 w/m²K	**0.15 w/m²K**
Roof U value	0.2 w/m²K	**0.15 w/m²K**
Windows	2 w/m²K	**Clear = 1.1 w/m²K** **Reglit = 1.8 w/m²K**
Thermal Bridging		**0.10**
Air Permeability	8 m³/m²/hr @ 50 Pa[1]	**5 m³/m²/hr @ 50 Pa**

Table 4.2 Proposed residential fabric performance

Notes

1. The reasonable air permeability limit remains unchanged from Part L 2006. However when a dwelling has not been tested, the assessed air permeability is the average test result obtained from testing other dwellings of the same type increased by 2m³/hr/m² @ 50 Pa. Therefore the apartments to be tested must either achieve an air permeability of 3 or must all be tested .

All dwellings will benefit from the following energy reduction and conservation measures:

- Green roof to reduce urban heat island effect
- Opening windows for rapid ventilation sized in accordance with Building Regulations Part F
- High efficiency gas combi boilers (gross efficiency = 89.4%)
- Background ventilation via low energy mechanical ventilation with heat recovery (SFP = 0.5, HR = 85%)
- 100% Low energy lights within dwellings
- 100% low energy lights within communal spaces plus occupancy detection

4.2.1. Part L compliance

The dwellings energy and CO_2 performance has been assessed by carrying out SAP 2009 assessments for a representative sample of dwellings. The results from the Part L assessments are shown in Table 4.3.

Flat	Target Emission Rate ($kgCO_2$ /m²/annum)	Dwelling Emission Rate ($kgCO_2$ /m²/annum)	Part L % improvement	Fabric Energy Efficiency
1	15.42	15.10	2.1%	42.44
2	19.34	18.55	4.1%	38.83
4 & 7	17.82	16.96	4.8%	34.67
6 & 9	17.38	15.18	12.7%	37.22
11	15.02	14.14	5.9%	37.60
12	18.69	17.87	4.4%	51.57
Average	**17.05**	**15.94**	**6.5%**	

Table 4.3 Residential Part L assessment results

The Part L analysis shows that the development has the potential to achieve 7 out of the 12 available CfSH credits as shown in Table 4.4. The proposed energy strategy therefore satisfies the London Borough of Camden requirement for 50% of the available energy credits to be achieved.

	CfSH credits
Ene 1 Dwelling Emission Rate	0.7 credits
Ene 2 Fabric Energy Efficiency	6.3 credits
Total Energy Credits	**7 credits**

Table 4.4 Predicted CfSH Energy credits

4.2.2. In Use loads

In use loads such as small power, cooking, etc has been predicted based on the methodology to assess small power set out in CfSH 2009.

4.3. Energy Signature of the Scheme

The total CO_2 footprint for the proposed development has been estimated at approximately **25 tonnes** per annum, using the development's Part L 2010 loads plus operational 'in use' loads, before the

addition of low and zero carbon technologies. This carbon dioxide emissions figure is calculated from the primary energy consumption estimates as shown in Figure 4.4.

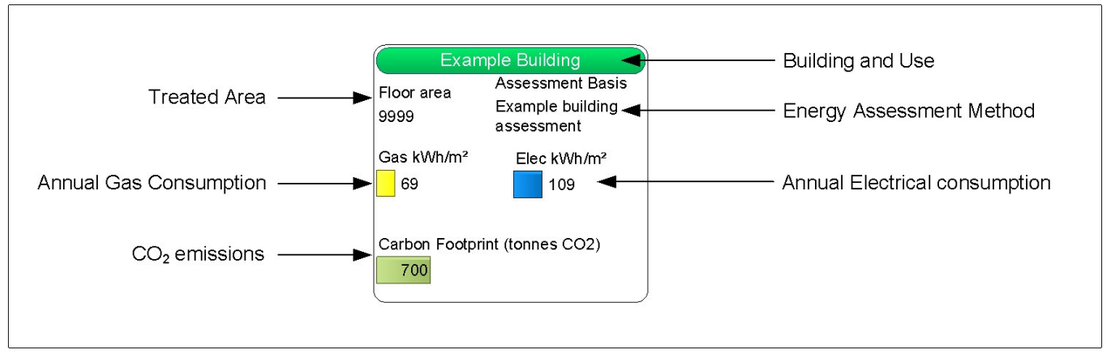


Figure 4.3 CO_2 Footprint Key

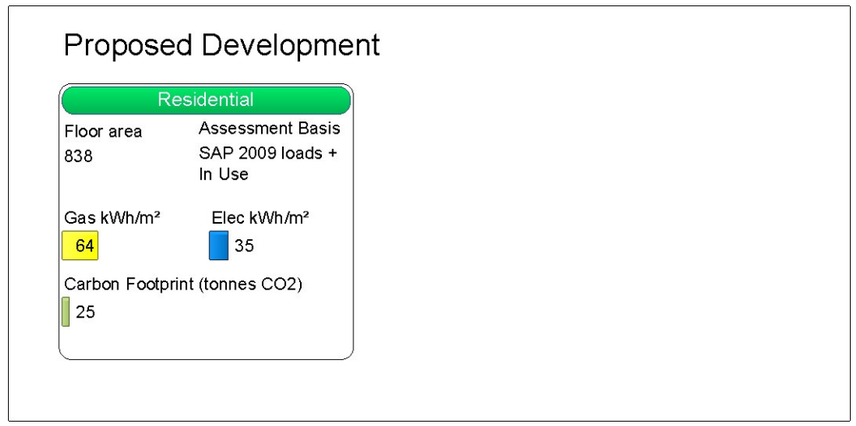


Figure 4.4 CO_2 footprint for the proposed development

The dominant energy consumption for this development is the domestic hot water production and heating. However the dominant CO_2 emissions are due to electrical consumption due to the higher CO_2 emissions associated with this fuel. This is illustrated in Figure 4.5.

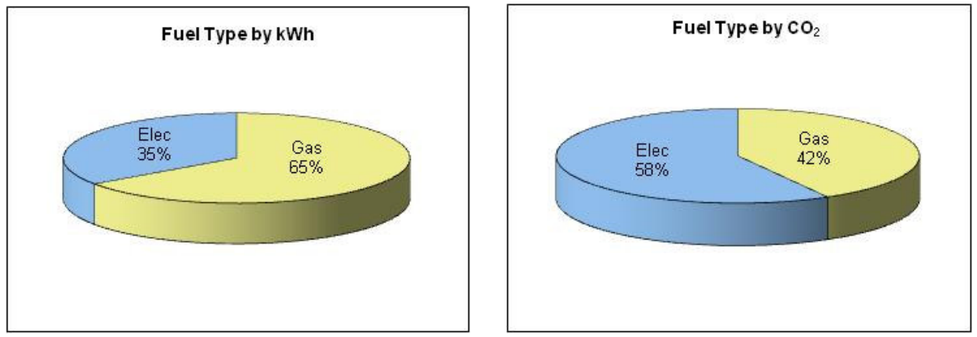


Figure 4.5 Fuel type by estimated kWh and CO_2 emissions

The comparison of the baseline and development emissions and the impact of 'in use' loads are shown in Figure 4.6.This shows that the proposed development offers a 3.5% improvement over a Part l 2010 compliant scheme on an operational basis.

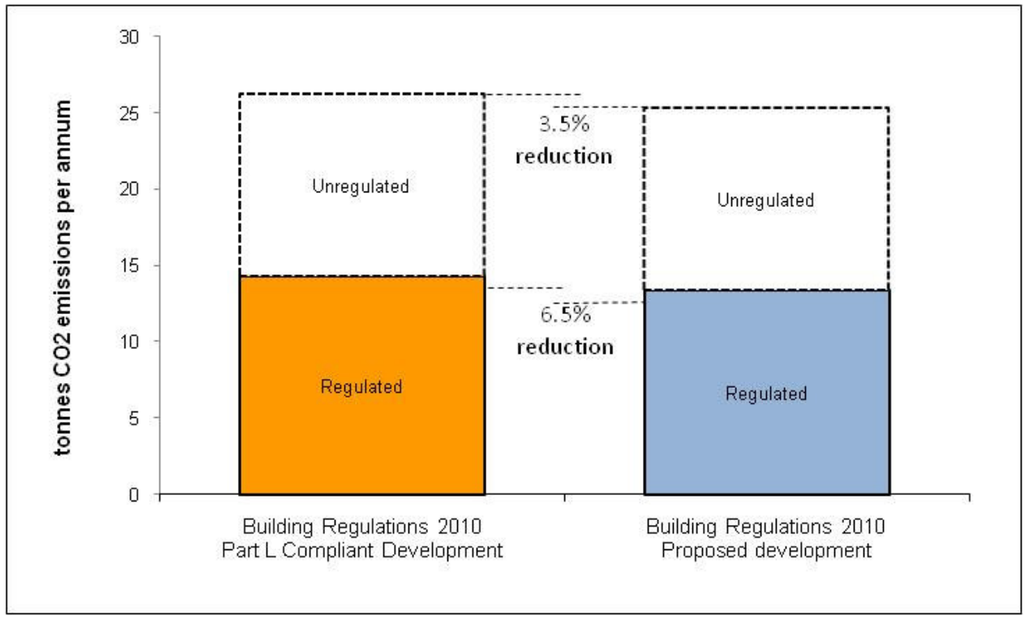


Figure 4.6 Comparison of baseline and proposed CO_2 footprint, including 'in use' loads

5. LOW AND ZERO CARBON TECHNOLOGIES

All commercially available Low and Zero Carbon options have been reviewed with respect to the development. These technologies have been considered within the constraints of the prevailing environmental conditions, building operation, loads, integration within the concept building services, viability, architectural design, capital and maintenance costs with associated payback and overall effective carbon dioxide reduction.

5.1. Be Clean

There are currently no existing community heating systems for the development to potentially connect into. The site is more than a 1km away from the proposed UCL and Euston Road networks and just over 600m from the Citigen network.

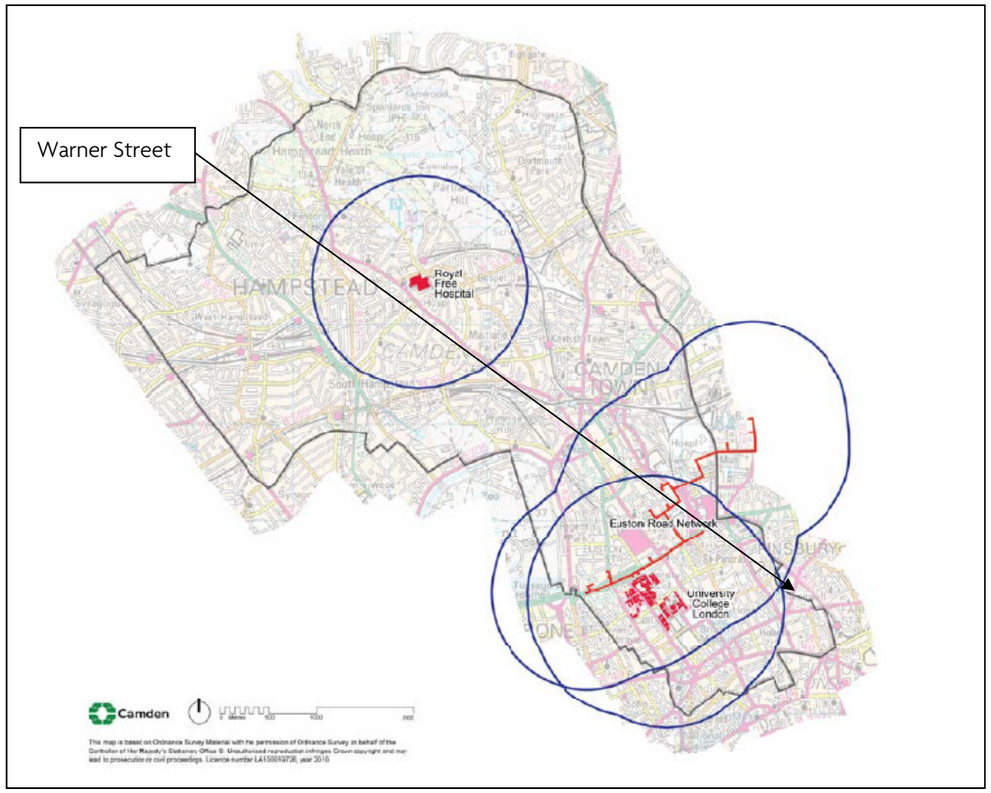


Figure 5.1 Extent of zone 1km from proposed district heating networks

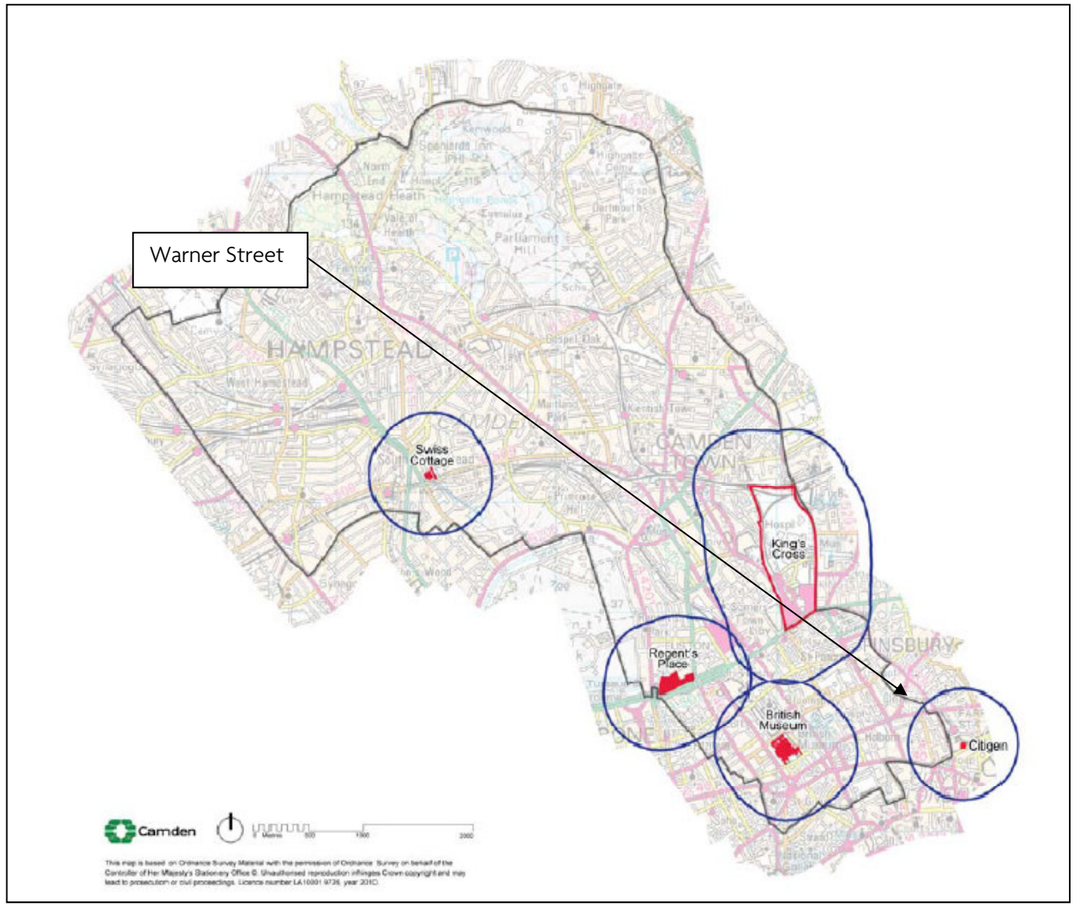


Figure 5.2 Extent of zone 500m from existing district heating networks

The development is considered too small at just 12 dwellings for a combined heat and power unit to be viable. Due to space constraints on the site and the need to minimise capital and running costs it is not proposed to install a community heating network. The most efficient solution is individual high efficiency gas fired combi boilers to provide the heating and hot water demand of each dwelling.

5.2. Renewable Energy – 'Be Green'

The following analysis of renewable energy technologies identified in the London Plan Policy 4A.1 'Tackling climate change', Policy 4A.7 'Renewable energy' and the London Renewables 'Toolkit' has been carried out for the development. Viable renewable technologies that can be integrated into the design and make a worthwhile contribution to reducing the site's CO_2 emissions have been reviewed in detail.

Technology	Feasible	Comments	Proposed
Wind Turbines	**No**	Wind turbines are not considered appropriate for this development: Ideally the turbine should be at least 10m above the tallest building within 100 m to limit the effects of turbulence. The visual appearance of very tall turbines is likely to be overwhelming and with the disrupted wind resource in urban sites this technology is not recommended.	**No**
Photo-voltaics	**Maybe**	The roof will have good solar access and is considered suitable for PV panels. It is estimated that the PV could displace approximately 2,500kWh equivalent to 1.3 tonnes of CO_2. (See Appendix A for details)	**Yes**
Solar Thermal	**Maybe**	The roof will have good solar access. In order to integrate solar thermal collectors on this development it is recommended that these are connected to a communal system. As set out in Section 5.1 a communal system is not considered viable for this scheme. Solar thermal collectors are not compatible with the proposed combi boilers and have been rejected.	**No**
Bio-fuel Heating	**No**	Bio-fuel (wood pellets) heating may be suitable for this development. However the following issues will need to be satisfactorily resolved: - environmental issues surrounding fuel type - fuel transportation / storage issues - potential air quality impact and resulting flue structure - plant space / maintenance requirements Biomass is not proposed due to concerns regarding air quality, transport implications and additional cost and maintenance requirements.	**No**
Air source heat pumps	**Maybe**	Air source heat pumps could be considered as an alternative to the proposed combi boilers. In order to achieve CO_2 savings the air source heat pump the heating water is typically limited to 50²C. Whilst this is ideal for under floor heating systems this is not suitable for domestic hot water due to the risks of legionella. Typically an electric immersion heater is used to heat the hot water to the recommended 60°C. As hot water is the dominant load these systems tend not to save CO_2.	**No**
Ground Source Heating / Cooling	**Maybe**	The site footprint is around 300m². A closed loop borehole system could provide heating to the dwellings via water to water heat pumps. This type of system would be required to be connected to a communal system. As set out in Section 5.1 a communal system is not considered viable for this scheme.	**No**

Table 5.1 Review of renewable technologies

It is considered that the only viable renewable technology is PV panels. It is proposed to incorporate PV panels on the roof as detailed in Appendix A.

6. SUMMARY

The proposed Energy Strategy achieves an 8.6% reduction in CO_2 emissions overall compared to a Part L 2010 compliant development on an operational basis. The key features of this strategy are:

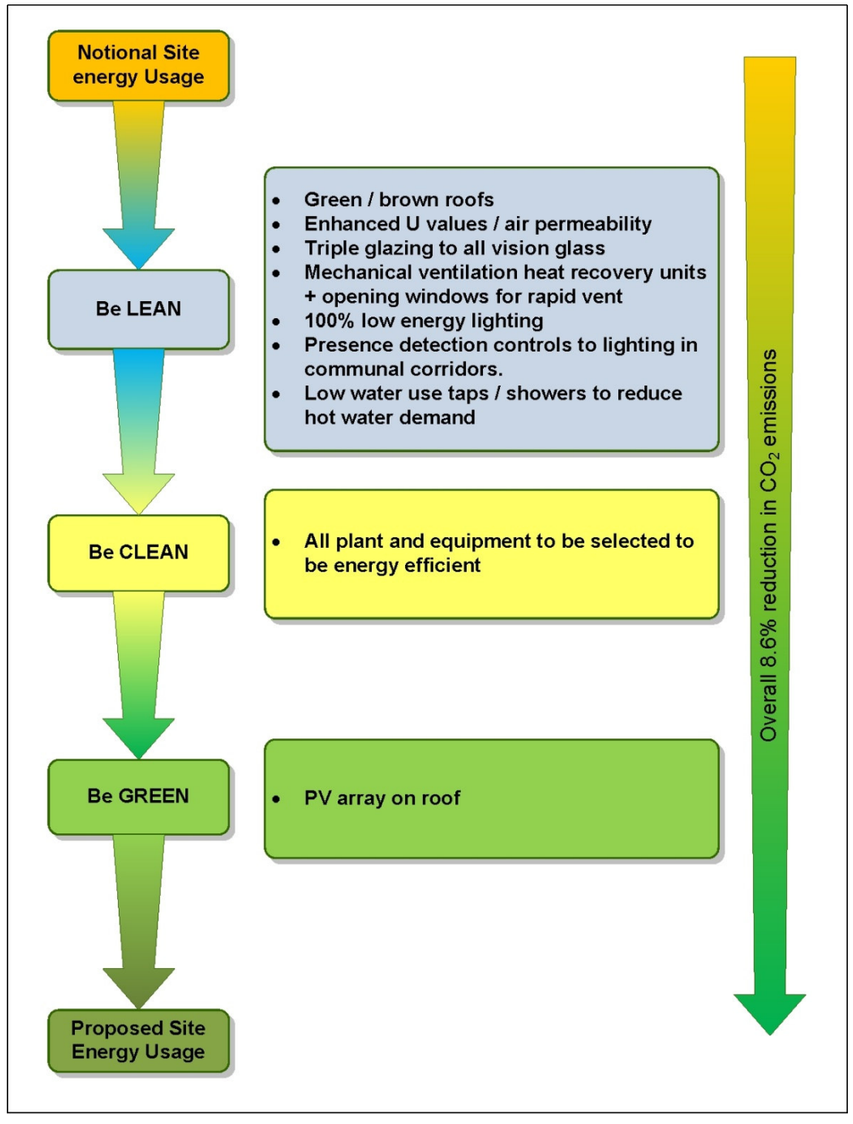


Figure 6.1 Proposed Energy Hierarchy

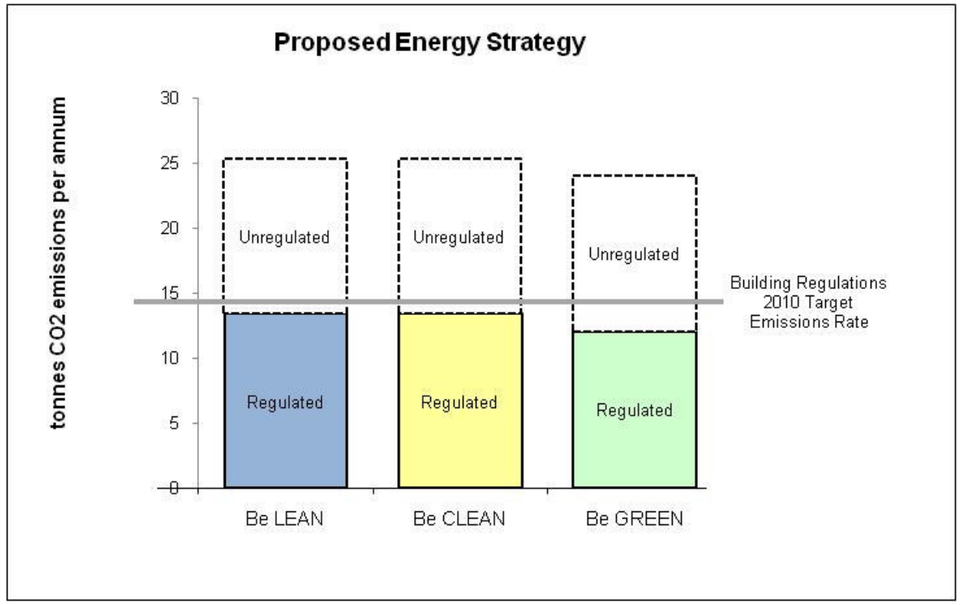


Figure 6.2 Proposed Energy Strategy

	CO_2 emissions (tonnes CO_2 per annum)		
	Regulated	**Unregulated**	**Total**
Building Regulations 2010 Part L Compliant Development	14.3	11.9	26.2
Be Lean	13.4	11.9	25.3
Be Clean	13.4	11.9	25.3
Be Green	12.0	11.9	24.0

Table 6.1 CO_2 emissions after each stage of the Energy Hierarchy

	CO_2 savings (tonnes CO_2)		CO_2 savings (%)	
	Regulated	**Total**	**Regulated**	**Total**
Be Lean	0.9	0.9	6.5%	3.5%
Be Clean	0.0	0.0	0.0%	0.0%
Be Green	1.3	1.3	9.9%	5.2%
Total cumulative savings			**15.8%**	**8.6%**

Table 6.2 CO_2 savings after each stage of the Energy Hierarchy

7. APPENDIX A – RESIDENTIAL TOWER PV STUDY

Photovoltaic cells directly convert sunlight into electrical current using semiconductors. The output of a cell is directly proportional to the intensity of the light received by the active surface of the cell. The location and positioning of PV cells is therefore critical to achieving acceptable performance. Exposure to sunlight causes electricity to flow through the cells. Direct sunlight produces the greatest output, but power is produced even on overcast days.

The roof of the proposed building will have good solar access. Currently a green roof is proposed. The PV support system panels will need to be integrated with the green roof and the PV located above the expected line of growth to prevent overshading.

Figure 7.1 PV integrated onto green roof

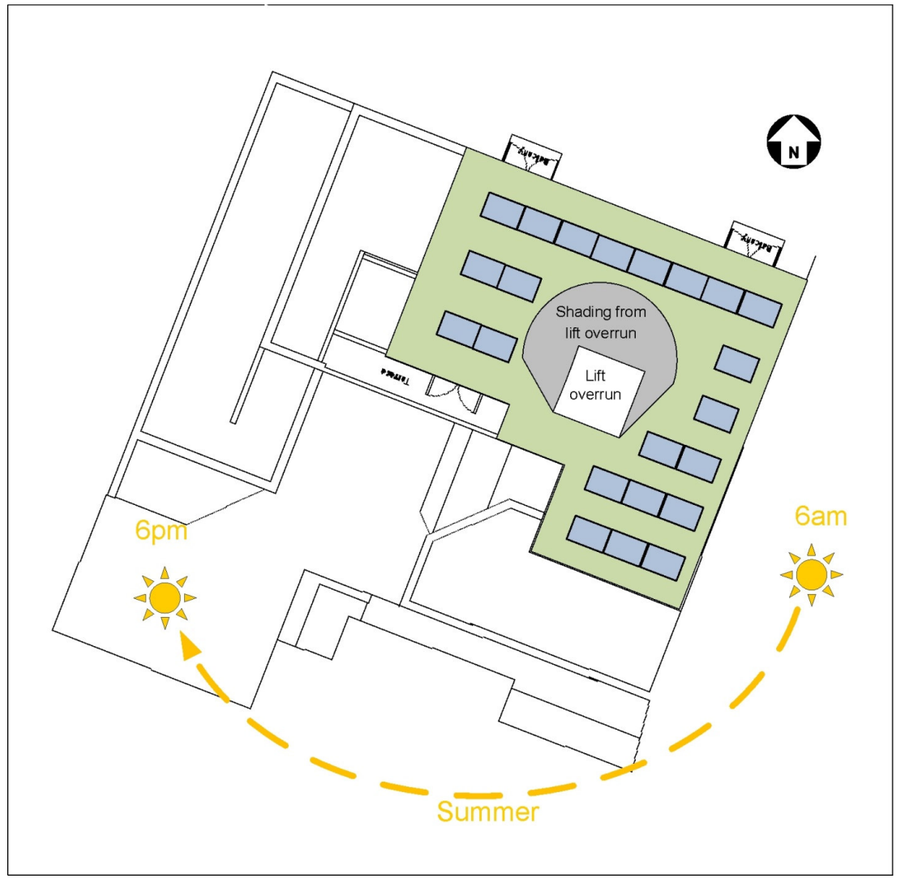


Figure 7.2 Proposed PV layoutA

The roof area will accommodate 22 PV panels as indicated in Figure 7.2. Typically PV panels are 1.3m x 1.0m in size. It is proposed to arrange the PV orientated SSE to align with the building at an inclination of 15°. The distance between the PV arrays will need to be at least 0.7m in order to minimise self shading. The electricity generated per annum by the proposed PV array is assessed in Table 7.1.

The proposed PV arrays will generate 2,500kWh displacing 1,325kgCO_2 per annum.

	Available Area	PV type	PV area	Output	Output
Roof	93m²	Mono crystalline	26.4m²	95kWh/m²	2,500kWh

Table 7.1 Proposed PV array

DOCUMENT HISTORY

ISSUE NO	DATE	DETAILS
1.0	18/3/11	Final Issue