Energy Strategy
1 – 11 Euston Road, NW1

Prepared by

metropolis green

On behalf of

Gaylord Investments Ltd

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On behalf of Gaylord Investments Ltd

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EXECUTIVE SUMMARY

i. This Energy Strategy has been prepared on behalf of Gaylord Investments Ltd for the proposed scheme at 1 - 11 Euston Road, in support of a full planning application.

ii. This document demonstrates how the development will progress to achieving London Borough of Camden's core policy.

iii. The development will specify low carbon as well as renewable energy technologies in order to achieve the London Plan Policy targets, the BREEAM 'Excellent' standard and Code for Sustainable Homes Level 4 as required by the London Borough of Camden.

iv. Nos. 1-11 Euston ('the site') is located in the London Borough of Camden. The site is located on the south side of Euston Road directly opposite Kings Cross Station and is bounded by Birkenhead Street and Crestfield Street to the east and west respectively.

v. The existing site contains buildings four storeys in height and comprises the Northumberland Hotel, student accommodation, low grade office space, the Kings Cross Methodist Church, and various commercial uses fronting Euston Road.

vi. The site benefits from unparalleled accessibility in terms of its proximity to local, national and international transport interchanges.

vii. The site occupies a truly strategic and sustainable location within the heart of the central London. The immediate Kings Cross/St. Pancras area is part of an international gateway that attracts tourists and other visitors.

viii. The proposed development involves the demolition of the existing buildings on the site and their replacement with a comprehensive mixed use redevelopment scheme comprising a 167 bed hotel, 7 residential units and retail/restaurant/bar uses.

ix. The proposed development will comprise 8 storeys plus a basement level.

x. A key objective of the project has been to reduce the carbon emissions associated with the proposed development, and to ensure that the development is a healthy and comfortable place to live/work/visit and that operating costs are minimised through appropriate and efficient energy systems.

xi. The building has been designed using fabric and system efficiencies beyond the minimum requirements of building regulations and will incorporate a double skin façade which contributes not only to the aesthetic of the building but, has a number of advantages in terms of occupant comfort, and sustainable design;

xii. In addition to integrating low and zero carbon technologies to the site, the design team have worked to ensure that 1 - 11 Euston Road has been designed to high sustainability standards by implementing a range of measures to ensure that the site is sustainable in construction and operation/occupation. These measures are set out in the Sustainable Design and Construction Statement (ref: 1962/SDCS-1105AA.00) produced by Metropolis Green.

xiii. This energy strategy follows the energy hierarchy: Be Lean, Be Clean, and Be Green. A range of low carbon and renewable energy technologies have been assessed in this energy appraisal in order to establish the most suitable energy solution for the site.

xiv. The results of calculations which have been undertaken in line with the 'energy hierarchy' have enabled significant carbon reductions to be achieved. These reductions can be summarised as follows;

- A 30.89% (268,992 kgCO_2/yr) reduction associated with proposed energy efficiency measures.
- A 27.43% (165,100 kgCO_2/yr) reduction associated with proposed low carbon measures.
- Photovoltaics have been determined to be the preferred renewable energy technology for to the site, resulting in a further reduction of 2.57% (11,244kgCO_2/yr).

xv. This report demonstrates that an overall total carbon emission reduction of 51.14% can be achieved from the Notional Baseline as a result of this energy strategy as well as contributing to the 2.57% carbon reduction from on-site renewables.

xvi. This report shows that the building is eligible for 8 credits under the BREEAM, Ene 1 – Reduction of CO_2 Emissions issue, meeting the mandatory requirements of this issue and contributing significantly to the overall achievement of a BREEAM rating of 'Excellent'. This strategy demonstrates that the development also achieves a total 58.12% improvement over the Notional Baseline BER.

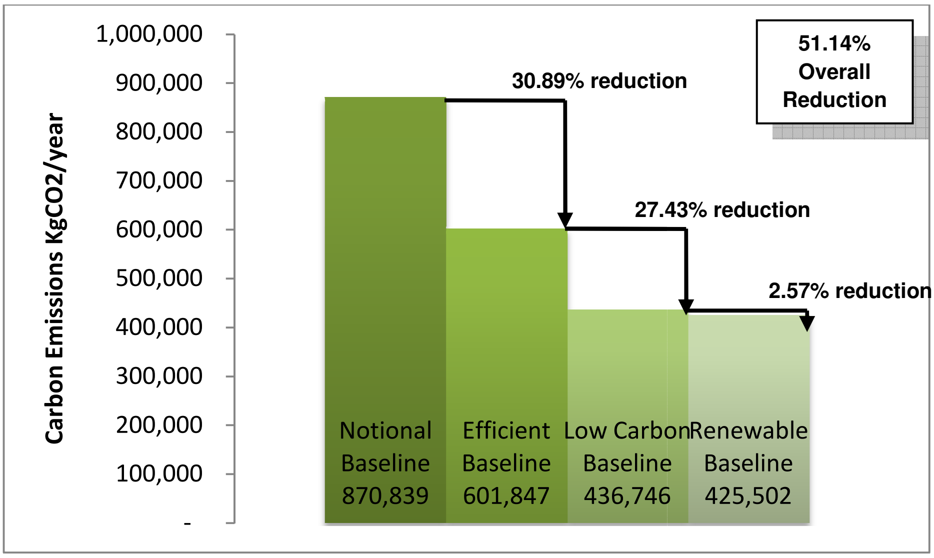
xvii. The residential units will meet the Code Level 4 mandatory minimum Dwelling Emissions Rate (DER) over TER improvement of 25%.

xviii. Additionally, in the context of the 2011 London Plan Policy 5.2, the site achieves BER over TER improvements beyond the 25% improvement on 2010 Building Regulations target set for the 2010 – 2013 period,

xix. Modelling and calculations show the development at 1 - 11 Euston Road has potential to achieve a total 29.50% BER over TER improvement,

xx. Figure 1 shows an 'at a glance' summary of the 'Be Lean, Be Clean and Be Green' CO_2 reductions for the modelled solutions. A more detailed breakdown of emissions by category stage and emissions reductions for each stage of the 'energy hierarchy' can be found in Table 10: Energy Hierarchy Summary on page 60

Figure 1: Whole Energy Carbon Emission Reductions



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CONTENTS

1.0 INTRODUCTION

1.1 Metropolis Green has been appointed by Gaylord Investments Ltd to prepare an energy strategy for the proposed scheme at 1 - 11 Euston Road, demonstrating how the relevant planning policies will be achieved.

1.2 This report firstly assesses the energy efficiency measures of the proposed scheme, and then examines low carbon options for supplying energy to the development, before examining the potential for renewable energy technologies to reduce carbon emissions.

1.3 This document should be read alongside the Sustainable Design and Construction Statement report also produced by Metropolis Green.

2.0 SITE AND DEVELOPMENT DESCRIPTION

2.1 Nos. 1-11 Euston ('the site') is located in the London Borough of Camden. The site is located on the south side of Euston Road directly opposite Kings Cross Station and is bounded by Birkenhead Street and Crestfield Street to the east and west respectively.

2.2 The existing site contains buildings four storeys in height and comprises the Northumberland Hotel, student accommodation, low grade office space, the Kings Cross Methodist Church, and various commercial uses fronting Euston Road.

2.3 The site benefits from unparalleled accessibility in terms of its proximity to local, national and international transport interchanges.

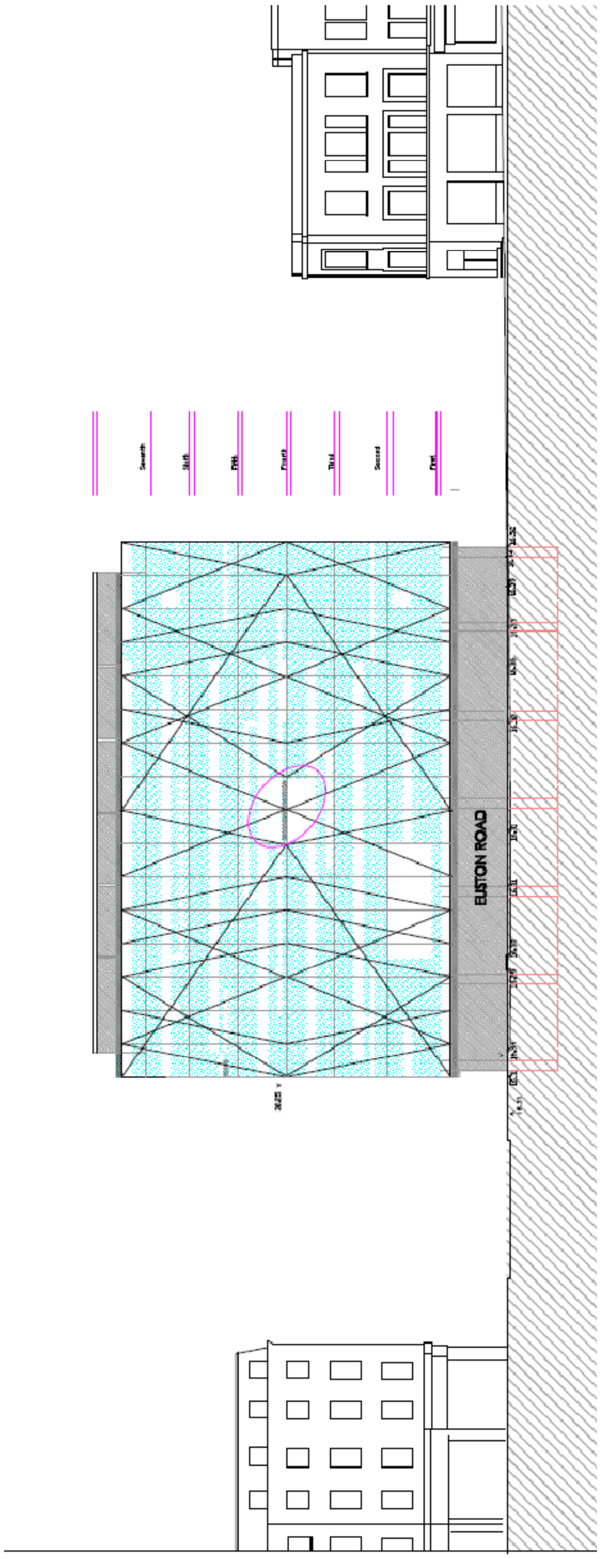
2.4 The site occupies a truly strategic and sustainable location within the heart of the central London. The immediate Kings Cross/St. Pancras area is part of an international gateway that attracts tourists and other visitors.

2.5 The proposed development involves the demolition of the existing buildings on the site and their replacement with a comprehensive mixed use redevelopment scheme comprising a 167 bed hotel, 7 residential units and retail/restaurant/bar uses.

2.6 The proposed development will comprise 8 storeys plus a basement level.

2.7 Figure 2 below is the north elevation of the proposed site.

Figure 2 – North Elevation



3.0 POLICY CONTEXT

Increased development of renewable energy resources and improvements in energy efficiency are vital to facilitating the delivery of the European, National, Regional and Local commitments on climate change. The relevant policy drivers applicable to new developments are as follows.

3.1 European Policy

European Union Energy Performance in Buildings Directive (2002)

3.1.1. The European Parliament passed the Energy Performance in Buildings Directive in December 2002, requiring member states to promote improved energy use in all buildings.

3.1.2. Article 5: requires minimum standards for energy performance and consideration of low/zero-carbon technologies in new buildings. This requirement is to be met through Part L of the 2006 Building Regulations.

3.2 National Policy

3.2.1 Planning Policy Statement notes (PPS's) set out the Government's national land use planning policies for England. Three of these notes, PPS 1 'Delivering Sustainable Development', PPS 22 'Renewable Energy', and the recently published PPS on Planning and Climate Change (supplement to PPS1) are particularly relevant to the development.

PPS1 Delivering Sustainable Development

3.2.2 Promotion of renewables is covered by the following statement: "Development plan policies should seek to minimise the need to consume new resources over the lifetime of the development by making more efficient use or reuse of existing resources, rather than making new demands on the environment; and should seek to promote and encourage, rather than restrict the use of renewable resources (for example, by the development of renewable energy)."

PPS Planning and Climate Change (supplement to PPS1)

3.2.3 Paragraph 20 states that: "Planning Authorities should: expect a proportion of the energy supply of new development to be secured from decentralized and renewable or low-carbon energy sources."

3.2.4 Decentralized is defined as a diverse range of technologies, including micro-renewables, which can locally serve an individual building, development or wider community and includes heating and cooling energy.

PPS22 Renewable Energy

3.2.5 Paragraph 8 states that: "Local planning authorities may include policies in local development documents that require a percentage of the energy to be used in new residential, commercial or industrial developments to come from on-site renewable energy developments. Such policies:

(i) should ensure that requirement to generate on-site renewable energy is only applied to developments where the installation of renewable energy generation equipment is viable given the type of development proposed, its location, and design;

(ii) should not be framed in such a way as to place an undue burden on developers, for example, by specifying that all energy to be used in a development should come from on-site renewable generation."

3.3 Building Regulations

3.3.1 Building Regulations exist to ensure the health, safety, welfare and convenience of people in and around buildings, and the energy efficiency of buildings. The regulations apply to most new buildings and many alterations of existing buildings in England and Wales, whether domestic, commercial or industrial.

3.3.2 The Building Act 1984 is the enabling Act under which the Building Regulations have been made. The Secretary of State, under the power given in the Building Act 1984, may for any purposes of:

- securing the health, safety, welfare and convenience of persons in or about buildings and of others who may be affected by buildings or matters connected with buildings;
- furthering the conservation of fuel and power
- preventing waste, undue consumption, misuse or contamination of water

- furthering the protection or enhancement of the environment
- facilitating sustainable development, or
- furthering the prevention or detection of crime
- make regulations with respect to the design and construction of buildings, demolition of buildings, and the provision of services, fittings and equipment in or in connection with buildings.

3.3.3 Approved Document Guidance on how to meet the functional 'requirements' of the Building Regulations, are contained in the Building Regulations - "Approved Documents"

3.3.4 Building Regulations 2010 Approved Documents Part L1A: “Conservation of Fuel and Power in Existing Dwellings” and Part L2A “Conservation of Fuel and Power in New Buildings Other Than Dwellings” require that the minimum energy performance requirement for new buildings are exceeded, however they do not currently require the installation of renewable energy technologies.

3.3.5 Approved Documents Part L1A and L2A also require that fabric performance and services comply with minimum standards.

3.4 Regional Policy

3.4.1 In London, the Mayor has established policies and strategies relating to renewable energy use in London.

Mayor’s Energy Strategy

3.4.2 The Mayor is taking steps to tackle climate change through policies and programmes seeking to reduce London’s carbon dioxide emissions and to manage resources more139 effectively. Under the Greater London Authority Act 2007, the Mayor has a new statutory duty to contribute towards the mitigation of, and adaptation to, climate change in the UK. The Mayor will use all of his powers, resources and influence to work with other agencies to raise awareness and promote behavioural change. He has already produced a strategy for Climate Change Adaptation (the first for a major world city) and a strategy for Climate Change Mitigation and Energy.

London Plan

3.4.3 The London Plan (2011) is the Spatial Development Strategy for London. Section 5 of the Plan covers the mitigation of, and adaptation to climate change and the management of natural resources. The London Plan supports the Mayor's Energy Strategy. The key policies regarding energy efficiency and renewables in new developments are summarised below.

POLICY 5.1 - CLIMATE CHANGE MITIGATION

3.4.4 The Mayor seeks to achieve an overall reduction in London's carbon dioxide emissions of 60 per cent (below 1990 levels) by 2025. It is expected that the GLA Group, London boroughs and other organisations will contribute to meeting this strategic reduction target, and the GLA will monitor progress towards its achievement annually

POLICY 5.2 - MINIMISING CO2 EMISSIONS

3.4.5 A. Development proposals should make the fullest contribution to minimising carbon dioxide emissions in accordance with the following energy hierarchy:

- Be lean: use less energy
- Be clean: supply energy efficiently
- Be green: use renewable energy

3.4.6 B. The Mayor will work with boroughs and developers to ensure that major developments meet the following targets for carbon dioxide emissions reduction in buildings. These targets are expressed as minimum improvements over the Target Emission Rate (TER) outlined in the national Building Regulations leading to zero carbon residential buildings from 2016 and zero carbon non-domestic buildings from 2019.

POLICY 5.5 - DECENTRALISED ENERGY NETWORKS

3.4.7 A. The Mayor expects 25 per cent of the heat and power used in London to be generated through the use of localised decentralized energy systems by 2025. In order to achieve this target the Mayor prioritises the development of decentralised heating and cooling networks at the development and area wide levels, including larger scale heat transmission networks.

3.4.8 D. As a minimum boroughs should require developers to prioritise connection to existing or planned decentralised energy networks where feasible.

POLICY 5.6 - DECENTRALISED ENERGY IN DEVELOPMENT PROPOSALS

3.4.9 A. Development proposals should evaluate the feasibility of Combined Heat and Power (CHP) systems, and where a new CHP system is appropriate also examine opportunities to extend the system beyond the site boundary to adjacent sites.

3.4.10 B. Major development proposals should select energy systems in accordance with the following hierarchy:

1. Connection to existing heating or cooling networks

2. Site wide CHP network

3. Communal heating and cooling.

3.4.11 C. Potential opportunities to meet the first priority in this hierarchy are outlined in the London Heat Map tool. Where future network opportunities are identified, proposals should be designed to connect to these networks.

POLICY 5.7 - RENEWABLE ENERGY

3.4.12 A. The Mayor seeks to increase the proportion of energy generated from renewable sources, and expects that the projections for installed renewable energy capacity outlined in the Climate Change Mitigation and Energy Strategy and in supplementary planning guidance will be achieved in London.

3.4.13 B. Within the framework of the energy hierarchy (see Policy 5.2), major development proposals should provide a reduction in expected carbon dioxide emissions through the use of on-site renewable energy generation, where feasible.

3.4.14 Individual development proposals will also help to achieve these targets by applying the energy hierarchy in Policy 5.2. There is a presumption that all major development proposals will seek to reduce carbon dioxide emissions by at least 20 per cent through the use of on-site renewable energy generation wherever feasible. Development proposals should seek to utilise renewable energy technologies such as: biomass heating; cooling and electricity; renewable energy from waste; photovoltaics; solar water heating; wind and heat pumps.

3.4.15 The Mayor encourages the use of a full range of renewable energy technologies, which should be incorporated wherever site conditions make them feasible and where they contribute to the highest overall and most cost effective carbon dioxide emissions savings for a development proposal.

POLICY 5.9 - OVERHEATING AND COOLING

3.4.16 A. The Mayor seeks to reduce the impact of the urban heat island effect in London and encourages the design of places and spaces to avoid overheating and excessive heat generation, and to reduce overheating due to the impacts of climate change and the urban heat island effect on an area wide basis.

3.4.17 B. Major development proposals should reduce potential overheating and reliance on air conditioning systems and demonstrate this in accordance with the following cooling hierarchy:

1. minimise internal heat generation through energy efficient design

2. reduce the amount of heat entering a building in summer through orientation, shading, albedo, fenestration, insulation and green roofs and walls

3. manage the heat within the building through exposed internal thermal mass and high ceilings

4. passive ventilation

5. mechanical ventilation

6. active cooling systems (ensuring they are the lowest carbon options).

3.4.18 C. Major development proposals should demonstrate how the design, materials, construction and operation of the development would minimise overheating and also meet its cooling needs. New development in London should also be designed to avoid the need for energy intensive air conditioning systems as much as possible. Further details and guidance regarding overheating and cooling are outlined in the London Climate Change Adaptation Strategy.

POLICY 5.11 - GREEN ROOFS AND DEVELOPMENT SITE ENVIRONS

3.4.19 A. Major development proposals should be designed to include roof, wall and site planting, especially green roofs and walls where feasible, to deliver as many of the following objectives as possible:

a. adaptation to climate change (ie aiding cooling)

b. sustainable urban drainage

c. mitigation of climate change (ie aiding energy efficiency)

d. enhancement of biodiversity

e. accessible roof space

f. improvements to appearance and resilience of the building

g. growing food

3.5 Local Policy

3.5.1 Alongside the Mayor's London Plan, London Borough of Camden's Local Development Framework (LDF) which includes Camden's Core Strategy and Camden Development Policies 2010-2025 adopted November 2010 have a number of policies dedicated to environmental protection and enhancement. These policies are set out below.

Core Strategy Policy CS13 - Tackling climate change through promoting higher environmental standards

Reducing the effects of and adapting to climate change

3.5.2 The Council will require all development to take measures to minimise the effects of, and adapt to, climate change and encourage all development to meet the highest feasible environmental standards that are financially viable during construction and occupation by:

a) ensuring patterns of land use that minimise the need to travel by car and help support local energy networks;

b) promoting the efficient use of land and buildings;

c) minimising carbon emissions from the redevelopment, construction and occupation of buildings by implementing, in order, all of the elements of the following energy hierarchy:

1. ensuring developments use less energy,

2. making use of energy from efficient sources, such as the King's Cross, Gower Street, Bloomsbury and proposed Euston Road decentralised energy networks;

3. generating renewable energy on-site; and

d) ensuring buildings and spaces are designed to cope with, and minimise the effects of, climate change.

3.5.3 The Council will have regard to the cost of installing measures to tackle climate change as well as the cumulative future costs of delaying reductions in carbon dioxide emissions

Local energy generation

3.5.4 The Council will promote local energy generation and networks by:

e) working with our partners and developers to implement local energy networks in the parts of Camden most likely to support them, i.e. in the vicinity of:

– housing estates with community heating or the potential for community heating and other uses with large heating loads;

– the growth areas of King's Cross; Euston; Tottenham Court Road; West Hampstead Interchange and Holborn;

– schools to be redeveloped as part of Building Schools for the Future programme;

– existing or approved combined heat and power/local energy networks (see Map4);

and other locations where land ownership would facilitate their implementation.

f) protecting existing local energy networks where possible (e.g. at Gower Street and Bloomsbury) and safeguarding potential network routes (e.g. Euston Road);

Camden's carbon reduction measures

3.5.5 The Council will take a lead in tackling climate change by:

j) taking measures to reduce its own carbon emissions;

k) trialing new energy efficient technologies, where feasible; and

l) raising awareness on mitigation and adaptation measures.

3.5.6 The subtext to CS 13 this policy is set out below

Making use of energy from efficient sources

3.5.7 Once a development has been designed to minimise its energy consumption in line with the approach above, the development should assess its remaining energy needs and the availability of any local energy networks or its potential to generate its own energy from low carbon technology. The Council's full approach to local energy generation and local energy networks is set out below (paragraphs 13.16 - 13.22).

Generating renewable energy on-site

3.5.8 Buildings can also generate energy, for example, by using photovoltaic panels to produce electricity, or solar thermal panels, which produce hot water. Once a building and its services have been designed to make sure energy consumption will be as low as possible and the used of energy efficient sources has been considered, the Council will expect developments to achieve a reduction in carbon dioxide emissions of 20% from on-site renewable energy generation (which can include sources of site-related decentralised renewable energy) unless it can be demonstrated that such provision is not feasible. Details on ways to generate renewable energy can be found in our Camden Planning Guidance supplementary document.

Camden Development Policy DP22 - Promoting sustainable design and construction

3.5.9 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.

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

- summer shading and planting;
- limiting run-off;
- reducing water consumption;
- Reducing air pollution; and
- not locating vulnerable uses in basements in flood-prone areas.

3.5.11 Sustainability is clearly a high priority for London Borough of Camden, and sustainability has been incorporated holistically into the proposed development at 1 - 11 Euston Road.

4.0 ENERGY/CARBON CALCULATIONS

4.0.1 The proposed development at 1 - 11 Euston Road must comply with a number of policies and regulations, which require the calculation of energy demand and carbon emissions. The calculation of energy demand and carbon emissions for each of the policies/standards is slightly different; this is discussed in the sections below.

- Building Regulations
- BREEAM 2008

4.1 Building Regulations

4.1.1 On the first of October 2010 a new version of Part L came into force, Part L 2010. 1 - 11 Euston Road will be registered for compliance with Part L1A and L2A 2010 and as such C_{O2} calculations are based on the 2010 requirements.

4.1.2 Calculations have been performed in order to demonstrate both Building Regulations compliance, Code and BREEAM achievement using the Domestic National Calculation Methodology (NCM), Standard Assessment Procedure (SAP) software and the non domestic National Calculation Methodology (NCM), Simplified Building Energy Modelling (SBEM) software. Appendix A contains a full set of SBEM calculation results for the development.

4.1.3 Building Regulations 2010 Approved Document Part L1A and L1B requires that the calculated CO_2 emission rate for the building. The Dwelling Emission Rate (DER), must not be greater than the Target Emission Rate (TER). Compliance is determined by SAP calculations,

4.1.4 Building Regulations 2010 Approved Document Part L2A: "Conservation of Fuel and Power in New Buildings Other Than Dwellings" requires that the calculated CO_2 emission rate for the building. The Building Emission Rate (BER), must not be greater than the Target Emission Rate (TER). Compliance is determined by SBEM calculations,

4.1.5 The TER is the minimum energy performance requirement for new building. It is expressed in terms of $kgCO_2$ per m^2 of floor area per year, emitted as a result of the provision of heating, hot water, ventilation and internal fixed lighting.

4.1.6 SAP gives reference values to define the notional building of the same size and shape as the actual building that is to be built. The DER and BER calculations for the building are based on:

- performance of the building fabric
- ventilation characteristics of the dwelling and ventilation equipment
- efficiency and control of the heating system(s)
- solar gains through openings of the dwelling
- the fuel used to provide space and water heating, ventilation and lighting
- renewable energy technologies

4.1.7 The contribution of renewable energy in reducing carbon emissions is taken into account when calculating the DER/BER. To comply with Building Regulations the DER/BER must be no worse than the TER. SAP and SBEM assessments are also necessary to show compliance with the Code and BREEAM which is detailed below.

4.2 BRE: Environmental Assessment Method (BREEAM)

4.2.1 BREEAM is the world's leading and a widely used environmental assessment method for buildings. It sets the standard for best practice in sustainable design and is used to describe a building's environmental performance.

4.2.2 Credits are awarded in 8 categories according to performance. These credits are then added together to produce a single overall score on a scale of Pass, Good, Very Good, Excellent and Outstanding.

4.2.3 A BREEAM standard covers 8 categories of sustainability including:

- Energy
- Water
- Transport
- Land Use and Ecology
- Pollution
- Health & Wellbeing
- Materials
- Management

4.2.4 Each category consists of a number of issues and each issue seeks to mitigate the impact of a new build element of the building against performance targets and assessment criteria.

4.2.5 The majority of BREEAM issues are tradable, meaning that a design team/client can pick and choose which to comply with in order to build up their BREEAM performance score. However, there are a few mandatory requirements which need to be met in order to achieve the aspired BREEAM level.

4.2.6 A scheme can be assessed at Design Stage (DS) - leading to an Interim BREEAM Certificate and/or Post-Construction Stage (PCS) – leading to a Final BREEAM Certificate.

4.2.7 BREEAM ratings are classified from 'Pass' to 'Outstanding' dependent on the total score received from achieving credits across the various categories. In order to achieve 'Outstanding' there are also additional criteria to be met. For more detail on this, please refer to the BREEAM website.

BREEAM Rating	% score
UNCLASSIFIED	<30
PASS	≥30
GOOD	≥45
V GOOD	≥55
EXCELLENT	≥70
OUTSTANDING*	≥85

4.2.8 A BREEAM Bespoke assessment is considered the most suitable assessment for the full assessment at 1 - 11 Euston Road. The credits that are assessed in a Bespoke assessment are determined by BRE in terms of suitability to the particular development at the time of registration with the BRE.

4.2.9 As each BREEAM Bespoke assessment is unique, BRE Global Ltd (the certifying body) do not provide a pre-assessment tool for the scheme. In order to undertake a pre-assessment the BREEAM Multi-Residential scheme and pre-assessment tool has been applied to the proposed development at Euston Road, as it is deemed the most relevant standard scheme and most of the issues can be applied directly to the proposed development at 1 - 11 Euston Road.

4.3 Code for Sustainable Homes (November 2010)

4.3.1 The element of the Code that deals with the calculation of energy and carbon dioxide is the first Issue - Ene 1: Dwelling Emission Rate.

4.3.2 Credits are awarded based on the percentage improvement of the Dwelling Emission Rate (DER) score over the Target Emission Rate (TER) as calculated by the SAP Assessments.

4.3.3 The required percentage improvement of DER over TER increases with each Code Level, as illustrated by Table 1 below. It should be noted that Part L compliance 2010 is roughly equivalent to an improvement of 25% over Part L compliance 2006

Table 1: Mandatory Requirements for Ene 1 – Dwelling Emission Rate

Criteria		
% Improvement 2010 DER/TER*1	Credits*2	Mandatory Requirements
≥ 8%	1	
≥ 16%	2	
≥ 25%	3	Level 4
≥ 36%	4	
≥ 47%	5	
≥ 59%	6	
≥ 72%	7	
≥ 85%	8	
≥ 100%	9	Level 5
Zero Net CO_2 Emissions	10	Level 6
Default Cases		
None		

*1 Performance requirements are equivalent to those in previous scheme versions but are now measured using the AD L1A 2010 TER as the baseline.

*2 Up to nine credits are awarded on a sliding scale. The scale is based on increments of 0.1 credits, distributed equally between the benchmarks defined in this table.

4.3.4 The SAP worksheets indicating the DER are necessary evidence for the Code Assessment to prove that this criterion has been met.

4.3.5 Credits are also available within the Code standard for carbon emission reduction through the use of low or zero carbon technologies in the Ene 7 issue. There is 1 credit available for carrying out a 10% reduction and 2 credits available for a 15% reduction. Credits are awarded based on the percentage reduction in total carbon emissions that result from using Low or Zero Carbon (LZC) Energy Technologies.

4.4 2011 London Plan - Policy 5.2 - Minimising CO_2 Emissions

4.4.1 The London Plan, section 5.2, sets out the methodology and targets for the journey towards zero carbon for domestic and non domestic buildings

A. Development proposals should make the fullest contribution to minimising carbon dioxide emissions in accordance with the following energy hierarchy:

- Be lean: use less energy
- Be clean: supply energy efficiently
- Be green: use renewable energy

B. The Mayor will work with boroughs and developers to ensure that major developments meet the following targets for carbon dioxide emissions reduction in buildings. These targets are expressed as minimum improvements over the Target Emission Rate (TER) outlined in the national Building Regulations leading to zero carbon residential buildings from 2016 and zero carbon non-domestic buildings from 2019.

Table 2 - Domestic Targets

Residential buildings:	
Year	**Improvement on 2010 Building Regulations***
2010 – 2013	25 per cent (Code Level 4)
2013 – 2016	40 per cent
2016 – 2031	Zero carbon

Table 3 - Non Domestic Targets

Non-domestic buildings:	
Year	**Improvement on 2010 Building Regulations***
2010 – 2013	25 per cent
2013 – 2016	40 per cent
2016 – 2019	As per building regulations requirements
2019 – 2031	Zero carbon

C Major development proposals should include a detailed energy assessment to demonstrate how the minimum targets for carbon dioxide emissions reduction outlined above are to be met within the framework of the energy hierarchy.

D As a minimum, energy assessments should include the following details:

a calculation of the energy demand and carbon dioxide emissions covered by the Building Regulations and, separately, the energy demand and carbon dioxide emissions from any other part of the development, including plant or equipment, that are not covered by the Building Regulations (see paragraph 5.22) at each stage of the energy

b Proposals to reduce carbon dioxide emissions through the energy efficient design of the site, buildings and services

c Proposals to further reduce carbon dioxide emissions through the use of decentralised energy where feasible, such as district heating and cooling and combined heat and power (CHP)

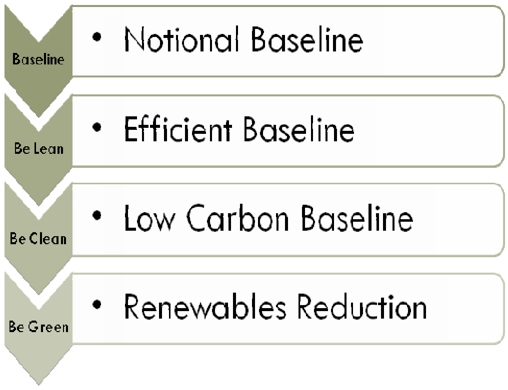
d Proposals to further reduce carbon dioxide emissions through the use of onsite renewable energy technologies.

4.4.2 E The carbon dioxide reduction targets should be met onsite. Where it is clearly demonstrated that the specific targets cannot be fully achieved onsite, any shortfall may be provided offsite or through a cash in lieu contribution to the relevant borough to be ring fenced to secure delivery of carbon dioxide savings elsewhere.

5.0 METHODOLOGY

5.1 The methodology that has been applied to this energy appraisal is in line with the Mayor's energy hierarchy of Be Lean and use energy efficiently, Be Clean and supply low carbon energy efficiently and Be Green and produce renewable energy. This is illustrated in Figure 3 below.

Figure 3: Energy Hierarchy



5.2 The Notional Baseline for the proposed development at 1 - 11 Euston Road has been calculated using the approved national calculation methodologies SAP and SBEM, as discussed in Section 4.1.

5.3 Improvements in the building fabric, lighting and performance of primary and secondary heating systems allowed for energy efficiency improvements to be achieved. These were also based on meeting best practice standards required to meet Code level 4 and BREEAM 'Excellent' standards. From the Notional Baseline, a new energy demand and carbon baseline is calculated, which will be referred to as the Efficient Baseline.

5.4 The London Plan Policy 5.6, requires that all new developments consider decentralised energy generation technology and communal heating systems. Combined Heat and Power technologies (CHP) and communal heating; hot water systems are examined in terms of their suitability for the site, which can reduce the Efficient Baseline further and it is to be referred to as the Low Carbon Baseline.

5.5 The reduction in carbon emissions from on-site renewables must then be investigated. This includes a feasibility appraisal of each of the approved renewable energy technologies in terms of their contribution to meeting the carbon reduction.

6.0 SITE ENERGY DEMAND & NOTIONAL BASELINE

6.1 The development at 1 - 11 Euston Road has been modelled in compliance with the preferred approach and Metropolis Green has determined the energy and carbon data for heating and hot-water demand, lighting and fans and pumps using SBEM approved software. In addition, the carbon emissions associated with appliances and cooking have also been calculated using the specified formulae in the SBEM manuals. Full detailed results are provided in Appendix A of this report.

6.2 Table 4: Predicted Notional Baseline, provides a breakdown of the energy demand for 1 - 11 Euston Road. The Notional Baseline is shown graphically in Figure 4 below.

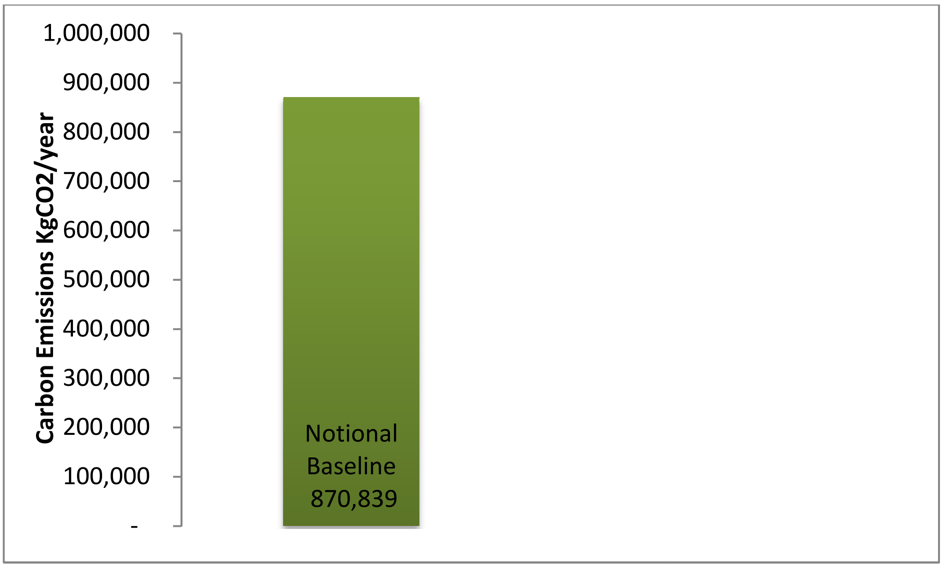
6.3 At this stage, no energy efficiency measures have been applied to this baseline. Improving the energy performance of the building is the next step, detailed in Section 7.0.

Table 4: Predicted Notional Baseline

Notional Baseline	Gas	Electricity
Space Heating Energy kWh/yr	202,680	530,225
DHW Energy kWh/yr	1,192,854	0
Cooling kWh/yr	0	170,911
Lighting Energy kWh/yr	0	170,353
Aux Energy kWh/yr	0	76,032
Un-Reg Energy kWh/yr	0	202,426
Carbon Emission $KgCO_2$/yr	276,316	594,523
Total Carbon Emission $KgCO_2$/yr	870,839	
Notional BER	108.30	

6.4 Modelling of the Notional Baseline is undertaken using minimum allowable U-values and controlled system efficiencies as detailed in Part L approved documents. Values used are listed in Table 5.

Figure 4 - The Energy Hierarchy – Predicted Notional Baseline



6.5 Please note that the calculations in this report are based on drawings and information provided pre-planning approval, and as such should be considered subject to change. These results are intended to provide initial assessment of the design to ensure that planning policies and BREEAM requirements can be achieved at this site. The actual Notional Baseline will be determined at the detailed design stage by detailed SBEM assessments with finalised drawings and services details.

7.0 BE LEAN – ENERGY EFFICIENCY MEASURES

7.1 Metropolis Green has been working with the project architects, Bill Greensmith Architects to determine the most efficient and feasible way to reduce the carbon emissions of the development.

7.2 Minimising heat loss from the building to avoid wasted energy is essential. Heat loss through walls, windows and surface areas of the building must be significantly lower than building regulations, requiring specifications with very low U-values. Heat loss through thermal bridges, where the continuity of insulation and/or the building envelope is broken, can be minimised through excellent workmanship and careful design, such as; removal of unnecessary structural elements, or insulation of structural elements, reducing window size (where appropriate), and through increased insulation.

7.3 Passive design measures will also feature within the building to prevent overheating and avoid excessive requirements for heating or cooling.

7.4 The building has been designed to incorporate a double skin façade which contributes not only to the aesthetic of the building but, has a number of advantages in terms of occupant comfort, and sustainable design;

- Improved Acoustic Insulation

- Improved Thermal insulation

  In winter when energy demand for heating is high, the air inside the cavity, which is preheated, can be introduced into the building and provide low energy thermal comfort for occupants. During the summer, the warm air inside the cavity can be extracted by natural, fan supported or mechanical ventilation.

- Natural Ventilation

  Double skin façade systems can be designed to provide natural (or fan supported) stack ventilation.

- Other advantages

  Double skin façades also have potential to:

  - Provide natural night ventilation that is both secure and offers weather protection

  - Save heating, cooling and lighting energy

  - Provide better protection of shading or lighting devices

- Reduce the effects of wind pressure

7.5 Highly Efficient Air Source Heat Pumps have been specified to provide space heating and cooling for the building. A VRF system has been specified, which alongside the fabric improvements contributes further to reducing the energy demand and associated carbon emissions.

7.6 The overall air tightness of the finished building will meet best practice standards equating to a maximum permeability of 5m^3/hour/m^2@50Pa. Improving the air tightness of a building results in the need for excellent ventilation which has been provided via highly efficient Mechanical Ventilation with Heat Recovery (MVHR) system.

7.7 The impact of the specified Efficient Baseline improvements have been calculated using SBEM and the input parameters used to undertake these calculations are outlined in Table 5 below.

Input Parameters

7.8 Fabric efficiency measures are the most effective way of reducing carbon emissions from a building. Reducing the Notional Baseline BER in turn reduces the amount of low carbon technologies and renewables required to comply with regulations and policies, as well as lowering costs.

7.9 The U-values that have been used to achieve an improvement over the Notional Baseline to the Efficient Baseline are shown in Table 5 below.

Table 5 - Notional – Summary of Input Parameters for Notional and Efficient Baselines

Building Fabric and Services		
	Notional Baseline	**Efficient Baseline**
External Wall U-value:	0.30	0.20
Internal Heat Loss Wall U-value:	0.30	0.20
Ground Floor / Basement Floor U-value	0.25	0.16
Flat Roof U-value	0.25	0.16
Windows & Openings U-values	1.80	1.40
Glazing Spec	Typical Low-E Double Glazing with Clear K Glass	Pilkington Solar Control Glazing - SunCool Brilliant 66/33
Window Opening %	50%	50%
Building Reg 2010 Accredited construction details	Yes	Yes
Air Permeability	7.5 $m^3/hr/m^2$	5 $m^3/hr/m^2$
DHW Systsem	Condensing Gas Boiler with Hot water storage Tank. 50mm factory tank insulation thickness	Dedicated Condensing Gas Boiler with Hot water storage Tank. 80mm factory tank insulation thickness
Space Heating System	Fan Coil units, heating via LTHW from Condensing Gas Boiler. 88% Boiler Efficiency	VRF system via Air Source Heat Pumps, EER of 4.10
Additional Heating System	Electric Floor warming/radiators in Bathroom	Electric Floor warming/radiators in Bathroom
Space Cooling System	Fan Coil units, cooling via Air Cooled Chillers, EER of 2.80	VRF system via Air Source Heat Pumps, EER of 4.10
Heating/Cooling Controls:	Central Time Control, Optimum start/stop control, Local Temp Control	Alarm out of range values, Central Time Control, Optimum start/stop control, Local time & temp zone control. Weather Compensator
Ventilation System	Mechanical ventilation without heat recovery	Mechanical ventilation with Heat Recovery via Plate Heat Exchanger. 75% HR efficiency
Lighting Efficacy	3.10W/m^2/100lux	2.40W/m^2/100lux

7.10 Thermal bridging will be minimised in accordance with Accredited Construction Details and the target air permeability will be no greater than 5 m^3/hour/m^2

7.11 Further energy efficiency measures can also be applied to space heating and hot water production with additional HVAC and heating system control features.

7.12 The design team have committed to going beyond the minimum lighting efficacy requirements outlined in SBEM and will specify higher efficacy lighting, this will reduce the lighting energy demand by 18.75% (18,785 kWh/yr) when compared to the Notional Baseline.

7.13 As a result of the above measures and improvements, a new energy demand and carbon baseline has been calculated from the Notional Baseline which will be referred to as the Efficient Baseline and is detailed in Table 6 below.

7.14 This new Efficient Baseline completes the first stage of the Energy Hierarchy, to be lean and use energy efficiently, as illustrated by Figure 5 below.

7.15 The predicted 'Whole Energy' CO_2 reduction delivered through the efficiency measures equates to 268,992 kg/CO_2/yr, which is a 30.89% reduction as a result of these efficiency measures. The improvement is illustrated in Figure 6 below. Please note this reduction is measured from the Notional Baseline and is across the 'whole energy' baseline which includes unregulated energy use.

Table 6 - Efficient Baseline Energy and Carbon Emissions

Efficient Baseline	Gas	Electricity
Space Heating Energy kWh/yr	0	193,316
DHW Energy kWh/yr	1,157,385	0
Cooling kWh/yr	0	97,518
Lighting Energy kWh/yr	0	151,568
Aux Energy kWh/yr	0	76,032
Un-Reg Energy kWh/yr	0	202,426
Carbon Emission $KgCO_2/yr$	229,162	372,685
Total Carbon Emission $KgCO_2/yr$	601,847	
% Improvement over Notional Baseline	30.89%	
BER	70.28	
BER % Improvement over Notional Baseline	35.11%	

Figure 5: Be Lean – 'Whole Energy' Efficient Baseline

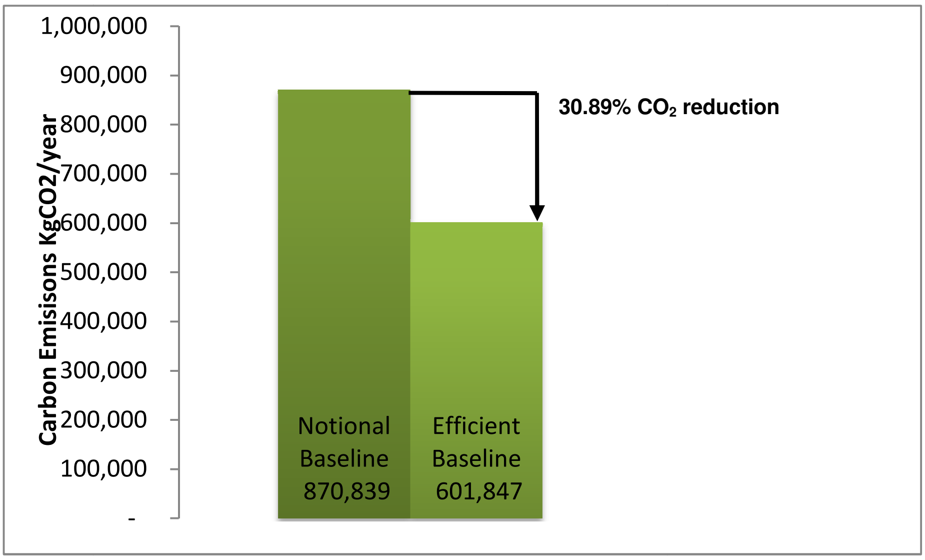
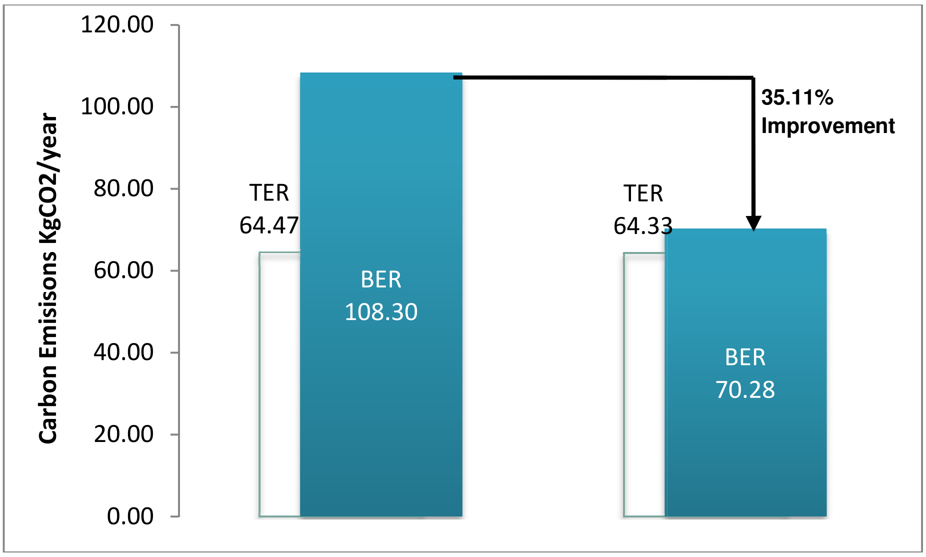


Figure 6: Efficient Baseline BER Percentage Improvement



Plant Selection

Plant

7.16 A system comprising Daikin VRF Multiisplit Air Source Heat Pumps (ASHPs) for space heating/cooling has been identified as being suitable for the development.

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Plant Location / Land Use

7.17 The VRF ASHP plant will be situated on the roof of the building. As all associated plant can be accommodated within the building footprint, no additional land is required for this technology.

7.18 The plant will be arranged out so that related plant items are located adjacent to each other and in a space efficient manner. All equipment requiring maintenance or servicing will be situated in an accessible location so that they can be worked on safely.

7.19 Plant operation will be automatic and will run under the dictates of a control system. Occupants will have control of certain simple comfort parameters within rooms and building managers will be able to control all aspects of the systems.

Plant Maintenance

7.20 Typically very little maintenance is required for heat pump systems, reducing the requirement for interruption of service and ongoing running costs.

Additional Information

Noise / Disturbance Impact

7.21 Due to the location of this technology and the manufacturers stated noise levels of 63-66 dB per outdoor unit with 'nighttime quiet operation'. At detailed design stage, careful attention will be paid to the siting and sound attenuation of the outdoor units, therefore it is considered that there will not be any noise disturbance to occupants of the building or to any neighbours.

Exporting Heat

7.22 The option for exporting heat is not available on this site.

Enhanced Capital Allowance (ECA)

7.23 To claim for ECAs, investments in air source split and multi-split (including variable refrigerant flow) heat pumps can only qualify for ECAs if the specific product identified by the outdoor unit and the matching indoor unit(s) is named in the ETL Heat Pump Master List.

7.24 To be eligible for inclusion on the ETL Heat Pump Master List, products must meet the eligibility criteria as set out below.

To be eligible, products must:

- Consist of an ‘outdoor’ unit and one or more ‘indoor’ units that are:
  a) Factory–built sub-assemblies.
  b) Supplied as a matched set of units.
  c) Designed to be connected together during installation.
- Incorporate an electrically driven refrigeration system.
- Be designed for, and include fittings for, permanent installation.
- Be CE marked.

7.25 Eligible products must meet the following performance criteria, for:

- Coefficient of Performance (COP) across the range of connected capacities and including 100% (full) load in heating mode.
- Energy Efficiency Ratio (EER) across the range of connected capacities and including 100% (full) load in cooling mode, where the product is designed to provide cooling.

7.26 All products must be tested in accordance with the procedures in BS EN 14511:2007 (or BS EN 14511:2004).

7.27 Expenditure on the provision of plant and machinery can include not only the actual costs of buying the equipment, but other direct costs such as the transport of the equipment to site.

8.0 BE CLEAN – COMMUNAL HEATING AND COMBINED HEAT & POWER

8.1 The third stage in the Mayors 'energy hierarchy' is to investigate the application of Combined Heat and Power (CHP) to the site, to produce energy more efficiently with the aim of reducing the carbon baseline further.

8.2 The Mayor requires that all new developments consider CHP, a decentralised energy generation technology before renewables are applied to the site. Building up a network of mini-power stations that are far more efficient than traditional centralised power stations is an important part of the Mayor's overall strategy to move London towards its long term carbon reduction targets.

8.3 CHP is an engine which produces electricity. The process of creating the electricity produces heat as a by-product. Heat can be easily stored in a thermal storage tank and distributed across the site to provide for the hot water demands of the site. The heat can also provide for some space heating within a development.

8.4 The Mayor's Hierarchy relating to London Plan Policy 5.6 expects all major developments to demonstrate that the proposed heating and cooling systems have been selected in accordance with the following hierarchy:

- connection to existing heating or cooling networks
- site-wide CHP powered by renewable energy
- communal heating and cooling

Application to Site – CHP – Feasible

Feasibility

8.5 A site-wide CHP solution has been investigated and found to be suitable for this site. The proposed CHP solution delivers a significant proportion of the overall savings, resulting in an 49.85% CO_2 reduction from the Notional Baseline and 27.43% from the Efficient Baseline.

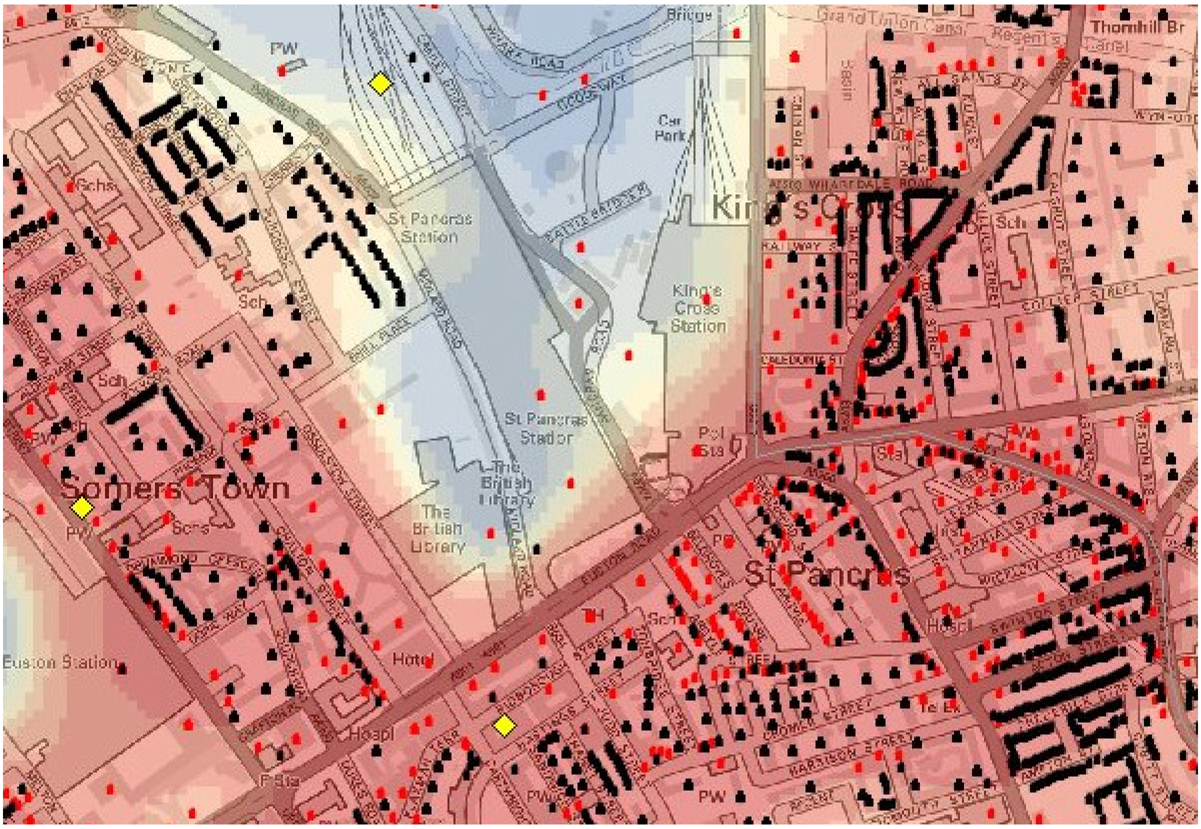
Local Connection

8.6 An investigation of the area was undertaken using the London Heat Map tool to determine opportunities to connect to existing heat infrastructure.

8.7 Investigation into existing heat networks in the area using the London Heat Map have shown that the nearest existing CHP installations are located at Kings Cross Station, the National Union of Teachers Headquarters on Bidborough Street and at St Richards House. These are all within a radius of 1km. It has not been possible to identify a district heat network in close proximity to the site. Serious consideration has been given to connection to the existing CHP installations and the new development at Kings Cross but it has been determined that connection to any of these facilities is not feasible due the distance between the sites (see Figure 7 below). Additionally the cost involved in infrastructure works would be extremely high and would include not only the cost of digging the roads and laying pipes but would be very disruptive to the local area in terms of road closures.

8.8 There is not currently a local heat network into which heat can be exported.

Figure 7 - London Heat Map Indicating CHP Sites and District Heat Networks



8.9 Although the research shows that there is not currently any opportunity to connect to a local heat network or CHP, calculations demonstrate that gas CHP is a feasible technology at this site and is ideal to meet the hot water demand. As such it is the preferred technology for the Low Carbon Baseline.

Energy and CO_2 Reductions

8.10 Specification of CHP reduces the CO_2 emissions by 165,100 kg per year and equates to a 49.85% CO_2 reduction from the Notional Baseline and 27.43% CO_2 reduction from the Efficient Baseline and is detailed in Table 7 below.

8.11 The CHP system helps to further reduce the BER as shown in Figure 9. The BER is now 56.66% better than the Notional BER contributing significantly to the development to achieving a BREEAM rating of 'Excellent'.

8.12 Please refer to Appendix A for SBEM results.

Table 7: Energy and Carbon Emissions with CHP

Low Carbon Baseline	Gas	Electricity
Space Heating Energy kWh/yr	0	193,316
DHW Energy kWh/yr	28,455	0
Cooling (SBEM) kWh/yr	0	97,518
Lighting Energy kWh/yr	0	151,568
Aux Energy kWh/yr	0	76,032
Un-Reg Energy kWh/yr	0	202,426
CHP Fuel Consumption	1,998,418	-637,541
Carbon Emission $KgCO_2/yr$	401,321	35,426
Total Carbon Emission $KgCO_2/yr$	436,746	
% Improvement over Notional Baseline	49.85%	
% Improvement over Efficient Baseline	27.43%	
BER	46.94	
BER % Improvement over Efficient Baseline	33.21%	
BER % Improvement over Notional Baseline	56.66%	

Figure 8: Be Clean – Low Carbon Baseline

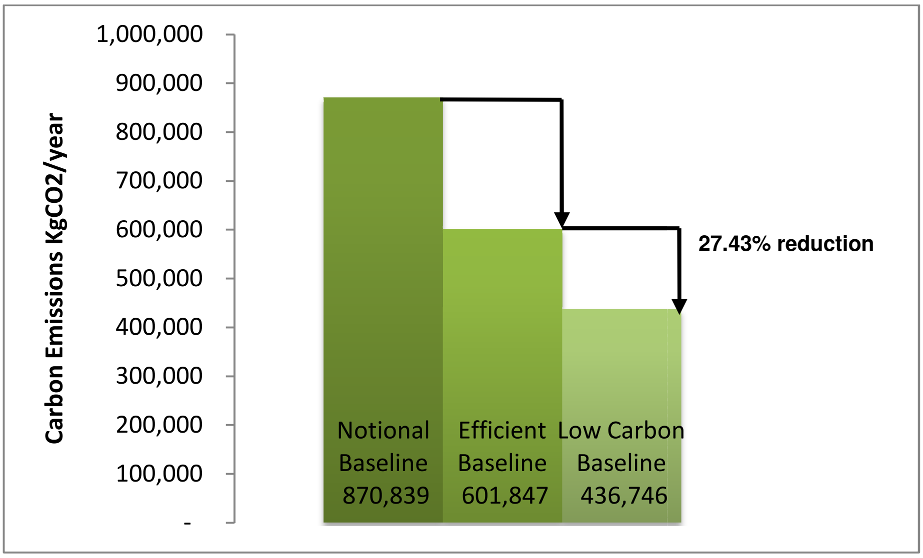
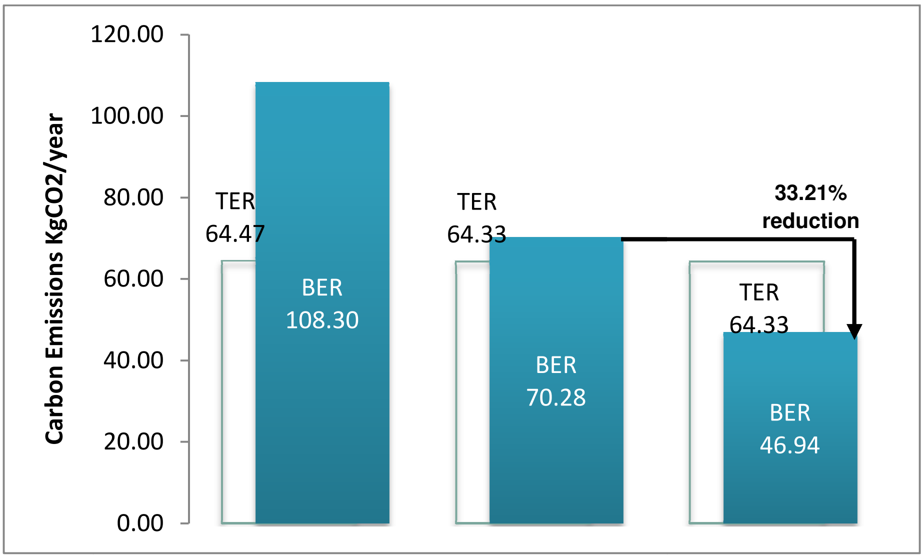


Figure 9: Low Carbon Baseline BER and Percentage Improvement



Plant Selection

8.13 To meet the domestic hot water baseline demand of the site, a combined heat and power plant with an electrical output capacity of 185kWe is required, the electrical output will supplement the buildings electricity requirement and its waste heat collected and connected to Low Temperature Hot Water (LTHW) buffer vessels for provision of domestic hot water.

8.14 Modelling for this site has been carried out based on the ENER.G 185 CHP engine which is deemed suitable to meet the requirements for this development (including a buffer vessel and associated plant to store heat at periods of low demand).

8.15 The CHP engine will be located in a plant room situated in the basement.

8.16 The CHP will be sized to provide the base load domestic hot water demand.

Backup System

8.17 To ensure continuity of domestic hot water supply, high efficiency gas fired condensing communal gas boilers are recommended, these will be connected to plate heat exchanges downstream of the LTHW buffer vessels and will be installed to provide back-up during times of peak demand and during periods where the CHP system is undergoing maintenance.

Other Equipment Required

8.18 Alongside the CHP engine, buffer vessels and associated pumps and fans will be required.

Plant Location / Land Use

8.19 The CHP plant will be located in a plant room situated in the basement. As all required plant can be accommodated within the building footprint, no additional land is required for this technology. The plant room will contain the CHP system, communal heating boilers and thermal store facilities.

8.20 The plant room will be laid out so that related plant items are located adjacent to each other. All equipment requiring maintenance or servicing will be situated in an accessible location so that they can be worked on safely.

8.21 Plant operation will be fully automatic and will run under the dictates of a control system.

Plant Maintenance

8.22 The ENER.G 185 will require regular, periodic maintenance and inspection. The unit will require a service after a predetermined number of hours. Units typically require between 6 and 10 services per annum dependant upon operation. The service procedures vary throughout the year from replacing and recalibrating components to oil and filter changes. The CHP unit uses natural gas as its fuel and is therefore subject to the Gas Safe regulations. The supplier offers two flexible maintenance packages

Additional Information

Noise / Disturbance Impact

8.23 Due to the location of this technology and the manufacturers stated noise levels of 44dB, it is considered that due to location of the plant room, there will be a low risk of noise disturbance to building occupants or neighbours.

Planning Considerations

8.24 It should be noted that there are unlikely to be obstacles in obtaining planning permission for a CHP system for this site because provision of CHP is in line with London Plan requirements. As the CHP is gas fired there are unlikely to be any air quality issues associated with specification of the ENER.G 185 system.

Exporting Electricity

8.25 Electricity generated through the operation of the CHP system that is not used within the building will be sold into the local grid networks. Selling electricity via a private wire network to customers is highly regulated, and it is not current practice to allow electricity to be sold by one supplier to the consumer, therefore the clean electricity would be sold into the grid. The regulations for supplying heating and electricity are very different, and at this time it is only possible to sell heat to the communal network.

Importing/Exporting Heat

8.26 As mentioned above the option for exporting heat is not available on this site, although provision could be made to allow for connection to a district heat network in future.

Enhanced Capital Allowance (ECA) and Capital Costs

8.27 In addition, the ENER.G 185 system will qualify for ECA. To claim ECAs, a CHPQA certificate will need to be obtained first. Most CHPQA Certificates record actual performance of the CHP scheme for the previous year. However, it is also possible to access the design of new or upgraded schemes and certify their expected performance in operation.

8.28 In order to comply with Good Quality CHP scheme, two criteria will need to be met. The first criteria is the Quality Index (QI), which is an indicator for the energy efficiency and environmental performance of a scheme, relative to the generation of the same amounts of heat and power by separate, alternative means. The second criteria is the power efficiency, which governs the amount of annual power output by the CHP relative to its annual fuel input.

8.29 Based on 'The CHPQA Standard' published by the Department for the Environment, Farming and Rural Affairs (DEFRA), the threshold criteria for proposed new Good Quality CHP scheme capacity, at design, specification, tendering and approvals stages, are:

QI ≥ 105 at (Maxheat) and Power Efficiency ≥ 20%, both under Annual Operation

8.30 The QI scored by the ENER.G 185 equates to 134.9 and Power Efficiency at 31.9%, and hence will comply with the Good Quality CHP scheme and will qualify for Enhanced Capital Tax Allowance at a corporation tax rate of 28%.

8.31 Please note that the figures quoted here are approximate and should be considered indicative only. Up to date and accurate figures should be obtained from product suppliers when budgeting for CHP and the associated plant.

9.0 BE GREEN – RENEWABLE ENERGY TECHNOLOGY

9.0.1 The third stage of the energy hierarchy refers to the production of renewable energy, which relates to London Borough of Camden and London Plan Policy 5.2 and 5.7.

9.0.2 Each of the approved renewable energy technologies have been appraised, examining the size and cost of each system required to maximise CO_2 reductions. The feasibility of each technology at the proposed site is also discussed in the following sections in order to determine the most suitable solution for the site.

9.0.3 London Plan approved renewable energy technologies include:

- Wind
- Photovoltaics
- Solar Water systems
- Biomass Heating / CHP
- Ground Sourced Heating / Cooling

9.0.4 The choice of technology will be dependent upon a range of factors including: orientation, height, window size, surrounding buildings and environment, site size and layout, geology, conservation and biodiversity.

9.0.5 The costs and sizing referred to in this report are approximate, based on preliminary data and market averages for fully installed systems, and are subject to change at the detailed design stage.

9.0.6 Analysis has shown that PV is the most suitable renewable technology reducing the Renewables Baseline to 425,502 by a predicted 11,244 $kgCO_2/yr$ from the Efficient Baseline of 601,847 $kgCO_2/yr$

9.0.7 A 2.57% reduction can be attributed to PV from the Low Carbon Baseline.

9.0.8 The total reductions equate to a 51.14% CO_2 reduction from the Notional Baseline due to Efficiency and Low Carbon measures combined with specification of PV.

9.1 Solar Photovoltaic (PV)

9.1.1 Photovoltaic systems convert solar energy directly into electricity through semiconductor cells. The panels generate electricity from both direct light and diffuse light. Photovoltaic panels can either be mounted external to the building or be integrated into the building cladding (known as Building Integrated Photovoltaic or BIPV).

Application to Site – Suitable

Feasibility

9.1.2 PV panels are the most feasible option for this site, offering the greatest CO_2 reduction in the space available.

Energy and CO_2 Reduction

9.1.3 It has been determined that PV panels can provide a total energy output of 21,256 kWh/yr at 1 - 11 Euston Road.

9.1.4 Results of implementing the PVs are summarised in Table 7 below. The proposed solution will deliver an overall 58.12% improvement in the BER over the Notional Baseline as indicated in Figure 12, with the average BER coming down to 45.35. The CO_2 Index Rating as shown on the Energy Performance Certificate is 29 and is therefore eligible for 8 credits under the BREEAM Ene 1 – Reduction of CO_2 Emissions issue, meeting the mandatory requirements of this issue and contributing significantly to the overall achievement of a BREEAM rating of ‘Excellent’.

9.1.5 With a total of 146 no. PV panels the electricity consumption of the development has been offset by a total of 21,256 kWh/yr, hence lowering the carbon emissions of the development by 11,244 kgCO_2/yr. The ‘whole energy’ carbon reduction is illustrated graphically in Figure 11 below.

Plant Selection

9.1.6 The modelled PV system consists of 146no. 185Wp PV panels with an efficiency of 14.5%. This equates to a total PV system size of 27.01 kWp. The information shown in Table 8 below is extracted from manufacturers specification.

9.1.7 It is estimated that the required PV system size of 146 PV panels will require approximately 186.88m^2 of roof space. A solar study has been undertaken for the roof, and it has been determined that the roof has sufficient space and is suitable for efficient placement and operation of the PV array.

Table 8 - PV system modelled

PV Make & Model	Cell Technology	Efficiency	Required area to produce 1kWp
AS-5M Amerisolar 185W	Mono-crystalline Silicon	14.5%	5.5 Panels

Plant Location / Land Use

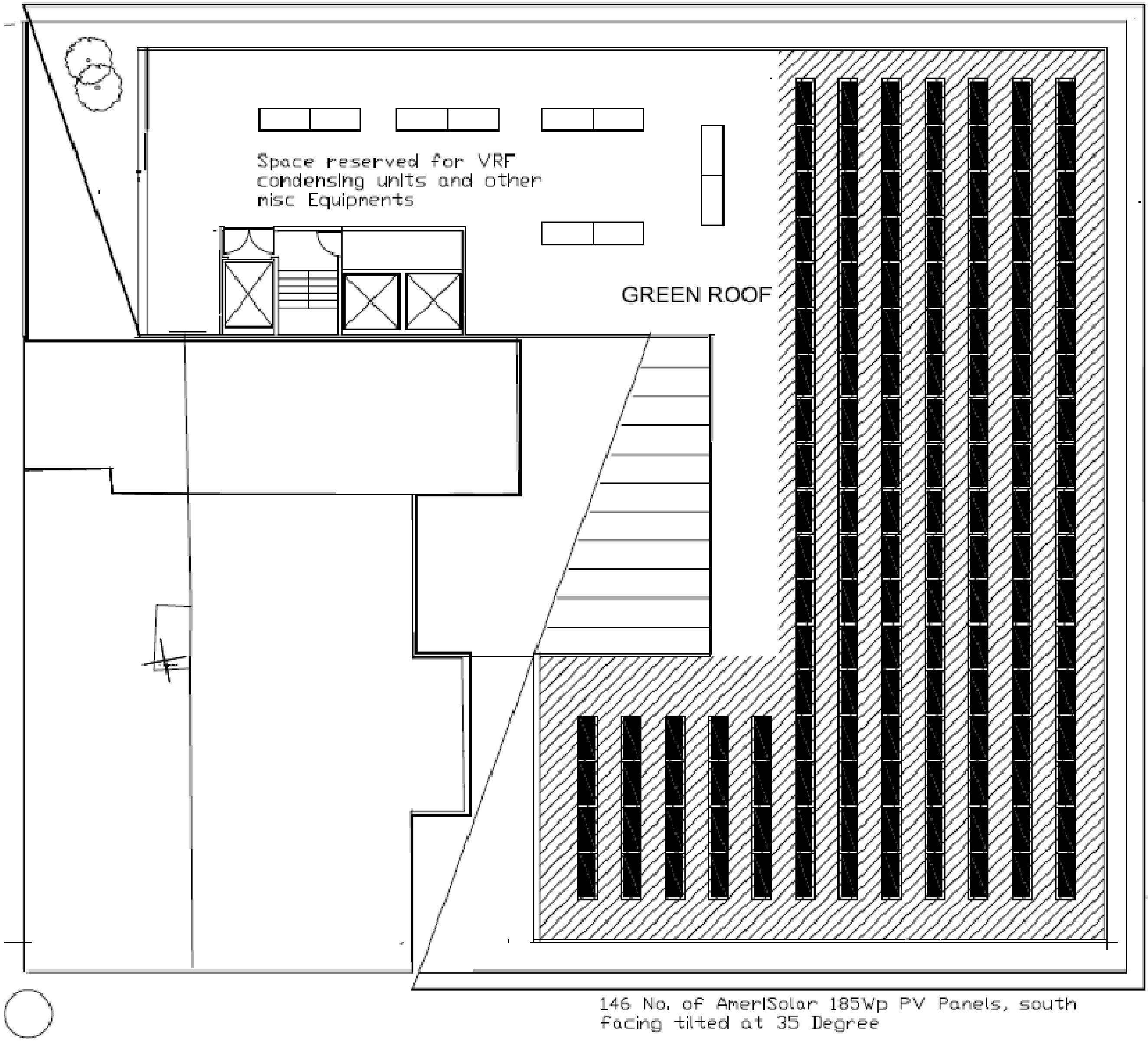
9.1.8 Orientation and layout of the PV panels on the available roof space has been carefully investigated, and the number of PV panels has been maximised to make the best possible use of the space. As all panels will be situated on the roof of the building, there is no additional land use associated with this technology.

9.1.9 The modules should be tilted at an optimum angle of 35° in order to capture the maximum amount of solar energy. The minimum tilt angle is 10°, any less and the modules will not self clean, invalidating their warranty. The proposed PV arrangement is shown in Figure 10 below:

9.1.10 The modules will also need to be spaced at approximately 700mm to avoid over shading on neighbouring modules and to provide a walkway for safe installation and access. The diagram shown below indicates the proposed PV arrangement layout; final layout is subject to specialist sub contractor design and may differ from this layout.

9.1.11 The roof space will accommodate a green roof with PV panels, and space has additionally been allocated for equipment associated with the proposed air source heat pumps. At the detailed design stage it will be ensured that compatible PV panels and green roof systems are specified to ensure the efficient and effective use of the roof space. The roof space will be utilised to its maximum potential and will actively contribute to the sustainability of the proposed development.

Figure 10: Option for PV Panels Arrangement on Proposed Roof Layout



Backup Systems

9.1.12 Backup systems are not required as minimal maintenance is required to the PV panels and ancillary equipment. Should a total system failure occur, the grid will maintain the electrical supply.

Ancillary Equipment

9.1.13 PV systems require an inverter which converts the low voltage direct current electricity produced by the array of panels into 240V 50/60Hz alternating current.

9.1.14 Please also note that it is a legal requirement to use an Ofgem approved meter in order to collect revenue from the meter readings displayed or transmitted to a data collection system. In addition, for electricity supplies to domestic customers by a licensed supplier, an Ofgem approved and certified meter must be used. The meter will be located in the will be housed inside the electrical services cupboards in the plant room and will be sited to ensure ease of access for maintenance or repair.

9.1.15 Meters will be housed inside the electrical services cupboards in the plant room.

9.1.16 All ancillary equipment will be sited to ensure ease of access for maintenance or repair.

9.1.17 Please note these arrangements are subject to change as the design progresses and will be finalised once a specialist contractor produces detailed designs at the detailed design stage.

Plant Maintenance

9.1.18 PV systems require minimal maintenance, as long as the panels are installed at or above the recommended angle they will self clean, there are no regular maintenance requirements for PV panels or the inverters. If panels are positioned at 35 degrees they will self clean, and monitoring of the system output will identify any panel problems or failures (monitoring can be remote/web based).

9.1.19 Inverters would be expected to be replaced after 12-13 years (we are working on a 25 year life based on feed in tariff incomes but PV panels will continue to provide output for up to 40 years (at a reduced level as output degrades over time)).

9.1.20 Inspection of the mechanical fixings to ensure that panels have not come loose due to fixings corroding etc will be required but does not require a specialist to undertake this and could be absorbed into the building inspection/maintenance programme.

Table 9: Energy and Carbon Emissions with PV

Renewables Baseline	Gas	Electricity
Space Heating Energy kWh/yr	0	193,316
DHW Energy kWh/yr	28,455	0
Cooling kWh/yr	0	97,518
Lighting Energy kWh/yr	0	151,568
Aux Energy kWh/yr	0	76,032
Un-Reg Energy kWh/yr	0	202,426
CHP Fuel kWh/yr	1,998,418	-637,541
Renewables kWh/yr	0	-21,256
Carbon Emission $KgCO_2/yr$	401,321	24,181
Total Carbon Emission $KgCO_2/yr$	425,502	
% Improvement over Notional Baseline	51.14%	
% Improvement over Efficient Baseline	29.30%	
%Improvement over Low Carbon Baseline	2.57%	
BER	45.35	
BER % Improvement over Low Carbon Baseline	3.39%	

Figure 11: PVs Carbon Emissions Reduction

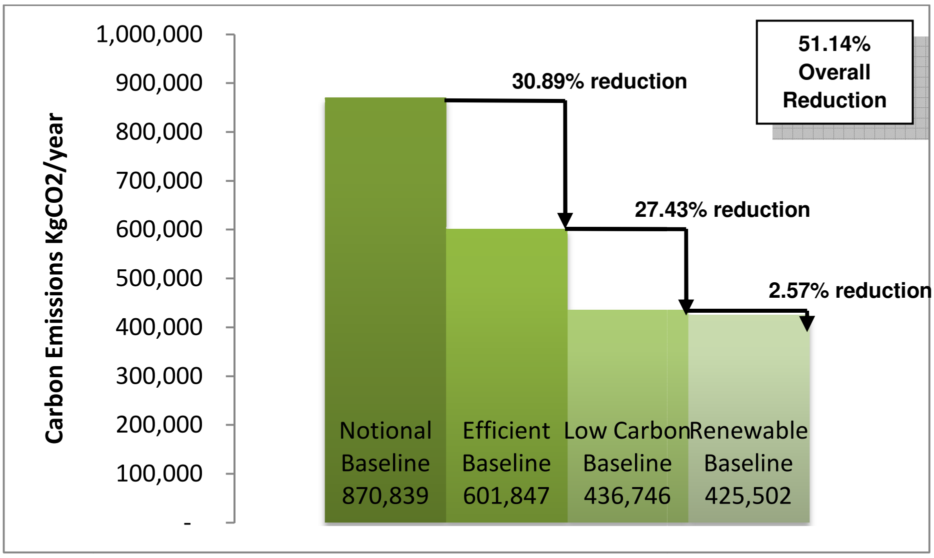
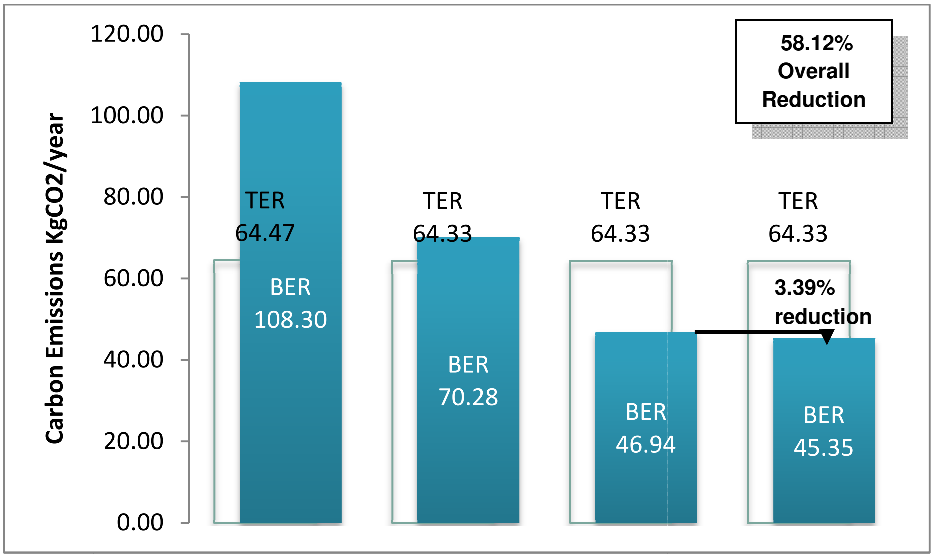


Figure 12: Renewable Baseline BER and Percentage Improvement



9.1.21 Modelling and calculations show the development at 1 - 11 Euston Road has potential to achieve a total 29.50% BER over TER improvement, which exceeds the 25% required to meet the London Plan Policy 5.2, 2010 – 2013 targets. This is illustrated in Figure 13 below.

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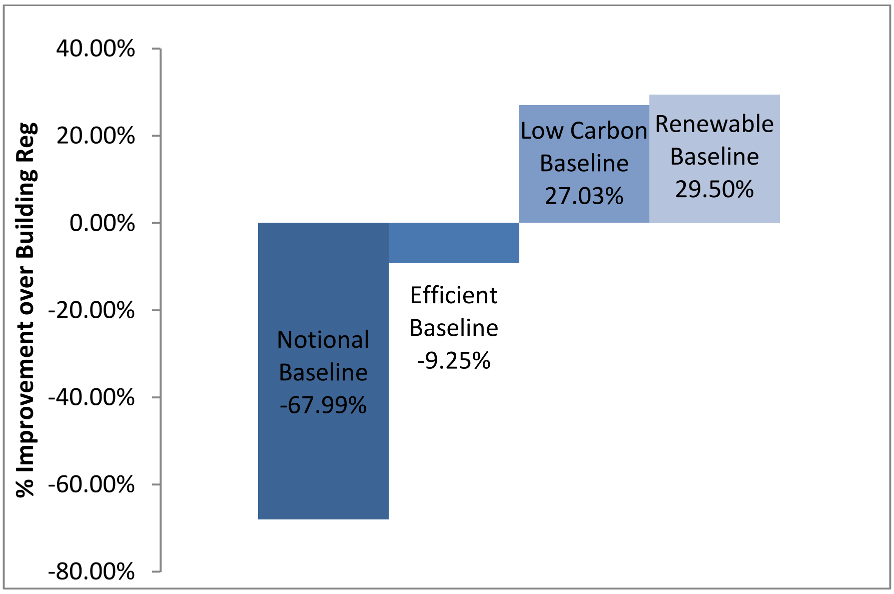
Figure 13 - BER over TER % Improvement - London Plan



9.1.22 Figure 13 above illustrates the percentage BER over TER improvement in line with the London Plan Policy 5.2 methodology. It should be noted that the total BER over TER percentage improvement from the Notional to Renewable Baseline is 58.12%. The Notional and Efficient Baseline improvements are shown as negative figures as the Notional Baseline model has been created using minimum fabric U-values and service efficiencies allowable under Building Regulations Part L2A.

Additional Information

Noise / Disturbance Impact

9.1.23 Due to the nature of this technology there will be no noise disturbance to occupants or neighbours caused by PV panels. Manufacturers information for inverters indicates operational noise levels of 33dB if installed correctly. This noise level in combination with the siting of inverters which will be housed inside the electrical services cupboards in the plant room will ensure no noise disturbance to occupants or neighbours.

Planning Considerations

9.1.24 It should be noted that there are unlikely to be obstacles in obtaining planning permission for a PV system for this site due to the fact that there is a clear policy objective for provision of renewable technologies for new construction projects to help reduce carbon emissions. Visual impact of the panels must be considered at this site.

Capital and Life Cycle Costs

9.1.25 It is estimated that the total capital cost of the PV panels, including inverters, installation, miscellaneous electrical components etc, equates to approximately £85,000 – 90,000, (please note, all figures are indicative and based on an generic system price range provided by a single PV provider/installer, Metropolis Green takes no responsibility for the accuracy of these figures as final costs will depend on detailed design of the PV array, ancillary equipment and site constraints. All prices should be considered subject to change at any time due to market forces and are dependent on the supplier/installer. Once detailed designs have been prepared quotes should be obtained from PV suppliers/installers for accurate system costs). PV panels have a long lifetime with low maintenance and replacement requirements.

Carbon Life Cycle Costs

9.1.26 PV panels and inverters have relatively high embodied energy, but studies show that appropriately sited systems will recuperate their embodied carbon within a few years.

Exporting Electricity

9.1.27 The annual income generated by the PV panels includes a Feed-In Tariff (FIT) generation tariff rate of 32.9 p/kWh (subject to further reductions). Tariffs will be linked to the Retail Price Index (RPI) which ensures that each year they follow the rate of inflation. The rate payable is set at the year of entering the FIT and the entrance rate will reduce annually. In addition to the generation tariff a micro generation export rate of 3p/kWh for the electricity exported to the grid, this rate is payable by the electricity provider and will also be RPI linked. The electricity export rate is collected from electricity utility provider.

9.2 Other Appraised Technologies

9.3 Solar Thermal

9.3.1 Solar Thermal hot water heating systems harvest energy from the sun to heat water. The solar heating collectors are generally positioned on the roof of a building, they can also be wall mounted, although with reduced efficiency. A fluid within the panels, heats up by absorbing solar radiation. The fluid is then used to heat up domestic water which is stored in a separate water cylinder.

9.3.2 As an alternative to PVs, implementing Solar Water Heating (SWH) can deliver carbon saving to domestic hot water generation for space heating as well as for domestic hot water production.

Application to Site – Not Feasible

Feasibility

9.3.3 CHP and solar thermal both provide hot water as all or a proportion of the base load hot water demand. CHP and solar thermal would therefore be competing for the same base load. As the CHP system modelled is sized to provide the base load domestic hot water demand for the development, to run the CHP system in conjunction with solar thermal would result in lower efficiencies for both systems and lower carbon reductions than are available with the CHP/PV option. Therefore, it is determined that the solar thermal water heating option is not a feasible solution for the development at 1 - 11 Euston Road.

Land Use

9.3.4 With regard to land use, Solar Thermal panels are installed in or on the building and do not require use of any space or land that is not within the footprint of the building.

Noise

9.3.5 Solar Thermal panels have no impact in terms of noise, although the pumps (equivalent to central heating pumps) may emit negligible noise levels the siting of the pumps, low levels of noise and the proximity of neighbours mean that there will be no impact on building users or neighbours through specification of Solar Thermal and related pumps.

Life Cycle Costs and Carbon

9.3.6 In terms of lifecycle costs of Solar Thermal, the panels have a long lifetime (up to 30 years) with low maintenance requirements and although the initial capital costs are high, the system modelled will pay back in a relatively few years. Maintenance and replacement of system components must be taken into account when considering life cycle costs, but these technologies will both still return a profit when factoring in the energy savings, RHI payments.

9.3.7 Solar Thermal systems have low embodied energy which is repaid within a few years (faster than photovoltaics).

9.4 Wind Turbines

9.4.1 Wind is one of the most cost-effective methods or generating renewable electricity. However wind is more suited to low density areas where there is more space necessary for maintenance, less turbulent wind patterns, and they are less likely to be the cause of noise and vibration to nearby properties. High density areas are not ideal with current wind turbine technology.

Application to Site – Not Feasible

Feasibility

9.4.2 Modelling indicates wind turbines at this site will not able to achieve the level of carbon emission reductions associated with the PV solution.

9.4.3 Installation of wind turbines are neither feasible or suitable for 1 - 11 Euston Road, there are a number of concerns with wind turbines in an urban environment including; visual impact, noise, cost, maintenance, space, as well as mechanical loading implications for installation of turbines ‘on building’. Although calculations for the modelled systems indicate that wind systems contribute to carbon reductions, it must be noted that under dense urban environments the energy outputs generated by wind turbines can be quite unpredictable. This is mainly due to the neighbouring buildings acting as obstructions causing turbulence to the incoming wind flow. The site would need to be evaluated appropriately (over a period of 12 months) using wind speed monitoring & recording devices in order to give an accurate prediction in terms of energy output derived by the real wind speed measurements recorded on site.

9.4.4 In addition to these concerns, the actual energy output of any turbines installed is likely to be much lower than the modelled outputs due to turbulence created in the urban environment. Turbulence can be overcome by installing turbines on minimum 30m high towers but this will exacerbate the concerns/impacts listed above.

9.4.5 Life cycle assessment of wind turbines shows that they can repay embodied energy within a few years if suitably sited. Additionally wind turbines have a long lifetime with relatively little maintenance required, and when considering life cycle costs, even with the feed in tariff and energy savings considered they have a longer payback time than other renewable technologies

9.4.6 In comparison to PV panels, the energy output is much less predictable, as the annual sun path remains the same year on year whereas wind is unpredictable. In addition, roof structures at 1 - 11 Euston Road would need to be properly assessed in order to determine whether it will be able to withstand the loading on the building caused by the turbines.

9.4.7 Therefore, wind turbines have been determined to be unsuitable for the development at 1 - 11 Euston Road.

9.5 Biomass Heating

9.5.1 Wood is the most commonly used form of biomass fuel, and can either be burned in solid fuel boilers for central heating applications, or for raising steam for power generation in large installations.

9.5.2 Typically, biomass installations are sized to meet a base heat load with peak load and load variations to be met from gas-fired boilers. Biomass boilers operate most efficiently and are therefore most cost effective when working continuously at full load, they do not respond well to rapidly fluctuating demand. When assessing the feasibility of a biomass installation, storage space and biomass delivery requirements need to be taken into account.

Application to Site – Not Feasible

Feasibility

9.5.3 Based on SBEM calculations, it is determined that a Biomass Boiler operating for no less than 8320 hours could provide a higher level of carbon reductions than Gas CHP (from Efficient Baseline).

9.5.4 The main operational concerns are raised in relation to air quality, storage capacity and logistics of parking for delivery of wood pellets/chips etc.

9.5.5 Air quality is another major concern with biomass heating due to NOx (Nitrogen Oxides) and Particulate Matter (PM10) emissions.

9.5.6 The entire London Borough of Camden has been declared an Air Quality Management Area. With current technology, biomass fuelled

CHP may negatively impact on air quality which is deemed inappropriate in an Air Quality Management Area unless abatement technology can provide sufficient mitigation.

9.5.7 Biomass systems also require space for storage and delivery of fuel, additionally, fuel delivery carries implications for parking, increased emissions and pressure from transport. The proposed plant room is situated in the basement of the development at 1 - 11 Euston Road. In the context of the current layout, there is insufficient space able to be allocated for the biomass storage facility. Therefore, it is determined that biomass heating solution cannot be practically implemented and it is not a suitable renewable energy technology for the site.

9.5.8 Life cycle assessment of biomass boilers shows that the embodied energy is usually repaid within a few years.

9.5.9 When considering life cycle costs, there are higher maintenance requirements than other forms of renewable energy, fuel costs are predicted to rise and the value of net lettable space required for storage must be considered.

9.5.10 When considering noise impact, the impact of fuel deliveries must be considered, otherwise, the impact is similar to conventional plant.

9.5.11 Therefore, it is determined that a biomass heating solution cannot be practically implemented in addition energy modelling, site and technology assessment have determined that biomass heating is not suitable for the development at 1 - 11 Euston Road.

9.6 Ground Source Heat Pump (GSHP)

9.6.1 In the UK, soil temperatures stay at a constant temperature of around 11-12℃, throughout the year. Ground source heat pumps take this low temperature energy and concentrate it into more useful, higher temperatures, to provide space heating and water heating. The process is similar to that used in refrigerators. A fluid is circulated through pipes in the ground absorbing the heat from the soil, the fluid is passed through a heat exchanger in the pump which extracts the heat from the fluid and increases it via a compression cycle. This is then used to provide underfloor heating and heat domestic hot water.

Application to Site – Not Feasible

Feasibility

9.6.2 It has been determined that connection to existing or installation of new Ground Source Heat Pump plant is not a feasible option for the 1 - 11 Euston Road scheme, this is due to the existing transport and utility infrastructure beneath the site and the large area required for boreholes exterior to the building. Boreholes are required to be 5 metres apart per 100kW of duty.

9.6.3 Energy modelling and cost analysis show that installation of a GSHP, although feasible is one of the most costly options, and would require further detailed analysis of conflicts with existing systems, ground conditions and soil conductivity before determining whether or not the required levels of carbon savings could be achieved.

9.6.4 Land use, plant space and physical security for the ground collectors and the heat pump units also needs to be taken into consideration. For horizontal collector systems, a potentially large area is required for the collector pipework. This area should be free of trees which will cause problems for installation of the pipework. It can be beneath the building but it is most effective in an open area. For borehole or vertical collectors, land requirements are reduced but still significant as the boreholes must be a minimum of five metres apart.

9.6.5 Noise impact of heat pumps is considered to be negligible although concerns have been raised where older systems are poorly maintained and become noisy.

9.6.6 Life cycle assessment shows that this technology has a low embodied energy and carbon which is repaid within a few years.

9.6.7 The capital cost of a heat pump system, the collector system and the heat distribution system compromises this technology as a cost effective solution. The cost of the heat pump itself is directly proportional to the output, so over-sizing should be avoided. A large proportion of the total cost is the cost of installing the collector, with vertical systems working out at around 25-50% more expensive owing to the need for borehole drilling. Larger systems will require major ground works to install a large horizontal collector or several boreholes. Installation costs can be reduced if the collector is installed as part of the ground works. The associated energy savings and RHI will reduce the lifecycle costs

9.6.8 Studies have raised concerns over operational efficiencies matching manufacturers stated efficiencies and costs of maintenance required. Taking all of these considerations into account, it is judged that GSHP is not a suitable or affordable technology for 1 - 11 Euston Road.

9.7 Renewables Summary

9.7.1 Each of the London Plan Policy 5.6 approved renewable technologies have been appraised in terms of their suitability for the proposed development at 1 - 11 Euston Road.

9.7.2 The implementation of a PV system has been found to be the most feasible solution for the site.

9.7.3 A 27.01 kWp Photovoltaic system (requiring 186.88m^2 of 185Wp panels) in conjunction with a 185kWe gas fired CHP system and VRF ASHP has been found to be the most suitable energy solution to achieve an overall 51.14% carbon reduction at the site.

9.7.4 Wind is not a feasible renewable technology for the site, due to space constraints, perceived planning issues and uncertainty surrounding expected energy output, roof loading, height restrictions and conservation sensitivity issues.

9.7.5 A solar thermal system is not feasible for the development, as there is limited roof space, distances for pipe runs to storage vessels are significant and it is not appropriate to specify solar thermal in conjunction with CHP. A solar thermal system alone could not achieve significant carbon reductions across the site.

9.7.6 A biomass fuelled CHP system providing hot-water and electricity has been deemed not to be feasible. This is due to efficiency management and plant space availability issues. Additionally, as the London Borough of Camden is an Air Quality Management Area, concerns are raised relating to the impact on local air quality without costly abatement technologies were biomass CHP to be considered. Also due to concerns relating to parking, fuel deliveries and plant room space constraints limiting fuel storage capacity at the site, it was determined that this option cannot be practically implemented.

9.7.7 A Ground Source Heat Pump System is not feasible due to site constraints and existing transport and utility infrastructure beneath the site.

9.7.8 Table 8 below provides a summary of the overall carbon reductions and improvement of BER over the Notional Baseline BER for the preferred technologies. An ASHP, CHP and PV system is determined to be the most suitable low carbon and renewable energy technology solution for the development at 1 - 11 Euston Road.

Table 10: Energy Hierarchy Summary

	Notional Baseline	Efficient Baseline	Low Carbon Baseline	Renewable Baseline
Space Heating Energy **kWh/yr**	732,905	193,316	193,316	193,316
DHW Energy kWh/yr	1,192,854	1,157,385	28,455	28,455
Cooling kWh/yr	170,911	97,518	97,518	97,518
Lighting Energy kWh/yr	170,353	151,568	151,568	151,568
Aux Energy kWh/yr	76,032	76,032	76,032	76,032
Un-Regulated Energy kWh/yr	202,426	202,426	202,426	202,426
CHP Fuel Energy kWh/yr	-	-	1,360,877	1,360,877
Renewables Contribution kWh/yr	-	-	-	-21,256
Actual CO_2 Emissions $KgCO_2/yr$	870,839	601,847	436,746	425,502
CO_2 Reduction (by baseline) $kgCO_2/yr$	-	268,992	165,100	11,244
Percentage CO_2 Reduction	**-**	30.89%	27.43%	2.57%
Total CO_2 Reduction $kgCO_2/yr$	-	268,992	434,092	445,336
Total Percentage CO_2 Reduction	-	30.89%	49.85%	51.14%
BER	108.30	70.28	46.94	45.35

BER % Improvement	-	35.11%	33.21%	3.39%
Total BER % Improvement	-	35.11%	56.66%	58.12%
BER over TER % Improvement London Plan Policy 5.2	-67.99	-9.25%	27.03%	29.50%

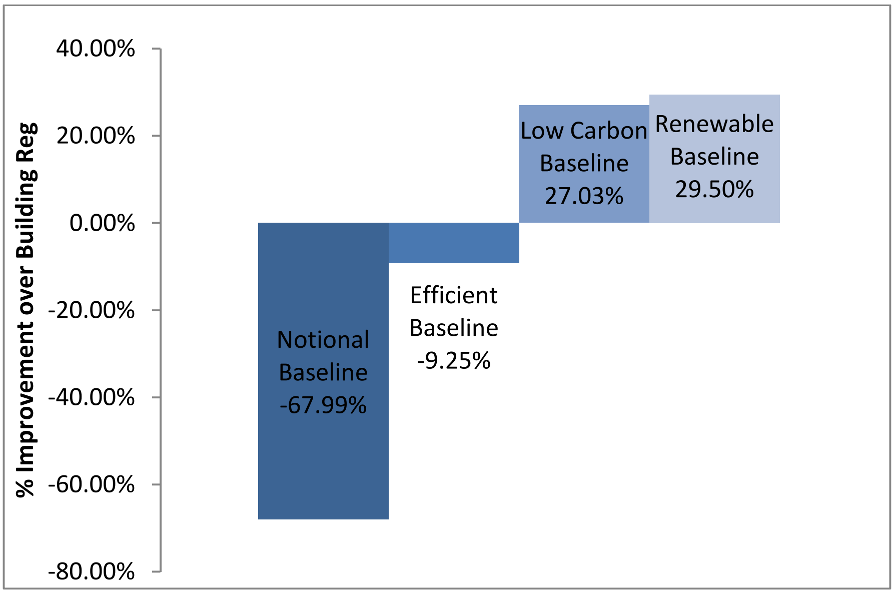
9.7.9 An overall total carbon emissions reduction of 51.14% from the Notional Baseline can be achieved as a result of this energy strategy. This strategy also achieves a 58.12% improvement over the Notional Baseline BER, contributing 8 credits for the BREEAM Ene 1 issue, contributing significantly to the development to achieving an BREEAM rating of 'Excellent', as well as achieving the minimum mandatory requirements for Code Level 4 for the Ene 1 – Dwelling Emissions Rate issue, and contributing to the 2.57% carbon reduction from on-site renewables.

9.7.10 The London Plan Policy 5.2 states that, 'As a minimum, all major development proposals should meet the following targets for carbon dioxide emissions reduction in buildings. These targets are expressed as minimum improvements over the Target Emission Rate (TER) outlined in the national Building Regulations'. For both residential and non domestic Buildings the target is a 25% improvement on 2010 Building regulations.

9.7.11 Modelling and calculations show the development at 1 - 11 Euston Road has potential to achieve a total 29.50% BER over TER improvement, which exceeds the 25% required to meet the London Plan Policy 5.2 2010 – 2013 targets. This is illustrated in Figure 14 below.

9.7.12 London Plan Policy 5.7 and London Borough of Camden policy requirements are for a 20% reduction in CO_2 emissions due to the specification of renewables. Clearly this target has not been met with the 2.57% carbon reduction from on-site renewables, although it should be noted that it is possible to achieve a total 'whole energy' CO_2 reduction from the Notional Baseline of 51.14%.

Figure 14 - BER over TER % Improvement - London Plan



9.7.13 Figure 14 above illustrates the percentage BER over TER improvement in line with the London Plan Policy 5.2 methodology. It should be noted that the total BER over TER percentage improvement from the Notional to Renewable Baseline is 58.12%. The Notional and Efficient Baseline improvements are shown as negative figures as the Notional Baseline model has been created using minimum fabric U-values and service efficiencies allowable under Building Regulations Part L2A.

10.0 CONCLUSION

10.1 Following the energy hierarchy has enabled significant carbon reductions to be calculated for the proposed development at 1 - 11 Euston Road. The total overall carbon reduction is predicted to be approximately 51.14% with renewables contributing 2.57%. These calculations demonstrate that the development will meet the mandatory BREEAM Ene 1 requirements and that the development is on track to achieve certification at the required level of 'Excellent' as well as achieving the minimum mandatory requirements for Code Level 4 for the Ene 1 – Dwelling Emissions Rate issue.. See Figure 15 for a graphical summary of CO_2 reductions.

10.2 In accordance with the London Plan Poicy 5.2, 'whole energy' figures derived from SBEM calculations have been used in this energy strategy, including: heating, hot-water, lighting, pumps and fans and un-regulated energy. The proposed development at 1 - 11 Euston Road is calculated to have a 'whole energy' Notional Baseline of 870,839 kgCO_2/yr.

10.3 In the first stage of the energy hierarchy (Be Lean), calculations to determine the Efficient Baseline predict a 30.89% carbon reduction through the proposed energy efficiency measures. This results in a reduction of 268,992 kgCO_2/yr from the Notional baseline to the Efficient Baseline.

10.4 The second stage (Be Clean) calculations to determine the Low Carbon Baseline predict that specification of CHP can deliver a further carbon reduction of 165,100 kg/CO_2,which equates to a 27.43% reduction from the Efficient to Low Carbon Baseline, and can be expressed as a total 49.85% carbon emission reduction from the Notional Baseline.

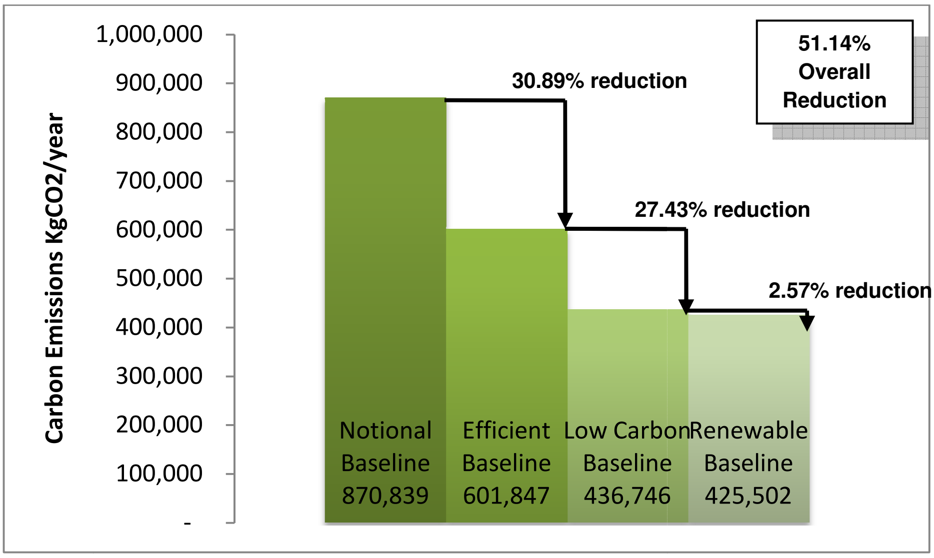
10.5 Finally, calculations to determine the Renewable Baseline have determined PV to be the most suitable renewable energy technology for to the site. The modelled PV panel array contributing a further carbon reduction of reduction of 11,244 kg/CO_2/yr, which is a 2.57% reduction from the Low Carbon Baseline. These reductions are achieved utilising 186.88m^2 of 185Wp PV panels. The calculations show that the fabric efficiency measures, including specification of ASHP and specification of CHP and PV can achieve an overall total 51.14% CO_2 reduction from the Notional Baseline

10.6 The roof of the building is being used to maximum advantage and is an active space which is being utilised for a green roof space, plant space for the ASHP units and for PV panels. The scope for CO_2 reduction using renewables is limited by the roof space and further limited by the level of activity on the roof. Nonetheless, the size and output of the PV array has been maximised.

10.7 London Plan Policy 5.7 and London Borough of Camden policy requirements are for a 20% reduction in CO_2 emissions due to the specification of renewables. Clearly this target has not been met with the 2.57% carbon reduction from on-site renewables, although it should be noted that it is possible to achieve a total 'whole energy' CO_2 reduction from the Notional Baseline of 51.14%.

10.8 Modelling and calculations show the development at 1 - 11 Euston Road has potential to achieve a total 29.50% BER over TER improvement, which exceeds the 25% required to meet the London Plan Policy 5.2, 2010 – 2013 targets.

Figure 15: Whole Energy Carbon Emission Reductions



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APPENDIX A – SBEM RESULTS

Renewables Baseline SBEM Results

SIMPLIFIED BUILDING ENERGY METHOD
Version: v4.1.c.3

REPORT- Energy consumption by Fuel Type (kWh/m2): PROJECT

7074.41	NatGas	LPG	BioGas	Oil	Coal	Anthracite	Smokeless	DualFuel	Biomass	GridSupElec	WasteHeat	DH	All	Displaced	All-Displaced
Month	kWh/m2	kWh/m2	kWh/m2	kWh/m2	kWh/m2	kWh/m2	kWh/m2	kWh/m2	kWh/m2	kWh/m2	kWh/m2	kWh/m2	kWh/m2	kWh/m2	kWh/m2
JAN	24.3271	0	0	0	0	0	0	0	0	6.65425	0	0	30.9814	7.74971	23.2317
FEB	22.0052	0	0	0	0	0	0	0	0	5.951	0	0	27.9562	7.03612	20.9201
MAR	24.3271	0	0	0	0	0	0	0	0	6.38248	0	0	30.7096	7.88167	22.8279
APR	23.5532	0	0	0	0	0	0	0	0	5.76448	0	0	29.3177	7.70713	21.6106
MAY	24.3271	0	0	0	0	0	0	0	0	5.99359	0	0	30.3207	8.02942	22.2913
JUN	23.5532	0	0	0	0	0	0	0	0	5.98784	0	0	29.541	7.83357	21.7075
JUL	24.3271	0	0	0	0	0	0	0	0	6.23945	0	0	30.5666	8.07133	22.4952
AUG	24.3271	0	0	0	0	0	0	0	0	6.12756	0	0	30.4547	8.03035	22.4243
SEP	23.5532	0	0	0	0	0	0	0	0	5.57573	0	0	29.1289	7.69521	21.4337
OCT	24.3271	0	0	0	0	0	0	0	0	5.98672	0	0	30.3138	7.84212	22.4717
NOV	23.5532	0	0	0	0	0	0	0	0	6.14666	0	0	29.6999	7.51003	22.1898
DEC	24.3271	0	0	0	0	0	0	0	0	6.47326	0	0	30.8004	7.73734	23.063
SUM	**286.509**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**73.283**	**0**	**0**	**359.791**	**93.1239**	**266.667**

Month	**Gas**	Electricity	Unreg Electricity	Electricity Offset	**Total Electricity**
	kWh	kWh	kWh	kWh	kWh
JAN	172,100	47,075	17,195	-54,825	9,446
FEB	155,674	42,100	15,532	-49,776	7,855
MAR	172,100	45,152	17,195	-55,758	6,589
APR	166,625	40,780	16,627	-54,523	2,884
MAY	172,100	42,401	17,189	-56,803	2,787
JUN	166,625	42,360	16,639	-55,418	3,582
JUL	172,100	44,140	17,195	-57,100	4,236
AUG	172,100	43,349	17,195	-56,810	3,734
SEP	166,625	39,445	16,633	-54,439	1,639
OCT	172,100	42,353	17,201	-55,478	4,075
NOV	166,625	43,484	16,645	-53,129	7,000
DEC	172,100	45,794	17,178	-54,737	8,235
SUM	**2,026,873**	**518,434**	**202,426**	**-658,797**	**62,063**

Whole Energy' Carbon Baseline: 425,502 KgCO2/annum

REPORT- Energy consumption by End Uses (kWh/m2):

7074.41	Heating	Cooling	Aux Energy	Lighting	Hot Water	All	Equipment	All+Equipment	CHP_Heat	CHP_Cool	CHP_HW	CHP_All	All+CHP_All
Month	kWh/m2	kWh/m2	kWh/m2	kWh/m2	kWh/m2	kWh/m2	kWh/m2	kWh/m2	kWh/m2	kWh/m2	kWh/m2	kWh/m2	kWh/m2
JAN	3.07354	0.783219	0.916284	1.88122	0.335186	6.98945	2.43063	9.42008	0	0	23.992	23.992	30.9814
FEB	2.73206	0.721614	0.828487	1.66883	0.335186	6.28618	2.19553	8.48171	0	0	21.6701	45.662	51.9482
MAR	2.77603	0.871705	0.916284	1.81847	0.335186	6.71768	2.43063	9.14831	0	0	23.992	69.654	76.3717
APR	2.17642	0.995846	0.871172	1.72103	0.33518	6.09965	2.35034	8.45	0	0	23.218	92.8721	98.9717
MAY	1.94724	1.3568	0.909492	1.78006	0.335186	6.32878	2.42981	8.75859	0	0	23.992	116.864	123.193
JUN	1.72354	1.66514	0.884755	1.71439	0.33518	6.323	2.352	8.675	0	0	23.218	140.082	146.405
JUL	1.6315	1.91838	0.916284	1.77328	0.335186	6.57463	2.43063	9.00526	0	0	23.992	164.074	170.649
AUG	1.67598	1.75001	0.916284	1.78528	0.335186	6.46275	2.43063	8.89338	0	0	23.992	188.066	194.529
SEP	1.75842	1.19248	0.877963	1.74686	0.33518	5.91091	2.35118	8.26209	0	0	23.218	211.284	217.195
OCT	2.2712	0.95431	0.923075	1.83815	0.335186	6.32192	2.43147	8.75338	0	0	23.992	235.276	241.598
NOV	2.64712	0.797177	0.891546	1.81082	0.33518	6.48184	2.35283	8.83468	0	0	23.218	258.494	264.976
DEC	2.91305	0.777918	0.895909	1.88638	0.335186	6.80844	2.42817	9.23661	0	0	23.992	282.486	289.294
SUM	**27.3261**	**13.7846**	**10.7475**	**21.4248**	**4.0222**	**77.3052**	**28.6138**	**105.919**	**0**	**0**	**282.486**	**282.486**	**359.791**

Month	**Gas Space Heating**	**Heat Pump Heating**	**Electric Heati**	**Hot Water by Boiler**	**Hot Water offset by CHP**	**Cooling**	**Aux Energy**	**Lighting**	**Equipment**	**CHP Gas Fuel**	**CHP Electricity Offset**	**PVs Electricity Offset**
	kWh	kWh	kWh	kWh	kWh	kWh	kWh	kWh	kWh	kWh	kWh	kWh
JAN	0	4,230	17,513	2,371	-81,938	5,541	6,482	13,309	17,195	169,729	-54,147	-677
FEB	0	3,473	15,855	2,371	-74,008	5,105	5,861	11,806	15,532	153,303	-48,907	-869
MAR	0	2,615	17,024	2,371	-81,938	6,167	6,482	12,865	17,195	169,729	-54,147	-1,611
APR	0	1,116	14,281	2,371	-79,295	7,045	6,163	12,175	16,627	164,254	-52,401	-2,123
MAY	0	247	13,529	2,371	-81,938	9,599	6,434	12,593	17,189	169,729	-54,147	-2,656
JUN	0	39	12,154	2,371	-79,295	11,780	6,259	12,128	16,639	164,254	-52,401	-3,017
JUL	0	0	11,542	2,371	-81,938	13,571	6,482	12,545	17,195	169,729	-54,147	-2,953
AUG	0	0	11,857	2,371	-81,938	12,380	6,482	12,630	17,195	169,729	-54,147	-2,663
SEP	0	120	12,320	2,371	-79,295	8,436	6,211	12,358	16,633	164,254	-52,401	-2,038
OCT	0	840	15,227	2,371	-81,938	6,751	6,530	13,004	17,201	169,729	-54,147	-1,331
NOV	0	2,640	16,086	2,371	-79,295	5,640	6,307	12,810	16,645	164,254	-52,401	-728
DEC	0	4,354	16,254	2,371	-81,938	5,503	6,338	13,345	17,178	169,729	-54,147	-590
SUM	**0**	**19,675**	**173,641**	**28,455**	**-964,754**	**97,518**	**76,032**	**151,568**	**202,426**	**1,998,418**	**-637,541**	**-21,256**

Low Carbon Baseline SBEM Results

SIMPLIFIED BUILDING ENERGY METHOD
Version: v4.1.c.3

REPORT- Energy consumption by Fuel Type (kWh/m2): PROJECT

7074.41	NatGas	LPG	BioGas	Oil	Coal	Anthracite	Smokeless	DualFuel	Biomass	GridSupElec	WasteHeat	DH	All	Displaced	All-Displaced
Month	kWh/m2	kWh/m2	kWh/m2	kWh/m2	kWh/m2	kWh/m2	kWh/m2	kWh/m2	kWh/m2	kWh/m2	kWh/m2	kWh/m2	kWh/m2	kWh/m2	kWh/m2
JAN	24.3271	0	0	0	0	0	0	0	0	6.65425	0	0	30.9814	7.65398	23.3274
FEB	22.0052	0	0	0	0	0	0	0	0	5.951	0	0	27.9562	6.91324	21.043
MAR	24.3271	0	0	0	0	0	0	0	0	6.38248	0	0	30.7096	7.65398	23.0556
APR	23.5532	0	0	0	0	0	0	0	0	5.76448	0	0	29.3177	7.40708	21.9106
MAY	24.3271	0	0	0	0	0	0	0	0	5.99359	0	0	30.3207	7.65398	22.6667
JUN	23.5532	0	0	0	0	0	0	0	0	5.98784	0	0	29.541	7.40708	22.134
JUL	24.3271	0	0	0	0	0	0	0	0	6.23945	0	0	30.5666	7.65398	22.9126
AUG	24.3271	0	0	0	0	0	0	0	0	6.12756	0	0	30.4547	7.65398	22.8007
SEP	23.5532	0	0	0	0	0	0	0	0	5.57573	0	0	29.1289	7.40708	21.7219
OCT	24.3271	0	0	0	0	0	0	0	0	5.98672	0	0	30.3138	7.65398	22.6599
NOV	23.5532	0	0	0	0	0	0	0	0	6.14666	0	0	29.6999	7.40708	22.2928
DEC	24.3271	0	0	0	0	0	0	0	0	6.47326	0	0	30.8004	7.65398	23.1464
SUM	**286.509**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**73.283**	**0**	**0**	**359.791**	**90.1193**	**269.672**

Gas	Electricity	Unreg Electricity	Electricity Offset	Total Electricity
kWh	kWh	kWh	kWh	kWh
172,100	47,075	17,195	-54,147	10,123
155,674	42,100	15,532	-48,907	8,725
172,100	45,152	17,195	-54,147	8,200
166,625	40,780	16,627	-52,401	5,007
172,100	42,401	17,189	-54,147	5,443
166,625	42,360	16,639	-52,401	6,599
172,100	44,140	17,195	-54,147	7,188
172,100	43,349	17,195	-54,147	6,397
166,625	39,445	16,633	-52,401	3,677
172,100	42,353	17,201	-54,147	5,406
166,625	43,484	16,645	-52,401	7,728
172,100	45,794	17,178	-54,147	8,825
2,026,873	**518,434**	**202,426**	**-637,541**	**83,319**

Whole Energy' Carbon Baseline: 436,746 KgCO2/annum

REPORT- Energy consumption by End Uses (kWh/m2):

7074.41	Heating	Cooling	Aux Energy	Lighting	Hot Water	All	Equipment	All+Equipment	CHP_Heat	CHP_Cool	CHP_HW	CHP_All
Month	kWh/m2	kWh/m2	kWh/m2	kWh/m2	kWh/m2	kWh/m2	kWh/m2	kWh/m2	kWh/m2	kWh/m2	kWh/m2	kWh/m2
JAN	3.07354	0.783219	0.916284	1.88122	0.335186	6.98945	2.43063	9.42008	0	0	23.992	23.992
FEB	2.73206	0.721614	0.828487	1.66883	0.335186	6.28618	2.19553	8.48171	0	0	21.6701	45.662
MAR	2.77603	0.871705	0.916284	1.81847	0.335186	6.71768	2.43063	9.14831	0	0	23.992	69.654
APR	2.17642	0.995846	0.871172	1.72103	0.33518	6.09965	2.35034	8.45	0	0	23.218	92.8721
MAY	1.94724	1.3568	0.909492	1.78006	0.335186	6.32878	2.42981	8.75859	0	0	23.992	116.864
JUN	1.72354	1.66514	0.884755	1.71439	0.33518	6.323	2.352	8.675	0	0	23.218	140.082
JUL	1.6315	1.91838	0.916284	1.77328	0.335186	6.57463	2.43063	9.00526	0	0	23.992	164.074
AUG	1.67598	1.75001	0.916284	1.78528	0.335186	6.46275	2.43063	8.89338	0	0	23.992	188.066
SEP	1.75842	1.19248	0.877963	1.74686	0.33518	5.91091	2.35118	8.26209	0	0	23.218	211.284
OCT	2.2712	0.95431	0.923075	1.83815	0.335186	6.32192	2.43147	8.75338	0	0	23.992	235.276
NOV	2.64712	0.797177	0.891546	1.81082	0.33518	6.48184	2.35283	8.83468	0	0	23.218	258.494
DEC	2.91305	0.777918	0.895909	1.88638	0.335186	6.80844	2.42817	9.23661	0	0	23.992	282.486
SUM	**27.3261**	**13.7846**	**10.7475**	**21.4248**	**4.0222**	**77.3052**	**28.6138**	**105.919**	**0**	**0**	**282.486**	**282.486**

Month	All+CHP_All	Gas Space Heating	Heat Pump Heating	Electric Heating	Hot Water by Boiler	Hot Water offset by CHP	Cooling	Aux Energy	Lighting	Equipment	CHP Gas Fuel	CHP Electricity Offset
	kWh/m2	kWh	kWh	kWh	kWh	kWh	kWh	kWh	kWh	kWh	kWh	kWh
JAN	30.9814	0	4,230	17,513	2,371	-81,938	5,541	6,482	13,309	17,195	169,729	-54,147
FEB	51.9482	0	3,473	15,855	2,371	-74,008	5,105	5,861	11,806	15,532	153,303	-48,907
MAR	76.3717	0	2,615	17,024	2,371	-81,938	6,167	6,482	12,865	17,195	169,729	-54,147
APR	98.9717	0	1,116	14,281	2,371	-79,295	7,045	6,163	12,175	16,627	164,254	-52,401
MAY	123.193	0	247	13,529	2,371	-81,938	9,599	6,434	12,593	17,189	169,729	-54,147
JUN	146.405	0	39	12,154	2,371	-79,295	11,780	6,259	12,128	16,639	164,254	-52,401
JUL	170.649	0	0	11,542	2,371	-81,938	13,571	6,482	12,545	17,195	169,729	-54,147
AUG	194.529	0	0	11,857	2,371	-81,938	12,380	6,482	12,630	17,195	169,729	-54,147
SEP	217.195	0	120	12,320	2,371	-79,295	8,436	6,211	12,358	16,633	164,254	-52,401
OCT	241.598	0	840	15,227	2,371	-81,938	6,751	6,530	13,004	17,201	169,729	-54,147
NOV	264.976	0	2,640	16,086	2,371	-79,295	5,640	6,307	12,810	16,645	164,254	-52,401
DEC	289.294	0	4,354	16,254	2,371	-81,938	5,503	6,338	13,345	17,178	169,729	-54,147
SUM	**359.791**	**0**	**19,675**	**173,641**	**28,455**	**-964,754**	**97,518**	**76,032**	**151,568**	**202,426**	**1,998,418**	**-637,541**

Efficient Baseline SBEM Results

Version: v4.1.c.3

REPORT- Energy consumption by Fuel Type (kWh/m2): PROJECT

7074.41	NatGas	LPG	BioGas	Oil	Coal	Anthracite	Smokeless	DualFuel	Biomass	GridSupElec	WasteHeat	DH	All	Displaced	All-Displaced
Month	kWh/m2	kWh/m2	kWh/m2	kWh/m2	kWh/m2	kWh/m2	kWh/m2	kWh/m2	kWh/m2	kWh/m2	kWh/m2	kWh/m2	kWh/m2	kWh/m2	kWh/m2
JAN	13.8885	0	0	0	0	0	0	0	0	6.65425	0	0	20.5428	0	20.5428
FEB	12.5769	0	0	0	0	0	0	0	0	5.951	0	0	18.5279	0	18.5279
MAR	13.8885	0	0	0	0	0	0	0	0	6.38248	0	0	20.271	0	20.271
APR	13.4513	0	0	0	0	0	0	0	0	5.76448	0	0	19.2158	0	19.2158
MAY	13.8885	0	0	0	0	0	0	0	0	5.99359	0	0	19.8821	0	19.8821
JUN	13.4513	0	0	0	0	0	0	0	0	5.98784	0	0	19.4391	0	19.4391
JUL	13.8885	0	0	0	0	0	0	0	0	6.23945	0	0	20.128	0	20.128
AUG	13.8885	0	0	0	0	0	0	0	0	6.12756	0	0	20.0161	0	20.0161
SEP	13.4513	0	0	0	0	0	0	0	0	5.57573	0	0	19.027	0	19.027
OCT	13.8885	0	0	0	0	0	0	0	0	5.98672	0	0	19.8752	0	19.8752
NOV	13.4513	0	0	0	0	0	0	0	0	6.14666	0	0	19.598	0	19.598
DEC	13.8885	0	0	0	0	0	0	0	0	6.47326	0	0	20.3618	0	20.3618
SUM	**163.601**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**73.283**	**0**	**0**	**236.885**	**0**	**236.885**

Month	**Gas**	Electricity	Unreg Electricity	Electricity Offset	**Total Electricity**
	kWh	kWh	kWh	kWh	kWh
JAN	98,253	47,075	17,195	0	64,270
FEB	88,974	42,100	15,532	0	57,632
MAR	98,253	45,152	17,195	0	62,348
APR	95,160	40,780	16,627	0	57,408
MAY	98,253	42,401	17,189	0	59,591
JUN	95,160	42,360	16,639	0	58,999
JUL	98,253	44,140	17,195	0	61,336
AUG	98,253	43,349	17,195	0	60,544
SEP	95,160	39,445	16,633	0	56,078
OCT	98,253	42,353	17,201	0	59,554
NOV	95,160	43,484	16,645	0	60,129
DEC	98,253	45,794	17,178	0	62,972
SUM	**1,157,385**	**518,434**	**202,426**	**0**	**720,860**

Whole Energy' Carbon Baseline: 601,847 KgCO2/annum

REPORT- Energy consumption by End Uses (kWh/m2):

7074.41	Heating	Cooling	Aux Energy	Lighting	Hot Water	All	Equipment	All+Equipment	CHP_Heat	CHP_Cool	CHP_HW	CHP_All	All+CHP_All
Month	kWh/m2	kWh/m2	kWh/m2	kWh/m2	kWh/m2	kWh/m2	kWh/m2	kWh/m2	kWh/m2	kWh/m2	kWh/m2	kWh/m2	kWh/m2
JAN	3.07354	0.783219	0.916284	1.88122	13.8885	20.5428	2.43063	22.9734	0	0	0	0	20.5428
FEB	2.73206	0.721614	0.828487	1.66883	12.5769	18.5279	2.19553	20.7234	0	0	0	0	18.5279
MAR	2.77603	0.871705	0.916284	1.81847	13.8885	20.271	2.43063	22.7016	0	0	0	0	20.271
APR	2.17642	0.995846	0.871172	1.72103	13.4513	19.2158	2.35034	21.5661	0	0	0	0	19.2158
MAY	1.94724	1.3568	0.909492	1.78006	13.8885	19.8821	2.42981	22.3119	0	0	0	0	19.8821
JUN	1.72354	1.66514	0.884755	1.71439	13.4513	19.4391	2.352	21.7911	0	0	0	0	19.4391
JUL	1.6315	1.91838	0.916284	1.77328	13.8885	20.1279	2.43063	22.5586	0	0	0	0	20.1279
AUG	1.67598	1.75001	0.916284	1.78528	13.8885	20.0161	2.43063	22.4467	0	0	0	0	20.0161
SEP	1.75842	1.19248	0.877963	1.74686	13.4513	19.027	2.35118	21.3782	0	0	0	0	19.027
OCT	2.2712	0.95431	0.923075	1.83815	13.8885	19.8752	2.43147	22.3067	0	0	0	0	19.8752
NOV	2.64712	0.797177	0.891546	1.81082	13.4513	19.598	2.35283	21.9508	0	0	0	0	19.598
DEC	2.91305	0.777918	0.895909	1.88638	13.8885	20.3618	2.42817	22.7899	0	0	0	0	20.3618
SUM	**27.3261**	**13.7846**	**10.7475**	**21.4248**	**163.601**	**236.885**	**28.6138**	**265.498**	**0**	**0**	**0**	**0**	**236.885**

Month	**Gas Space Heating**	**Heat Pump Heating**	**Electric Heati**	**Hot Water**	**Cooling**	**Aux Energy**	**Lighting**	**Equipment**
	kWh	kWh	kWh	kWh	kWh	kWh	kWh	kWh
JAN	0	4,230	17,513	98,253	5,541	6,482	13,309	17,195
FEB	0	3,473	15,855	88,974	5,105	5,861	11,806	15,532
MAR	0	2,615	17,024	98,253	6,167	6,482	12,865	17,195
APR	0	1,116	14,281	95,160	7,045	6,163	12,175	16,627
MAY	0	247	13,529	98,253	9,599	6,434	12,593	17,189
JUN	0	39	12,154	95,160	11,780	6,259	12,128	16,639
JUL	0	0	11,542	98,253	13,571	6,482	12,545	17,195
AUG	0	0	11,857	98,253	12,380	6,482	12,630	17,195
SEP	0	120	12,320	95,160	8,436	6,211	12,358	16,633
OCT	0	840	15,227	98,253	6,751	6,530	13,004	17,201
NOV	0	2,640	16,086	95,160	5,640	6,307	12,810	16,645
DEC	0	4,354	16,254	98,253	5,503	6,338	13,345	17,178
SUM	**0**	**19,675**	**173,641**	**1,157,385**	**97,518**	**76,032**	**151,568**	**202,426**

Notional Baseline SBEM Results

SIMPLIFIED BUILDING ENERGY METHOD
Version: v4.1.c.3

REPORT- Energy consumption by Fuel Type (kWh/m2): PROJECT

7074.41	NatGas	LPG	BioGas	Oil	Coal	Anthracite	Smokeless	DualFuel	Biomass	GridSupElec	WasteHeat	DH	All	Displaced	All-Displaced	**Total Gas**	Reg Electricity	Unreg Electricity	Electricity Offset	**Total Electricity**
Month	kWh/m2	kWh/m2	kWh/m2	kWh/m2	kWh/m2	kWh/m2	kWh/m2	kWh/m2	kWh/m2	kWh/m2	kWh/m2	kWh/m2	kWh/m2	kWh/m2	kWh/m2	kWh	kWh	kWh	kWh	kWh
JAN	20.1781	0	0	0	0	0	0	0	0	11.2891	0	0	31.4672	0	31.4672	142,748	79,864	17,195	0	97,059
FEB	17.5832	0	0	0	0	0	0	0	0	10.2674	0	0	27.8506	0	27.8506	124,391	72,636	15,532	0	88,168
MAR	17.958	0	0	0	0	0	0	0	0	11.4696	0	0	29.4276	0	29.4276	127,042	81,141	17,195	0	98,336
APR	15.8289	0	0	0	0	0	0	0	0	10.5353	0	0	26.3641	0	26.3641	111,980	74,531	16,627	0	91,158
MAY	14.9057	0	0	0	0	0	0	0	0	11.5169	0	0	26.4226	0	26.4226	105,449	81,475	17,189	0	98,665
JUN	13.9773	0	0	0	0	0	0	0	0	11.8539	0	0	25.8312	0	25.8312	98,881	83,859	16,639	0	100,498
JUL	14.3121	0	0	0	0	0	0	0	0	12.3385	0	0	26.6506	0	26.6506	101,250	87,288	17,195	0	104,483
AUG	14.3121	0	0	0	0	0	0	0	0	11.9558	0	0	26.2679	0	26.2679	101,250	84,580	17,195	0	101,776
SEP	14.2524	0	0	0	0	0	0	0	0	10.3439	0	0	24.5963	0	24.5963	100,827	73,177	16,633	0	89,810
OCT	15.9202	0	0	0	0	0	0	0	0	11.1226	0	0	27.0428	0	27.0428	112,626	78,686	17,201	0	95,887
NOV	17.6061	0	0	0	0	0	0	0	0	10.8282	0	0	28.4344	0	28.4344	124,553	76,603	16,645	0	93,248
DEC	20.4311	0	0	0	0	0	0	0	0	10.4152	0	0	30.8463	0	30.8463	144,538	73,681	17,178	0	90,859
SUM	**197.266**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**133.936**	**0**	**0**	**331.202**	**0**	**331.202**	**1,395,535**	**947,521**	**202,426**	**0**	**1,149,947**

Whole Energy' Carbon Baseline: 870,839 KgCO2/annum

REPORT- Energy consumption by End Uses (kWh/m2):

7074.41	Heating	Cooling	Aux Energy	Lighting	Hot Water	All	Equipment	All+Equipment	CHP_Heat	CHP_Cool	CHP_HW	CHP_All	All+CHP_All	**Gas Space Heating**	**Heat Pump Heating**	**Electric Heating**	**Hot Water**	**Cooling**	**Aux Energy**	**Lighting**	**Equipment**
Month	kWh/m2	kWh/m2	kWh/m2	kWh/m2	kWh/m2	kWh/m2	kWh/m2	kWh/m2	kWh/m2	kWh/m2	kWh/m2	kWh/m2	kWh/m2	kWh	kWh	kWh	kWh	kWh	kWh	kWh	kWh
JAN	13.1915	0.943595	0.916284	2.10368	14.3121	31.4672	2.43063	33.8978	0	0	0	0	31.4672	41,498	0	51,824	101,250	6,675	6,482	14,882	17,195
FEB	11.2528	0.925238	0.828487	1.87341	12.9707	27.8506	2.19553	30.0461	0	0	0	0	27.8506	32,631	0	46,976	91,760	6,546	5,861	13,253	15,532
MAR	10.8051	1.35069	0.916284	2.04342	14.3121	29.4276	2.43063	31.8582	0	0	0	0	29.4276	25,793	0	50,647	101,250	9,555	6,482	14,456	17,195
APR	7.88094	1.80794	0.871172	1.9391	13.865	26.3642	2.35034	28.7145	0	0	0	0	26.3642	13,893	0	41,860	98,087	12,790	6,163	13,718	16,627
MAY	6.49989	2.70605	0.909492	1.99501	14.3121	26.4226	2.42981	28.8524	0	0	0	0	26.4226	4,199	0	41,784	101,250	19,144	6,434	14,114	17,189
JUN	5.61572	3.533	0.884755	1.93266	13.865	25.8311	2.352	28.1831	0	0	0	0	25.8311	794	0	38,934	98,087	24,994	6,259	13,672	16,639
JUL	5.40336	4.02056	0.916284	1.99827	14.3121	26.6506	2.43063	29.0813	0	0	0	0	26.6506	0	0	38,226	101,250	28,443	6,482	14,137	17,195
AUG	5.50804	3.52012	0.916284	2.01132	14.3121	26.2679	2.43063	28.6985	0	0	0	0	26.2679	0	0	38,966	101,250	24,903	6,482	14,229	17,195
SEP	5.82791	2.05739	0.877963	1.96799	13.865	24.5963	2.35118	26.9474	0	0	0	0	24.5963	2,741	0	38,489	98,087	14,555	6,211	13,922	16,633
OCT	8.33547	1.40741	0.923075	2.06464	14.3121	27.0427	2.43147	29.4742	0	0	0	0	27.0427	11,376	0	47,593	101,250	9,957	6,530	14,606	17,201
NOV	10.6588	0.984951	0.891546	2.03404	13.865	28.4344	2.35283	30.7872	0	0	0	0	28.4344	26,466	0	48,938	98,087	6,968	6,307	14,390	16,645
DEC	12.6196	0.902064	0.895909	2.11661	14.3121	30.8463	2.42817	33.2745	0	0	0	0	30.8463	43,288	0	45,988	101,250	6,382	6,338	14,974	17,178
SUM	**103.599**	**24.159**	**10.7475**	**24.0802**	**168.616**	**331.202**	**28.6138**	**359.815**	**0**	**0**	**0**	**0**	**331.202**	**202,680**	**0**	**530,225**	**1,192,854**	**170,911**	**76,032**	**170,353**	**202,426**

APPENDIX B – RENEWABLE TECHNOLOGIES

B1.0 Combined Heat and Power –CHP

B1.1 CHP is an engine which produces electricity. The process of creating the electricity produces heat as a by-product. Heat can be easily stored in a thermal storage tank and distributed to across the site to provide for the hot water demands of the site. The heat can also provide for some space heating within a development.

B1.2 CHP systems are far more efficient than traditional centralised power plants. The CHP plant reduces losses such that for the same energy output, CHP requires 100 input units to the centralised plants 180 units, a result of the high losses associated with traditional centralised power stations.

B1.3 CHP engines operate most efficiently at a constant output. Demand profiling is therefore an important factor in the sizing of a CHP system. For example, it is unlikely to be cost effective to size the plant on the basis of space heating requirements when there are no space heat requirements for several months of the year. Therefore, CHP plant is usually sized on the basis of a steady hot water demand which provides electricity which can either be used on-site or exported to assist in decarbonising the grid.

B1.4 Combined heat and power (CHP) is not a renewable source, unless it is powered by bio-fuels.

B2.0 Solar Photovoltaic (PV)

B2.1 Photovoltaic systems convert solar energy directly into electricity through semiconductor cells. The panels generate electricity from both direct light and diffuse light. Photovoltaic panels can either be mounted external to the building or be integrated into the building cladding (known as Building Integrated Photovoltaic or BIPV).

B2.2 PV panels are arguably the cleanest method of using solar energy, but the lower levels of solar radiation which occur within the United Kingdom limits the achievable power output of the panels. However, panels come with a guarantee of 25 years and will work efficiently for at least 40 years. They are cleaned naturally by rainfall, and as there are no moving parts they are virtually maintenance free. The power output levels from PV are well documented and developers can be confident that they will generally perform to manufacturers specifications.

B2.3 They come in a wide range of types and are often integrated into the buildings structure as an alternative to conventional tiling, as façade, shading features, or as flat roofing systems It is possible to get combined PV/solar thermal tiles such as the c21e which can be an ideal solution for low rise housing.

B2.4 PV inverters are required to change the direct current (DC) electricity from the PV panels into alternating current (AC) for use with home appliances and electricity grid.

B2.5 Grid-tied inverters use high-frequency transformers, to convert DC current directly to 240 volts AC. Most PV inverters on the market will include a maximum power point tracker that enables the inverter to extract an optimal amount of power from the solar array by tracking the array's maximum power point.

B3.0 Solar Thermal

B3.1 Solar Thermal hot water heating systems harvest energy from the sun to heat water. The solar heating collectors are generally positioned on the roof of a building, they can also be wall mounted, although with reduced efficiency. A fluid within the panels, heats up by absorbing solar radiation. The fluid is then used to heat up domestic water which is stored in a separate water cylinder.

B3.2 There are two types of collectors – flat plate and evacuated tube. Evacuated tube collectors are generally more expensive because they are more complex but are considered to be more efficient saving approximately 582 kWh per m2 per year. Flat plate collectors save approximately 454 kWh per m2 per year.

B3.3 A fewer number of more efficient panels may achieve the same heat output, but the cost of panels increases significantly as efficiency is increased.

B3.4 The majority of heat output from solar hot water systems is achieved during the summer and mid seasons, with the least heat energy obtained during the winter.

B3.5 The best location for solar thermal collectors is on a south-east/south-west facing roof, and positioned at an elevation of between 10 and 60°. Depending on the angle of the roof, the collectors can potentially be roof integrated, otherwise the collectors will require frame mounting at the appropriate angle.

B3.6 A solar thermal system can provide between 50 and 70 % of annual domestic hot water needs. Savings from solar hot water are difficult to predict and will depend on how much water is used and at what time of day.

B3.7 Solar Thermal systems are most effective when combined with water efficient fixtures and fittings and the hot water can be used during the day and early afternoon, this may require the provision of additional information to the user in order to understand the system.

B3.8 When a series of collectors are frame mounted, space will be required surrounding each collector to prevent each panel from shading the next, as the sun moves through the sky and when there is low sun in winter.

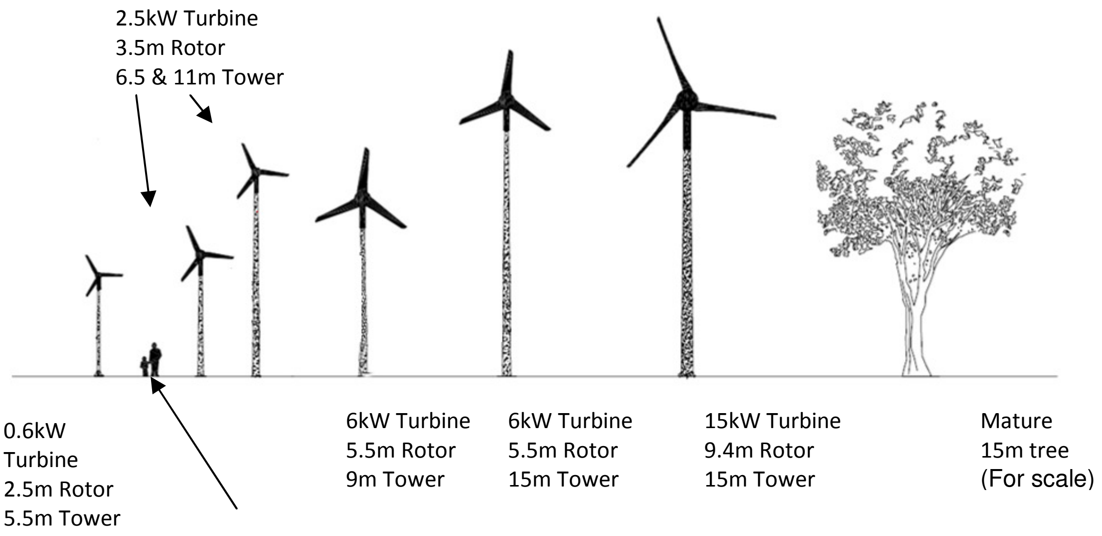
B4.0 Wind Turbines

B4.1 Wind turbines are available in a variety of shapes, sizes and duties, with the most common being a propeller blade/windmill configuration with a horizontal axis. Turbines are also available in vertical axis arrangements in a number of styles, and purpose built rooftop modules or integrated systems are emerging onto the market.

B4.2 Due the size of the wind turbines they are typically ground mounted. Vibration, noise and appearance can be issues associated with wind turbines, and must be considered early during the design if they are incorporated into the development.

B4.3 Wind is one of the most cost-effective methods or generating renewable electricity. However wind is more suited to low density areas where there is more space necessary for maintenance, less turbulent wind patterns, and they are less likely to be the cause of noise and vibration to nearby properties. High density areas are not ideal with current wind turbine technology.

Figure 16: Illustration of scale for different sized wind turbines



metropolis green

B5.0 Biomass Heating / CHP

B5.1 Wood is the most commonly used form of biomass fuel, and can either be burned in solid fuel boilers for central heating applications, or for raising steam for power generation in large installations. The wood is either burned as raw wood-chippings, or processed into pellets. Pellets have a more even temperature burn and as such are more efficient than raw chippings; however, there is a carbon factor to their manufacture so the CO_2 reduction potential is lowered.

B5.2 In considering this type of system, space for storage and the necessary feed system to supply the boilers would need to be provided. In addition, a guaranteed ongoing and dependable fuel supply would be required.

B5.3 The biomass-fired system requires more fuel handling and storage equipment than is required for typical gas or oil fired boiler systems. A large storage bin is typically provided which can be used on a rotational basis, with a regular top-up of fuel that would be delivered by lorry. The low density and calorific value of wood means that large storage volumes are required, and there must be suitable access for the fuel delivery vehicles.

B5.4 Typically, biomass installations are sized to meet a base heat load with peak load and load variations to be met from gas-fired boilers. Biomass boilers operate most efficiently and are therefore most cost effective when working continuously at full load, they do not respond well to rapidly fluctuating demand. When assessing the feasibility of a biomass installation, storage space and biomass delivery requirements need to be taken into account.

B6.0 Ground Source Heat Pump

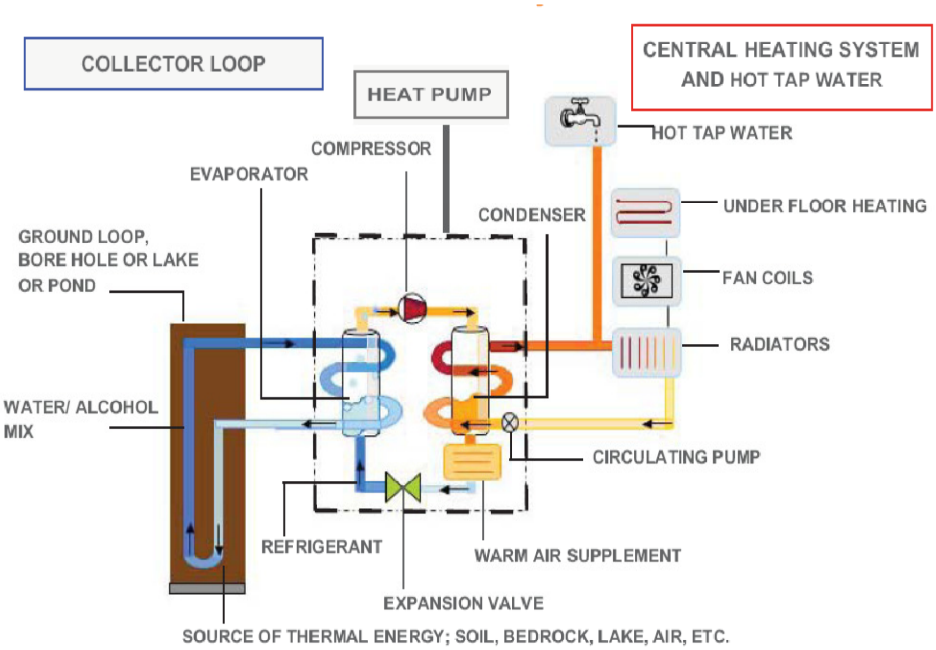
B6.1 In the UK, soil temperatures stay at a constant temperature of around 11-12℃, throughout the year. Ground source heat pumps take this low temperature energy and concentrate it into more useful, higher temperatures, to provide space heating and water heating. The process is similar to a refrigerator. A fluid is circulated through pipes in the ground absorbing the heat from the soil, the fluid is passed through a heat exchanger in the pump which extracts the heat from the fluid and increases it via a compression cycle. This is then used to provide underfloor heating and heat domestic hot water.

B6.2 Grid electricity is used to power the heat pumps and a Coefficient of Performance (CoP) of at least three is required for efficient energy provision and carbon savings. GSHP should be used in conjunction with underfloor heating because it requires lower temperatures than traditional radiators and maintains the efficiency of the heat pump. The CoP of the heat pump can reduce over time and so standard maintenance is importance to ensure the continued efficiency of the system. In individual houses GSHP can provide the majority of the heating and hot water demand but in larger buildings the heat pump may only provide a proportion of the heating and hot water needs.

B6.3 Ground source systems can be installed in horizontal trenches or in vertical boreholes. Horizontal trenches require access to relatively large areas of ground and are buried about 1 to 2 metres below the surface. Whereas boreholes require much less surface area, however have a higher cost attached to drilling 30m to 100m below the ground level. Boreholes need to be adequately spaced to ensure each borehole doesn't interfere with the next. This is known as thermal breakthrough, when the temperature of the soil is reduced overtime, which in turn affects the productivity of the system. Allowing more space between each borehole allows the soil temperatures to replenish. Once installed, GSHPs cannot be seen and so offer no visual impact on an area.

B6.4 Geological information is required to assess the thermal conductivity of the soil at a particular site. The soil's thermal conductivity affects the sizing of the boreholes and therefore efficiency and cost of the system. A test borehole is only recommended if there are no space constraints at the site, a GSHP system is the preferred technology, and the only uncertainty is the thermal conductivity of the soil and therefore the number of boreholes required. In this case the test borehole would become part of the ground source system and the cost would be absorbed into the total cost.

Figure 17: Ground Source Heat Pump System



APPENDIX C – GRANTS AND INCENTIVES

C1.0 Renewables Obligation

C1.1 The Renewables Obligation (RO) scheme obliges all electricity suppliers in Great Britain to ensure that a proportion of electricity supplied is produced from renewable sources of energy. Suppliers can meet this obligation either by supplying power from renewable generating stations, or by purchasing green certificates (*Renewables Obligation Certificates - "ROC's*) or by paying a buy-out price, collected by a fund and recycled to suppliers. There are value bands for the price received for a ROC produced from different types of renewable energy generation technologies. The Renewables Obligation (RO) focuses on supporting large-scale renewable electricity projects.

C2.0 Feed In Tariff

C2.1 The Energy Act 2008 established enabling powers for the introduction of FITs to supplement the RO and incentivise small-scale low-carbon electricity generation, up to a maximum limit of 5MW capacity for renewable energy and up to 50kW in the case of fossil-fuelled CHP.

C2.2 Government introduced the Feed-In Tariff (FIT) in April 2010. FiT is a new financial incentive for renewable generators with an installed capacity below 5MW. It has been developed by the Department of Energy and Climate Change (DECC) and is designed to encourage individuals and business in the UK to generate renewable energy. Under this scheme energy suppliers make regular payments to householders, communities and organisations who generate their own electricity from renewable or low carbon sources.

C2.3 The Feed-In Tariffs scheme will be reviewed by the government every five years, to coincide with the reviews of the Renewables Obligation. There is a risk that tariff levels may be reduced when the scheme is reviewed, and as such care must be taken when forecasting income over the 25 year life of the tariff scheme.

C2.4 Also note that it is a legal requirement to use an Ofgem approved meter in order to collect revenue from the meter readings displayed or transmitted to a data collection system. In addition, for electricity supplies to domestic customers by a licensed supplier, an Ofgem approved and certified meter must be used.

C3.0 Renewable Heat Incentive

C3.1 The counterpart to small scale electricity generation is The *Renewable Heat Incentive (RHI)* scheme. It will provide financial support for those who install renewable heating, which qualifies for support under the scheme. However, Support for RHI for residential installation does not begin until October 2012, though there will be a "RHI Premium Payment" similar to a capital grant for systems installed before then.

C3.2 At a domestic level, the incentive will apply to:

- solar thermal water heating
- biomass boilers
- ground and water source heat pumps
- Biogas Injection

C3.3 The RHI is to support non-residential installations from July 2011 (Phase 1), businesses, offices, public sector buildings and industrial processes in large factories. Residential support will not start until October 2012 (Phase 2).

C3.4 No Tariffs have yet been published for residential installations, apart from indicative levels for the Premium Payment:

Heat Technology	Payment per installation
Air source heat pumps	£850
Biomass boilers	£950
Ground source heat pumps	£1,250
Solar water heating	£300

C3.5 The Energy Act 2008 provides the statutory powers for a renewable heat incentive scheme to be introduced across England, Wales and Scotland. The detailed legal framework will be set out in secondary legislation.

C3.6 Each eligible installation has to be registered by the energy regulator Ofgem. There are some specific requirements. For example, systems below 45kW capacity must com-ply with the Microgeneration Certification Scheme.

C3.7 The heat cannot be wasted and must be used for a prescribed purpose; space, water or process heating (not for electricity production). There are two different approaches that can be used to measure the heat output of systems: metering and 'deeming', which implies that the level of payment would be based on a 'deemed' output based on what the installed system would be expected to deliver if the property were well insulated. However, for Phase 1 of the scheme all systems will have to be metered, the government has outlined how the metering should be configured in the system, calibrated, maintained and read.

C3.8 The exact mechanisms for deeming are still under consultation. It is not yet confirmed whether deeming of the heat output will be applicable to domestic installations in Phase 2.

C4.0 Enhanced Capital Allowance

C4.1 The Enhanced Capital Allowance (ECA) scheme is a key part of the Government's programme to manage climate change. It provides businesses with enhanced tax relief for investments in equipment that meets published energy-saving criteria.

C4.2 Enhanced Capital Allowances (ECAs) enable a business to claim 100% first-year capital allowances on their spending on qualifying plant and machinery.

C4.3 Enhanced Capital Allowances (ECAs) can only be claimed on energy-saving products that meet the relevant criteria for their particular technology group

C4.4 The criteria on the list are reviewed each year, to reflect technological advances and market changes. New technology groups might also be added as part of the annual review, but they must have the approval of the Department of Energy and Climate Change (DECC), Her Majesty's Revenue and Customs (HMRC) and the Treasury.

C4.5 The list of qualifying products, within each technology, is updated each month to include any new or modified products that meet the criteria.

C4.6 **Which technologies and products qualify for ECAs?**
An up-to-date list of the technologies that qualify for the allowance can be found on the Energy Technology Product List (ETPL). The groups currently on it are:

- Air-to-air energy recovery
- Automatic monitoring and targeting (AMT)
- Boiler equipment
- Combined heat and power (CHP)
- Compact heat exchangers
- Compressed air equipment
- Heat pumps for space heating
- Heating ventilation and air conditioning equipment
- Lighting
- Motors and drives
- Pipework insulation

- Radiant and Warm Air Heaters
- Refrigeration equipment
- Solar thermal systems
- Uninterruptible Power Supplies (UPS)

Within these 15 groups, there are 54 sub-technologies such as single speed motors and biomass boilers

C4.7 Businesses can write off the whole of the capital cost of their investment in these technologies against their taxable profits of the period during which they make the investment.

C4.8 This can deliver a helpful cash flow boost and a shortened payback period.

Bookmark Source Data

Bookmark Name	Bookmark	Notes
ReportDate	August 2011	Date to show on Report Title Page
ReportRef	1962	Project Reference No
SiteName	1 - 11 Euston Road	
SiteNamePostCode	1 – 11 Euston Road, NW1	

LocnDesc	Nos. 1-11 Euston ('the site') is located in the London Borough of Camden. The site is located on the south side of Euston Road directly opposite Kings Cross Station and is bounded by Birkenhead Street and Crestfield Street to the east and west respectively. The existing site contains buildings four storeys in height and comprises the Northumberland Hotel, student accommodation, low grade office space, the Kings Cross Methodist Church, and various commercial uses fronting Euston Road. The site benefits from unparalleled accessibility in terms of its proximity to local, national and international transport interchanges. The site occupies a truly strategic and sustainable location within the heart of the central London. The immediate Kings Cross/St. Pancras area is part of an international gateway that attracts tourists and other visitors. The proposed development involves the demolition of the existing buildings on the site and their replacement with a comprehensive mixed use redevelopment scheme comprising a 167 bed hotel, 7 residential units and retail/restaurant/bar uses. The proposed development will comprise 8 storeys plus a basement level.	Describe the location of the Site
SiteArea (Sqm/Ha)	XXApproximately 3,600	
ClientName	Gaylord Investments Ltd	

LAName	London Borough of Camden	
ArchitectName	Bill Greensmith Architects	
LACO2Target (%)	20	LA CO2 Target % Reduction
TargetCO2Redn (KgCO$_2$/yr)	XXXX	LA CO2 Target Reduction for Low Carbon Baseline
CSHTargetLevel	xxLevel 3	
CSHEne1Target (%)	xx25	
EcoHomesTargetLevel	'Excellent'	
MaxAirtight (m^3/hour/m^2@50Pa)	7.5	
MinAirtight (m^3/hour/m^2@50Pa)	5	
BoilerEff (%)	86	
ACDECD	Accredited	
PercentLEL (%)	100	
PlantRoomLocn	in a plant room situated in the basement	Brief description of the location of the plantroom (watch for capitalisation of first letter as this text will be inserted into a sentence)
RoofAreaAvail (m2)	XX168	Roof area available for PV and/or SHW
TotFloorArea (m2)	XX3062	Floor area
Whole Energy Results		
Notional Baseline		

NOTBaseCO2 (KgCO2/yr)	870,839	
NOTAvgDER	108.30	Average DER for Notional Baseline
Efficient Baseline		
EffBaseCO2 (KgCO2/yr)	601,847	
EFFAvgDER	70.28	Average DER for Efficient Baseline
NOTEFFPercCO2Redn	30.89	Notional to Efficient Baseline Percentage CO2 reduction
NOTEFFkgCO2Redn	268,992	Notional to Efficient Baseline kgCO2 reduction
NOTEFFkWhRedn	667,237	Notional to Efficient Baseline kWh reduction
NOTEFFDERTERImpr	XXNEDERTER10	Notional to Efficient Baseline DER TER Impr
NOTEFFDERPercImpr	35.11	USE FOR ECOHOMES REPORTS Notional to Efficient Baseline DER Percentage Improvement
NOTEFFLELRednkWh	18,785	kWh reduction in Lighting Energy due to efficient baseline
LELSavingPercCO2 (%)	18.75	Percentage CO2 reduction in Lighting due to efficient baseline
NOTEFFCommCO2Redn	9,601	CO2 reduction in communal/commercial areas due to efficient baseline
NOTEFFCommkWhRedn	20,660	kWh reduction in communal/commercial areas due to efficient baseline
NOTEFFCommPercCO2Redn	6.92	Percentage CO2 reduction in communal/commercial areas due to efficient baseline

Low Carbon Baseline		
PrefLOWCTech	CHP	Preferred Low Carbon Technology
LowCBaseline (KgCO_2/yr)	436,746	
LOWCAvgDER	46.94	Average DER for Low C Baseline
EFFLOWCPercCO2Redn	27.43	Efficient to Low Carbon Baseline Percentage CO2 reduction
EFFLOWCkgCO2Redn	165,100	Efficient to Low Carbon Baseline kgCO2 reduction
EFFLOWCkWhRedn	-231,946	Efficient to Low Carbon Baseline kWh reduction
NOTLOWCPercCO2Redn	49.85	Notional to Efficient Baseline % CO2 reduction
NOTLOWCkgCO2Redn	434,092	Notional to Efficient Baseline kg CO2 reduction
EFFLOWCDERTERImpr	XXELderter10	Notional to Efficient Baseline DER TER Impr
EFFLOWCDERPercImpr	33.21	USE FOR ECOHOMES REPORTS Efficient to Low C Baseline DER Percentage Improvement
NotLowCBERPercImpr	56.66	
Renewables Baseline		
PrefRENTech	PV	Preferred renewable technology
RENBaselineCO2	425,502	
RENAvgDER	45.35	Average DER for Renewable Baseline
NOTRENPercCO2Redn	13.31	Notional to Renewable Baseline Percentage CO2 reduction
EFFRENPercCO2Redn	29.30	Efficient to Renewable Baseline Percentage CO2 reduction

LOWCRENPercCO2Redn	2.57	Low Carbon to Renewable Baseline Percentage CO2 reduction
LOWCRENkgCO2Redn	11,244	Low Carbon to Renewable Baseline kgCO2 reduction
LOWCRENkWhRedn	21,256	Low Carbon to Renewable Baseline kWh reduction
LOWCRENDERTERImpr	XXLR12XX	Improvement in DER over TER from Low C to REN baseline
LOWCRENDERPercImpr	3.39	USE FOR ECOHOMES REPORTS Low C to Renewable Baseline DER Percentage Improvement
EffRenBERPercImpr	35.47	
OVERALL Figures		
NOTRENPercCO2Redn	51.14	Notional to Renewable Baseline Percentage CO2 reduction
NOTRENkgCO2Redn	445,336	Notional to Renewable Baseline kgCO2 reduction
NOTRENkWhRedn	456,546	Notional to Renewable Baseline kWh reduction
NOTRENDERTERImpr	XX19.95	Improvement in DER over TER from NOT to REN baseline
NOTRENDERPercImpr	58.12	USE FOR ECOHOMES REPORTS Notional to Renewable Baseline DER Percentage Improvement
EcoHomesPol4PercCO2Redn	xx39.54	Percentage CO2 reduction due to LZCs in line with EcoHomes Methodology
CHP		
CHPHeatProvision	domestic hot water	What will the plant provide in terms of space/DHW heat and or electrical supply
CHPPlantSelected	ENER.G 185	Low Carbon Plant Selected for Modelling

CHPPlantCapacity	185kWe	
CHPOpHours	7,884	Modelled operation hours for Low C technology
CHPCost (£)	xxapproximately £90,000	
CHPQI	134.9	
ECATaxAllowance (£)	xxapproximately £25,200	
CorpTaxRate (%)	28	
CHPPowerEff (%)	31.9	
BackupBoilerType	high efficiency gas fired condensing communal gas boilers	Gas / BioMass / Communal / Individual
CHPMaintSched	require regular, periodic maintenance and inspection. The unit will require a service after a predetermined number of hours. Units typically require between 6 and 10 services per annum dependant upon operation. The service procedures vary throughout the year from replacing and recalibrating components to oil and filter changes. The CHP unit uses natural gas as its fuel and is therefore subject to the Gas Safe regulations. The supplier offers two flexible maintenance packages	Details of maintenance req for CHP System
CHPNoise (dB)	44	manufacturers stated noise levels in decibels
CHPPlanningConsiderations	provision of CHP is in line with London Plan requirements. As the CHP is gas fired there are unlikely to be any air quality issues associated with specification of the	Please note any planning considerations for this technology in this local authority area
CHPPayback (years)	XX5.3 years	Payback time in years

PV		
PVTotalANOutput (kWh/yr)	21,256	total energy output of from the PV panels.
PVOffsetElecCons (kWh/yr)	21,256	Electrical consumption offset by PV system
PVPanelOutput (Wp)	185	Oputput of selected PV panel from manufacturers info
PVPanelSize (m2)	1.28	
PVPanelEff (%)	14.5	Percentage efficiency of PV panel from manufacturers info
PVSysSize (kWp)	27.01	kWp size of whole PV system
PVTotalArea (m2)	186.88	Total area required for PV system
PVTotalPanels	146	Number of PV Panels required
PVOptAngle	35	Optimal angle for PV panels
PVMinAngle	10	Minimum effective angle for PV panels
PVSelected	AS-5M Amerisolar 185W	Selected PV panel product name
PVType	Mono-crystalline Silicon	PV technology type
PVPanelMfr	Amerisolari	
PVArea1kWp (no of panels)	5.5	No of panels required for 1 kWp
PVSpacing (mm)	700	Space required between PV panels
PVCommInvertLocn	plant room	Communal Inverter Location
PVIndividInvertLocn	will be housed inside the electrical services cupboards in the plant room	Individual Inverter Locations
MeterLocn	will be housed inside the electrical services cupboards in the plant room	Meter Location

PVSysMaintSched	there are no regular maintenance requirements for PV panels or the inverters. If panels are positioned at 35 degrees they will self clean, and monitoring of the system output will identify any panel problems or failures (monitoring can be remote/web based). Inverters would be expected to be replaced after 12-13 years (we are working on a 25 year life based on feed in tariff incomes but PV panels will continue to provide output for up to 40 years (at a reduced level as output degrades over time)). Inspection of the mechanical fixings to ensure that panels have not come loose due to fixings corroding etc will be required but does not require a specialist to undertake this and could be absorbed into the building inspection/maintenance programme.	Detail maintenance schedule for PV panels and assoc plant
PVPlanningConsiderations	there is a clear policy objective for provision of renewable technologies for new construction projects to help reduce carbon emissions. Visual impact of the panels must be considered at this site	
PVPlantNoise (dB)	33	manufacturers stated noise levels (for Inverters etc)in decibels
PVSysCapCost (£)	£85,000 – 90,000	Cost of PV system System and ancillaries
PVSysPayback (yrs)	11.9	Payback PV system
SHW		
SHWSysSel	Vallaint auroTHERM glazed	Name of modelled SHW system
SHWCHPEnergy (KgCO2/kWh)	49,497	
SHWWECO2Emission (KgCO2/kWh)	67439	SHW Whole Energy CO2 Emissions

SHWPercCO2Redn (%)	8.8	Percentage of CO2 reduction due to SHW
SHWNoPanels	68	Number of SHW panels required
SHWPlanningConsiderations	Planners Love/Hate it	Please note any planning considerations for this technology in this local authority area
SHWSysMaintSched	Details Of Maintenance Schedule For SHW Systems	Details Of Maintenance Schedule For SHW Systems
SHWSysPayback (years)	XX7XX	Payback Time for Low C and SHW system modelled
Wind		
WNoTurbinesReq	3	Number of turbines required to meet modelled output
WSelTurbine	Proven 11	Product Name of modelled turbine
WSelTurbinePowerOutput (kW)	6	Power output for selected model of turbine
WModelledPowerOutYr (kWh)	5400	Annual power output of modelled wind turbine system (all turbines combined)
WCHPDERTERImpr (%)	56.4	Wind and CHP improvement of DER of TER
WWECO2Emission (KgCO2/kWh)	64716	Wind Whole Energy CO2 Emissions
WCO2Offset (KgCO2/kWh)	9225	Wind CO2 Carbon Offset
WPowerOffsetYr (kWh/yr)	16,200	Wind Power Offset
WPercLowCBaseCO2Redn	12.48	Wind CO2 Reduction from Low Carbon baseline
WTurbineLocn	Roof/Tower	Where turbines will be installed
WTurbineNoise (dB)	55	Manufacturers stated operation noise levels in decibels
WSysMaintSched	System maintenance schedule	System maintenance schedule
WPlanningConsiderations	Planners LOVE/HATE it	Please note any planning considerations for this technology in this local authority area

Wind+ Low Carbon System		
WLowCSysCapCost (£)	98,500	Cost of Wind system and Low CO2 System and ancillaries combined
WLowCSysPayback (years)	6 years	Payback time in years
Biomass System		
BioSysSel	Treco BioStar 12W	Biomass System selected
BioSysSelPower (kW)	12	Power Output of system selected
BioSysSelEff (%)	90	System efficiency
BioMinOpHrs	8320	Minimum operating hours for biomass system
BioSysCost (£)	100000000	Cost of biomass system and assoc plant installed
BioMaintSched	XXXXXXXXXXXX	Detail recommended maintenance for biomass and assoc plant
BioSysPlantArea (m2)	25	Area required for biomass system and assoc plant
BioModelledPowerOutYr (kWh)	99864	Annual power output of biomass system
BioDERTERImpr (%)	YYY	Biomass improvement of DER of TER
BioWECO2Emission (KgCO2/kWh)	64716	CO2 reduction on the Whole Energy Baseline due to Biomass
BioCO2ReductYr (KgCO2/kWh)	123456	Biomass CO2 reduction from efficient baseline
BioPercReductWEBase (%)	26.44	Percentage CO2 reduction on the Whole Energy Baseline due to Biomass
BioPercCO2ReductYr (%)	xxx	Percentage of CO2 reduction due to Biomass
BioRHIPayment (£)	100000000	Biomass system RHI annual payment
BioCHPQAQI	105	CHPQA QI figure for selected system
BioCHPQAPowerEff (%)	25	Power efficiency for biomass system (for CHPQA payment eligibility)

BioECAAllowance (£)	100000000	ECA Payment
BioSysPayback (years)	3 years	Payback time
BioNoise (dB)	77	Manufacturers stated operation noise levels in decibels
BioPlanningConsiderations	Planners LOVE/HATE it	Please note any planning considerations for this technology in this local authority area
GSHP System		
GSHPSysSel	GSHP System Name	Selected GSHP system name
GSHPCoP	4	Coefficient of Performance modelled
GSHPBestSoilCond (W/m2)	40	Best Case soil conductivity
GSHPNoBoreBestSoil	5	Number of boreholes required given best soil conductivity
GSHPWorstSoilCond (W/m2)	25	Worst Case soil conductivity
GSHPNoBoreWorstSoil	21	Number of boreholes required given worst soil conductivity
GSHPBoreDepthAss (m)	100	Assumed bore hole depth
GSHPMinDistBores (m)	5	Minimum distance between collectors per 100kW duty
GSHPSysCost (£)	175,000	Cost of GSHP system incl ancillaries and installation
GSHPSysUse (Heat/DHW)	space	What the system will be used for - Enter 'space', 'DHW' or 'space and DHW'
GSHPEnergyUsed (kW)	17.5	GSHP operational energy requirement
GSHPSysSizeHeat (kW)	70	System size for space heating only
GSHPAssDHWReqPerson (w)	250	Assumed energy requirement per person for DHW
GSHPSysSizeDHW (kW)	0	System size for DHW only (enter 0 where space heating only)
GSHPTotSysSize (kW)	70	Total system size
GSHPGroundEnergyReq (kW)	52.5	Energy required from ground

GSHPPercDERTERImpr (%)	47.2	Percentage improvement of DER over TER with GSHP
GSHPWECO2Emission (Kg/CO2/yr)	65,006	Whole energy CO2 emissions with GSHP
GSHPPercWECO2Redn (%)	28.03	Whole Energy Percentage CO2 reduction
GSHPPercEffBaseCO2Redn (%)	20	Efficient Baseline Percentage CO2 reduction
GSHPHPULocn	Outside in a shed	Location of HPUs
GSHPHPUMinDistDwell (m)	6	Minimum distance between HPU and dwelling
GSHPHPUMinDistColl (m)	10	Minimum distance between HPU and collector
GSHPHPUMinClearance (mm)	150	Minimum clearance between HPU and dwelling/other HPUs etc
GSHPHPUSpaceReq (m2)	1	Space requirement for siting of HPU
GSHPHPUFinishing	HPU to be enclosed in a 1m2 steel enclosure to prevent vandalism	Details of how collector tails will be terminated and any buildings required
GSHPInstNotes	XXXXXXXXXXXX	Enter any relevant notes related to installation of GSHP
GSHPAvgRHIDwell (£)	250	Avg RHI Income per dwelling
GSHPRHIDevt (£)	2500	RHI Income for the development
GSHPPayback (years)	2 years	Payback in years
GSHPTailTerm	Tails to be terminated in a 1m2 brick enclosure	Details of how collector tails will be terminated and any buildings required
GSHPSysMaintSched	System maintenance schedule	System maintenance schedule (include details of maintenance for HPU and Collector)
GSHPNoise (dB)	77	Manufacturers stated operation noise levels in decibels
GSHPPlanningConsiderations	Planners LOVE/HATE it	Please note any planning considerations for this technology in this local authority area