Energy Statement 21 John Street, London, WC1N 2BF

Prepared by

metropolis green

On behalf of

One West Smithfield LLP

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1.0 INTRODUCTION

1.1. Document Purpose

1.1.1 This document has been prepared by sustainability consultants Metropolis Green, on behalf of our client One West Smithfield LLP in order to demonstrate how local energy policies will be achieved and how the development at 21 John Street will reduce energy consumption and associated carbon emissions, well beyond the minimum standards required by Building Regulations.

1.1.2 This document sets out the energy efficiency measures and achievements that will be implemented at 21 John Street It demonstrates that the development will be highly sustainable in both construction and occupation and how it will perform against the EcoHomes Ene 1 – Dwelling Emission Rate standard.

1.1.3 One West Smithfield LLP and the design team are making best efforts to ensure that the planning policy requirements are met and/or exceeded using the criteria set out in the EcoHomes as guidelines for incorporation into the design to ensure that the required standards are adhered to and met throughout the design and construction of the development.

1.2. Site and Development Description

1.2.1 21 John Street is situated within the London Borough of Camden and is located on the boundaries of Clerkenwell and Bloomsbury, midway between the West End and the City of London. The surrounding area is a mix of residential and office accommodation.

1.2.2 The building was constructed in the 1930s and is Art Deco in style. It has predominantly brick elevations with a Portland stone plinth from ground to second floor. The building is Listed under a group designation comprising 21 John Street, The Duke of York Public House, 7 Roger Street and 1-4 Mytre Court, John's Mews.

1.2.3 The property is located within the Bloomsbury Conservation Area. The property is Grade II Listed.

1.2.4 The proposed development is the change of use of the upper floors of 21 John Street from office to residential use. Retaining office uses throughout the building is not considered viable in the short, medium or long term throughout the whole of the building and the introduction of 2 residential units on second floor and then a single residential unit on each of the floors above, in conjunction with retained office floorspace at lower levels would safeguard the future of this listed building.

1.2.5 External refurbishment work will be undertaken to the fabric of the building. Two office floors will also be retained and measures installed to facilitate modern office occupation, within the constraints of the existing building.

1.2.6 The upper floors would be converted to residential use to provide a mix of two and three bedroom units.

2.0 POLICY CONTEXT

2.0.1 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.

2.1 European Policy

European Union Energy Performance in Buildings Directive (2002)

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

2.1.2. 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 2010 Building Regulations.

2.2 National Policy

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

PPS1 Delivering Sustainable Development

2.2.2 Some of the key principles are: "Development plans should ensure that sustainable development is pursued in an integrated manner, in line with the principles for sustainable development set out in the UK strategy. Regional planning bodies and local planning authorities should ensure that development plans promote outcomes in which environmental, economic and social objectives are achieved together over time. Regional planning bodies and local planning authorities should ensure that development plans contribute to global sustainability by addressing the causes and potential impacts of climate change – through policies which reduce energy use, reduce emissions, promote the development of renewable energy resources, and take climate change impacts into account in the location and design of development.

<u>PPS Planning and Climate Change (supplement to PPS1)</u>

2.2.3 This PPS on climate change sets out how planning should contribute to reducing emissions and stabilising climate change.

2.2.4 Applicants for planning permission should consider how well their proposals for development contribute to the Government's ambition of a low-carbon economy and how well adapted they are for the expected effects of climate change.

2.2.5 The guidance requests planning authorities, developers and other partners in the provision of new development to engage constructively and imaginatively to encourage the delivery of sustainable buildings.

2.3 Building Regulations

2.3.1 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 new, commercial or industrial.

2.3.2 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.

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

2.3.4 Building Regulations 2010 Approved Documents Part L1B: “Conservation of Fuel and Power in Existing Dwellings” require that fabric performance and services comply with minimum standards; however they do not currently require the installation of renewable energy technologies.

2.4 Regional Policy

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

Mayor’s Energy Strategy

2.4.2 The Mayor’s Energy Strategy aims to improve London’s environment, reduce the capital’s contribution to climate change, tackle fuel poverty and promote economic development by changing the way energy is supplied and used in London.

London Plan

2.4.3 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 in refurbished dwellings are summarised below. It should be noted that Policy 5.4 is the only policy specifically relevant to refurbished/retrofitting dwellings.

Policy 5.2 - Minimising CO_2 Emissions

2.4.4 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

Policy 5.4 Retrofitting

2.4.5 A The environmental impact of existing urban areas should be reduced through policies and programmes that bring existing buildings up to the Mayor's standards on sustainable design and construction. In particular, programmes should reduce carbon dioxide emissions, improve the efficiency of resource use (such as water) and minimise the generation of pollution and waste from existing building stock.

Policy 5.7 - Renewable Energy

2.4.6 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.

2.4.7 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.

2.4.8 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.

2.5 Local Policy

2.5.1 The London Borough of Camden adopted their Local Development Framework (LDF), which replaced tour Unitary Development Plan (UDP) in November 2010. The LDF is a collection of planning documents that (in conjunction with national planning policy and the Mayor's London Plan) sets out our strategy for managing growth and development in the borough.

2.5.2 The LDF comprises a selection of planning policy documents including amongst others, the Core Strategy, Development Policies and Site Allocations. The Borough has also adopted Supplementary Planning Documents that although they are not part of our statutory development plan, play an important role in our planning decisions.

2.5.3 The Core Strategy is a central part of the Local Development Framework (LDF) setting out the borough's vision over the next 15 years. Section 3 of the Core strategy covers issues relating to climate change and improving and protecting Camden's environment and quality of life.

2.5.4 The Development Management Policies document sets out detailed planning criteria used to determine applications for planning permission in the borough. Section 3 of the Development Management policies sets out the specific planning policy that will guide planning applications towards meeting the borough's vision set out in Section 3 of the Core Strategy.

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

2.5.5 This policy requires all development to take measures to minimise the effects of, and adapt to, climate change and encourages all development to meet the highest feasible environmental standards that are financially viable during construction and occupation. The policy suggests that the Code and BREEAM are helpful tools in assessing general sustainability.

2.5.6 The Policy promotes the sustainable patterns of development through making use of land that is located well in terms of public transport. The efficient use of land and building is also promoted to relieve pressure on green field development.

2.5.7 The Council encourages the reduction of carbon emissions from the redevelopment, construction and occupation of buildings by implementing, in order, all of the elements of the energy hierarchy. This hierarchy includes ensuring developments use less energy, make use of energy from efficient sources and generate renewable energy on-site. The policy subtext does however indicate that development involving existing buildings will be expected to take proportionate measures to improve their environmental sustainability, where possible.

2.5.8 The Policy also aims to make Camden a water efficient borough and minimise the potential for surface water flooding. The borough will seek to protect existing drinking water supplies, promote responsible water consumption (through Code/BREEAM/EcoHomes) and require development to avoid harm to the water environment, water quality or drainage systems.

Camden Development Policy DP22 – Promoting sustainable design and construction

2.5.9 This policy indicates that developments will be required to incorporate sustainable design and construction measures. This will include demonstrating how sustainable development principles have been incorporated into the design and proposed implementation. The incorporation of green or brown roofs and green walls have are also required wherever suitable.

2.5.10 The Council will promote and measure sustainable design and construction through requiring to new housing to meet Code for sustainable home Homes Level 3 by 2010 and Code Level 4 by 2013 and encouraging Code Level 6 (zero carbon) by 2016. Residential 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.

Camden Planning Guidance 3: Sustainability

2.5.11 This SPD encourages all buildings, whether being updated or refurbished, toreduce their carbon emissions by making improvements to the existing building. Work involving a change of use or an extension to an existing property is included. As a guide, at least 10% of the project cost should be spent on the improvements.

2.5.12 The document reaffirms that the EcoHomes standard should be applied where 5 or more dwellings are proposed. However, it goes further by stating that minimum standards of 60% of credits within the Energy and Water Categories and 40% of the within the Materials Category.

2.5.13 In terms of renewable energy all developments are to target at least a 20% reduction in carbon dioxide emissions through the installation of on-site renewable energy technologies.

2.5.14 Both in terms of energy efficiency and renewable energy, the SPD state on numerous occasions that special consideration will be given to heritage buildings and features to ensure that their historic and architectural features are preserved.

3.0 ENERGY/CARBON CALCULATIONS

3.0.1 The proposed development at 21 John Street 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
- EcoHomes 2006
- London Plan and Camden Council Policies

3.1 EcoHomes 2006

3.1.1 London Borough of Camden has required the refurbished dwellings at 21 John Street to be built to EcoHomes 'Very Good' standard. The element of EcoHomes that deals with the calculation of energy and carbon dioxide is the first Issue - ENE 1: Dwelling Emission Rate.

3.1.2 Credits are awarded based on the percentage the Dwelling Emission Rate (DER) score as calculated by the SAP 2005 Assessments.

3.1.3 The lower the DER the higher the number of credits awarded, as illustrated in Table 1 below.

3.1.4 The SAP worksheets indicating the DER are required as evidence for the EcoHomes Assessment to show that this criterion has been met.

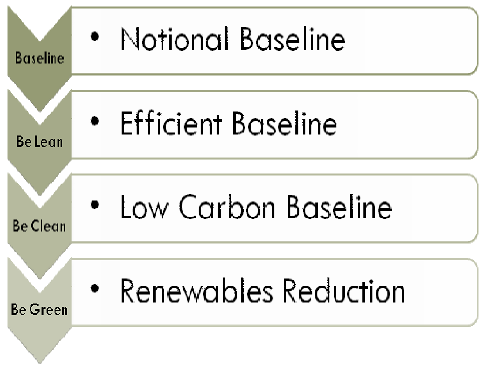
Table 1: Mandatory requirements for EcoHomes ENE 1 – Dwelling Emission Rate

Credits	CO_2 emissions DER (kg/m^2/yr)
1	≤ 40
2	≤ 35
3	≤ 32
4	≤ 30
5	≤ 28
6	≤ 26
7	≤ 24
8	≤ 22
9	≤ 20
10	≤ 18
11	≤ 15
12	≤ 10
13	≤ 5
14	≤ 0
15	≤ - 10

4.0 METHODOLOGY

4.1 The methodology that has been applied to this energy statement follows 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 1 below.

Figure 1: Energy Hierarchy



4.2 The Notional Baseline for the proposed development at 21 John Street has been calculated using the approved national calculation methodology, SAP.

4.3 Improvements in the building fabric and performance of heating system allowed for energy efficiency improvements to be achieved. These were also based on meeting best practice standards. From the Notional Baseline, a new energy demand and carbon baseline is calculated, which will be referred to as the Efficient Baseline.

4.4 The methodology requires that all new developments consider decentralised energy generation technology and communal heating systems. Although the proposed development is a refurbishment project, Combined Heat and Power technology (CHP) was examined in terms of its suitability for the site, which can reduce the Efficient Baseline further and to be referred to as the Low Carbon Baseline.

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

4.6 SAP 2009 calculations have been performed in order to calculate 'whole energy' figures for the baselines and SAP 2005 to determine building's DER and performance against EcoHomes Ene 1 issue.

5.0 SITE ENERGY DEMAND & NOTIONAL BASELINE

5.1 The development at 21 John Street 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 SAP approved software. In addition, the carbon emissions associated with appliances and cooking have also been calculated using the specified formulae in the SAP manuals. Full detailed results are provided in Appendix A of this report.

5.2 Table 2 provides a breakdown of the energy demand for 21 John Street . The Notional Baseline is shown graphically in Figure 2 below.

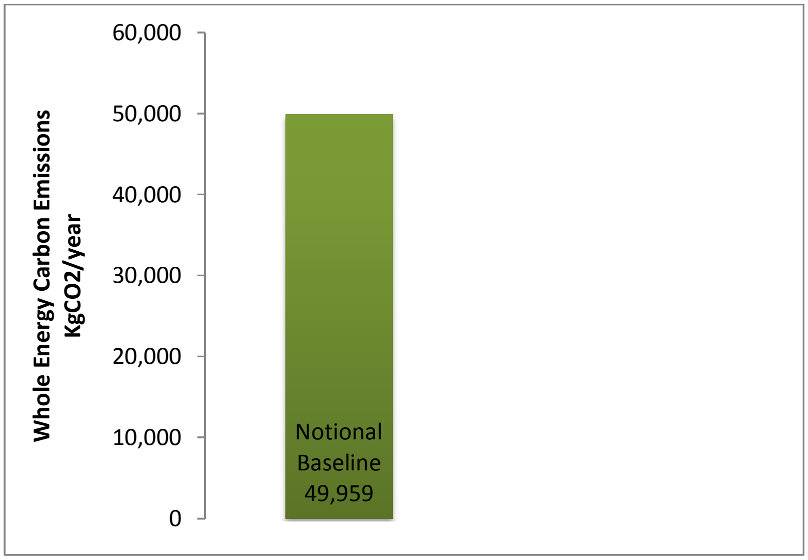
5.3 At this stage, no energy efficiency measures have been applied to this baseline. Improving the energy performance of the building is the next step, detailed in Section 6.

Table 2: Predicted Notional Baseline

Notional Baseline	
Space Heating Energy kWh/yr	138,032
DHW Energy kWh/yr	22,582
Cooling kWh/yr	0
Lighting Energy kWh/yr	6,679
Aux Energy kWh/yr	1,400
Un-Reg Energy kWh/yr	27,041
Carbon Emissions $KgCO_2$/yr	49,959
Average DER	51.48

5.4 Modelling of the Notional Baseline is undertaken using current fabric and openings U-values of the building. Values used are listed in Table 3 on page 18.

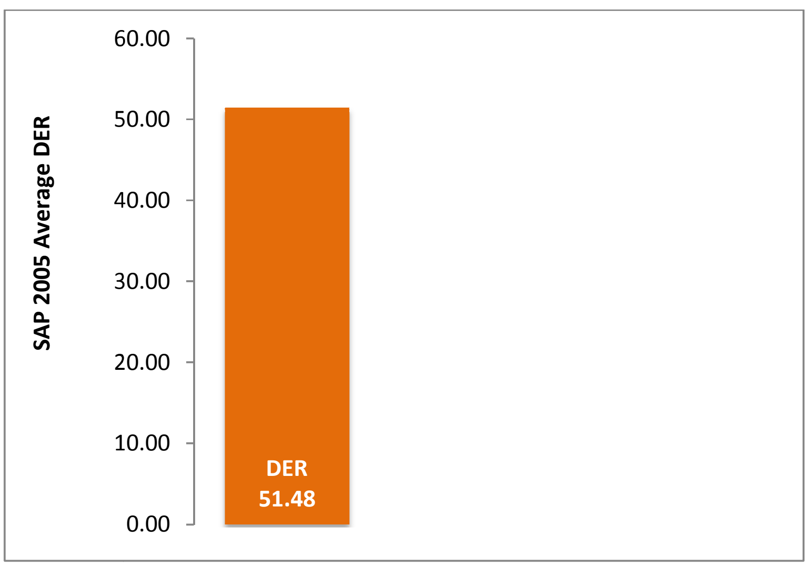
Figure 2: The Energy Hierarchy – Predicted Notional Baseline



5.5 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 EcoHomes requirements can be achieved at this site. The actual Notional Baseline will be determined at the detailed design stage by detailed SAP assessments with finalised drawings and services details.

5.6 Figure 3 below illustrates calculated Average DER of the dwellings.

Figure 3: SAP 2005 Average DER



6.0 BE LEAN – ENERGY EFFICIENCY MEASURES

6.1 Metropolis Green has been working with the project architects to determine the most efficient and feasible way to reduce the carbon emissions of the development.

6.2 Minimising heat loss from the building fabric 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.

Input Parameters

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

6.4 The U-values and input parameters that have been used to achieve the optimum improvement over the Notional Baseline to the Efficient Baseline are shown in Table 3 below.

Table 3: Summary of Input Parameters for Notional and Efficient Baselines

	Notional Baseline	Efficient Baseline
External Wall U-value	2.1	0.28
Internal Heat Loss Wall U-value (between flat and stairwell)	0.3	0.3
Internal Heat Loss Floor (separating flats from offices)	0.4	0.4
Roof U-value	2.3	0.18
Windows & Openings U-values	4.8	2.5
Air Permeability:	15	15
DHW Systsem	250 L hot water cylinder	250 L hot water cylinder
Space Heating System	Gas boiler SEDBUK 2005 91%, radiators, time and temperature zone control, weather compensator	Gas boiler SEDBUK 2005 91%, radiators, time and temperature zone control, weather compensator
Ventilation System	Natural ventilation	Natural ventilation
Energy Efficient Lighting	0%	75%

6.5 The fabric of the existing building will be upgraded from its current state, meeting and exceeding the Building Regulations standards for existing buildings. These improvements will be achieved through specification of insulation, reduction of U-values of the external doors and windows. All existing windows will be replaced with Crittall W20. These measures will significantly reduce carbon emissions and will ensure that emissions will be minimised throughout the life of the development in its current form.

6.6 Further energy efficiency measures can also be applied to space heating and hot water production with highly efficient individual gas condensing boilers being specified.

6.7 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 4 below.

6.8 This new Efficient Baseline completes the first stage of the Energy Hierarchy, to be lean and use energy efficiently, as illustrated by Figure 4 below.

Energy and CO_2 Reductions

6.9 The predicted 'Whole Energy' CO_2 reduction delivered through the efficiency measures equates to 16,372 $kgCO_2/m^2$/year, or 32.8% reduction. Please note this reduction is measured from the Notional Baseline and is across the 'whole energy' baseline which includes unregulated energy use.

6.10 The energy consumption of the development has been reduced by 78,672 kWh/year due to proposed improvements and the Average DER calculated under SAP 2005 as required in section Ene 1 of EcoHomes 2006 achieves a rating of 25.35 $kgCO_2/m^2$/year, a 50.8% improvement over the Notional Baseline DER (Figure 5).

Table 4: Efficient Baseline Energy and Carbon Emissions

Efficient Baseline	
Space Heating Energy kWh/yr	61,653
DHW Energy kWh/yr	22,782
Cooling kWh/yr	0
Lighting Energy kWh/yr	4,186
Aux Energy kWh/yr	1,400
Un-Reg Energy kWh/yr	27,041
Carbon Emissions $KgCO_2$/yr	33,586
% Improvement over Notional Baseline	32.8%
Average DER	25.35

Figure 4: Be Lean – 'Whole Energy' Efficient Baseline

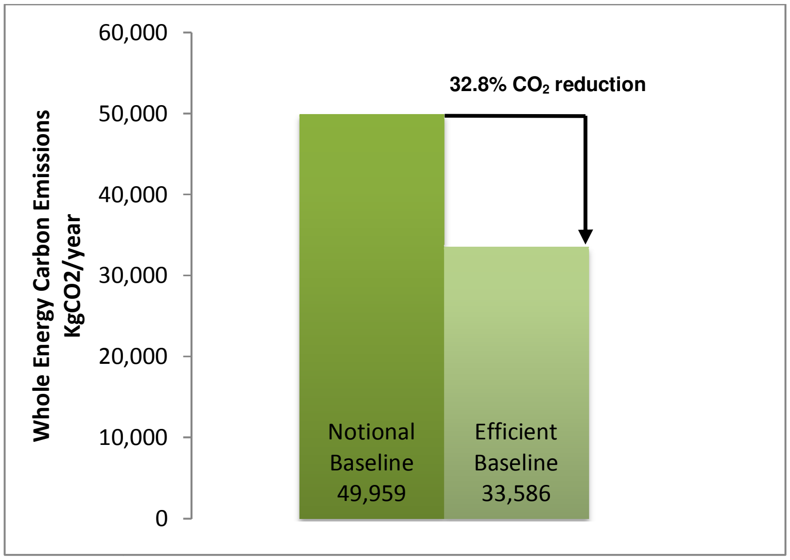
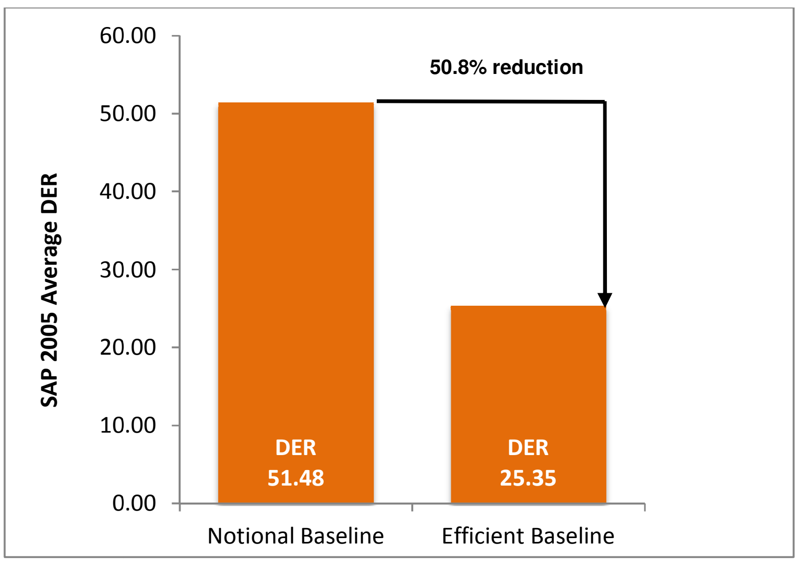


Figure 5: Average DER improvement



7.0 BE CLEAN – COMMUNAL HEATING AND COMBINED HEAT & POWER

7.1 The second stage in the Mayor's '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.

7.2 A site-wide CHP solution has been investigated and found not to be suitable for this site due to the baseline space and water heating demand being insufficient to ensure efficient operation of a communal CHP. Implementation of the CHP would be impractical in terms of space required for the equipment and works associated with installation that may negatively impact an appearance of the Grade II listed building.

7.3 During modelling for this energy strategy a number of low carbon heat technologies have been investigated. After assessment for suitability to the site and detailed calculations to determine energy and CO_2 reductions that can be attributed to each technology it has been determined that high efficiency individual gas boilers for space heating and domestic hot water (DHW) provision is the viable alternative to CHP on the site.

Local Connection

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

7.5 Investigation into existing heat networks in the area using the London Heat Map has shown that the nearest existing CHP installation is located at the Great Osmond Street Hospital. The site is within approximately 300m from the application site. Consideration has been given to connection to the existing CHP installation and the hospital has been contacted but as yet no response has been received; however, it is unlikely that the existing scheme has been designed with spare heat capacity. It has also been determined that feasibility of connection to the facility is questionable due the distance between the sites (see Figure 6 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.

Figure 6: London Heat Map Indicating CHP Site

8.0 BE GREEN – RENEWABLE ENERGY TECHNOLOGY

8.0.1 The third stage of the energy hierarchy refers to the production of renewable energy.

8.0.2 The feasibility of each of the approved renewable energy technologies has been appraised in the following sections in order to determine the most suitable solution for the site.

8.0.3 London Plan approved renewable energy technologies include:

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

8.0.4 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.

8.0.5 London Plan Policy 5.7 requirements are for a 20% reduction in CO_2 emissions where feasible due to the specification of renewables. This target has not been met as this energy strategy shows that on-site renewables are not appropriate for the development, although as stated previously it should be noted that it is possible to achieve a significant total 'whole energy' CO_2 reduction from the Notional Baseline of 32.8%.

8.0.6 Investigation and modelling have shown that none of the approved renewable technologies are suitable or feasible for the site. The only technology that would be feasible is photovoltaics, but in this case, due to the site's location within the Bloomsbury Conservation Area, the prominent visibility of the front elevation and significant impact on the appearance of the building an installation may cause, PV technology has been ruled out.

8.1 Solar Photovoltaic (PV)

8.1.1 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 – Not Suitable

8.1.2 Due to the limited roof space, the site's location within the Bayswater Conservation Area and prominent visibility of the front elevation of the Grade II listed building the application of PV system to the site is found not to be suitable.

8.2 Solar Thermal

8.2.1 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 new water which is stored in a separate water cylinder.

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

Application to Site – Not Suitable

8.2.3 Due to the sensitive nature of the site, its location within the conservation area and prominent visibility of the front elevation of the building the application of Solar Thermal system is not a feasible solution for the development at 21 John Street .

8.3 Wind Turbines

8.3.1 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

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

8.3.3 Installation of wind turbines are neither feasible or suitable for 21 John Street , 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.

8.3.4 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.

8.3.5 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

8.3.6 Therefore, wind turbines have been determined to be unsuitable for the development at 21 John Street .

8.4 Biomass Heating

8.4.1 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.

8.4.2 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

8.4.3 Biomass systems also require space for storage and delivery of fuel. Additionally, fuel delivery carries implications for parking, increased emissions and pressure from transport. 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.

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

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

8.4.6 The entire London Borough of Camden is designated as an Air Quality Management Area (AQMA), with current technology, biomass fuelled boiler may negatively impact on air quality which is deemed inappropriate in an Air Quality Management Area unless abatement technology can provide sufficient mitigation.

8.4.7 Therefore, it is determined that a biomass heating solution is not suitable for the development at 21 John Street .

8.5 Ground Source Heat Pump (GSHP)

8.5.1 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 new hot water.

Application to Site – Not Feasible

Feasibility

8.5.2 It has been determined that connection to existing or installation of new Ground Source Heat Pump plant is not a feasible option for the 21 John Street scheme, this is due to the large area required for boreholes exterior to the building. There is a lack of available suitable space for boreholes due to the existing buildings and utility infrastructure beneath the site and in addition the area of plant space required for the external heat pump units would impact visually on amenity space.

8.5.3 Energy modelling and cost analysis show that installation of a GSHP, is one of the most costly options for this site 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.

8.5.4 Land use, plant space and physical security for the ground collectors and the heat pump units also need 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.

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

8.5.6 Taking all of these considerations into account, it is judged that GSHP is not a suitable or affordable technology for 21 John Street .

8.6 Renewables Summary

8.6.1 Each of the London Plan approved renewable technologies have been appraised in terms of their suitability for the proposed development at 21 John Street .

8.6.2 None of the renewable systems have been found to be a feasible or suitable solution for the site and as such there will not be any CO_2 reduction associated with the renewable technology. However the development will achieve a significant CO_2 reduction of 32.8% (16,372 kg/year) through the implementation of energy efficiency measures to reduce the energy use and amount of wasted energy.

8.6.3 PV and solar thermal system are not feasible for the development, due to the visual impact it may cause, particularly within a conservation area.

8.6.4 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.

8.6.5 A biomass fuelled boiler system providing hot-water has been deemed not to be feasible. This is due to efficiency management and plant space availability issues. Additionally, as the Camden is within an Air Quality Management Area, concerns are raised relating to the impact on local air quality. 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.

8.6.6 A Ground Source Heat Pump System is not feasible as there is a lack of available suitable space for boreholes due to the existing utility infrastructure beneath the site and in addition the area of plant space required for the external heat pump units would impact visually and on amenity space.

8.6.7 Table 5 below provides a summary of the overall carbon reductions and improvement of an Average DER for the modelled baselines.

Table 5: Energy Hierarchy Summary

	Notional Baseline	Efficient Baseline
Space Heating Energy kWh/yr	138,032	61,653
DHW Energy kWh/yr	22,582	22,782
Cooling kWh/yr	0	0
Lighting Energy kWh/yr	6,679	4,186
Aux Energy kWh/yr	1,400	1,400
Un-Regulated Energy kWh/yr	27,041	27,041
Actual CO_2 Emissions $KgCO_2$/yr	49,959	33,586
Total CO_2 Reduction $kgCO_2$/yr	-	16,372
Total Percentage CO_2 Reduction	-	32.8%
SAP 2005 Average DER	51.48	25.35
Total Average DER % Improvement	-	50.8%

9.0 CONCLUSION

9.1 Following the energy hierarchy has enabled significant carbon reductions to be calculated for the proposed development at 21 John Street . The total overall carbon reduction is predicted to be 32.8%.

9.2 In accordance with the London Plan energy hierarchy methodology requirements, 'whole energy' figures have been used in this energy strategy, including: heating, hot-water, lighting, pumps and fans and un-regulated energy. The proposed development at 21 John Street is calculated to have a 'whole energy' Notional Baseline of 49,959 kgCO_2/year.

9.3 In the first stage of the energy hierarchy (Be Lean), calculations to determine the Efficient Baseline predict a 32.8% carbon reduction through the proposed energy efficiency measures. This results in a reduction of 16,372 kgCO_2/year from the Notional baseline to the Efficient Baseline.

9.4 The second stage (Be Clean) calculations to determine the Low Carbon Baseline have shown that specification of CHP is not suitable for this site due to the baseline space and water heating demand being insufficient to ensure its efficient operation. The potential of local connection to the existing CHP installation has also been investigated. The nearest site has been contacted in order to confirm the possibility to connect but as yet no response has been received.

9.5 The scope for CO_2 reduction using renewables is limited due to the sensitivity of Grade II listed building. In order to ensure its historic and architectural features are preserved and the visual impact it may cause in a Bloomsbury Conservation Area is reduced a significant carbon reductions has been achieved with energy efficiency measures alone.

9.6 These calculations demonstrate that the development will meet EcoHomes Ene 1 requirements and that the development is on track to achieve certification at the required level of 'Very Good'.

9.7 The calculations show that the fabric efficiency measures, including specification of highly efficient individual gas boilers can achieve an overall 32.8% CO_2 reduction from the Notional Baseline. See Figure 7 for a graphical summary of CO_2 reductions.

9.8 Additionally, in the context of London Plan Policy 5.4, the site achieves significant Average DER improvement which equates to a 50.8% improvement over the Notional Baseline average DER, see Figure 8.

9.9 The London Plan Policy 5.7 and Camden Council policy requirements are for a 20% reduction in CO_2 emissions through the specification of renewables. Clearly, due to on site constraints this target has not been met, although it should be noted that it is possible to achieve a total 'whole energy' CO_2 reduction from the Notional Baseline of 16,372 kgCO_2/year and energy savings of 78,672 kWh/year.

Figure 7: 'Whole Energy' Carbon Emissions

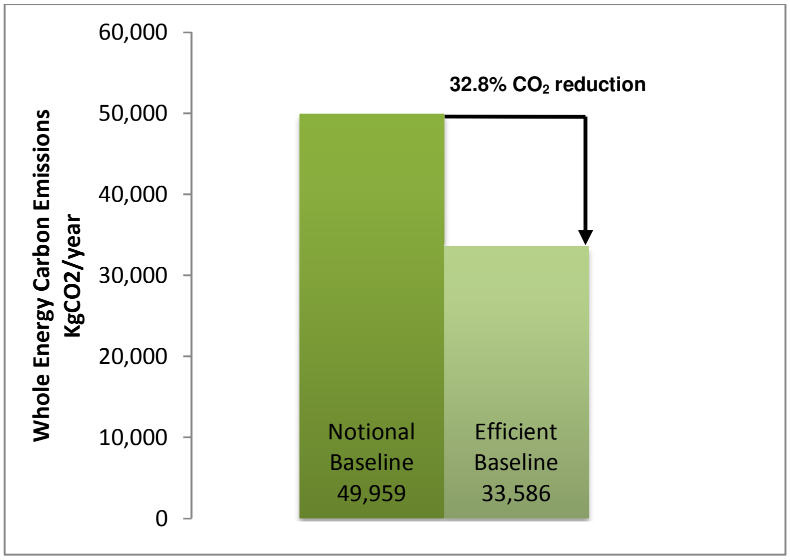
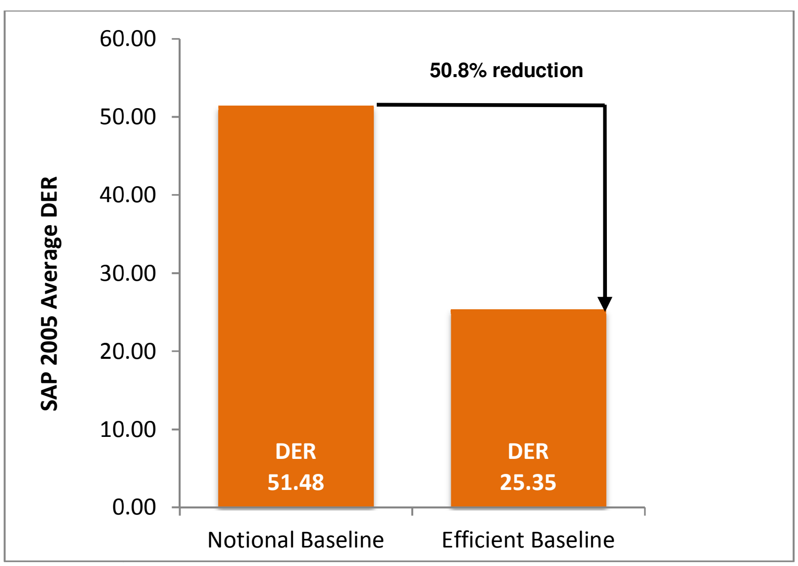


Figure 8: SAP 2005 average DER improvement



APPENDIX A – SAP RESULTS

Notional Baseline

Residential					Energy Consumption Breakdown								Gas Consumption	Electricity Grid	Electricity Offset	CO2 Emission	SAP 2005
Floor	**Unit**	**Dwelling Type**	**Floor area (m2)**	**HLP**	**Space Heating from Boiler (Main 1) (kWh/an)**	**Space Heating (Main 2) (kWh/an)**	**Space Heating (Secondary) (kWh/an)**	**DHW from Boiler (kWh/an)**	**Cooling (SAP 2009)**	**Lighting (kWh/an)**	**Aux (kWh/an)**	**Un-Reg (kWh/an)**	**kWh.annum**	**kWh.annum**	**kWh.annum**	**KgCO2.annum**	**DER**
Ground floor	Flat 2.01	Apartment	148.8	4.59	24,536			2,923		1,005	175	4,011	27,459	5,191	0	**8,121**	53.22
	Flat 2.02	Apartment	83.35	2.8	8,689			2,761		714	175	2,931	11,450	3,820	0	**4,242**	38.13
	Flat 3.01	Apartment	87.3	4.63	13,487			2,777		737	175	3,022	16,264	3,934	0	**5,254**	52.91
	Flat 3.02	Apartment	59.4	3.06	7,083			2,506		543	175	2,279	9,589	2,997	0	**3,448**	43.68
	Flat 4.01	Apartment	127.2	3.59	16,890			2,910		927	175	3,725	19,800	4,827	0	**6,416**	44.75
	Flat 5.01	Apartment	127.2	3.97	18,612			2,908		927	175	3,725	21,520	4,827	0	**6,757**	48.45
	Flat 6.01	Apartment	127.2	4.04	18,903			2,908		927	175	3,725	21,811	4,827	0	**6,814**	49.33
	Flat 7.01	Apartment	120.2	6.77	29,832			2,889		899	175	3,623	32,721	4,697	0	**8,907**	73.99
Total / Average			**880.65**	**4.18**	**138,032**	**0**	**0**	**22,582**	**0**	**6,679**	**1,400**	**27,041**	**160,614**	**35,120**	**0**	**49,959**	**51.48**

Efficient Baseline

Residential					Energy Consumption Breakdown								Gas Consumption	Electricity Grid	Electricity Offset	CO2 Emission	SAP 2005
Floor	Unit	Dwelling Type	Floor area (m2)	HLP	Space Heating from Boiler (Main 1) (kWh/an)	Space Heating (Main 2) (kWh/an)	Space Heating (Secondary) (kWh/an)	DHW from Boiler (kWh/an)	Cooling (SAP 2009)	Lighting (kWh/an)	Aux (kWh/an)	Un-Reg (kWh/an)	kWh.annum	kWh.annum	kWh.annum	KgCO2.annum	DER
Ground floor	Flat 2.01	Apartment	148.8	2	11,024			2,944		628	175	4,011	13,968	4,814	0	**5,255**	25.62
	Flat 2.02	Apartment	83.35	1.71	5,293			2,781		452	175	2,931	8,074	3,558	0	**3,438**	25.16
	Flat 3.01	Apartment	87.3	1.9	5,561			2,809		461	175	3,022	8,370	3,658	0	**3,548**	25.14
	Flat 3.02	Apartment	59.4	1.54	3,396			2,537		344	175	2,279	5,933	2,798	0	**2,621**	25.18
	Flat 4.01	Apartment	127.2	1.7	8,279			2,934		580	175	3,725	11,213	4,480	0	**4,536**	23.21
	Flat 5.01	Apartment	127.2	1.81	8,862			2,931		579	175	3,725	11,793	4,479	0	**4,651**	24.35
	Flat 6.01	Apartment	127.2	1.78	8,673			2,932		580	175	3,725	11,605	4,480	0	**4,614**	24.13
	Flat 7.01	End Terrace	120.2	2.33	10,565			2,914		562	175	3,623	13,479	4,360	0	**4,923**	30.02
Total / Average			**880.65**	**1.85**	**61,653**	**0**	**0**	**22,782**	**0**	**4,186**	**1,400**	**27,041**	**84,435**	**32,627**	**0**	**33,586**	**25.35**