17 & 19 FERDINAND STREET, LONDON, NW1 8EU

Energy Statement

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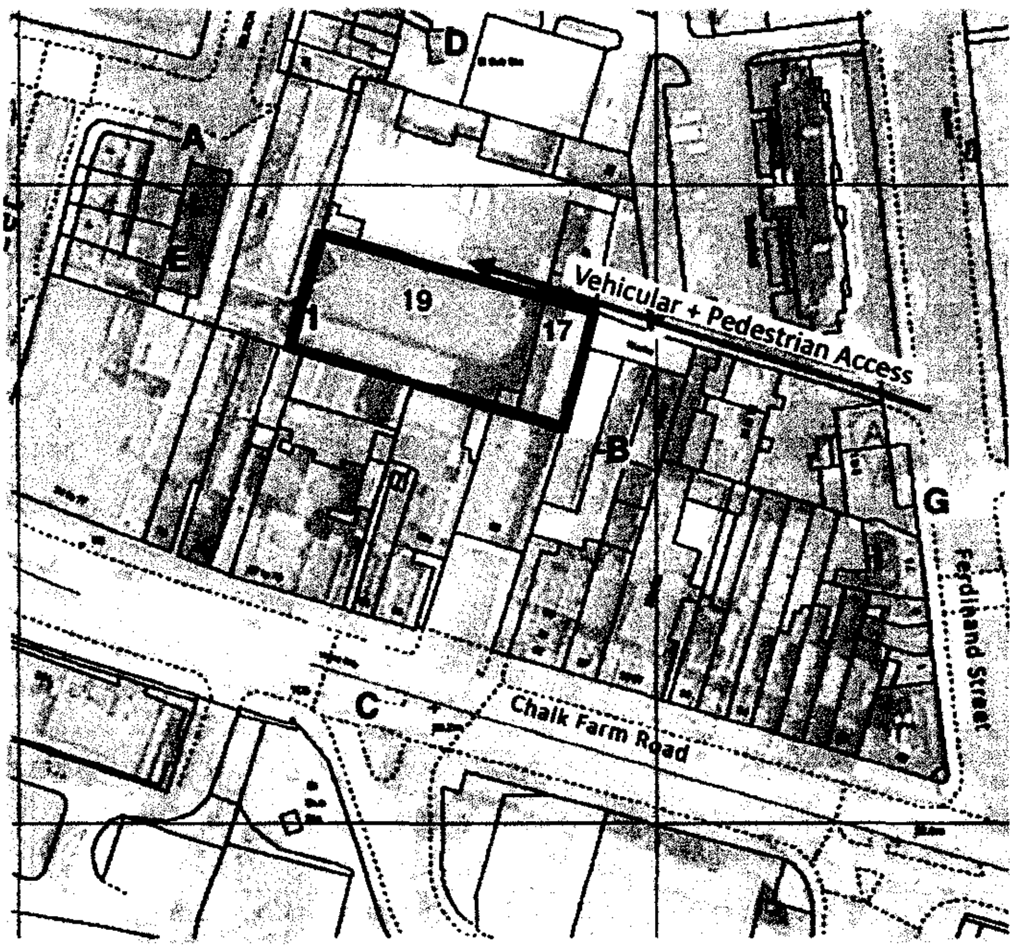
17 & 19 Ferdinand Street, London, NW1 8EU
Energy Statement – Revision A

1.0 INTRODUCTION

1.1 Create Consulting Engineers Ltd has been commissioned by S Aspris & Son Ltd to provide an Energy Statement in support of their planning application for the proposed development at 17 & 19 Ferdinand Street, London. The Energy Statement will demonstrate how the development will comply with the CO_2 emission and energy related sustainability requirements of the London Plan, July 2011, and the London Borough of Camden policies and guidance.

Current Site Use

1.2 *The proposed mix use development is located at 17 & 19 Ferdinand Street, London NW1* 8EU, within a dense urban location. The site currently comprises an existing two storey warehouse, the second floor of which has not been used for some time. The warehouse is located between the former piano factory at 10 Belmont Street and number 17 Ferdinand Street. The front elevation of the existing building faces onto a large courtyard surrounded by existing commercial and residential properties. The site is accessed via a small alley way off Ferdinand Street. Please refer to Figure 1, site location plan.



Aerial photography courtesy of googlemaps

Figure 1: Site Location Plan, 17 & 19 Ferdinand Street, London NW1 8EU

Development Description

1.3 The proposal includes the demolition of an existing warehouse and its replacement with a mixed use four storey building of a similar size. The proposed development consists of 6 ground floor office units and 16 residential apartments, comprising 14 two bedroom apartments and 2 one bedroom apartments, spread over the upper three stories. The proposed development is north/south facing in orientation with the main entrance to the building on the south side accessed via the large courtyard off Ferdinand Street.

1.4 The assessment has been based on drawings prepared by GLA Architecture and Design. Please refer to the following drawings, which accompany the planning submission and for which this report has been based.

- 1002-11- Rev A4 Proposed Ground Floor Plan
- 1002-12- Rev A3 Proposed First Floor Plan
- 1002-13- Rev A3 Proposed Second Floor Plan
- 1002-14- Rev A3 Proposed Third Floor Plan
- 1002-15- Rev A3 Proposed Fourth Floor Plan
- 1002-16- Rev A1 Proposed Sectional Elevation AA
- 1002-17- Rev A1 Proposed Sectional Elevation BB

2.0 PLANNING POLICIES AND PROJECT REQUIREMENTS

2.1 This Energy Statement outlines how the proposed development will meet the energy requirement as specified by the London Borough of Camden and the requirements of Part L1A and L2A of the 2010 Building Regulations.

2.2 Camden Core Strategy 2010 – 2025 sets out the key elements of the Council's planning vision and strategy for the borough. The strategy forms the central part of the Local Development Framework; a group of documents setting out their planning strategies and policies. The Core Strategy is supported by a number of development policy documents and supplementary planning documents, which provide detailed guidance on how the council's planning strategy and policies will be implemented.

2.3 Camden Core Strategy Policy CS13 - *Tackling climate change through promoting higher environmental standards* provides the overarching policy requirements with respect to minimising the effects of climate change, adaptation measures and improved environmental standards during construction and occupation. The requirements of Policy CS13 are supported by Camden Supplementary Planning Document CPG 3 *Sustainability*.

2.4 CPG 3 *Sustainability* outlines the specific targets and policy requirements relating to the energy performance and sustainable design and construction of new and existing buildings, and provides detailed information on how the requirements of the Core Strategy Policy CS13 are to be implemented along with preferred calculations methodologies for inclusion within the Energy Statement.

2.5 Camden Policy CPG 3 *Sustainability* requires developments of 5 or more dwellings and/or 500 m^2 (gross internal floor space) to demonstrate how the developments carbon dioxide emissions are to be reduced in accordance with the London Plan 'Energy Hierarchy'.

2.6 The London Plan, July 2011 Policy 5.2 'Minimising Carbon Dioxide Emissions' outlines the carbon dioxide emission reduction targets for major development proposals. In accordance with Policy 5.2 both residential and non domestic buildings constructed between the years 2010 – 2013 are required to achieve a 25 per cent improvement over the Target Emission Rate (TER) outlined within the 2010 Building Regulations.

2.7 Camden Policy CPG 3 *Sustainability* requires development proposals to be supported by an energy statement to demonstrate how the targets for carbon dioxide emissions reduction detailed in London Plan Policy 5.2 are to be met within the framework of the energy hierarchy of Be Lean, Be Clean and Be Green. The Energy Statement will provide calculations for the energy demand and carbon dioxide emissions covered by Part L Conservation of Fuel and Power of the 2010 Building Regulations, referred to as regulated energy, and separate calculations covering the energy demand and carbon dioxide emissions not covered by the

Building Regulations, referred to as unregulated energy at each stage of the energy hierarchy.

2.8 Within the framework of the energy hierarchy the following opportunities will be explored and their feasibility assessed concluding in a final recommendation for how the proposed development will meet the energy requirements outlined within Camden Core Strategy Policy CS13.

Be Lean: use less energy: The energy demand of the proposed mix use development will be reduced by improving the building fabric performance, through the incorporation of energy efficiency measures. Camden recommends the following minimum standards of building fabric performance:

- External walls 0.2 w/m^2k
- External roof 0.13 w/m^2k
- Floor 0.2 w/m^2k
- Windows 1.5 w/m^2k plus British Fenestration Rating council band B or better
- Doors 1.0 w/m^2k (solid), 1.5 w/m^2k (glazed)
- Air permeability 3.0 $m^3/h.m^2$@50Pa

2.9 The proposed development will also be designed and constructed to achieve Code level 3 of the Code for Sustainable Homes and BREEAM 'Very Good' rating demonstrating a high standard of sustainable design and construction in accordance with Development Policy DP22 – *Promoting Sustainable Design and Construction.*

2.10 In accordance with Development Policy DP22 Camden strongly encourage development proposals to achieve a minimum of 50% of the un-weighted Code for Sustainable Homes energy credits, and 60% of the un-weighted BREEAM energy credits. These requirements will be taken into consideration within this Energy Statement.

2.11 Further details on the Code for Sustainable Homes and BREEAM assessments and an appraisal of the wider sustainability issues can be found within the Sustainability Statement (Report Ref FK/CS/P11-282/02 Rev A) prepared by Create Consulting Engineers Ltd in support of the planning application.

2.12 Be Clean: supply energy efficiently: Opportunities for linking into an existing or planned decentralised energy network will be explored using the London Heat Map tool. Where an existing decentralised energy network is not present, an assessment of the feasibility of establishing a decentralised energy system for the proposed development will be undertaken; including an assessment of the feasibility of a Combined Heat and Power (CHP) communal heating system, and whether the system could be extended beyond the site boundary into adjacent sites. The feasibility of a Combined Heat and Power system will be assessed in accordance with the hierarchy detailed within Camden guidance document CPG 3 *Sustainability*.

2.13 Where it is unfeasible to connect to a decentralised energy network or include a Combined Heat and Power (CHP) system within the development designs, the London Borough of Camden request a financial contribution towards the expansion of the current decentralised energy network and future connection of the proposed development to the network.

Be Green: use renewable energy: A percentage reduction in the carbon emissions of the proposed development will be achieved through the use of on site renewable energy generation in accordance with Camden Core Strategy Policy CS13. The policy states 'the Council will expect developments to achieve a reduction in carbon dioxide emissions of 20% from on-site renewable energy generation unless it can be demonstrated that such provision is not feasible.' The policy requirement is for a reduction in site wide carbon emissions, and therefore includes the emissions from both regulated and unregulated energy. A feasibility study will be undertaken and the most economically viable renewable technology providing the highest overall reduction in carbon dioxide emissions within the proposed development will be recommended.

3.0 CALCULATION METHODOLOGY

Baseline energy and carbon dioxide emissions

3.1 A total baseline energy demand and carbon dioxide emissions of the entire development including the energy demand of the 16 apartments and 6 commercial units will be established prior to the inclusion of any measures to reduce carbon dioxide emissions. Camden's guidance document CPG 3 *Sustainability* confirms that the baseline energy demand should include both the regulated energy associated with lighting, heating and hot water systems, covered by the Building Regulations, and unregulated energy sources not covered by the Building Regulations such as cooking and appliances. In addition to the regulated and unregulated energy sources, the baseline calculations will also consider the energy consumption associated with the communal lighting and lift.

3.2 In accordance with the London Plan, 2011 and document CPG 3 the baseline for the calculations will be a 2010 Building Regulations compliant development.

3.3 The estimated annual energy demand and carbon dioxide emissions for the apartments within the proposed development have been calculated using the Standard Assessment Procedure (SAP) methodology L. The energy demands and carbon dioxide emissions of the ground floor commercial units have been calculated using the Simplified Building Energy Model (SBEM). SAP and SBEM are the national calculation methodologies accepted calculation method for the energy rating of domestic and non domestic buildings respectively, and the recommended calculation method preferred by the London Borough of Camden.

Calculation and Site Constraints

3.4 This assessment uses SAP 2009 and SBEM vs. 4.1c to determine the regulated energy requirements and associated emissions. The regulated energy demands are those associated with space heating, hot water and fixed electrical items. The unregulated energy use and associated carbon dioxide emissions have been determined based upon the calculation procedures contained within SAP 2009 Appendix L.

3.5 This development is at the pre planning stage and as such this report has made several assumptions. The assumptions made and their impacts are detailed below.

3.6 Building geometric information, zoning and assigned activities has been based upon the drawings provided by GLA Architecture and Design. All ground floor commercial spaces are assumed to be office units. At the time of writing no specific construction methods had been determined. This report assumes a medium level thermal mass structure.

3.7 This report has used a representative number of apartments to determine the overall site wide CO_2 emissions and energy requirements. The representative apartments used were those judged to be an average to worst case with higher than average areas of exposed wall or roof areas. This selection is intended to give a robust calculation of the energy requirements and associated CO_2 emissions.

3.8 All circulation spaces have been assumed to be unheated. No lighting scheme was available at the time of writing. This report assumes that lighting in communal spaces will have a design illuminance of 150lux and an efficacy of 60 lumens per circuit Watt. A control system based on occupancy sensing (PIR sensors) has been assumed.

3.9 At the time of writing no details were available for the proposed lift system to be fitted. The energy consumption and guidance given in CIBSE Guide D 'Transport systems in buildings' has been used to inform the calculations.

3.10 Air permeability has been based upon a presumed value of $4m^3/m^2$@50PA/hr. This is slightly higher than the value detailed within Camden guidance document CPG 3. This higher level was felt to be justified as it provided a good compromise between limiting energy loss through infiltration and unwanted air exchange while still being sufficiently high enough to ensure a successful natural ventilation strategy. Low levels of air permeability reduce space heating energy demand but can also result in a corresponding requirement for mechanical ventilation to provide adequate fresh air to ensure occupier comfort. The energy saved with a lower level of air permeability must be weighed against the energy required to operate a mechanical ventilation system and the added complexity and cost of installing such a system. In accordance with the guidance provided in guidance document CGP 3 the proposed development at Ferdinand Street will favor a natural ventilation strategy.

3.11 The base case development is assumed to use a communal heating system for all space and hot water heating requirements. The system assumed is a communal gas boiler.

Baseline Emissions and Energy Consumption

3.12 The baseline development CO_2 emissions and energy requirements have been determined and detailed within the following table. Please refer to Appendix A for a full breakdown of the calculation methodology used to establish the baseline carbon dioxide emissions and energy consumption.

	Regulated (Heating, lighting, pumps and fans)	Unregulated (Cooking and appliances)	Lighting systems in communal areas	Lift Systems	Total site wide value
CO_2 Emissions $kgCO_2$/year	31,234	20,918	302	1736	54,190
Energy Requirement kWh/year	190,680	49,163	584	3358	243,785

Table 1: Baseline development CO_2 emissions and energy requirements

4.0 ENERGY HIERARCHY

4.1 The energy hierarchy as detailed by the London Plan, 2011 and Camden Core Strategy CS13 outlines a series of sequential steps that should be assessed in order for any new development. The steps and the order in which they are to be assessed are as follows:

1. Be Lean: use less energy
2. Be Clean: supply energy more efficiently
3. Be Green: use renewable energy

4.2 These steps are examined in the context of this development below.

5.0 BE LEAN: USE LESS ENERGY

5.1 Minimising the requirement for energy is the first step that should be considered. The rate at which heat energy is lost from a building greatly influences the annual heat load, and therefore the CO_2 emissions and energy requirements of that building. Energy requirements for hot water applications are essentially independent of improvements to the building's fabric efficiency as these are functions of occupancy and usage rather than rate of heat loss. The main areas where the efficiency of a building can be improved are detailed below.

Building Fabric's Thermal Transmittance

5.2 Building fabric thermal transmittance is measured by the U-value of each building element in Watts/m^2/K. The U-value is essentially a measure of the rate at which energy is lost through a building element; the greater the U-value, the higher the rate of energy loss.

5.3 The building fabric performance will be generally as per the guidance provided by Camden within their guidance document CPG 3, with the exception of the U values of the external walls of the ground floor commercial units.

5.4 The ground floor commercial units have been assumed to have a wall U value of 0.25 W/m^2k. This is a lower level of insulation than detailed by guidance document CPG 3; however as noted in this guidance a balance must be reached between heat generated and the need to remove excess heat. The occupancy pattern of the ground floor offices will typically be during the warmest parts of the day; additionally offices will typically incorporate high concentrations of high heat gain equipment such as monitors, computers and photocopiers. For an office the need to remove excess heat is more likely to be an issue than the need to generate heat and to that end a lower level of insulation has been used.

5.5 Table 2 shows the fabric performance levels assumed in relation to the values stated in guidance document CPG 3 and the minimum requirements of the 2010 Building Regulations.

Bu lding Element/Characteristic	Proposed Development	Camden Document CPG 3	Building Regulations Part L Requirements
Exterior Wall U values (Dwellings)	**0.2** W.m².K	**0.2** W.m².K	**0.30** W.m².K (L1A)
Exterior Wall U values (Non -dwellings)	**0.25** W.m².K	**0.2** W.m².K	**0.35** W.m².K (L2A)
Floor U value	**0.2** W.m².K	**0.2** W.m².K	**0.25** W.m².K
Roof U value	**0.1** W.m².K	**0.13** W.m².K	**0.20** W.m².K
Window U value (Dwellings)	**1.3** W.m².K	**1.5** W.m².K	**2.0** W.m².K (L1A)
Window U value (Non-dwellings)	**1.5** W.m².K	**1.5** W.m².K	**2.2** W.m².K (L2A)
Door U value (solid)	**0.85** W.m².K	**1.0** W.m².K	**2.0** W.m².K (L1A) **2.2** W.m².K (L2A)
Design Air Permeability	**4** m³/hr/m²@50Pa	**3** m³/hr/m²@50Pa	**10**m³/hr/m²@50Pa

Table 2: Proposed fabric efficiency standards versus Part L1A and L2A acceptable standards

Air Permeability

5.6 Air permeability is a measure of infiltration. It indicates how often the entire air quantity in a building is exchanged with outside air within 1 hour without any ventilation in place. Any air exchange with outside air is carrying heat energy away from the building, resulting in a higher heating load. From an efficiency perspective lower air permeability levels are desirable, however reduced air permeability, usually below 4 m3h/m2 @50Pa, can make natural ventilation ineffective, necessitating the use of mechanical ventilation.

5.7 As detailed in Section 3 Calculation Methodology, the air permeability of the proposed development has been assumed to be 4m³/m²@50PA/hr to ensure that a natural ventilation strategy would be capable of supplying sufficient fresh air to maintain occupier comfort.

5.8 The development will utilise a natural ventilation and cooling strategy. The design level of air permeability will aid in achieving sufficient levels of natural ventilation. The layout of the development will also facilitate natural ventilation and cooling. The north south orientation of the development and the internal layout of both the ground floor commercial units and the upper floor residential spaces would allow for cross ventilation on all floors. Additionally the three stair cores distributed throughout the centre of the building will allow a natural stack effect for cooling.

Thermal Bridging

5.9 Thermal bridging of junctions is the loss of heat energy through the junction between different building elements (such as a wall and window) or where a building element changes direction (such as a corner). Such areas can result in breaks in the continuity of insulation that can form 'bridges' for heat energy to escape from the building. To minimise the effects of thermal bridging at the proposed development 'Accredited Construction Details' would be used for all junctions.

Thermal Mass and Solar Gain

5.10 Thermal mass and passive solar gains are two related aspects of efficient building design. Thermal mass is the ability of the fabric of the building to absorb excess heat. If effectively utilised, it can reduce heating and cooling loads and, in some cases, remove the requirement to provide air conditioning. Timber frame is typically a lightweight construction with low thermal mass whereas a building with external, party and internal walls made from dense blocks and with concrete lower and upper floors typically has a high thermal mass. Buildings with a high thermal mass and high level of insulation generally make better use of solar gains in the day by absorbing them and radiating the warmth later on as the level of solar radiation drops.

5.11 Passive solar gain is the use of heat absorbed by the building to contribute towards the heating demand of that building. Passive solar gain is a complex issue requiring numerous criteria to be met in order to be effective. Correct orientation as well as the correct integration of glazed areas and high thermal mass elements is essential. High thermal mass elements typically have a far higher environmental impact than low thermal mass. The benefits of passive solar gain must be carefully weighed against the environmental cost and design restrictions imposed upon a development.

5.12 The proposed development does contain a significant area of south facing elevation and could potentially take advantage of passive solar gain and thermally massive building materials; however the interaction of passive solar gain, building thermal mass and the risk of overheating is a complex one beyond the scope of an initial energy assessment. At this stage it can only be determined that the development is potentially suitable; a precise determination will be reliant on more comprehensive dynamic thermal simulation of the development undertaken at the detailed design stage.

Lighting and Appliances

5.13 High efficiency low energy lighting and controls would be specified throughout. All residential spaces will utilise 100% low energy lighting. All commercial units will utilise a high efficiency lighting design with a minimum efficacy of 65 lumens/circuit Watt (approximately equivalent to very high efficiency florescent system with high frequency ballast). All commercial and communal spaces will utilise automatic lighting controls. The commercial spaces will use daylight sensing controls in all office areas and occupancy sensing in all other areas. The communal circulation spaces will utilise occupancy sensors.

5.14 The residential spaces will be fitted with energy display devices to allow the occupants to accurately monitor their energy consumption and to inform them of areas of high consumption to allow for effective adjustment of their usage patterns. The commercial areas will utilise extensive sub-metering of all major energy consuming systems with the same intent of informing building users on areas of high consumption. Both energy display devices and sub metering will be required as part of the respective Cod for Sustainable Homes and BREEAM strategies.

Limiting the Risk of Overheating

5.15 The design of the development will contribute to reducing the risk of overheating. The development has an extensive south facing elevation with large areas of glazing which would typically constitute a high risk of overheating. To reduce this risk the south facing elevations feature an integrated balcony which provides substantial levels of shading for the south facing glazed areas, particularly at high sun angles. The internal layout will also facilitate north, south cross ventilation which would also act to reduce the risk of overheating.

5.16 The overall effect on the energy demand and associated CO_2 emissions of incorporating the energy efficiency measures detailed above into the proposed development would be as follows:

	Regulated (Heating, lighting, pumps and fans)	**Unregulated (Cooking and appliances)**	**Lighting systems in communal areas**	**Lift Systems**	**Total site wide value**
CO_2 Emissions $kgCO_2$/year	29,033	20,918	302	1736	51,989
Energy Requirement kWh/year	120,858	49,163	584	3358	173,963

Table 3: Lean development CO_2 emissions and energy requirements

5.17 The use of energy efficiency measures would reduce the regulated CO_2 emissions in comparison to the 2010 Building Regulations Compliant case by:

(31,234 – 29,033)/31,234 x 100 = 7%

5.18 The CO_2 emissions for the Lean and Base case are shown on the graph below:

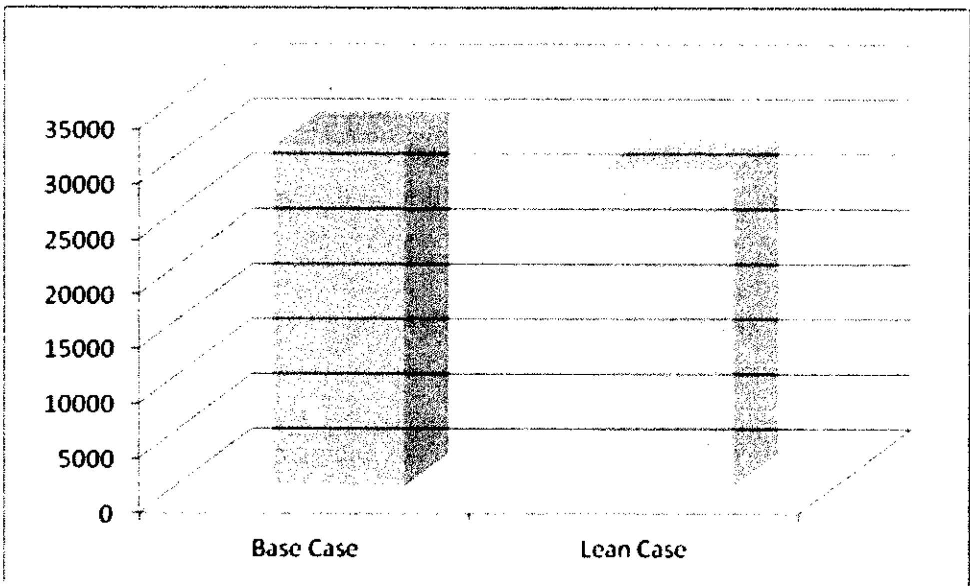


Figure 2: Base Case and Be Lean Case reduction in carbon dioxide emissions

6.0 BE CLEAN: SUPPLY ENERGY EFFICIENTLY

6.1 The connection to a decentralised energy network and the use of combined heat and power is a recognised method of generating energy more efficiently. The London Borough of Camden Core Strategy Policy CS13 and guidance document CPG 3 *Sustainability* requires development proposals to explore the opportunities to link into an existing or planned decentralised energy network using the London Heat Map tool. Where an existing decentralised energy network is not present, an assessment of the feasibility of establishing a decentralised energy system for the proposed development should be undertaken; including an assessment of the feasibility of a Combined Heat and Power (CHP) communal heating system.

6.2 Where it is unfeasible to connect to a decentralised energy network or include a Combined Heat and Power (CHP) system within the development designs, the London Borough of Camden request a financial contribution towards the expansion of the current decentralised energy network and future connection of the proposed development to the network.

6.3 The feasibility of connecting to an existing network and specification of a Combined Heat and Power system has been assessed within the following section.

Decentralised Energy Networks

6.4 The London Heat Map tool is operated by the London development agency, and details the existing and proposed major heat loads and supplies within London as well as existing and proposed heat distribution networks. The London Heat Map was consulted during the writing of this report. The output from the London Heat Map with the location of the proposed development is provided in Appendix B. Based on the information given by the London Heat Map and the maps contained in Section 5 of Camden's guidance document CPG 3 there are no existing or proposed heat networks or suitable heat sources or heat loads within 1700m of the proposed development location. As this distance is considerably further than the 1km recommended in guidance document CPG 3 for assessing viability, connection to a decentralised heat network has not been explored further for this development.

Combined Heat and Power System

6.5 The incorporation of a Combined Heat and Power (CHP) system would be feasible. Sizing a CHP system can be a complex undertaking depending upon a developments heat usage profile. Typically a CHP system would be sized to the base heat load (the heat load present all year round) in order to maximise the running time, and therefore the efficiency of the system. For a residential development the base heat load would typically be the hot water demand. The commercial units are likely to have a very low base heat load. Offices typically have very low hot water demand with their heat load being almost all for space heating. As such it will vary considerably throughout the year.

6.6 Integration of a CHP system requires that the proposed system is compatible with the expected heat and pressure parameters of the buildings heating system. This report assumes a micro CHP system suitable for integration within conventional low pressure heating circuits and for connection in sequence with conventional gas boiler systems. The model assumed for calculation purposes is the BAXI DACHS mini CHP system although detailed system design and client preference may alter the model selected at the detailed design stage.

6.7 The incorporation of a gas powered mini CHP system as the lead heat generator within the sequenced communal gas boiler system would allow the CHP system to achieve maximum run time and therefore efficiency. The calculations that support this report have assumed that a gas CHP system would meet 20% of the overall heat load of the development. This level has been assumed as a robust (conservative) value approximately equivalent to around 35% of the developments total hot water heating requirement. More detailed design analysis may increase this percentage.

Communal Heating

6.8 The development will utilise a central communal heating system, distributing a heating flow to both the residential and commercial units. The heat source would utilise sequenced high efficiency gas boilers. The use of sequenced gas boilers would allow the heating system to more efficiently match the heat load at any one time as only those boilers required would operate.

6.9 The use of a communal heating system would be a pre requisite for the incorporation of a CHP system and for the possible connection of the building's heating system to a decentralised energy network at a later date.

6.10 The design and layout of the buildings plant room will be such that it will facilitate the possible future connection of the development to an energy network. Space will be allowed for the possible inclusion of heat exchange equipment and the building heating circuit will be designed to incorporate connection points suitable for future connection to a decentralised energy network.

6.11 The effect on CO_2 emissions and energy requirements of incorporating a CHP system and the energy efficiency measures noted above would be as follows:

	Regulated (Heating, lighting, pumps and fans)	Unregulated (Cooking and appliances)	Lighting systems in communal areas	Lift Systems	Total site wide value
CO_2 Emissions $kgCO_2$/year	27,336	20,918	302	1736	50,292
Energy Requirement kWh/year	122,602	49,163	584	3358	175,707

Table 4: Clean development CO_2 emissions and energy requirements

6.12 The use of a CHP system along with the energy efficiency measures would reduce the regulated CO_2 emissions in comparison to the 2010 Building Regulations compliant case by:

(31,234 – 27,336)/31,234 x 100 = 12.47%

6.13 The CO_2 emissions for the Clean, Lean and Base case are shown on the graph below:

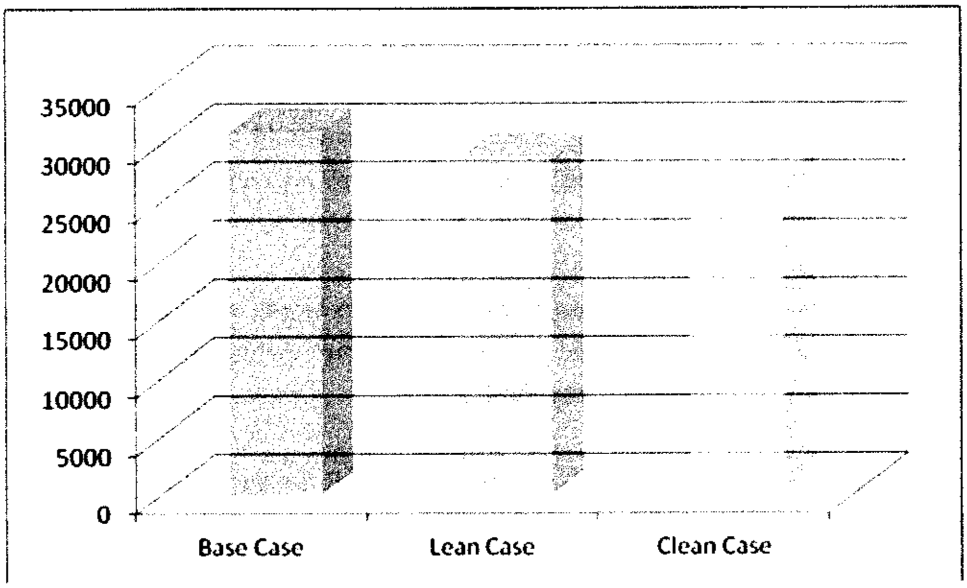


Figure 3: Base Case, Be Lean Case and Be Clean Case reductions in carbon dioxide emissions.

7.0 BE GREEN: USE RENEWABLE ENERGY

7.1 The requirements of Policy 5.2 of the London Plan adopted by Camden within guidance document CPG 3 for a 25 per cent improvement over the Target Emission Rate (TER) outlined within the 2010 Building Regulations. Therefore renewable energy technologies will be required in combination with the energy conservation measures to meet Policy 5.2 'Minimising Carbon Dioxide Emissions'.

7.2 The final step in the energy hierarchy requires the clean generation of energy by renewable energy technologies be examined. Camden Core Strategy Policy CS13 requires the incorporation of on site renewable energy generation to provide a percentage reduction in the carbon emissions from the proposed development. The London Borough of Camden require all developments to achieve a 'reduction in carbon dioxide emissions of 20% from on-site renewable energy generation unless it can be demonstrated that such provision is not feasible'.

7.3 A feasibility study has been undertaken to establish the most economically viable renewable technology which provides the highest overall reduction in carbon dioxide emissions for the proposed development to meet Camden's policy requirements. The feasibility study will also explore the possibility of reducing carbon dioxide emissions by 20 per cent through the sole use of on site renewable technologies in accordance with Camden Core Strategy Policy CS13 and London Plan Policy 5.7 'Renewable Energy'. The following renewable technologies are identified in Camden planning guidance document CPG 3:

- Biomass heating, cooling and electricity
- Photovoltaic panels
- Solar water heating
- Wind turbines
- Heat pumps

7.4 The following chapter of this report assesses the suitability of the renewable energy technologies listed above in the context of this development. A more detailed study of those technologies considered viable will then be undertaken and the results summarised in Table 5.

Solar/Thermal Hot Water Panels

<u>System Characteristics:</u>

7.5 Solar water systems use the energy radiated by the sun and convert it into useful heat in the form of hot water. Fifty to sixty percent of domestic hot water may be provided by a system sized to provide one hundred percent of hot water during summer months; this is considered to be the optimum system design target.

7.6 The solar systems use a heat collector/panel mounted on the roof in which a fluid is heated by the sun. This fluid is circulated through a hot water cylinder within the building which heats the stored water. Collectors should be mounted on southwest to southeast facing roofs or flat roofs orientated at this angle, at an elevation of between 10° and 60°. Sufficient space inside the building needs to be allocated for the heat exchange cylinder which stores the domestic hot water heated during the day and supplied for later use.

7.7 Heat will be transferred and stored in a central thermal store. The solar panel system would ideally supply approximately 40-50% of developments domestic hot water requirement; the remainder of energy required for domestic hot water would be supplied by gas boilers within the individual dwellings.

7.8 Solar water collector panels are generally either flat plate or evacuated tube designs. Flat plate units are less efficient but are cheaper and visually less intrusive as they can be incorporated into the roof structure. Evacuated tube units are more expensive and have a higher visual impact but are more efficient.

System Suitability:

7.9 Solar thermal panels would not be a viable option for this development. They would not meet the DER/TER requirements of Camden guidance document CPG 3 or London Plan Policy 5.2 'Minimising Carbon Dioxide Emissions'. A solar thermal system would also not integrate well with a CHP system. As the base heat load for CHP is likely to be the hot water demand any reduction in this demand will reduce the run time and therefore the efficiency and viability of the CHP system. Solar thermal systems would also not greatly contribute towards meeting 50% and 60% of the un-weighted energy credits under the Code for Sustainable Homes and BREEAM respectively with regards to ENE 7 (Code for Sustainable Homes) and ENE 4 (BREEAM) Low and Zero Carbon Technologies. For these reasons solar thermal hot water panels have not been considered further for this development.

Photovoltaic Panels

System Characteristics:

7.10 Photo Voltaic (PV) panels may be used to capture the sun's energy and generate electricity. PV systems use cells to convert solar radiation into electricity. The PV cells consist of one or two layers of semi conducting material, usually silicon. These cells are linked and encapsulated into modular panels. When light shines onto the cell it creates an electric field across the cell layers, causing electricity to flow. PV panels do not require direct sunlight to operate; however, the greater the intensity of light received by the panel, the greater the flow of electricity.

7.11 PV panels are generally mounted on roofs and require a southwest to southeast facing elevation with a roof pitch ideally between 30° to 40°, alternatively, they can be mounted on flat roofs either at the optimum elevation and orientation or horizontally mounted. Horizontal mounting is marginally less efficient but has the advantage of allowing far greater panel densities for a given flat roof area as the issue of raised pitched panels over shading each other is not present. The electricity generated by the PV panels can be harmonised with grid electricity by converting the electricity from direct current (DC) to alternating current (AC) via an inverter and used for domestic electricity or sold back into the grid under agreement with the district network operator (DNO).

7.12 The installation of PV panels to supply electricity for domestic use depends on a number of issues: the estimated electricity demand to be supplied by the PV panels, the type of cell used, the amount of roof space available, cost and whether it is compatible with the required electricity demands. PV panels are typically smaller and easier to install than solar thermal panels.

System Suitability:

7.13 PV panels would be a viable option for meeting the requirements outlined within Camden's guidance document CPG 3 and the London Plan Policy 5.2 for a 25% DER/TER reduction. The available roof area would limit the overall size of system that could be feasibly fitted, which would compromise the ability of the proposed development to achieve the 20% site wide reduction in carbon dioxide emissions. Photovoltaic panels would be suitable for gaining the required energy credits under BREEAM and Code for Sustainable Homes to contribute towards achieving 50% and 60% of the un-weighted energy credits respectively.

Heat Pumps

System Characteristics:

7.14 Heat pumps are a thermodynamic device based on the vapor compression cycle. The four elements of the refrigeration circuit are: the evaporator, compressor, heat exchanger and condenser. The heat, which is extracted from the medium goes through a number of processes, and is distributed throughout individual dwellings through a standard wet central heating system. Heat pumps utilise electricity to drive their pumps and compressor units. They are essentially a form of efficient electric heating. The efficiency of a heat pump is rated by its coefficient of performance (CoP).

7.15 The CoP is a measure of the electricity input to the system and the heat energy extracted. Several factors affect the CoP of a heat pump; the consistency of the heat source and the required output temperature. A consistent heat source (such as the ground) will deliver greater efficiencies than a heat source that varies seasonally. Also, heat pump efficiency is greatest when the required output temperature rise is lowest; hence heat pumps are commonly paired with under floor heating systems that require lower flow temperatures than conventional radiator emitters.

7.16 There are several heat pump variants available, differentiated primarily by the source medium from which heat is obtained. Common variants are:

- **Ground Source Heat Pump (GSHP)** - exploit the Earth's ability to store vast amounts of heat energy absorbed from the sun in the ground mass and also tap into geothermal heat in vertical ground loop installations deeper than 15m. The heating system consists of a ground heat exchanger which extracts the Earth's steady supply of heat energy through a sealed loop of high density polyethylene pipe laid either horizon ally in trenches or vertically in bore holes.

- **Air Source Heat Pump (ASHP)** - operate in a similar way to GSHPs but extract heat from external air rather than from the ground. Air temperature is much less consistent that ground temperature, so the efficiency of the process is reduced when compared to GSHPs. ASHPs however are cheaper to install because they do not require ground collector loops, particularly when compared to GSHPs with vertical collector loops.

System Suitability:

7.17 The Building Regulations incorporate a Fuel factor into the TER calculation for heat pumps that results in a TER that is proportionally higher than that for an equivalent gas powered dwelling. This high TER value gives more favorable improvements in the DER/TER ratio meaning a heat pump powered development can have a significant DER over TER reduction yet have CO_2 emissions comparable to a conventional gas boiler. Camden Borough Council requires that any calculation for the contribution of electric heating (which includes heat pumps) be compared to a gas fuelled heating system and not an electric one.

7.18 Using this methodology ASHP's would not offer any improvement over the use of conventional gas powered heating systems. Depending upon the efficiency of the system installed a GSHP installation would offer a reduction in CO_2 emissions when compared to gas installations; however these reductions would not be significant enough to meet the 25% DER/TER reductions required by guidance document CPG 3 and London Plan Policy 5.2, and so additional measures would also be required.

7.19 Heat pumps typically provide output temperatures far lower than conventional boiler systems; as such the integration of a CHP system into the space heating circuit may be difficult if heat pumps were installed. The integration of a CHP system would not affect the hot water circuit.

7.20 The London Borough of Camden require the coefficient of performance (CoP) for both air and ground source heat pumps to be at least 4:1 before they can be considered a renewable technology. Heat pump CoP can be a misleading parameter. The efficiency (CoP) of a heat pump at any one time is dependant on the temperature that needs to be supplied and the thermal energy available from the heat source. If the heat source has high levels of thermal energy the system will have a higher CoP. By example on a hot day the ambient air temperature is relatively high and so any given volume of air contains a relatively large amount of thermal energy for an air source heat pump to extract, and therefore the system will have a high CoP. However hot days are when you are least likely to require heating. Conversely on a cold day the system has to work proportionally harder to extract thermal energy and so has a far lower CoP.

7.21 Calculation methodologies such as SAP and SBEM use an approximated seasonal coefficient of performance (SCoP) which measures the energy in versus the energy out over one complete season, and as such gives a more realistic interpretation of heat pump performance. The respective default SCoPs used by SAP and SBEM are 2.5:1 and 3.2:1 for air and ground source, neither of which would meet the 4:1 minimum required by the London Borough of Camden. For this reasons heat pumps are considered unviable for this development and have not been considered further in this assessment.

Biomass Heating, Cooling and Electricity

System Characteristics:

7.22 A biomass fuel source can be used to power a heat generation process. Heat would be generated and distributed to the apartments and offices via insulated pipe network. Heat exchange units within each dwelling and commercial unit would extract heat from the distribution network for use in space and domestic hot water heating.

7.23 A biomass boiler system would utilise several sequenced boilers fuelled by either biomass or bio fuel. The boilers would be located in a dedicated plant room with an adjoining fuel store or gas reservoir. Typically bio fuel installations utilise the bio fuel boilers to deal with the average heat load and utilise a secondary gas boiler to deal with peak heat loads or periods of maintenance on the main boilers.

7.24 Biomass CHP systems are available that can combine the heat generation process with simultaneous electricity generation. Heat generated by a biomass boiler/CHP system can be utilised in absorption chillers to provide a cooling facility.

System Suitability:

7.25 A biomass boiler system would potentially be viable for this development. This report assumes that a biomass boiler system would provide 70% of the heat demand with the remainder met by conventional gas boilers. This arrangement would result in DER/TER reductions that would meet the requirements of guidance document CPG 3 and London Plan Policy 5.2. This system would also reduce the site wide CO_2 emissions by more than 20% meeting Camden's requirements for renewable energy generation.

7.26 The London Plan states that planning submissions proposing biomass systems will require an air quality assessment to demonstrate the system will not have an adverse affect on air quality; this is synonymous with Camden Borough Council's application requirements.

7.27 To be feasible a biomass CHP system would typically require a minimum level of generation beyond the requirements of this development. As such biomass CHP would not be suitable for this development.

Wind Turbines

System Characteristics:

7.28 Electricity is produced from wind energy by linking a generator to a turbine which is generally a horizontal axis three-blade design. Electricity is then converted to AC for use in buildings. Turbines are generally mounted on slender towers sufficiently high to maximise the wind energy which may be captured and to isolate the turbine from disturbance to wind patterns caused by adjacent buildings.

7.29 Electricity generated at any one time by a wind turbine is highly dependent on the speed and direction of the wind. The wind speed is dependent on a number of factors, such as location within the UK, height of the turbine above ground level and nearby obstructions. There are also issues with planning such as visual impact, noise and conservation issues which have to be considered.

7.30 The wind turbine would be sized so that the annual output (which takes into account variations in wind speeds throughout the year) is sufficient to meet the targets for this development. As the output will fluctuate in accordance with wind speed rather than electricity demand at any given time, there will be times when generation will exceed demand and when demand will exceed generation. To resolve this, the turbine should be connected to the local electricity grid so that any excess can be exported to the grid and the shortfall imported from the grid, creating a balanced flow.

7.31 To be efficient, a wind turbine is generally used with wind speeds that average over the year at approximately 6m/s. In this location, a height of at least 25m would be necessary to achieve a minimum wind speed of 6m/s. A single large turbine would be erected on a tower at this height with the electricity fed to a private network serving the development. A metered connection would be made to the grid and any surplus bought back by the District

Network Operator under agreement. A management company would need to be set up to maintain the turbine and manage energy distribution, charging and sale of any surplus.

System Suitability:

7.32 A wind turbine would not be a viable option for this development. Whilst wind turbines can be sized to meet the requirements of this development there are numerous factors that would discount it as suitable in this setting. Typically wind turbines perform poorly in urban environments as surrounding buildings and features dissipate much of the winds useful energy before it can be extracted by the turbine. The requirement for a 25m mounting tower would necessitate a large amount of free space for the erecting and periodic maintenance of the turbine, which is likely to be an issue with this site.

7.33 Environmental concerns such as noise and shadow flicker would also be problematic. While modern turbines have low levels of noise generation even at high rotational speeds, the noise generated may still be an issue for local residents particularly given the close proximity of the turbine. Given the dense urban setting of this development, shadow flicker is likely to be a problem for the residents of the proposed development and surrounding buildings.

8.0 SUITABLE RENEWABLE TECHNOLOGIES

8.1 The technologies identified as potentially suitable are examined in greater detail in relation to this development in the following section. The systems will be evaluated against the following criteria:

- System size;
- CO_2 emissions from renewables;
- Capital and life cycle costs, payback and grants;
- Environmental and visual impact;
- Site suitability;
- Security and availability of fuel supply;
- Installation and maintenance issues.

8.2 Table 5 examines the suitable technologies in relation to the above criteria.

Renewable Energy Option		Proposal	System Size	DER/TER reduction (%)	Site wide CO_2 reduction from renewables	Capital Cost (£)	Environmental/Visual Impact	Site Suitability	Availability of Fuel Supply	Maintenance and Installation issues
				CPG 3 and London Plan Policy 5.2 requires 25%	CPG 3 and London Plan Policy 5.7 requires 20% to be targeted					
1.	**Photo voltaic panels**	Roof mounted PV panels horizontally mounted on flat roof area	125m² (16.5Wp) horizontally mounted on flat roof areas. To meet BREEAM energy credit requirements commercial areas require 65m² of PV panel array. To meet the CfSH energy credit requirements the apartments will require 60m²	30.8%	11.4%	Approximately £62,000	Minimal impact. Horizontal roof mounted panels will likely not be visible on this development. No noise impact with PV.	Satisfactory, provided panels will not be obstructed by surrounding buildings or tree growth.	Very reliable – all UK areas appropriate for photo voltaic panels.	No moving parts, minimal maintenance requirements. Cleaning and replacement of units may involve working at height risks. Installation relatively simple. PV independent of boiler and water system therefore no compatibility issues.
2.	**Biomass heating**	Communal biomass boiler with gas boiler peak load back up serving all apartments	150kW boiler capacity for total heat load.	43.8%	22.95%	Approximately £100,000 for the site (includes saving incurred from not requiring individual dwelling gas connections and boilers)	A sizeable fuel store adjacent to the boiler will be required. Emissions of smoke and NO_x from the boilers and transportation of the fuel. London Plan and Camden Borough Council requires that planning proposals recommending a biomass installation require an air quality impact assessment.	Sufficient space for boiler and fuel store will be required and may have a significant impact on site layout. Sufficient site access will be required for refueling operations.	Immediate and long-term availability of a suitable fuel supply must be checked and considered and may be an issue.	Boiler and fuel store will require regular maintenance and satisfactory access must be provided within the boiler house. Installation will require extensive infrastructure work to install insulated pipe work network.

Table 5: Suitable technologies data - Shaded cells indicate unsuitability

8.3 Table 5 details the two technologies that are considered potentially suitable to meet the requirements of this development. Both PV and biomass have features that would count for and against their recommendation for this development. Of the two potentially viable technologies biomass has been considered to be the least suitable primarily due to the (relatively) high maintenance and servicing requirements, concerns regarding air quality, concerns associated with integrating such a system into the development and securing a long term dependable fuel source.

8.4 Maintenance will be an ongoing concern. The nature of a biomass system and associated fuel storage and feeding mechanisms necessitates a high servicing and maintenance requirement. The mechanical elements of the system are relatively complex with numerous moving parts (primarily associated with the fuel feed mechanism). Ash build up and disposal will need to be addressed and as this development has no soft landscaping or planted areas disposal as a site fertilizer would not be an option. There are also concerns regarding the location of the fuel store adjacent to the plant room whilst allowing easy access for deliveries.

8.5 Modern biomass systems are relatively clean and typically have low air quality impacts. However their impacts are typically greater than an equivalent gas system. Filtration systems and careful exhaust stack design can greatly reduce these impacts but will increase the level of maintenance required and associated costs. A detailed air quality assessment of the proposed system would be required to satisfy the London Borough of Camden and London Plan requirements regarding biomass.

8.6 A secure fuel source would be required for the life of the development. While this issue would apply to a conventionally powered development the conventional energy industry is well established in both infrastructure and generation capacity. The biomass fuel industry is expanding as demand increases but is still relatively small in comparison. The delivery of biomass to the site would also render biomass unsuitable for the development, due to concerns over transport related emissions and accessibility of the site.

9.0 RECOMMENDED RENEWABLE TECHNOLOGIES

Photovoltaic Panels

9.1 Our recommended option for renewable technology application is for photovoltaic panel mounted on the roof of the proposed development. The technology is considered to be the most suitable in terms of contributing towards Camden guidance document CPG 3 and London Plan Policy 5.2 for a 25 per cent improvement in the Dwelling Emission Rate over the Target Emission Rate, and provides a reasonable contribution towards the 20 per cent reduction in the carbon emissions recommended by Camden Core Strategy Policy CS13 where feasible. Cost effectiveness of the system and ease of installation were also taken into account when choosing the most suitable renewable technology.

System Size

9.2 The drawings available indicate that sufficient flat roof area would be available for mounting PV panel or tile arrays of the required size.

9.3 PV panel and tile systems vary by make and model. This report has assumed that Polycrystalline based system will be utilised. Polycrystalline are a good compromise between system efficiency and capital cost. Monocrystalline panels are available that offer moderately increased levels of efficiency but at a proportionally far greater cost.

9.4 PV panel sizes vary by manufacturer and model but typically standard sizes are around 1.5m x 0.95m (1.425m^2) per panel. To allow a small margin for panel mounting this report assumes an individual panel size of 1.5m^2.

9.5 The designs available at the time of writing indicate sufficient flat roof to mount 125m^2 (16.6kWp) of PV panels. This allows a margin of space for mounting the systems and for roof access.

CO_2 Emissions

9.6 When combined with energy efficiency measures (Be Lean measures) and a gas fired CHP system (Be Clean measures) detailed within previous chapters of this report the total regulated CO_2 emissions from using a PV array would be: 21,616kgCO_2/year

This equates to a regulated CO_2 reduction (DER/TER) of:
((31,234 – 21,616)/31,234) x 100 = 30.8%

9.7 The site wide reduction from renewables would be as follows. Note this is calculated after the contribution of the 'Lean and Clean' measures and is not compared to the 'base' CO_2 emissions.

Site wide CO_2 emissions after incorporation of Be Lean and Be Clean measures: 50,292kg CO_2/year

Site wide CO_2 emissions with Be Lean, Be Clean and Be Green (PV) measures: 44,572kg CO_2/year

Percentage CO_2 reduction from renewables: ((50,292 – 44,572)/50,292) x 100 = 11.4%

9.8 The value of 11.4% is below the targeted value of 20% detailed in CPG 3 and the London Plan but is sufficient to meet the minimum energy credit requirements for both BREEAM and Code for Sustainable Homes specified by Camden Borough Council. The size of the PV array is deliberately conservative to allow for safe roof access as well as leaving sufficient roof area for the incorporation of a green roof if required. The PV array could conceivably be increased in size however this would remove the option of installing a green roof. PV is an inherently flexible system and increasing the array size at a later date is relatively simple.

9.9 The graph below shows the reduction in CO_2 emissions for this site for the Lean, Clean and Green (with PV) cases.

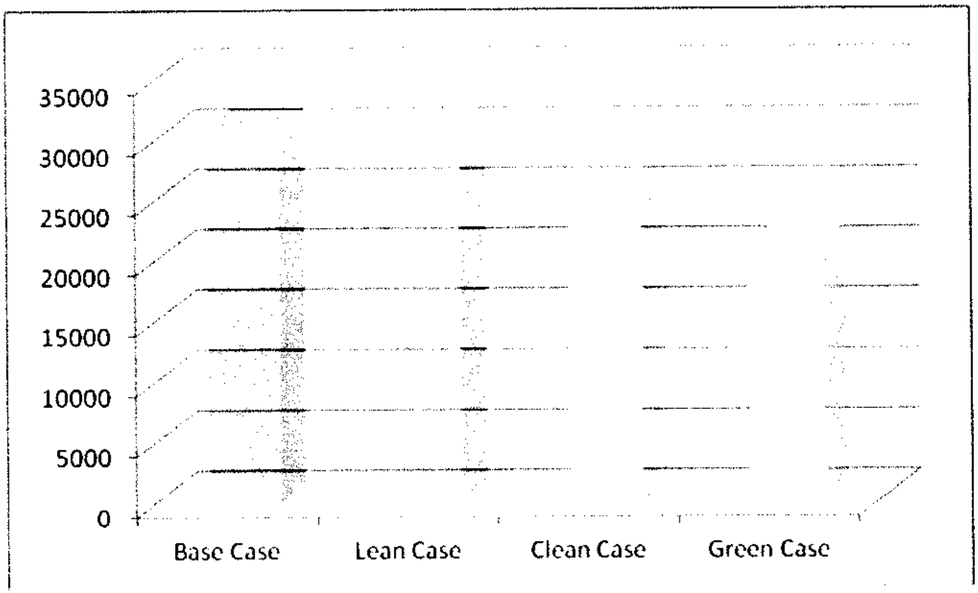


Figure 4: Base Case, Be Lean, Be Clean and Be Green Case reduction in carbon dioxide emissions

Capital and Life Cycle Cost and Grants

9.10 Prices of PV systems will be dependant on type, quantity and the developers buying power. An approximate cost for the systems described above would be: £62,000. PV systems do not require any notable additional power input to operate resulting in negligible running cost.

9.11 Feed in tariffs, introduced in April 2010; offer a guaranteed price per kWh significantly above the market rate for energy generated. The rates are dependant on system size and date of installation. For the size of PV array proposed for this development the rate is currently 15.2p/kWh (April 2012) however this is set to decrease progressively every year.

Environmental and Visual Impact

9.12 PV systems have a low level of visual impact and no noise impact on the development. PV collectors can be incorporated into the roof structure to further reduce the visual impact if required. Horizontally mounted panels have particularly low levels of visual impact.

Site Suitability

9.13 This site is suitable for PV panels, providing over shading by adjacent buildings or trees is considered and minimised. Based upon available site information this should not be an issue.

Maintenance and Installation Issues

9.14 PV systems have no moving parts and minimal maintenance requirements. Maintenance is generally restricted to periodic visual inspection and cleaning. PV tiles and slates only require electric cabling to connect multiple panels making them relatively simple and quick to install.

9.15 PV is typically more tolerant of varying roof layouts and is more readily expanded at a later date.

9.16 An advantage of PV for the developer is that the system can be incorporated at the end of the build rather than at the early stages allowing longer lead times for supply and hence greater flexibility in purchasing.

Security and Availability of Fuel Supply

9.17 PV panels generate electricity from solar radiation, an inexhaustible resource. All UK sites are suitable.

10.0 CONCLUSION AND SUMMARY

10.1 This Energy Statement outlines how the proposed re-development of 17 & 19 Ferdinand Street, Camden will meet the energy requirements as specified by Core Strategy Policy CS13 *Tackling Climate Change through promoting high environmental standards*. The requirements of Policy CS13 are supported by Camden Supplementary Planning Document CPG 3 *Sustainability*.

10.2 Camden guidance document CPG 3 *Sustainability* requires developments of 5 or more dwellings and/or 500m² (gross internal floor space) to demonstrate how the developments carbon dioxide emissions are to be reduced in accordance with the London Plan 'Energy Hierarchy'.

10.3 This Energy Statement has been prepared following the principles of the London Plan Energy Hierarchy: Be Lean, Be Clean and Be Green. The overriding objective in the formulation of the Energy Statement has been to maximise the viable reductions in total carbon dioxide emissions from the development within the framework of the energy hierarchy.

10.4 In addition to the Energy Hierarchy the Energy Statement takes into consideration adopted London Plan Policy 5.2 'Minimising Carbon Dioxide Emissions', decentralised energy in development proposals and supply of renewable energy detailed within Camden planning guidance document CPG 3 *Sustainability.*

10.5 Be Lean: Energy efficiency measures will be applied to the development. The development will meet the majority of the building fabric performance standards suggested within Camden guidance document CPG 3 and exceed the minimum requirements of Part L1A for fabric efficiency standards. In stances where the building fabric performance standards suggested by Camden have not been met, a justifiable reason has been provided, which focuses on maintaining internal thermal comfort for future occupants.

10.6 The opportunity for the proposed development to link into an existing or planned decentralized energy network has been explored using the London Heat Map tool. In the absence of an existing heat network within a reasonable distance of the proposed development site, the report assessed the feasibility of incorporating a CHP communal heating system within the development. The installation of the CHP system in combination with the Be Lean measures will reduce the regulated carbon dioxide emissions in comparison to the 2010 Building Regulations compliant case by 12.47 per cent.

10.7 A feasibility study has been undertaken to establish the most suitable renewable technology for integration at the proposed development. Solar photovoltaic panels are the recommended renewable technology within the constraints of the site and provide the most cost effective carbon dioxide emission saving for the proposed development.

10.8 A 125m² 16.5kWp photovoltaic system mounted horizontally on the flat roof areas, combined with the Be Lean: energy conservation measures and Be Clean CHP system will provide a 30.8% reduction in the Dwelling Emission Rate over the Target Emission Rate in accordance with Policy 5.2 'Minimising Carbon Dioxide Emissions' of the London Plan.

10.9 The specified photovoltaic system will provide a reduction in carbon dioxide emissions of 11.4%, providing a reasonable contribution towards meeting the 20% reduction in carbon dioxide emissions detailed within the London Plan Policy 5.7 Renewable Energy, and Camden Core Strategy Policy CS13. The 20% reduction in carbon dioxide emissions is required 'unless it can be demonstrated that such provision is not feasible'.

10.10 The PV panel area used in the calculations is the largest feasible PV array that can be incorporated, while still allowing sufficient roof area for the possible future inclusion of a green roof. Further increases in panel area would be possible but would make the future inclusion of a green roof impractical, as such this report has elected to retain a degree of flexibility by leaving sufficient roof area for expansion of either the renewable energy system or the sites ecology.

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APPENDICES

APPENDIX A

Appendix A - CO_2 Calculations

Methodology

The CO_2 and energy calculations for the proposed development at 17 & 19 Ferdinand Street have been determined based upon calculations for a cross section of the proposed dwellings proportioned upwards relative to the total residential floor areas.

The dwellings selected have been chosen as they represent the average to worst case for energy consumption with higher than average areas of heat loss wall/floor or roof.

The emissions and energy use of the commercial areas has been based on all the commercial units.

All areas and dimensions have been determined based upon AutoCAD drawings supplied by the GLA Architects.

The proportional sizing has been determined as follows:

Floor	Total Floor Area (m^2)	Assessed Dwelling floor area (m^2)	Proportional Ratio
Ground (commercial)	532	532	1
1st	426.6	77	5.54
2nd	426.6	77	5.54
3rd	251.15	74	3.4

In addition to the residential floor space there is approximately 160.7 m^2 of communal corridors and stairwells shared between the residential units (these circulation space areas are already accounted for in the ground floor commercial areas in the SBEM calculation).

Unregulated Emissions

The energy associated with cooking and appliances is not accounted for in the DER and TER calculations used to confirm compliance with the Building Regulations. Section D of London Plan Policy 5.2 requires that these demands be accounted for. Section 16 and Appendix L of the SAP 2009 guidance detail procedures for calculating the unregulated CO_2 and energy associated with cooking and appliances.

The calculations for the assessed dwellings are given below; all CO_2 is in kg/year all energy is in kWh/year:

Floor	Cooking		Appliances		Combined	Combined Energy	Ratio	Total CO_2	Total Energy
	CO_2	Energy	CO_2	Energy	CO_2				
1st	193	977	1261	2438	1454	3415	5.54	8055	18919
2nd	193	977	1261	2438	1454	3415	5.54	8055	18919
3rd	192	969	1222	2363	1414	3331	3.4	4808	11325

Total unregulated CO_2 emissions and energy from cooking and appliances will be:

CO_2: 20,918kg/CO_2/year

Energy: 49,163kWh/year

Communal Lighting

It has been assumed based on industry standards that a design lighting level of 150Lux will be utilised for the corridors and stair wells.

1 Lux = 1 Lumen/m^2

The floor area of communal corridors and stairwells is 160.7m^2

160.7 x 150 = 24,105 Lumens.

A high efficacy lighting system capable of at least 60Lumens/Circuit Watt is assumed (equivalent to a modern compact fluorescent lamp system)

24,105/60 = 401.75 Watts.

PIR occupancy sensing is assumed. The daily hours of operation are assumed to be 4.

4 x 365 x 401.75 = 584555Watt/hours per year or 584kWh/year

The emissions factor for grid supplied electricity is 0.517kgCO2/kWh

0.517 X 584 = 302kgCO2/year

Lift Energy

The lift calculation assumes a 9.2kW motor operating for a total duration of 1 hour a day.

9.2 x 365 = 3358kWh/year

3385 x 0.517 = 1736kgCO2/year

Total Unregulated emissions and energy

20,918kg + 302kg + 1736kg = 22,956kgCO2/year

49,163kWh + 584kWh + 3358kWh = 53,105kWh/year

Base Case CO_2 emissions and energy requirements

The base case CO_2 emissions and energy requirements have been determined from the TER worksheets for the assessed dwellings and the SBEM output data for the non-domestic areas.

Floor	$kgCO_2$	Ratio	Total
Ground (Commercial)	8820	1	8820
1st	1423.73	5.54	8936
2nd	1317.47	5.54	8504
3rd	1354.2	3.4	4974

Total Base Case regulated (TER) CO_2: 31,234kgCO_2/year

Total Base Case site wide CO_2: 31,234 + 22,956 = 54,190kgCO_2/year

Floor	Energy	Ratio	Total
Ground (commercial)	27,717	1	27,717
1st	11,752	5.54	65,106
2nd	11,146	5.54	61,749
3rd	10,620	3.4	36,108

Total Base Case regulated (TER) Energy: 190,680kWh/year

Total Base Case site wide Energy: 190,680 + 53,105 = 243,785 kWh/year

Be Lean- Efficiency Measures Only CO_2 Emissions and Energy Requirements

The CO_2 emissions and energy requirements of the development have been determined from the DER worksheets for the assessed dwellings and SBEM output documents for the commercial areas.

Floor	$kgCO_2$	Ratio	Total
Ground (commercial)	8453	1	8453
1st	1454	5.54	8055
2nd	1442	5.54	7989
3rd	1334	3.4	4536

Total LEAN Case regulated (DER) CO_2: 29,033kgCO_2/year

Total LEAN Case site wide CO_2: 29,033 + 22,956 = 51,989kgCO_2/year

Floor	Energy	Ratio	Total
Ground (commercial)	23,206	1	23,206
1st	6721	5.54	37,234
2nd	6835	5.54	37,866
3rd	6633	3.4	22,552

Total regulated (DER) Energy: 120,858kWh/year

Total site wide Energy: 120,858 + 53,105 = 173,963 kWh/year

Percentage CO_2 Reduction (DER/TER):

((31,234 – 29,033)/29,033 x 100 = 7%

Be Clean – Generating energy efficiently using CHP (and efficiency measures) CO_2 Emissions and Energy Requirements.

The CO_2 emissions and energy requirements of the development have been determined from the DER worksheets for the assessed dwellings and SBEM output documents for the commercial areas. Calculations assume a BAXI –DACHS Mini CHP (non condensing) unit provides 20% of development heat load.

Floor	$kgCO_2$	Ratio	Total
Ground (commercial)	8257	1	8257
1st	1348	5.54	7468
2nd	1337	5.54	7407
3rd	1236	3.4	4204

Total CLEAN Case regulated (DER) CO_2: 27,336$kgCO_2$/year

Total CLEAN Case site wide CO_2: 27,336 + 22,956 = 50,292$kgCO_2$/year

Floor	Energy	Ratio	Total
Ground (commercial)	20,987	1	20,987
1st	6992	5.54	38,735
2nd	7113	5.54	39,406
3rd	6904	3.4	23,474

Total CLEAN case regulated energy: 122,602kWh/year

Total site wide Energy: 122,602 + 53,105 = 175,707 kWh/year

Percentage CO_2 Reduction (DER/TER):

((31,234 – 27,336)/31,234) x 100 = 12.47%

Be Green – Generating energy from renewable energy sources CO_2 Emissions

The CO_2 emissions and energy requirements of the development have been determined from the DER worksheets for the assessed dwellings and SBEM output documents for the commercial areas.

PHOTOVOLTAICS

Calculations assume 125m² of PV panels. All panel area is assumed to be horizontally mounted on the flat roof area.. Each panel is rated at 0.2kWp and is 1.5m²

Calculations assume a minimum of 65m² of PV panels are apportioned to the commercial areas and that each residential unit has 0.5kWp (3.75m²) of panels. This is required to meet the BREEAM and Code for Sustainable Homes energy credit requirements.

Floor	$kgCO_2$	Ratio	Total
Ground (commercial)	5479	1	5479
1st	1145	5.54	6343
2nd	1134	5.54	6282
3rd	1033	3.4	3512

Total GREEN (PV) Case regulated (DER) CO_2: 21,616$kgCO_2$/year

Total GREEN (PV) Case site wide CO_2: 21,616 + 22,956 = 44,572$kgCO_2$/year

Percentage CO_2 reduction(DER/TER): **((31,234 – 21,616)/31,234) x 100 = 30.8%**

Site wide reduction from renewable

Site wide emissions with LEAN and CLEAN: 50,292$kgCO_2$/year

((50,292 – 44,572)/50,292 X 100 = 11.4%

BIOMASS CO_2 EMISSIONS

The CO_2 emissions and energy requirements of the development have been determined from the DER worksheets for the assessed dwellings and SBEM output documents for the commercial areas. These calculations assume that a biomass system will provide 70% of the total development heat load with a conventional gas boiler system contributing the remaining 30%.

Floor	CO_2	Ratio	Total
Ground	6719	1	6719
1st	609	5.54	3374
2nd	630	5.54	3490
3rd	650	3.4	2210

Total GREEN (Biomass) Case regulated (DER) CO_2: 15,793kgCO_2/year

Total GREEN (Biomass) Case site wide CO_2: 15,793 + 22,956 = 38,749kgCO_2/year

Percentage CO_2 reduction (DER/TER): **((28,122 – 15,793)/28,122) x 100 = 43.8%**

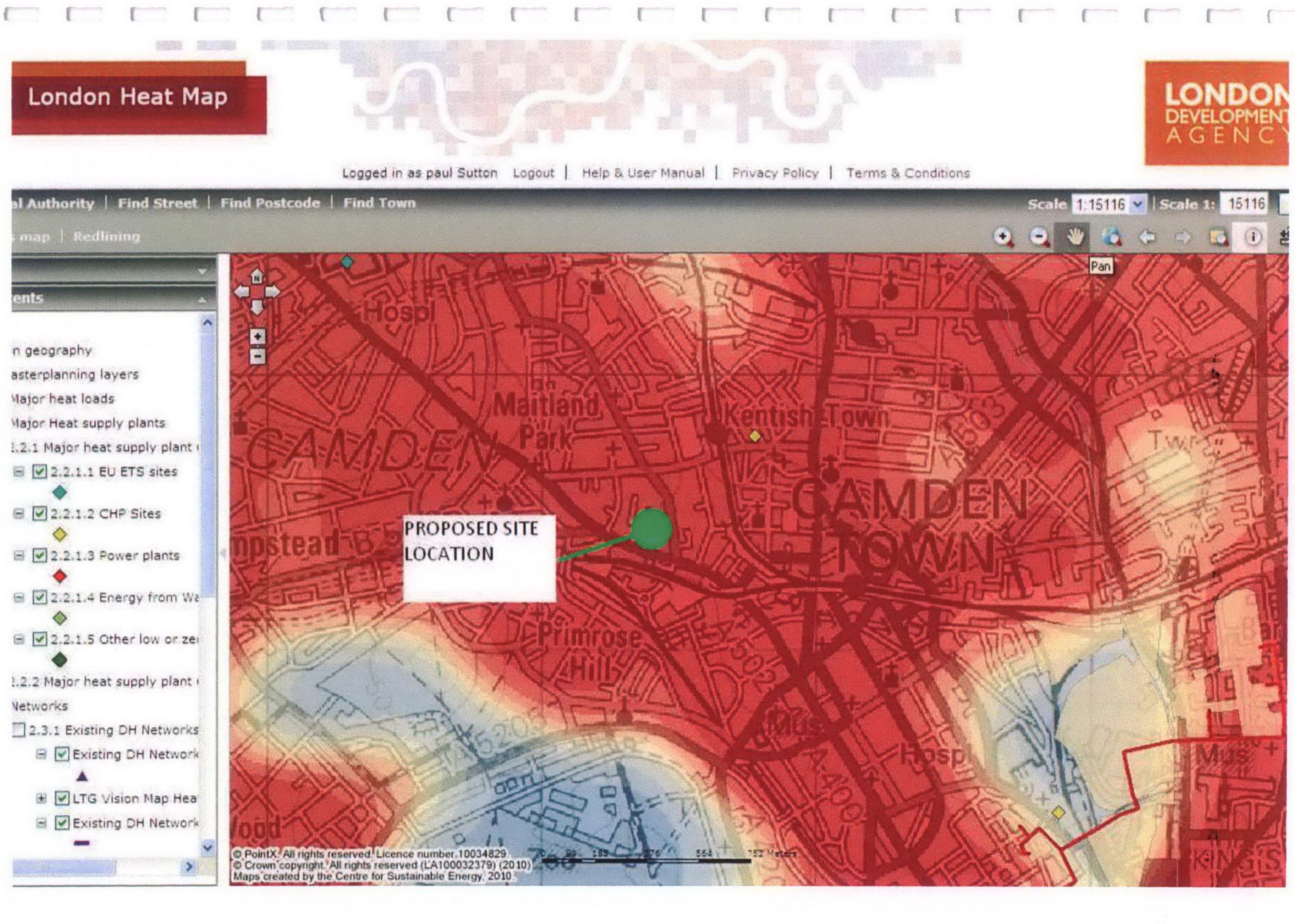
Note: Base CO_2 is altered to 28,122 as the 2010 Building Regulations Part L2A methodology for calculating TER for a commercial building assigns the same fuel type to the TER calculation as for the actual building, hence a biomass building will be compared to a biomass notional building. This results is a different TER for a given building powered by biomass to one powered by gas. This is not the same for domestic properties were a biomass powered dwelling is compared to a notational (TER) building powered by gas.

Site wide reduction from renewable

Site wide emissions with LEAN and CLEAN: 50,292 kgCO_2/year

((50,292 – 38,749)/50,292 X 100 = 22.95%

APPENDIX B


London Heat Map
LONDON DEVELOPMENT AGENCY
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al Authority | Find Street | Find Postcode | Find Town
Scale 1:15116 | Scale 1: 15116
map | Redlining
Pan
ents
n geography
asterplanning layers
Major heat loads
Major Heat supply plants
2.2.1 Major heat supply plant
2.2.1.1 EU ETS sites
2.2.1.2 CHP Sites
2.2.1.3 Power plants
2.2.1.4 Energy from Wa
2.2.1.5 Other low or ze
2.2.2 Major heat supply plant
Networks
2.3.1 Existing DH Networks
Existing DH Network
LTG Vision Map Hea
Existing DH Network
PROPOSED SITE LOCATION
CAMDEN
Maitland Park
Kentish Town
CAMDEN TOWN
Primrose Hill
Hospl
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