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Doherty Design & Planning Limited

ENERGY STATEMENT

(To Accompany Detailed Planning Application)

Site

8A BELONT STREET, LONDON NW1 8HJ

Proposal

ERECTION OF TWO DWELLINGS

Applicant

ELI NATHENSON

1st FEBRUARY 2016

Ref. E565-ES-00

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1.0 SUMMARY OF RECOMMENDATIONS

a) This development is for the erection of a pair of semi-detached dwellings at 8a Belmont Street, London NW1 8HJ.

b) It is proposed that in order to meet the requirements of policy this development will adopt a high standard of design with regard to energy efficiency principles.

c) This report highlights a total reduction of over 35.6% in carbon dioxide emissions by the incorporation of a combination of energy efficiency measures and the provision of on-site renewable energy production equipment.

d) This development is at the planning stage and the detailed construction drawings have not been prepared, therefore initial stage SAP calculations and procedures provided in the London Renewables Toolkit, have been used to estimate that the baseline carbon dioxide emissions of this development.

e) This report has demonstrated using initial SAP calculations that it is possible to achieve a 26.7% reduction in carbon dioxide emissions by making fabric and energy efficiency measures, with a further 12.1% reduction in carbon dioxide emissions by incorporating photovoltaic systems, resulting in a total reduction of 35.6% in carbon dioxide emissions. It is envisaged during detailed construction design, these figures can be improved.

f) It is suggested here that in order to ensure the best possible reduction in carbon dioxide emissions after consent is granted, that a planning condition is added requiring the Building Regulations carbon dioxide emission calculations and detailed proposals to be prepared and submitted prior to commencement on site.

2.0 INTRODUCTION

a) Doherty Design and Planning Limited have been instructed by Eli Nathenson to prepare an Energy Statement to support the submission of the planning application for the development at 8a Belmont Street, London NW1 8HJ. This report must be read in conjunction with the application forms, certificates, detailed plans and other supporting documents submitted to the Local Authority as part of the application.

b) The Application is for the erection of two semi-detached dwellings.

c) Policies 5.2 and 5.3 from the London Plan 2015 require new residential developments to minimise and exhibit the highest standards of sustainable design and construction, whilst policy 5.7 presumes that developments will seek to reduce carbon dioxide emissions by the use of on-site renewable energy generation wherever feasible. Policy 5.2 sets a target reduction in carbon dioxide emissions of 40%, over the Target Emission Rate, as defined by the Building Regulations 2010.

d) However, as the Building Regulations were revised in 2013, the Greater London Authority issued their "Sustainable Design and Construction SPG" in April 2014, which clarifies the current target. This document states:

> *"To avoid complexity and extra costs for developers, the Mayor will adopt a flat carbon dioxide improvement target beyond Part L 2013 of 35% to both residential and non-residential development."*

e) The objectives of this Energy Statement are to make an appraisal of the carbon dioxide emissions of the proposed dwellings, the various methods of generating and using renewable energy at source, and to suggest the most appropriate means by which the development can contribute towards the aspiration of policy relating to renewable energy provision. The Assessment shall follow the principles set out in the London Renewable Energy Toolkit.

f) The London Renewable Energy Toolkit is the system developed by the Greater London Authority to assist Planners, Developers and Consultants with the assessment of the appropriateness of renewable energy resources and technologies.

g) The Assessment shall be carried out following the principles set out in the Mayor's "Energy Hierarchy" which is implemented through the London Plan. These principles can be summarised as follows:

- Be Lean –use less energy
- Be Clean – supply energy efficiently
- Be Green – use renewable energy

h) In order to demonstrate this, it is proposed to use the Standard Assessment Procedure (2012) (SAP) for the calculations to obtain initial baseline carbon dioxide emissions figures for the development. Further SAP calculations will be used to demonstrate the potential carbon dioxide emission savings from the initial calculations by enhancements to the building fabric, plant and controls – BE LEAN. The suitability of supplying energy, both heat and power, through the use of a combined heat and power system shall be assessed – BE CLEAN. Finally, the carbon dioxide emission saving by the use of renewable energy shall be assessed through the outputs from the SAP calculation – BE GREEN.

i) At this stage in the design of the dwellings, the detailed Building Regulations construction information has not yet been prepared so the initial SAP calculations are based on preliminary construction information. Following detailed construction design, the SAP calculations will be revisited to ensure the energy requirements and carbon dioxide emissions are up to date.

j) As these calculations are based on the initial design at planning stage, it is suggested that in order to ensure the best possible reduction in carbon dioxide emissions after consent is granted, that a planning condition is added requiring the carbon dioxide emission calculations be updated to reflect the Building Regulations construction information.

3.0 RENEWABLE ENERGY AND LOW CARBON ENERGY SYSTEMS

3.1 Introduction

a) This section of the Energy Statement shall make an appraisal of the carbon dioxide emissions of the proposed dwellings, the various methods of generating and using renewable energy at source, and to suggest the most appropriate means by which the development can contribute towards the aspiration of policy relating to renewable energy provision.

b) The London Renewables Toolkit (LRT) is the system developed by the Greater London Authority to assist Planners, Developers and Consultants with the assessment of the appropriateness of renewable energy resources and technologies. It offers advice on which renewable technologies are suitable including aesthetic issues, risks, reliability and gives an insight into the cost benefit analysis of installing renewable.

c) It also provides guidance on how to comply with the requirements of the London Plan and relevant borough development documents. Typical detailed calculations are provided to help determine the most appropriate renewable technology for each scheme.

d) Within Section 4 of the LRT – 'Including Renewables in the Development Proposals', a route map is provided to help consider the feasibility of renewable technologies and how to include them in the development proposals.

e) The dwellings emissions have been estimated using the Standard Assessment Procedure (2012). A second set of SAP calculations have been undertaken to demonstrate an improvement in the carbon dioxide emissions by incorporating better fabric constructions, better windows and doors, improved ventilation systems and enhanced air tightness.

3.2 Baseline Carbon Dioxide Emissions

a) In order to assess the carbon dioxide emissions of the development, the delivered energy demand needs to be estimated. At this stage in the design of the dwellings, the detailed Building Regulations construction information has not been prepared so the initial carbon dioxide emission calculations have been prepared using the design information currently available.

b) The dwellings carbon dioxide emission estimates are based on the initial stage SAP calculations. For this project, an initial SAP calculation has been prepared for 50% of the dwellings and prorated for the entire development.

c) Table 1 below shows that the results for the standard dwelling of the same size and bulk, constructed to comply with the current Building Regulations.

Typical Dwelling Floor Area (m^2)	152.7
SAP CO_2 Emissions	
Space Heating ($kgCO_2/yr$)	1,339
Hot Water ($kgCO_2/yr$)	552
Pumps & Fans ($kgCO_2/yr$)	39
Lighting ($kgCO_2/yr$)	330
Estimated CO_2 emissions for Assessed Dwellings ($kgCO_2/yr$)	**2,260**
CO_2 emissions Per Floor Area ($kgCO_2/m^2/yr$)	14.8
Total Development Floor Area (m^2)	300.6
Total Estimated Development CO_2 emissions ($kgCO_2/yr$)	**4,448**

Table 1 – Baseline Carbon Dioxide Emissions

3.3 Improved Baseline Carbon Dioxide Emissions – BE LEAN

a) Following the principles set out in the Mayor's "Energy Hierarchy" which is implemented in the London Plan and the Local Policy, the design has been improved to use less energy - BE LEAN.

b) This has been achieved by improving the thermal performance of the various constructions, like the walls, roof, floors, windows, doors etc and improving the air tightness of the dwelling.

c) The floor U Values can be improved by incorporating insulation under the creed, or by using insulation blocks instead of concrete blocks between the beams. For the purposes of these calculations, the U Values of the current wall constructions have been calculated as 0.15 W/m^{2}K

d) The wall U Values can be improved by improving the thermal performance of the insulation, either by increased thickness or lower thermal conductivity. For the purposes of these calculations, the U Values of the current wall constructions have been calculated as 0.15 W/m^{2}K.

e) There are a number of options and details to fully fill the party walls and still provide excellent acoustic performance. If the party walls are fully filled with sealed edges, the U Value of 0.0 W/m^{2}K can be used.

f) The roof areas offer excellent opportunity to enhance the insulation levels and for the purposes of these calculations, the U Value of 0.14 W/m^{2}K has been used.

g) The thermal performance of the windows can be improved by adding coatings to the panes or adding an inert gas to the cavities. For the purposes of these calculations, the U Values of the windows has been taken as 1.2 W/m^{2}K, which incorporates planitherm glass, argon gas and warm edge spacer bars.

h) A composite front door can be used instead of a timber door. Modern composite doors have good thermal, fire, acoustic and security properties. These types of door can have U Values as low as 0.55 W/m^{2}K.

i) The air leakage rate for the dwellings can be improved. The maximum allowed under the current Building Regulations Approved Document L1A:2013 is 10 $m^3/hr/m^2$ at 50 Pascal's. With carful detailing, this can be easily improved to 3 $m^3/hr/m^2$ at 50 Pascal's.

j) The use of Accredited Construction Details in the development means that the thermal bridging coefficient can be greatly improved, thus lowering the γ can be lowered.

k) Each individual dwelling will have its own heating by means of a highly efficient mains gas condensing boiler. This will eliminate distribution heat losses and the circulation losses.

l) Highly efficient and insulated hot water storage cylinders can be installed to maximise heat transfers to the hot water and to minimise heat loss from the cylinder.

m) The heating and hot water primary pipework can be insulated to minimise heat loss.

n) More efficient controls can be installed to control the heating, which can include weather compensation on the boiler control and the use of programmers, thermostats and thermostatic radiator valves all improve the efficiency of the heating system. In this case, time and temperature zone control can be used to efficiently control the heat distribution throughout the dwellings at the required time.

o) Instead of simply installing 75% of the light fittings as low energy efficient light fittings, as required by the current Building Regulations, 100% of the light fitting could be low energy fittings.

p) Mechanical ventilation heat recovery can be used to provide ventilation to the dwellings. These systems recover the waste heat from the extract air from the bathrooms and kitchens and use it to preheat the incoming fresh air for the living spaces. This helps reduce the heating load and the carbon dioxide emissions.

q) The development shall be designed to ensure that the both the Dwelling Emission Rate and Building Emission Rates are better than the Target Emission Rates and the Fabric Energy Efficiency is better than the Target

Fabric Energy Efficiency. These are the requirements from Criterion 1 of the current Building Regulations Approved Document L (2013).

r) By incorporating items like those stated above, the SAP calculations have been updated to demonstrate the effect of these improvements and the results are listed in Table 2.

Typical Dwelling Floor Area (m^2)	152.7
SAP CO_2 Emissions	
Space Heating ($kgCO_2/yr$)	625
Hot Water ($kgCO_2/yr$)	561
Pumps & Fans ($kgCO_2/yr$)	206
Lighting ($kgCO_2/yr$)	264
Estimated CO_2 emissions for Assessed Dwellings ($kgCO_2/yr$)	**1,656**
CO_2 emissions Per Floor Area ($kgCO_2/m^2/yr$)	10.8
Total Development Floor Area (m^2)	300.6
Total Estimated Development CO_2 emissions ($kgCO_2/yr$)	**3,260**
Percentage Improvement over current Building Regulations	**26.7 %**

Table 2 – Improved Baseline Carbon Dioxide Emissions

s) As demonstrated above, it can be seen that the improvements in the thermal performance and fixed building services, a reduction of 26.7% can be achieved.

3.4 Supplying Energy Efficiently – BE CLEAN

a) Following the principles set out in the Mayor's "Energy Hierarchy" which is implemented in the London Plan and the Local Policy, the second step is to reduction the carbon dioxide emissions by supplying energy efficiently - BE CLEAN.

b) Combined Heat and Power typically generates electricity on site as a by-product of generating heat. It uses fuel efficient energy technology that, unlike traditional forms of power generation, uses the by-product of the heat generation required for the development. Normally during power generation, the heat is discharged or wasted to atmosphere. A typical CHP plant can increase the overall efficiency of the fuel use to more than 75%, compared to the traditional power supplies of 40%, which uses inefficient power stations and takes into account transmission and distribution losses.

c) The use of this development is residential and it will be built to the current building regulations. The aim of these regulations is to minimise the base heating load and electrical loads. The site base heating and electrical loads is key to the sizing and operation of any CHP system.

d) The current design utilises highly efficient gas fired condensing boilers in each dwelling, with no central boiler room or communal risers or heating system. The use of individual system has the benefit of eliminating distribution heat losses and circulation losses.

e) Due to the high levels of insulation and energy efficiency measures that will be incorporated into this development, there is no year round heat load for the CHP plant and therefore, a CHP system would not be viable on this development. If a CHP system were to be incorporated, it would not operate efficiently and therefore NOT BE CLEAN.

3.5 Renewable Technologies Considered – BE GREEN

a) Taking into account the requirements of planning policy set out by Camden Council and the London Plan, the annual carbon dioxide emission reduction target of 35% for the development has been calculated as 1,557 kgCO_2/year.

b) The final step in the Mayor's "Energy Hierarchy" is to reduction the carbon dioxide emissions by the use of renewable technologies - BE GREEN.

c) In accordance with the toolkit the following renewable energy resources have been assessed for availability and appropriateness in relation to the site location, building occupancy and design.

- Combined Heat and Power
- Biomass Heating
- Biomass CHP
- Heat Pumps
- Solar Photovoltaics
- Domestic Solar Hot Water Systems
- Wind Power

d) A preliminary assessment has been carried out for each renewable energy technology and for those appearing viable a further detailed appraisal has been undertaken.

e) The preliminary study considered the site location and the type of building in the development and surroundings and produced a shortlist of renewable energy technologies that will be the subject of a further feasibility study.

f) Table 3 below provides a summary of the assessment.

3.6 Renewables Toolkit Assessment

Energy System	Description	Comment
Combined Heat and Power (CHP)	Combined Heat and Power systems use the waste heat from an engine to provide heating and hot water, while the engine drives an electricity generator. These systems uses gas or oil as the main fuel and therefore can not truly be considered as renewable technology however, it is recognised that they have a significant reduced impact on the environment compared to conventional fossil fueled systems.	As CHP systems produce roughly twice as much heat as they generate electricity, they are usually sized according to the base load heat demand of a building, to minimise heat that is wasted during part-load operations. Therefore, to be viable economically they require a large and constant demand for heat, which make their use in new energy efficient housing, with high insulation, not really suitable. The efficiency of small scale CHP is relatively low and is unlikely to result in CO_2 emission savings. Economic viability relies on 4000 hours running time, which is unlikely to be achieved in this scheme. As policy requires a reduction in carbon dioxide emissions via true renewable sources this would not assist in achieving the policy objectives.
Combined Heat and Power		**Feasible – NO**
Biomass Heating	Solid, liquid or gaseous fuels derived from plant material can provide boiler heat for space and water heating. Biomass can be burnt directly to provide heat in buildings. Wood from forests, urban tree pruning, farmed coppices or farm and factory waste, is the most common fuel and is used commercially in the form of wood chips or pellets, although traditional logs are also used. Other forms of Biomass can be used, e.g. bio-diesel.	Wood pellet or wood chip fired or dual bio-diesel/gas-fired boilers could be considered. As this development consists of a new building, it offers the opportunity to accommodate such a system. The flues would have to be discharged to atmosphere above roof level and concerns raised by Environmental Health regarding the pollutants and particles, which would have to be addressed. Care need to be taken with the design of the flue to ensure particle discharge is not a concern to residents. The fuel storage silo/tank would have to be located external to the building, taking up private space for the dwellings. A suitable local fuel supplier is required to supply the site.
Biomass Heating		**Feasible – NO**

Energy System	Description	Comment
Biomass CHP	CHP as above, but with biomass as the fuel.	Biomass CHP overcomes the issue of the reduction in carbon dioxide emissions via true renewable sources, however, the lack of a year round base load is still a problem and therefore Biomass CHP is not feasible for this development.
Biomass CHP		**Feasible - NO**
Ground/Air Source Heat Pumps (GSHP / ASHP) - heating	The ground collector can be installed, either as a loop of pipe, in the piles or using a borehole and a compressor offer efficient heating of a space in winter, as the temperature of the ground (below approx 2m) remains almost constant all year. For air source, the external condensing unit can be located adjacent to the dwelling in a discreet location.	Ground and air source heat pumps are most efficient when supplying heat continuously and in areas where a mains gas supply is not available. In dwellings, GSHP and ASHP are capable of supplying the majority of the total space heating and pre heat for the hot water demand. This site does not have external areas of sufficient size for the installation of ground loops for the collection of heat. Due to the size of the dwellings and their location in relation to neighbouring properties, it is considered that the use of ASHP to offset the heat losses of these dwellings is not feasible.
Ground/Air Source Heat Pumps		**Feasible – NO**
Solar Photovoltaics (PV)	Building Integrated Photovoltaics (BIPV) or Roof mounted collectors provide noiseless, low maintenance, carbon free electricity.	There appears to be a reasonable amount of flat roof area that can be utilitised to install PV panels onto the scheme. These could be integrated into the roof finishes or mounted on frames on the roof and orientated south for optimal performance. Careful consideration must be given to the chosen roof finish to ensure compatibility.
Solar PhotoVoltaics		**Feasible – YES**
Solar Thermal Hot Water	Solar collectors for low temperature hot water systems require direct isolation, so the chosen location, orientation and tilt are critical.	This solution could be utilised to generate hot water using the energy from the sun. The area of flat roof could be used for the installation of solar thermal collectors. These could be mounted on frames and orientated south for optimal performance. These would have to be installed at a pitch of 30-40 degrees and ideally as close to the dwelling served as possible.
Solar Thermal Hot Water		**Feasible – YES**
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Energy System	Description	Comment
Wind Power	Most small (1-25kW) wind turbines can be mounted on buildings, but larger machines require foundations at ground level and suitable site location	It could be viable to install some form of wind turbines on this site, however due to surrounding buildings and the visual impact it is not considered to be the most sensitive system of providing energy via renewable resources in this built up location. There are also concerns that the wind across the site would be turbulent because of the surrounding buildings.
Wind Power		**Feasible – NO**

Table 3 – Renewable Technology Feasibility Assessment

a) From the above it has been established that there are two potential ways of providing energy via renewable sources appropriate for inclusion in this scheme, that being the use of solar photovoltaics or domestic solar hot water.

b) CHP and Micro CHP are considered not feasible as the economic viability relies on at least 4,000 hours runtime which is unlikely to be achieved in this development.

c) Biomass systems have been considered unfeasible for this site due to particle discharge in a built up area, fuel handling and storage on a site with limited open space, required plant areas and the on going maintenance of the system.

d) Heat pumps have been considered not feasible for this development as there is insufficient ground area for the installation of ground loops. Air source have been considered unfeasible due to the close proximity of the neighboring dwellings.

e) Wind has been considered not viable for this site as there are a lot of the buildings in the surrounding area which are likely to cause disruption to air flows.

3.7 Solar Photovoltaics

a) Photovoltaics (PV) is a technology that allows the production of electricity directly from sunlight. The term originates from “Photo” referring to light and “voltaic” referring to voltage. This type of technology has been developed for incorporation within building design to produce electricity for either direct consumption or re-sale to the National Grid.

b) PV panels come in modular panels which can be fitted on the top of roofs or incorporated in the finishes like slates or shingles to form integral part of the roof covering. PV cells can be incorporated into glass for atria walls and roofs or used in the cladding or rain screen on a building wall.

c) When planning to install PV panels, it is important to consider the inherent cost of installation in comparison to possible alternatives. The aesthetic impact of the PV panels also requires careful consideration.

d) Roof mounted PV panels should ideally face south-east to south-west at an elevation of about 30-40°. However, in the UK even if installed flat on a roof, they receive 90% of the energy of an optimum system.

e) PV installations are expressed in terms of the electrical output of the system, i.e. kilowatt peak (kWp). The Department of Trade and Industry estimate that an installation of 1kWp, could produce approximately 700-850 kWh/yr, which would require an area of between 8-20m^2, depending on the efficiencies and type of PV panel used.

f) It is also estimated that a gas heated, well insulated typical dwelling would use approximately 1,500kWh/year electricity for the lights and appliances, therefore the 1kWp system could save approximately 45% of a single dwellings electrical energy requirements.

g) Although often not unattractive, and possible to integrate into the building or roof cladding system PV systems are still considered likely to have visual implications, therefore careful sighting of the panels is required.

h) As this installation will be contained on the roof of the proposed dwellings, it involves no additional land use.

i) With regard to noise and vibration, a PV system is completely silent in operation.

j) Care must be taken with the design and installation of PV systems as they need to meet standards for electrical safety.

Development incorporating Energy Efficiency Measures	Total Carbon Dioxide Emissions ($kgCO_2/yr$)	Percentage Reduction (%)
No Renewables	3,260	-
Reduction by including 1.0 kWp PV system	395	12.1%

Table 4 – Photovoltaic Carbon Dioxide Emissions

k) As can be seen from Table 4 above, the incorporation of a minimum of 1.0 kWp photovoltaic systems on the roof of the dwellings could reduce the carbon dioxide emissions by a further 12.1% and when combined with the fabric energy efficiency measures from in Table 2 above, a total reduction of 35.6% is achieved, which exceeds the requirements of the Planning Policies from Camden Council and the London Plan.

l) From the above calculations, based on 250 watt panels, orientated towards the southwest and mounted on the roof finishes at a 30 degree pitch, it is calculated that a total of 4-No. panels are required on the roofs of the proposed dwelling, which equates to required roof area of between 10-20m^2 with a southerly facing aspect for the installation of the roof finishes. This is the total amount and can be split over the two dwellings.

m) It is estimated that this size of system could generate 760 kWh of electricity in a year.

n) Further detailed calculations for the carbon dioxide emissions and system size shall be carried out during detailed design.

3.8 Domestic Solar Hot Water Systems

a) This system uses the energy from the sun to heat water, most commonly to provide the hot water demands of the development. The system uses heat collectors, generally mounted on the roof, in which a fluid is heated by the sun. This fluid is used to heat up water that is stored in either a separate cylinder or a twin coil hot water cylinder inside the dwelling. The system works very successfully in the UK, as it can operate in diffused light conditions.

b) As with PV panels, the collectors should be mounted facing in a southerly direction, from south-east through to south-west and at an elevation of 10 to 60°. The panels can be installed on the roof, either on the slope of the roof, on a frame, or they can be integrated into the roof finishes.

c) This system would be best suited on sites where the solar thermal collectors can be located close to the hot water storage vessel within the dwelling and therefore any losses can be minimised.

d) Approximately 2-4m^2 of solar thermal collectors could provide the hot water requirements of a typical dwelling. These could be used to feed twin coil hot water cylinders positioned within the dwellings, allowing the water to be heated by the sun when possible whilst retaining the back up of the main heating system when required.

e) This system would be relatively easy to install. However, the visual impact needs to be given consideration.

f) Although often not unattractive, and possible to integrate into the building or roof cladding system domestic solar thermal collectors are still considered likely to have visual implications, therefore careful sighting of the panels is required.

g) As this installation will be contained on the roof of the proposed dwellings, it involves no additional land use.

h) With regard to noise and vibration, a domestic solar hot water system is completely silent in operation.

i) Incorporating a 3m^2 evacuated tube systems for each dwelling, mounted on the roof at a 30 degree pitch and orientated south west, with a cylinder in each dwelling, into the SAP calculations, the reduction in carbon dioxide emissions can be estimated.

Development incorporating Energy Efficiency Measures	Total Carbon Dioxide Emissions ($kgCO_2/yr$)	Percentage Reduction (%)
No Renewables	3,260	-
Reduction by including 2x3m^2 of DSHW	477	14.6%

Table 5 – Domestic Solar Hot Water Carbon Dioxide Emissions

j) As can be seen from Table 5 above, the installation of domestic solar hot water systems incorporating 3m^2 of evacuated tube solar collectors for each of the dwellings would reduce the carbon dioxide emissions by 14.6% when combined with the fabric energy efficiency measures from in Table 2 above, a total reduction of 37.4% is achieved, which meets the requirements of the Planning Policies from Camden Council and the London Plan.

3.9 Annual Carbon Dioxide Emission Reduction

a) From the above, it can be seen that either a photovoltaic system or a domestic solar hot water system, together with the fabric and energy efficiency measures, could be used to achieve the 35% reduction in carbon dioxide emissions as required by Planning Policy.

b) Based on the initial SAP calculations for the dwellings, it has been calculated that the baseline carbon dioxide emissions figure for the development is 4,448 $kgCO_2$/year.

c) In accordance with the planning policies set out by Camden Council and in the London Plan, this report has demonstrated a 26.7% improvement in carbon dioxide emissions by fabric and energy efficiencies. In addition, a further reduction of either 12.1 or 14.6% in carbon dioxide emissions is possible by the use of a renewable technology, resulting in a total reduction of between 25.6 and 37.4%.

d) A number of options have been considered and the potential carbon dioxide reductions calculated using the SAP calculations and a summary of the results is provided in Table 6 below.

	Total Carbon Dioxide Emissions ($kgCO_2$/yr)	Reduction in Carbon Dioxide Emissions (%)
Building Regulations Compliant Development	4,448	-
Development incorporating Energy Efficiency Measures	3,260	26.7%
Further Reduction in Carbon Dioxide Emissions by incorporating a Renewable Technology		
PV (1.0 kWp)	395	12.1%
DSHW (2-No. $3m^2$)	477	14.6%
Percentage Improvement incorporating the Fabric Improvement and the PV system only		**35.6 %**

Table 6 – Summary of Reduction in Carbon Dioxide Emissions

e) It has been demonstrated that it is possible to achieve a 35.6% reduction in carbon dioxide emissions over and above the 2013 Building Regulations by improving the energy efficiency of the dwellings and their building services efficiencies and by the incorporation of 1.0 kWp of photovoltaic panels as a renewable technology.

f) CHP and Biomass CHP have been analysed but are considered not feasible for this development as the heating and electrical load profiles would not provide a good clean efficient system for the dwellings.

g) Biomass heating has been analysed but is considered not feasible for this development due to particle discharge in the built up area, space requirements and the cost and the reliability of a biomass fuel source.

h) Wind power is considered not feasible for this development due to the turbulence caused by the surrounding buildings and trees etc.

i) The use of heat pumps has been considered but initial calculations demonstrate that they will not provide the required reduction in carbon dioxide emissions and there are concerns on the siting of the outdoor units.

j) With regard to the installation of domestic solar hot water (DSHW), although the calculations show that if $3m^2$ of southerly facing solar collectors were installed for the dwellings; they would provide the required reduction in carbon dioxide emissions. This solution could be incorporated, but is not the preferred option at this time.

k) The initial SAP assessments calculations show that in order to achieve in excess of the 35% reduction via PV panels, a 1.0 kWp system with a southerly aspect would be required on the roofs of the dwellings. Detailed calculations of the total carbon dioxide emissions compared to the estimated carbon dioxide reduction for the proposed development can be undertaken once the detailed design has progressed to construction drawing stage.

l) For the purpose of planning and based on the figures provided by initial SAP calculations, this report has demonstrated that it is feasible, with the improvement of the building fabric, the introduction of energy efficient controls and systems and the incorporation of photovoltaic systems, a reduction in excess of 35% of the developments carbon dioxide emissions could be achieved. This complies with the requirements of the planning policies set out by Camden Council and in the London Plan.

4.0 CONCLUSION

a) In the planning policies set out by Camden Council and in the London Plan, there is a requirement for all new residential developments to achieve a reduction in carbon dioxide emissions of 35% over the 2013 Building Regulations, with a presumption that 20% of this is by renewable technology.

b) This development is for a pair of semi-detached dwellings at 8a Belmont Street, London NW1 8HJ.

c) It is proposed that in order to meet the requirements of policy this development will adopt a high standard of design with regard to energy efficiency principles and will achieve a reduction of at least 35% in the carbon dioxide emissions by energy efficiency measures and on site renewable energy generation.

k) At planning stage it is only possible to produce reports on the energy demand, carbon dioxide emissions or financial appraisals of the appropriate systems, based on the initial construction information. This report has demonstrated using initial SAP calculations that it is possible to achieve a 26.7% reduction in carbon dioxide emissions by making fabric and energy efficiency measures, with a further 12.1% reduction in carbon dioxide emissions by a PV system, resulting in a total carbon dioxide emissions reduction of more than 35.6%. It is envisaged during detailed construction design, these figures can be improved.

d) It is suggested that in order to ensure the best possible reduction in carbon dioxide emissions after consent is granted, that a planning condition is added requiring the detailed Building Regulations carbon dioxide emission calculations and proposals to be prepared and submitted prior to commencement on site.