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Doherty Design & Planning Limited

ENERGY STATEMENT

(To Accompany Detailed Planning Application)

Site

DEVELOPMENT AT 234 BATH ROAD, HAYES UB3 5AP

Proposal

EXTENSION OF AN EXISTING HOTEL

Applicant

NINE HEATHROW VENTURES LIMITED

19th December 2025

Ref: E595-ES-01

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1.0 SUMMARY OF RECOMMENDATIONS

a) This development is for the extension of an existing hotel to create an additional 108 bedrooms at 234 Bath Road, Hayes UB3 5AP.

b) It is proposed that in order to meet the requirements of Planning Policy, this development will adopt a high standard of design with regard to energy efficiency principles. This report highlights a total reduction of 44.7% in carbon dioxide emissions by the incorporation of a combination of energy efficiency measures and the provision of on-site renewable energy production equipment.

c) New efficient air source heat pumps shall be used to provide the heating for the hotel. These units will also be reversible and can be used to provide cooling if required.

d) This development is in the early stages and detailed design has not been undertaken, therefore initial calculations using SBEM modelling 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 the SBEM modeling, that it is possible to achieve a 17.5% reduction in carbon dioxide emissions by fabric improvements and energy efficiency measures, with a further 33.0% reduction by the incorporation of air source heat pumps systems. This results in a total reduction in carbon dioxide emissions of 44.7%. It is envisaged during detailed 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 accurate 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 Nine Heathrow Ventures Limited to prepare an Energy Statement to support the submission of the planning application for the development at 234 Bath Road, Hayes, UB3 5AP. 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 extension of an existing hotel to provide an additional 108 bedrooms and associated spaces.

c) The objectives of this Energy Statement are to make an appraisal of the carbon dioxide emissions of the proposed development, 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.

d) 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.

e) At this stage in the design of the hotel, the detailed working drawings have not been prepared and therefore final detailed calculations cannot be undertaken to produce the energy requirements and carbon dioxide emissions.

f) In order to follow the Energy Hierarchy outlined in the London Plan, it is proposed to use initial SBEM modelling to obtain the baseline carbon dioxide emissions figures for the development. Further SBEM modelling shall 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.

g) The suitability of supplying energy, both heat and power, through the use of a combined heat and power system shall be assessed – BE CLEAN.

h) Finally, the carbon dioxide emission saving by the use of renewable energy shall be assessed through the use of further SBEM Modelling – BE GREEN.

i) As these calculations are based on the initial design at planning stage, 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 carbon dioxide emission calculations and detailed proposals to be prepared and submitted after detailed design and prior to commencement on site.

3.0 SUSTAINABLE CONSTRUCTION AND LOW CARBON ENERGY SYSTEMS

3.1 Introduction

a) 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.

b) 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.

c) 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.

d) The developments carbon dioxide emissions have been estimated using Simplified Building Energy Method (SBEM) Modelling.

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 development, the detailed working drawings have not been prepared and therefore the final detailed carbon emission calculations cannot be undertaken to produce the carbon dioxide emissions.

b) However, the developments energy requirements and carbon dioxide emission estimates can be based on the current drawings and the construction information know as this time.

c) Table 1 below shows that the results for the development using the initial SBEM modelling figures for the hotel extension.

Development Floor Area	3,568	m^2
Energy Requirements		
Heating	87.15	$kWh/m^2/yr$
Cooling	20.47	$kWh/m^2/yr$
Auxiliary	95.64	$kWh/m^2/yr$
Lighting	38.67	$kWh/m^2/yr$
Hot Water	277.77	$kWh/m^2/yr$
Building Emission Rate		
BER	159.16	$kgCO_2/m^2/yr$
Total Predicted Development Carbon Dioxide Emissions	**567,882.9**	**$kgCO_2/yr$**

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) The energy and carbon dioxide emissions figures used above demonstrate compliance with the current Building Regulations Approved Document L2. This section shall investigate improvements over the current Building Regulations to reduce the energy demands and lower the carbon dioxide emissions of the building. These shall be further investigated and demonstrated during the detailed design process of the development.

c) Typically, these improvements can be achieved by enhancing the thermal performance of the various constructions, like the walls, roof, floors, windows, doors etc and incorporating mechanical ventilation heat recovery and improving the air tightness of the building.

a) As a result of central Government objectives, followed through at local level the general design philosophy for this site has a strong emphasis on sustainable design. This is not only in terms of the location and suitability of the site but also in relation to the way in which the building is constructed and will be used by its future occupants.

b) The first step in developing an integrated design is to establish the function of the buildings envelope and how it interacts with the usage patterns of the building and the technology used to condition the individual spaces.

c) Good fabric design can minimize the need for services. Where appropriate, designs should avoid simply excluding the environment, but should respond to factors like weather and occupancy and make good use of natural light, ventilation, solar gains and shading, where they are beneficial. In this case, the external envelope shall be retained, but enhanced where possible.

d) This section of the report will look at the ways in which energy is used within the proposed building and how the design can encourage efficient levels of energy consumption.

3.4 Building Envelope

a) Improving the building fabric will have the greatest effect on the energy demand and carbon dioxide emissions of the building.

b) The floor 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 floor constructions have been calculated as 0.12 W/m^2K.

c) 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^2K.

d) The roof areas offer excellent opportunity to enhance the insulation levels and for the purposes of these calculations, the U Value of 0.09 W/m^2K has been used.

e) 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 1.0 W/m^2K, which uses planitherm glass, argon gas and warm edge spacer bars.

f) The air leakage rate for the dwellings can be improved. The maximum allowed under the current Building Regulations Approved Document L1A:2010 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.

g) 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.

h) An insulation that is used in this development shall have global warming potential of less than 5. This shall include not only the thermal insulation, but any acoustic insulation.

3.5 Management

a) Although improvements can be made to the fabric and services of a building, often the biggest impact on the day-to-day energy consumption is influenced by the way in which the building is managed. It is common to find well-designed buildings operating badly due to poor management. Conversely, poorly designed buildings can be optimized to their maximum efficiency through good management practices.

b) It is recommended that due consideration is given to the management strategy of the buildings. There is an opportunity to provide for the most efficient management system and to encourage the future occupants to manage the hotel efficiently.

c) This may include the use of movement sensor switched lighting systems in communal areas, the installation of key/card operated lighting, heating, cooling and power services in the rooms, efficient lighting and fittings that do not permit the use of non-efficient lamps, tightly controlled heating and ventilation specific to the location within the hotel, installation of efficient hot water systems and the provision of recycling facilities.

3.6 Ventilation

a) Natural ventilation is the most energy efficient form of ventilating any space. However, as this development reuses an existing building and due to noise and air quality in the surrounding area, it may not be possible to provide natural ventilation to the hotel.

b) A system using mechanical ventilation with heat recovery shall be considered for the hotel. This conserves energy in buildings by recovering heat from extracted air and transferring it to the incoming air. This works both ways so if the outside temperature is higher than inside the exchanger helps to maintain a comfortable internal environment. The mechanical ventilation with heat recovery system ensures high air quality whilst maintaining a balance between extraction and supply.

c) Any new external grilles or louvers shall be carefully specified and installed to avoid impacting on the external elements of the building too much.

3.7 **Heating System**

a) The current proposed method of heating to be provided to the hotel is by the use of air source heat pumps. However, the final choice should be proven as efficient and appropriately designed to provide suitable conditions for the occupants and to offset the heat losses through the fabric of the buildings.

b) Air source heat pumps are used to extract the heat from the air around the building and transfer it to a heating distribution system such as under floor heating, radiators or fan coil units, using an electric pump. They are usually efficient enough to provide for all space heating requirements and in this case, can be reversed and provide cooling to the rooms as well.

c) In general terms heat pumps of all kinds are expected to operate an average output efficiency of 3:1, this means that for every 1 unit of energy used to run the system it will produce 3 units of energy as a result.

d) The use of thermostatic controls together with time switches, key/card operation and override facilities shall ensure that heating is optimally controlled to use the least amount of energy.

e) Weather compensation can be incorporated into the controls of the heating system. This will automatically adjust the flow temperature of the heating as the outside temperature rises, thus reducing the energy used by the heating system and the carbon dioxide emissions of the hotel.

3.8 **Lighting (Natural / Artificial)**

a) The proposed design makes best use of natural daylight to reduce the amount of electrical energy used to provide the minimum luminance for the required conditions. All rooms within the building apart from bathrooms and water closets should be provided with natural light via windows. The number of windows proposed and the use of dimming controls on the lighting scheme where appropriate may assist in achieving the maximum reduction of electrical consumption.

b) When selecting luminaries, consideration should be given to their inherent local power consumption and luminance levels. This together with the use of energy saving lamps will reduce the consumption of energy through lighting to a minimum. It is suggested that a development of this kind could reduce the energy usage further by installing luminaries that only allow the use of energy saving lamps.

c) Any lighting in the communal areas shall be fitted with automatic control systems, like passive infrared sensors, timeswitches or “dawn to dusk” day light sensors. These luminaires shall fitted with low energy lamps.

3.9 Hot Water Systems

a) The hot water system shall be designed to appropriate standards required by the current building regulations. This will ensure the minimum amount of heat loss from hot water pipe work by applying a high standard of thermal insulation and ensuring the correct circulation throughout the system.

b) The hot water generation plant will consist of highly efficient gas fired condensing water heaters, with a domestic solar hot water pre-heat system. The water heaters shall be selected to have low Nitrogen Oxide emissions.

c) Any hot water storage vessels shall be insulated to a high standard to minimise any heat loss.

d) It is possible, with the ever-increasing demand on the limited supply of the natural resource of water, to suitably restrict the flow of water outlets. Flow restrictors can be installed on outlets where a reduced flow is acceptable, for example on showers and basins. This system allows for a uniform maximum flow to be provided regardless of natural water pressures throughout the building.

3.10 Cold Water Systems

a) Cold water consumption can be kept to a minimum by the installation of a numbers of facilities.

b) Modern water efficient dual flush WC cisterns should be fitted as standard and as with the hot water system flow restrictors can be fitted to provide a uniform maximum flow rate throughout the building.

3.11 Sustainable methods of construction

a) Sustainable methods of construction can range from the simplest of solutions, such as construction in locations with access to sustainable modes of transport to the more complex solutions including passive solar design and rainwater harvesting.

b) The following paragraphs will briefly discuss some of the additional options available for incorporation into the scheme at this early stage or later during the detailed design process.

3.12 Sustainable Material Choices

a) A high percentage of carbon dioxide emissions are generated by unsustainable modes of transport. This is not only made up of the use of the private car but is substantially increased by the use of road as the popular way of transporting materials and goods needed for construction purposes.

b) Many opportunities are now available to Architects wishing to make more sustainable choices when specifying building materials. The consideration can include where the materials come from, its' travel distance, mode of transport, and the nature in which the material resource is manufactured and managed.

3.13 Sustainable Location

a) The proposed development is situated on the North side of Bath Road (A4) adjacent to Heathrow Airport which is located approximately 0.25 miles to the south.

b) The building is extremely well connected by road and rail. The M4 motorway (Junction 4) is approximately 2 miles to the north of the property providing excellent access to the M25 and the National Motorway Network.

c) Bath Road has numerous local bus services with some providing free access to Heathrow Terminals.

d) London Paddington can be reached in approximately 15 minutes via the Heathrow Express. The Piccadilly Line also provides a regular underground service to Central London.

e) There are numerous local amenities within one mile of the development, via safe pedestrian routes. These include food shops, postal facilities, banks, pharmacy, leisure centre, places of worship, public houses and outdoor open access public areas.

f) The development shall incorporate save, secure and weatherproof cycle storage facilities. This shall have direct access to the public highway.

3.14 **Recycling Facilities**

a) In order to encourage the hotel users to recycle waste, the hotel can be provided with recycling bins. The recycling bins could be in the form of three separate bins for different types of waste and shall be located throughout the building. They will be clearly identified and labelled.

b) External bins shall be provided for the Local Authority collection scheme and shall be located in a dedicated location as shown on the Architects drawings. This area is suitably sized and located to comply with the Local Authority's refuse guidelines for collection.

3.15 Improved Carbon Dioxide Emissions

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

Development Floor Area	3,568	m^2
Energy Requirements		
Heating	45.53	$kWh/m^2/yr$
Cooling	13.51	$kWh/m^2/yr$
Auxiliary	78.49	$kWh/m^2/yr$
Lighting	36.78	$kWh/m^2/yr$
Hot Water	256.31	$kWh/m^2/yr$
Building Emission Rate		
BER	131.36	$kgCO_2/m^2/yr$
Total Predicted Development Carbon Dioxide Emissions	**468,692.5**	**$kgCO_2/yr$**
Percentage Improvement over current Building Regulations	**17.5 %**	

Table 2 – Improved Baseline Carbon Dioxide Emissions

3.16 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 for a hotel with no leisure facilities like a pool. It is proposed to use heat pump technology for the heating and cooling of the building and therefore, as there is no pool to use as a heat dump, the size of the CHP unit would be quite small. The site base heating and electrical loads is key to the sizing and operation of any CHP system.

d) The initial assessment of a CHP system for this hotel shows that it 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.

3.17 Renewable Technologies Considered – BE GREEN

a) The requirement of planning policy, as set out by London Plan, is that the proposed developments annual carbon dioxide emission is reduced by the target of 40% over the 2010 Building Regulations, which has been clarified as 35% over the 2013 Building Regulations.

b) However, the proposed development will follow the Mayor's "Energy Hierarchy" and the final step is to reduce 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.

3.18 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 hotels, with high hot water demand, 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.
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. Although this development consists of an existing building which is to be extended, 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 amenity and parking space for the hotel. A suitable local fuel supplier is required to supply the site. It is considered at this time, there is insufficient space for this fuel storage and particle discharge may be an issue in this location
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 fuel storage space 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 building 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. On this site, a GSHP and ASHP could capable of supplying the majority of the total space heating and pre heat for the hot water demand. However, this site does not have external areas of sufficient size for the installation of ground loops for the collection of heat. With regard to the use of an ASHP system, this could be incorporated into the design of the building.
Ground/Air Source Heat Pumps		**Feasible – YES**
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 south facing 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 south facing roof could be used for the installation of solar thermal collectors. These could be mounted directly onto or incorporated into the roof. These would have to be installed at a pitch of 30-40 degrees and ideally as close to the water heaters as possible.
Solar Thermal Hot Water		**Feasible – YES**

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 built up nature of the site, the close proximity of Heathrow 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.
Wind Power		**Feasible – NO**

Table 3 – Renewable Technology Feasibility Assessment

a) From the above, it has been established above, that there are three potential way of providing energy via renewable sources appropriate for inclusion in this scheme, is by the use of air source heat pumps, solar photovoltaics and solar hot water.

b) 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.

c) The use of ground source heat pumps for this development has been excluded as it is believed that there is insufficient area for the installation of the ground loops.

d) Wind has been considered not viable for this site as there are a lot of the buildings which are likely to cause disruption to air flows and the close proximity of Heathrow Airport.

3.1 Heat Pumps

f) Heat pumps are used to extract the heat from the ground, air or water and transfer it to a heating distribution system, such as under floor heating or radiators using an electric pump. They are usually efficient enough to provide for all space heating requirements and a pre-heat for the domestic hot water systems.

g) The system would comprise of a heat exchanger either buried in the ground, or mounted on the exterior of the building, or located within a water course, and a heat pump. These would be connected to a traditional heating distribution system, like radiators, underfloor heating, fan coil units etc.

h) The system uses the latent solar energy stored in the ground or water, or the latent temperature of the air around or within the building. The heat pump upgrades the heat energy to provide the heating for the building. The heat pump operates on the same principles as a refrigeration cycle, like a domestic fridge, except the heat is retained and the cold rejected.

i) Ground source heat pumps are generally the most efficient however can be expensive to install as the heat exchanger needs to be buried under the ground. Their efficiency and practicality can also be affected by the ground conditions of the site. Water source heat pumps are only suitable where there is a water source available and when appropriate consents have been obtained to utilize this source. Air source heat pumps are generally more flexible as the heat pump and exchanger unit is usually mounted external to the building or within a garage or storage space.

j) With regard to emissions, noise and vibration, heat pump installations are pollution free and noise levels are generally low. There are no local emissions and, although there will be carbon dioxide emissions associated with their electricity use, these are much less than other forms of electric heating and can be lower than those associated with conventional gas or oil fired boilers.

k) Heat pump installations are unobtrusive. The technology used in ground-source heating systems has very low visual impact and most of the infrastructure can be hidden beneath the ground and therefore has additional land use surrounding the building. However, as the heat exchangers are buried more than 1 metre below ground, the future use of the land, for either hard or soft landscaping is not effected.

l) Many of the safety considerations appropriate to any refrigeration or air conditioning systems apply to the use of heat pumps since the working fluid is often a controlled substance that needs to be handled by trained personnel. However, once the system is commissioned, accidental release of refrigerant is unlikely.

m) In general terms heat pumps of all kinds are expected to operate an average output efficiency of 3:1, this means that for every 1 unit of energy used to run the system it will produce 3 units of energy as a result.

n) As the main principle of this development is to reuse the existing building, there is not sufficient area around the site and to incorporate ground loops to collect the heat for the building. Therefore, it is suggested that a system incorporating the use of air source heat pump systems could be used.

	Total Carbon Emissions ($kgCO_2/yr$)	Percentage Reduction (%)
Development with no Renewables	468,692.5	-
Reduction by including ASHP	154,779.8	33.0%

Table 4 – ASHP Carbon Dioxide Emissions

o) As can be seen in Table 4 above, the use of air source heat pumps could reduce the carbon dioxide emissions by 33.0%.

3.19 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) 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.

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

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

i) 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	468,692.5	-
Reduction by Incorporating ASHP	154,779.8	33.0%
Further Reduction by including PV system (50kWp)	20,373.3	6.5%
Total Reduction	175,153.1	48.3%

Table 5 – Photovoltaic Carbon Dioxide Emissions

j) As can be seen from Table 5 above, the incorporation of a 50 kWp photovoltaic system on the roof of building could reduce the carbon dioxide emissions by a further 6.5% which, in total, provides a 48.3% reduction in carbon dioxide emissions.

k) The above calculations are based on a system sized to fit the available roof area of $750m^2$. Additional area maybe available during detailed design. Further detailed calculations for the carbon dioxide emissions and system size shall be carried out during detailed design.

l) At this stage of the project, the addition of a 50kWp photovoltaic system shall not be considered further as the reduction achieved is relatively small compared to the capital cost for the installation.

3.20 Domestic Solar Hot Water System

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 pre-heat for the water heaters. 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.

e) This system would be best suited on sites where the solar thermal collectors can be located close to the water heaters within the roof plantrooms and therefore any losses can be minimised.

f) Approximately 8m^2 of solar thermal collectors could provide the hot water requirements to a gas fire water heater without the need for additional storage.

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

h) 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. On this development, the panels could be installed on the roof.

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

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

k) Incorporating a $8m^2$ evacuated tube system for each water heater, mounted south facing at a 30 degree pitch, the reduction in carbon emissions can be estimated.

	Total Carbon Emissions ($kgCO_2/yr$)	Percentage Reduction (%)
No Renewables	468,692.5	-
Reduction by Incorporating ASHP	154,779.8	33.0%
Further Reduction by including DSHW system	23,727.2	7.6%
Total Reduction	178,507	48.9%

Table 6 – Domestic Solar Hot Water Carbon Emissions

l) As can be seen from Table 6 above, the installation of a domestic solar hot water system incorporating evacuated tube solar collectors preheating the water supply to each water heater, would reduce the carbon dioxide emissions by a further 7.6%, which results in a total reduction of 48.9%.

m) At this stage of the project, the addition of the domestic solar hot water system shall not be considered further as the reduction in carbon dioxide emission has been achieved without the solar hot water system.

3.21 Annual Carbon Dioxide Emission Reduction

a) Based on the initial SBEM modelling figures, it has been calculated that the baseline carbon dioxide emissions figure for the development is 567,882.9 $kgCO_2$/year.

b) For the purposes of planning and in accordance with the London Plan, this report has demonstrated a 17.5% improvement in carbon dioxide emissions by fabric and energy efficiencies over the Building Regulations Approved Document L2. By incorporating a renewable technology, the air source heat pump systems, a further reduction of 33.0% in carbon dioxide emissions is possible, resulting in a total reduction of 44.7%.

c) The final 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 working drawing stage.

4.0 CONCLUSION

a) In the London Plan Policy 5.2 – Minimising Carbon Dioxide Emissions, there is a requirement for all new non-domestic developments to achieve a 40% improvement in carbon dioxide emissions over the Building Regulations Approved Document L2:2010. Following the revision of the Building Regulations in 2013, further advice has been issued to clarify that a 35% reduction in carbon dioxide emissions should be achieved over the Building Regulations Approved Document L2:2013.

b) This development is for the extension of an existing office building to create an additional 108 bedrooms at 234 Bath Road, Hayes, UB3 5AP.

c) It is proposed that in order to exceed 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 carbon dioxide emissions over the Building Regulations levels.

d) At planning stage it is not possible to produce the final detailed reports on the energy demand, carbon dioxide emissions or financial appraisals of the appropriate systems. However, this report has demonstrated using initial SBEM modelling that it is possible to achieve a 17.5% reduction in carbon dioxide emissions by making fabric and energy efficiency measures, with a further 33.0% reduction in carbon dioxide emissions by incorporating air source heat pump systems, resulting in a total carbon dioxide emissions reduction of more than 44.7%. It is envisaged during detailed construction design, these figures can be improved.

e) 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 detailed carbon dioxide emission calculations and proposals to be prepared and submitted prior to commencement on site.