FRANKHAM

Viacom Camden Lock Ltd
17 - 29 Hawley Crescent
Camden
Energy Statement

VIACOM

Frankham Consultancy Group
Building Services
VIMN Courtyard Infill Project

Project Number	Revision	Author	Date
225870	F2	Darren Jacobs	March 2015

Document Control

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Version	Author	Details of Revision	Date	Reviewed	Approved	Status
F	DJ	FIRST ISSUE	20/02/15	JC	ST	**FINAL**
F1	DJ	SECOND ISSUE	03/03/15	JC	ST	**FINAL**
F2	DJ	THIRD ISSUE	06/03/15	JC	ST	**FINAL**

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1.0 Executive Summary

This report has been produced by Frankham Consultancy to support the planning application for the proposed development at VIACOM's headquarters at 17-29 Hawley Crescent. The production of the Energy Strategy has followed the energy hierarchy set out in the London Plan. Thermal modelling by a suitably accredited person took place to investigate the proposed strategies. This information allowed the project to be assessed for potential CO2 emissions and to produce an energy strategy to comply with the requirements.

The London plan calls for a 35% reduction in site wide CO2 reductions below Part L 2010.

The energy strategy for the development adopted Photo-voltaics for renewable energy production via roof mounted arrays. This was considered to be the most appropriate form of renewable energy production, having followed the energy hierarchy. There will be high efficiency building services systems throughout the development delivering the heating, cooling, lighting and ventilation.

The proposed works also include the provision of thermally efficient external fabric throughout.

It was found that the CO2 reduction levels of approx 32% below Part L could be reached with the adopted energy strategy.

The following table summarises the total baseline carbon emissions in the form of $kgCO_2/m^2$ for the development, and the savings achieved by the proposed scheme following the application of passive and active energy efficiency measures, and the implementation of a Solar Photovoltaic array.

	Annual Carbon Emissions
Baseline Scheme	29,119 $kgCO_2/yr$
Proposed scheme	19,572 $kgCO_2/yr$
Annual Savings	9,547 $kgCO_2/yr$
% Reduction	32.7%

Table 1.Summary of CO_2 savings against Part L target

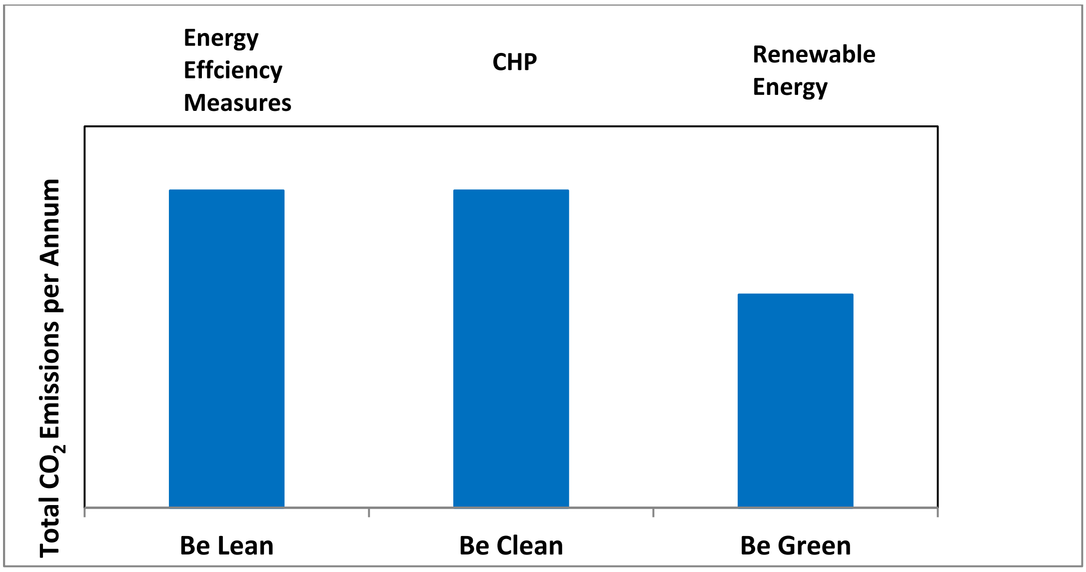

Fig.1. Graph showing reduction in CO_2 emissions against baseline

As can be seen from the tables and figure above, the proposed measures achieve a 32.7% reduction in annual Carbon Dioxide emissions. This means that the London Plan requirement of 35% reduction of CO2 emissions below Part L is not achievable with the proposed energy strategy.

There will have to be off site CO2 offsetting or another arrangement agreed with the London Borough of Camden in order to comply with this requirement.

2.0 Introduction and Context

2.1 Introduction

This report is intended to demonstrate the energy efficiency measures that will be employed within the construction of the proposed development, in order to minimise its lifetime energy consumption and the associated production of carbon dioxide. The report also aims to outline low or zero carbon technologies which are technically and financially feasible to incorporate, in addition to the application of the passive and active sustainability measures.

The final report will demonstrate the following:

- The baseline CO_2 emissions & energy demand associated with the development.
- The energy efficiency measures employed to reduce the energy demand.
- The feasibility of connecting to an existing district heating network.
- The feasibility of employing CHP and on-site renewable technologies.
- The type, location and capacity of those renewable technologies deemed feasible to reduce the building's annual CO_2 emissions.
- Final design proposals and predicted annual carbon emissions

The regulated and unregulated carbon emissions and energy consumption have been calculated using approved SBEM software, such as IES Virtual Environment.

2.2 Site Information

The proposed site is located at 17- 29 Hawley Crescent. The surrounding area is predominantly made up of office and commercial space with some residential on upper floors.

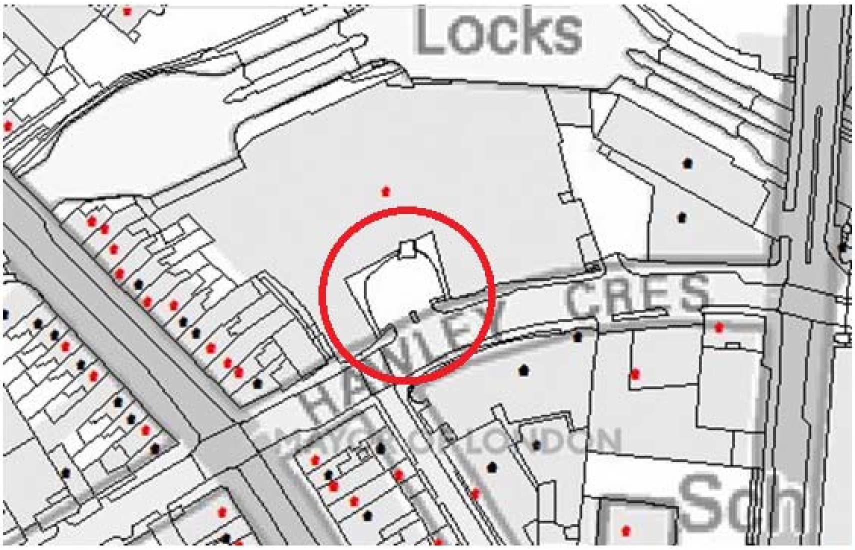

Fig.2. The proposed site location

2.3 Policy Context

London Plan Policy 5.2A requires that all "*development proposals should make the fullest contribution to minimising carbon dioxide emissions in accordance with the following energy hierarchy;*"

1. *Be Lean - Reduce energy demand*
2. *Be Clean - Supply energy efficiently*
3. *Be Green - Use renewable energy*

Policy 5.2B requires that all major developments shall achieve a 40% reduction in annual carbon dioxide emissions against the levels permitted by 2010 Building Regulations.

Policies 5.5 and 5.6 of the London Plan 2011 encourage developers to utilise or connect to existing heat networks, or to consider constructing new networks where none already exist, where this is feasible.

Policy 5.6 states "*major development proposals should select energy systems in accordance with the following hierarchy;*"

1. *Connecting to Existing District Networks*

2. *Site wide Combined Heat & Power network*

3. *Communal Heating and Cooling*

This is further supplemented by paragraph 5.38 which says "*In this area of policy, as all others, feasibility includes questions of financial and technical viability*" which "*will ensure that requirements are not imposed on the development that could lead to uneconomic costs on occupiers*."

In addition, paragraph 5.42 of the London Plan 2011 states "there is a presumption that all major development proposals will seek to reduce carbon dioxide emissions by at least 20% through the use of on-site renewable energy generation wherever feasible".

This report will set out how the proposed development responds to these planning policies.

3.0 Demand Reduction (Be Lean)

As outlined above, there is a planning requirement for the proposed development to achieve a 40% reduction in annual Carbon Dioxide Emissions beyond the 2010 Building Regulations targets, and to achieve a 20% reduction in site wide carbon dioxide emissions through on-site renewable energy generation.

In accordance with London Plan Policy 5.2, the following Energy Hierarchy has been applied to the development of the design, ensuring that carbon savings are delivered through passive and active energy efficiency measures, prior to the application of any on-site renewable energy generation.

1. Be Lean - Reduce energy demand
2. Be Clean - Supply energy efficiently
3. Be Green - Use renewable energy

If the heating system is taken as an example (being a significant use of energy within a building) the first step taken to reduce energy demand is to assess the factors that can reduce the amount of energy needed (being lean) to maintain the internal temperature, through improving the insulating properties of the building fabric.

When aiming to "be lean" the key elements which have an impact and need to be considered in the architectural design are:

- The building's shape & geometry;
- The materials selected for the building fabric;
- The air permeability of the building envelope;
- Passive solar control devices;
- Natural ventilation.

After the passive measures above have been fully exhausted, the fixed building services which provide a comfortable environment for the end user (e.g. heating system) must then be as efficient as possible in the way they convert fuel or electrical energy to ensure that we “be clean”. The following systems have to be carefully assessed and selected to achieve this aim:

- Heating system;
- Ventilation system;
- Lighting system;
- Hot water generation system.

Each of the elements described above must be assessed in partnership to ensure the design team deliver an energy efficient building that not only complies with the Building Regulations and Planning requirements, but also meets the needs of the future occupiers.

The energy strategy for the proposed development is currently under review, therfore, the following section describes the proposed energy efficiency measures (“lean”) that are being considered for the site to reduce energy demand and the associated emissions of Carbon Dioxide, *prior to the application of on-site renewable energy generation* (“being green”).

3.1 The Building’s Geometry

The shape and orientation of the proposed buildings has a significant impact upon potential energy consumption. For example, should the majority of the glazing be south facing and exposed to direct sunlight, a greater amount of energy may be required in the form of cooling to prevent over-heating when compared to a building with glazing that predominantly faces north.

Conversely, concentrating a larger proportion of the glazing on the south façade of the building will capture a greater amount of natural daylight and reduce the usage of the indoor lighting, offering a significant reduction in energy consumption for lighting in comparison to an overshadowed building.
The key to a successful design is to balance these conflicting requirements to minimise the net annual carbon emissions whilst still providing a comfortable internal environment.

In the case of this particular development, the size and shape of the site place constraints on the orientation and form of the buildings. However, there are still passive energy efficiency measures which can be feasibly employed within the design, and these are being reviewed.

3.2 The Building Fabric

The choice of materials selected to build the structure have a dramatic effect upon the energy required to heat and cool the building. By improving the U-values (a measure of insulation, the lower the number the better) and thus reducing the heat lost from the building, less energy will be consumed with a resultant reduction in annual CO_2 emissions.

Most building users will be aware of the benefit of reducing heat loss in a winter scenario, and will understand the principle of achieving this through increased insulation performance.

However, careful selection of the building fabric is equally important to performance in summer conditions, and is usually manifested in the cooling and lighting loads. One area where this is extremely important is the specification of the glazing. There are three key parameters which have been considered;

i) The amount of insulation provided by the window (u-value).

ii) The amount of solar heat energy able to pass through the window (g-value).

iii) The amount of visible light able to pass through the window (visible light transmittance).

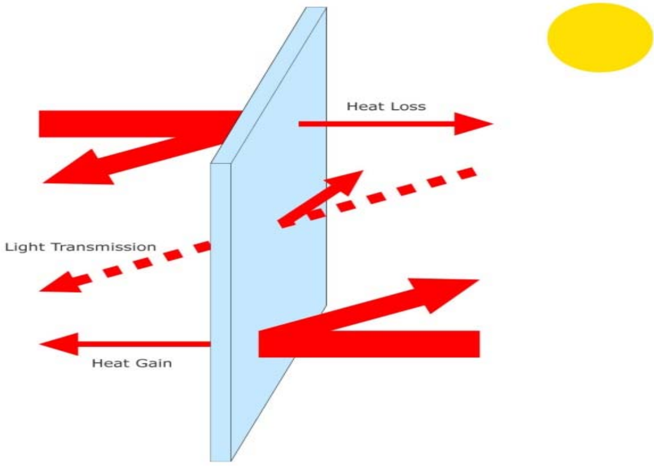

Fig.3. Energy flow through glazing

These three parameters have been carefully reviewed to select a glazing specification that minimises heat loss and therefore boiler loads (u-value), reduces the risk for potential overheating through controlling solar heat gain (g-value) and minimises the amount of artificial lighting that will be required through day-lighting (visible light transmittance).

Table 2 indicates the proposed performance specification that the fabric of the proposed development will achieve. The proposed U-values are shown against the current minimum requirements of the Building Regulations.

Construction Element	**ADL1A U-Value W/m²K**	**Proposed U-Value for Flats W/m²K**	**Proposed *G-Values**
Walls	0.3	0.15	-
Ground/exposed floors	0.25	0.15	-
Roofs	0.20	0.1	-
Window (incl. roof windows, roof lights etc).	2.0	1.4	0.57
Pedestrian doors and high usage entrance doors	2.0	2.25	0.57

Table 2. Summary of proposed building fabric values.

3.3 Air Permeability/Thermal Bridging

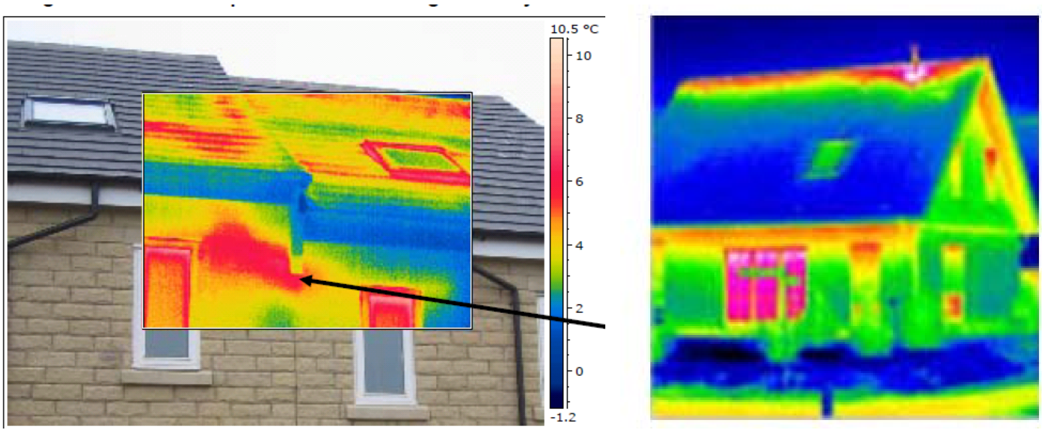

Fig.4. Thermal image from a typical House

The Air Permeability rating of a building (a measure of uncontrolled air infiltration) has become as important an issue as the improvement of the building's insulation. More heat is lost through poor building construction and resulting air leakage, than through the fabric in modern buildings.

The development will be designed to achieve an air permeability rate of $3m^3/m^2$/hour at 50 Pa.

The air tightness of the new build areas of the development shall be tested by an accredited assessor upon practical completion of the building in accordance with Approved Document L2B.

The second area that will be achieved through careful detailing will be the reduction of heat lost across non-repeating thermal bridges. The building will also be designed and constructed to accredited construction details to ensure that thermal bridging is minimised.

4.0 Heating & Cooling Infrastructure including CHP (Be Lean)

In accordance with the London Plan energy hierarchy, having incorporated measures to reduce energy demand within the design of the proposed development, the next stage is to investigate measures to supply the required energy efficiently.

This section of the report addresses these requirements, and discusses how it applies to the proposed development.

4.1 Policy Context

Policies 5.5 and 5.6 of the London Plan 2011 encourage developers to utilise or connect to existing heat networks, or to consider where feasible constructing new networks where they do not already exist.

Policy 5.6 states "*major development proposals should select energy systems in accordance with the following hierarchy;*"

1. *Connecting to Existing District Networks*
2. *Site wide Combined Heat & Power network*
3. *Communal Heating and Cooling*

This is further supplemented by paragraph 5.38 which says "*In this area of policy, as all others, feasibility includes questions of financial and technical viability*" which "*will ensure that requirements are not imposed on the development that could lead to uneconomic costs on occupiers*."

In accordance with this policy, and its supporting text, we set out an assessment of the feasibility of these energy systems.

4.2 Connecting to Existing District Networks

The London Heat Map (www.londonheatmap.org.uk) is an online tool which exists to enable information relating to large heat loads and energy supplies within the Greater London area to be collated and searched. By using the tool to search the areas adjacent to a site, local authorities and developers can locate within a given area; areas of high heat demand, major heat supply plant that may have surplus capacity, and existing and proposed district heating networks. Hence it is possible to identify any opportunities that may exist for connecting a proposed development to an existing network, proposals for future networks that could be connected to the proposed development, or identify centres of significant energy demand which could help the viability of a proposed new heat network.

Figure 7 below is an extract from the London Heat Map, with the site of the proposed development indicated within the red circle.

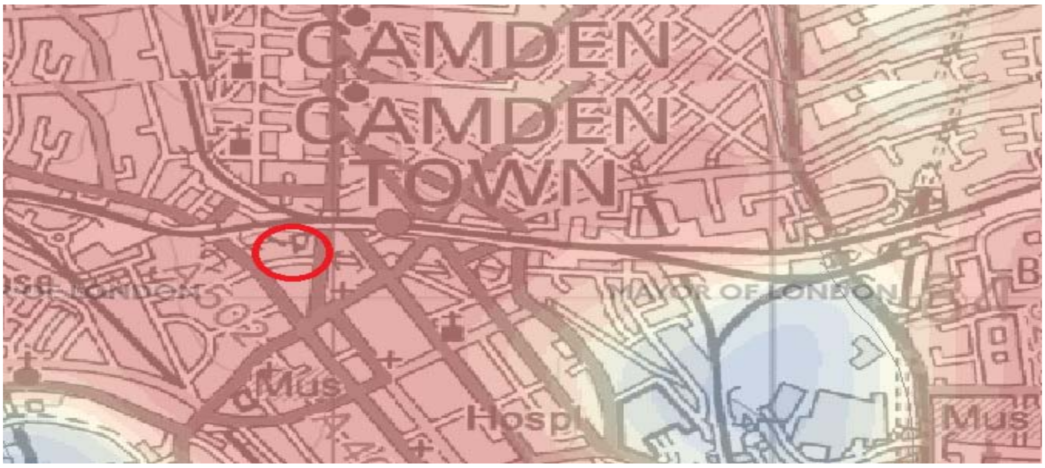

Figure 5: Extract from the London Heat Map.

As indicated in figure 5 above, the proposed development is within an area where there are existing or proposed district heating networks that could be connected to the site.

The creation of a new heat network for the proposed development would not be viable, as the only requirement for low temperature hot water is to serve the roof air-handling unit re-heat coil and domestic hot water services, both of which will be connected to the existing central heating system. As such, the creation of, or connection to, a district heating network is not viable in the case of this development.

4.3 Site Wide Combined Heat & Power

Combined heat and power (CHP) can provide an effective means of generating heat and electricity on site. However it requires careful consideration. If installed in the wrong application, i.e. in a building where there is not a relatively constant heating and electricity demand, it will not deliver the energy and carbon emissions reductions, and place uneconomic costs on the operators for the lifetime of the system.

The following table is based on the CIBSE TM38 “Reset method” for analysing the feasibility of Low or Zero Carbon Technologies;

Will the CHP plant operate for more than 4,500 hours per year?	No
Will the buildings have a year round demand for heat? (E.g. Swimming pool heating, canteen, washroom, or process use).	Yes
Is there a reliable base load for electricity between 7:00am and midnight?	No
Is there a requirement for heating distribution systems to operate at temperatures in excess of 80°C	No

Table 3: CIBSE TM38 Feasibility Analysis Checklist

The London Plan aims to encourage development proposals to evaluate the feasibility of decentralised energy supply methods. Usually this means combined heat and power units (CHP) fired by natural gas, biomass or municipal waste, serving individual buildings, groups of buildings or entire development sites by means of a heat network. By generating electricity on-site rather than at distant power stations, more efficient use is made of the primary energy source. If the fuel is biogas or biomass then the opportunity exists for very high levels of carbon reduction to be achieved.

Given the benefits of CHP, it is understandable why the London Plan favours its use where practical. However, it is a technology with very specific requirements, and is not suitable in every development. Being heat-led, CHP needs a year-round demand for heating and hot water to be viable. This pattern of demand will not be experienced in the proposed development, but is more often associated with developments such as swimming pools and hospitals, which help provide the necessary demand profile.

For this reason, CHP is considered unsuitable for this particular development.

4.3.1 The Proposed Heating System

The existing gas-fired boiler installation will be used to generate low temperature hot water (LTHW) for the new development.

New circulating pumps are to be installed to create a new constant temperature heating circuit to serve the new air handling plant as required.

The LTHW heating system will operate using optimum flow and return temperatures to allow the system to operate at the highest possible efficiency, operating the boiler in condensing mode.

All pipe work shall be thermally insulated in accordance with Approved Document L2B to minimise system losses.

Heating System Summary	
Heating Source	Modular Gas Fired Boilers
Seasonal Efficiency (SEDBUK)	88%

Table 4. Proposed Heating System

4.4 Hot Water

Hot water services will be provided by the same heating source for the space heating system. Hot water will be extended from the existing hot water system to serve the new development.

All pipe work will be thermally insulated to reduce system losses. There will be no pumped secondary return.

4.5 Ventilation

The offices will be served by a central air handling unit located at roof level. The unit shall be fitted with high efficiency fans, air source heat pump and heat recovery devices. Toilets will be served via extract ventilation systems.

4.6 Lighting

The use of electrical energy for lighting is a major element of the site's total energy usage. The fixed lighting shall utilise low energy fittings throughout.

The use of natural day-lighting will be maximised throughout the scheme to minimise the quantity of energy consumed by lighting.

Low energy fixed lighting will be installed in all rooms.

4.7 Results – Energy Efficiency Saving

The buildings were modelled using IES accredited software to analyse the CO2 emissions of the buildings with the various energy strategies in comparison with "notional" building, which produces the "Target" rate against which the emissions are compared.

The table below shows the baseline emissions and the resultant emissions of the proposed scheme following the application of the energy efficiency measures.

As can be seen from the table below, the improvements made to the building fabric and the efficiency of the building services beyond the 2010 building regulations, have produced a significant overall saving in annual carbon dioxide emissions of 1,750 kgCO_2/yr, equating to a 6.3% reduction compared with the baseline scheme.

	Annual Carbon Emissions
Baseline Scheme	27,846 kgCO_2/yr
Proposed scheme	26,096 kgCO_2/yr
Annual Savings	**1,750 kgCO_2/yr**
% Reduction	**6.3%**

Table 5 Proposed energy efficiency measures against 2010 Part L compliant baseline.

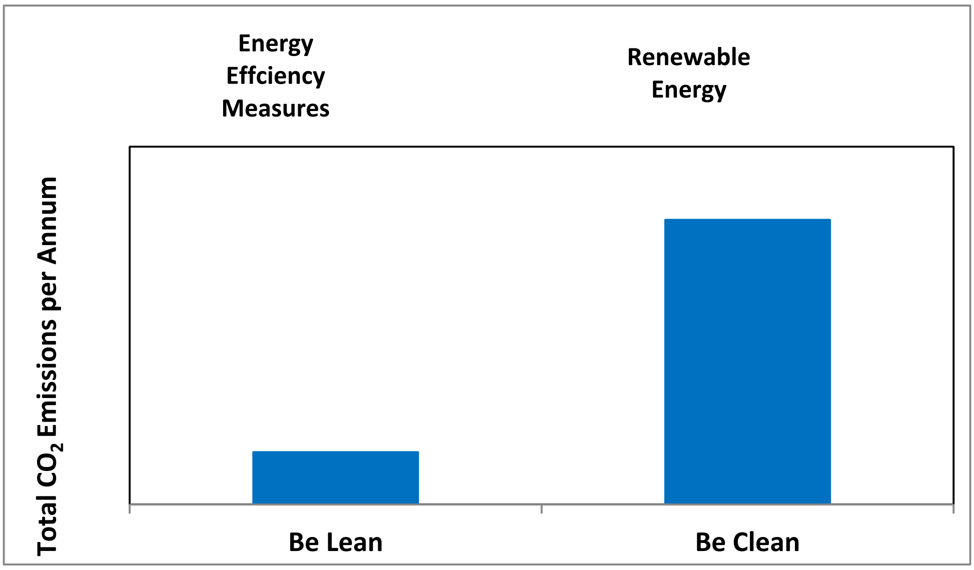

Fig.6. Graph showing reduction in CO_2 emissions against baseline after energy efficiency measures.

5.0 Renewable Energy (Be Green)

It is the aim of the design team to achieve a total reduction in annual carbon dioxide of at least 25% over the Part L 2010 target for the proposed development, and to achieve a 20% CO_2 reduction against the baseline building through the application of on-site renewable electric generation.

This section of the report will discuss the appropriate on-site renewable energy generating technologies required to achieve this target.

5.1 Initial Site Assessment

The proposed site has been assessed for the suitability of installing on-site renewable technologies for the purpose of on-site energy generation. The technologies considered are as follows:

- Solar Thermal Hot Water;
- Solar Photovoltaic Electricity;
- Biomass Boilers;
- Air Source Heat Pumps;
- Ground Source Heat Pumps;
- Wind Turbine Electricity.

Water driven technologies, such as tidal & wave power, have been dismissed due to the site's geographical location.

Having conducted an initial assessment utilising the CIBSE RESET method, figure 7 provides a visual indication of which technologies are deemed to be technically feasible. Further explanation is included for each technology under the appropriate headings.

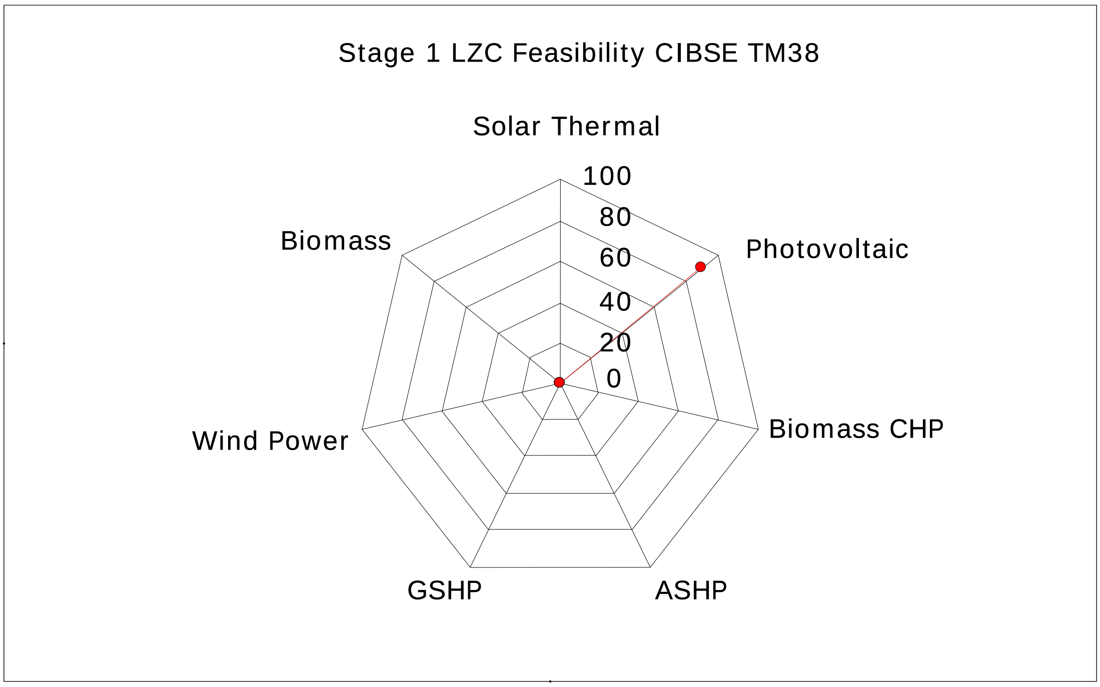

Fig 7.TM38 tool Spidergram showing feasibility of renewable technology options.

5.2 Solar Thermal Hot Water

Will the building have either a flat roof or a roof facing within 45° of south available for use?	Yes
Will the building have a year round demand for hot water (e.g. for swimming pool heating, canteen, washroom, showers, or ('process use')?	No
Is there space for hot water storage adjacent to the collectors?	No

Solar Thermal Hot Water systems operate by passing cold water through a roof-mounted solar collector, which is designed to absorb heat from solar radiation, and transfer that to the water passing through it. This warm water is distributed back to a hot water cylinder, where it is used to raise the temperature of the water required for use in wash hand basins and showers for example. The domestic water may need further heating to reach the desired temperature with the assistance of traditional water heating plant.

Such a system does not generate noise, and doesn't require the use of any additional land, as it would be located upon the roof of the building.

5.3 Solar Photovoltaic Electricity

Will the building have either a flat roof or a roof facing within 45° of south available for use?	Yes
Are high quality cladding materials proposed for the building, which could be replaced with photovoltaic materials?	No
Will the building be free from overshadowing for most of the day from other buildings, structures and other objects (e.g. trees)?	Yes

Solar Photovoltaic electricity generation is a widely recognised form of renewable energy generation, generating electrical current (DC) when sunlight hits a semi-conductor material (Silicon crystals). This DC current is then converted to a usable AC current via an inverter, from where a connection to the building's electrical distribution system will be made.

PV is a clean and silent form of renewable energy generation and as such would cause no disturbance to the occupants and neighbouring buildings. With the roof space available, the system would not require the use of any additional land.

PV requires little maintenance, and with the panels set at 30° they are effectively self-cleaning, requiring an annual clean and inspection. They also have a lifespan of 50 years, in comparison to solar thermal panels that may need replacement within 15 years (with the exception of the inverters, which have a 15 year lifespan).

5.4 Combined Heat and Power

Is there a reliable base heating load over a 12 month period?	No
Is there a reliable base load for electricity between 7:00am and midnight?	No
Will the CHP plant operate for more than 5000 hours per year?	No
Is there a requirement for heating distribution systems to operate at temperatures in excess of 80°C	No

There is insufficient seasonal heat demand over a 24 hour period to maintain this technology, therefore, it is unviable. For CHP plant to be feasible, the system needs to be in operation in excess of 4500 hours per year. There is no heating load during the summer, and the hot water load is intermittent, so would not provide a suitable base load.

Such a system would require careful consideration to mitigate the noise it generates.

There are alternative systems which are more suitable for the proposed development which will be pursued. CHP has been dismissed as a feasible option for this development.

5.5 Ground Source Heat Pumps

Is the heating system for the proposed building/development served by a low temperature heating circuit?	Yes
Is there sufficient accessible ground space around the building/development to install a horizontal closed loop system?	No
Is the ground free from obstructions such as sewers, tunnels, etc?	No

Due to the compressed nature of the site there will be no suitable space for the location of horizontal or bore hole ground heat exchangers.

The use of ground source heat pumps would significantly increase the area of land affected by the development, as well as adding significantly to the scope of works and construction budget.

For these reasons a ground source heat pump system is not considered feasible.

5.6 Air Source Heat Pumps

Is the heating system for the proposed building/development served by a low temperature heating circuit?	No
Is there sufficient plant space allowed in the building/development to install the system?	No

Air source heat pumps offer the same advantages as ground-source heat pumps (energy and carbon savings compared to conventional heating systems) but without the need for costly or disruptive ground works. This makes them suited to new developments, particularly for well-insulated buildings.

Air source heat pumps operate on the same principle as ground source heat pumps, with the important difference that they use an outdoor fan unit to collect energy from the ambient air. This low-grade heat is then 'upgraded' into heat suitable for supplying heating and hot water systems, through the use of an electric pump and refrigerant compression circuit. An internal immersion heater is provided to provide a boost to the system on the coldest days.

The outdoor fan unit(s) would be situated discretely within a dedicated enclosure and coupled to an indoor communal hot water storage cylinder. The hot water produced is at a lower temperature compared to a boiler, therefore, underfloor heating should be used instead of radiators – this offers a number of benefits to the occupant, including a more even room temperature and more freedom to locate furniture.

5.7 Biomass Boilers

Is there potential for local supply and delivery of biomass fuel?	No
Is the proposed boiler house location such that it can be served by biomass, with adequate facilities for storage?	No

Biomass boilers are widely acknowledged as being a cost effective method of introducing renewable technologies.

However, there are greater operational issues to consider. Fuel must be delivered in bulk, and this has implications in terms of storage and delivery arrangements. Biomass heating in city areas can be undesirable, with local authorities not wishing for buildings to contribute to the already high level of nitrogen oxides present in the air due to traffic pollution.

The advantages of biomass heating, therefore, have to be balanced against the practical issues, particularly in built-up areas where air pollution levels may already be high and opportunities for delivering fuel may be limited.

As such, Biomass boilers have been discounted as a technically viable solution for the proposed development.

5.8 Wind Turbine Electricity

Is the average wind speed on site greater than 7 m/s	No
Is the area free from obstructions which could interfere with the wind flow turbulence?	No
Is the site in or near either of the following? • Conservation area • Area of historic interest • Metropolitan open land • Green belt	No

Small horizontal-axis wind turbines (HAWTs) mounted onto the roofs of buildings are not generally recommended in urban and sub-urban areas as there is a high risk of local and planning opposition, for questionable benefit. Research carried out into the effectiveness of roof-mounted wind turbines has found that their performance in practice falls well short of manufacturers' claims. This is because the wind speeds needed to produce useful amounts of energy are found only in open areas and not in built-up areas. Furthermore, most turbines are designed to operate in a clear air stream, free of the turbulent airflows that occur around buildings and obstacles. As such, when placed upon a building, their performance is generally poor and less predictable.

For this reason, small wind turbines are not considered to be a feasible option for this development

6.0 CO_2 Offset by on-Site Renewable Energy Generation

Having concluded that a Solar Photovoltaic system is the most technically feasible low and zero carbon technology to be employed at the site, it was necessary to determine the annual carbon savings that would be achieved by the employment of such a system.

At this stage of the design, it is not possible to give precise sizes for the required Solar PV array. However, the results assume an array size of $145m^2$. There should be sufficient space on the roofs to meet the 25% requirements of CO2 emissions below Part L 2010. However, the final amount of PV which can be accommodated and the subsequent overall reduction in emissions cannot be stated at this time.

The following table indicates the annual CO_2 emissions savings of the energy efficiency measures, should the above system be installed. The figures have been calculated using IES.

	Annual Carbon Emissions
Proposed Scheme after Energy Efficiency Measures	26,096 $kgCO_2$/yr
Proposed scheme	19,572 $kgCO_2$/yr
Annual Savings	**6,524 $kgCO_2$/yr**
% Reduction	**25%**

Table 5. CO_2 savings due to Photovoltaic.

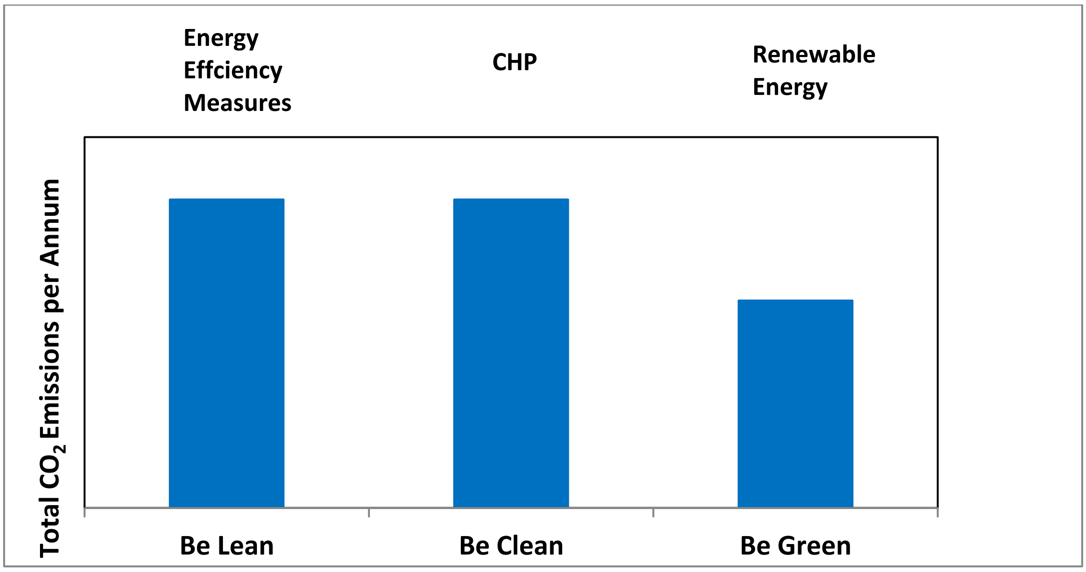

Fig.8. Graph showing reduction in CO_2 emissions against baseline after renewable technology was employed.

7.0 Conclusion

In addition to the passive and active energy efficiency measures described in section 3, a Solar Photovoltaic array with a peak output in the order of 30kWp will be installed, resulting in a 25% reduction in annual Carbon Dioxide emissions against the 2010 Part L target.

It has been determined that the most feasible low or zero carbon technology for incorporation within the scheme is the Solar Photovoltaic array described above, which alone will satisfy the London Plan (2011) requirement to achieve a 25% reduction in annual carbon emissions through on-site renewable energy generation.

	Annual Carbon Emissions
Baseline Scheme	29,119 kgCO_2/yr
Proposed Efficiency Measures	26,096 kgCO_2/yr
Final Proposed Scheme	19,572 kgCO_2/yr
Total Annual Savings	**9,547 kgCO_2/yr**
Total % Reduction	**32.7%**

As demonstrated in Table 6 above, the energy efficiency measures combined with on-site renewable energy generation achieve a 32.7% reduction in annual CO_2 emissions or 9,547 kgCO_2 per year against a Part L compliant baseline for the development.

This does not quite meet the London Plan requirement for 35% reductions.

It will therefore be necessary to look for offsite offset of CO2 reductions or seek alternatives in agreement with the London Borough of Camden.