UNIVERSITY OF LONDON

GARDEN HALLS, UNIVERSITY OF LONDON

Energy Statement

March 2013

Table of Contents

Executive Summary

This Energy Statement will outline the key features and strategies adopted by the development team to reduce energy use in the proposed redevelopment of Cartwright Gardens Student Accommodation. The strategy for reducing energy use and associated carbon emissions through the design of the scheme follows the London Plan energy hierarchy, namely:

- Reducing the energy demand through passive design strategies and provision of high quality building envelope
- Reducing the energy consumption through best practice design of building services, lighting and control
- Installation of on-site Renewable Energy Technologies

Passive and active energy efficiency features include:

- High performance building fabric
- Excellent air tightness
- Highly efficient building services design
- High efficiency lighting

This energy efficient design proposals achieve the following:

- Carbon emissions reduction of the building is in excess of 28%, compared to the Part L 2010 standards for new buildings.
- A site wide Combined Heat and Power system is proposed to meet the base heating and hot water demand of the development.
- The scheme also incorporates renewable energy systems in the form of photovoltaic panels to provide electricity.

Table 1 demonstrates the reduction in the regulated carbon emission of the development as a result of implementing the abovementioned strategies. The total non-regulated carbon dioxide emission of the development according to NCM guidelines is around 400 tonnes per year. Estimating reductions in non-regulated carbon dioxide emissions is challenging as reductions will generally be based on the operational regime of the site and users behaviour. The building will be operated by UPP (University Partnerships Programme) who have extensive experience of operating student accommodation. Based on other developments they manage we would estimate that the suggested strategies could reduce operational carbon emissions by 10-20%.

Table 1 Carbon Dioxide emissions reduction for the development

Carbon Dioxide emissions (Tonnes CO_2 per annum)	
Building Regulations 2010 Part L Compliant Development	1,452
After Energy demand reduction	1,330
After CHP	1,064
After Renewable energy	1,041

Table 2 demonstrates the calculated CO_2 savings, which will be realised from each proposed technology. As demonstrated below overall 28.3% reduction in carbon emission can be achieved applying the proposed strategies.

Table 2 Regulated carbon dioxide savings from each stage of the Energy Hierarchy

Regulated carbon dioxide savings	Tonnes CO_2 per annum	%
Savings from energy demand reductions	123	8.4
Savings from CHP	266	20.0
Savings from Renewable Systems	22	2.1
Total Cumulative Savings	411	28.3

Figure 1 is a graphical representation of the total carbon emission saved using the proposed efficiency, low and zero carbon strategies.

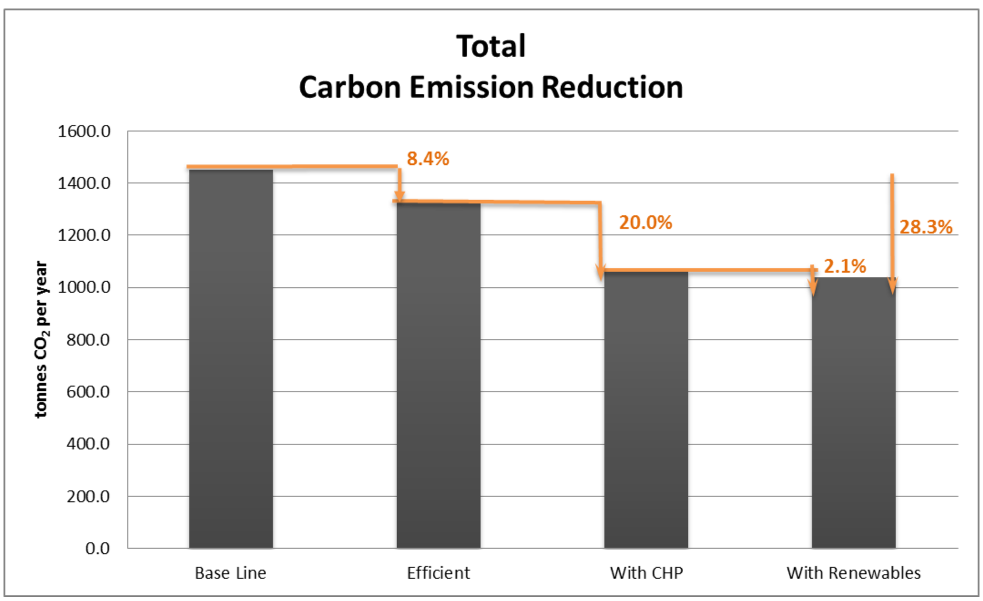


Figure 1 CO_2 reduction achievable from proposed strategies

1 Introduction

This Energy Statement provides an outline of the energy strategy that has been developed and will be implemented in the detailed design of the proposed development.

Over recent years, global public opinion has been increasingly concerned with the state of the environment and the impact of climate change. Buildings account for almost half of the energy consumption and carbon emissions in the UK[1]. This highlights the need for building owners, developers and designers to design environmentally sustainable buildings.

1.1 The Development

The Garden Halls are located on Cartwright Gardens to the south of Euston Road in the London Borough of Camden (see Figure 2). The application is for the redevelopment of the existing student accommodation, comprising the demolition of Canterbury (including York) and Commonwealth Halls, partial-demolition and refurbishment of Hughes Parry Hall and provision of new student accommodation (Sui Generis) to provide a net increase of 187 units (from 1,013 to 1,200 student bedspaces); associated ancillary uses (including Communal areas); two external courtyards; together with public realm improvements to Cartwright Gardens and the surrounding area

This Report outlines the proposed energy and sustainability strategy for the proposed refurbishment and new build development at Cartwright Gardens, Camden.

For a detailed description of the proposed development please refer to the Design and Access statement produced by TP Bennett architects and Maccreanor Lavington Architects.

Figure 2 Existing Situation- Plan

Table 3 is a schedule of proposed student accommodation blocks with a breakdown of areas and the total Net Internal Area per block. As demonstrated, the total Net Internal Area of student accommodation units is circa 22,432 m^2 and the total number of rooms is 1200.

[1] DCLG (Department for Communities and Local Government), 2007, A guide for businesses: Reducing the energy usage and carbon emissions from your heating and hot water systems,

Table 3 Schedule of Proposed Student Accommodation Blocks

Total Development	NIA	GIA	GEA
basement	-	-	-
lower ground	4,104	4,015	4,271
ground	2,770	3,789	4,031
1st	2,187	3,436	3,710
2nd	2,288	3,555	3,831
3rd	2,288	3,555	3,831
4th	2,250	3,541	3,821
5th	1,874	2,964	3,189
6th	1,611	2,554	2,763
7th	859	1,421	1,550
8th	836	1,380	1,519
9th	227	382	421
10th	227	382	421
11th	227	382	421
12th	227	382	421
13th	227	382	421
14th	231	368	424
15th	-	-	-
16th	-	-	-
totals	22432	32488	35045

En suite [C]	660
Mini clusters [SC]	61
Dis en suite [C]	48
Dis studio [SC]	12
HP en suite [SC]	245
Wardenial flat [SC]	2
Wardenial ensuite [C]	-
Town House rooms [SC]	172
total rooms	1,200

2 Overview of Environmental Standards, Targets and Policies

This section provides an overview of the environmental rating schemes, mandatory regulations and policy documents applicable to the development.

Key national policy documents consulted in the development of this report and environmental strategies include:

- The European Directive on the Energy Performance of Buildings (EPBD)
- The National Planning Policy Framework (March 2012)
- Energy White Paper, "Creating a Low Carbon Economy"[2]

In addition to the standards, targets and policies discussed above, the relevant British Standards; and CIBSE Guidelines were used to assist in determining the most appropriate Ecologically Sustainable Design (ESD) initiatives for the development.

Key regional environmental policy and guidance documents consulted in the development of this

- The London Plan – Spatial Development Strategy for Greater London[3], July 2011.
- Sustainable Design and Construction - London Plan Supplementary Planning Guidance (SPG)[4], May 2006

Key local environmental policy and guidance documents consulted in the development of this

- The Camden Council - Core Strategy – adopted 2010
- Camden Development Policies 2010-2025, Local Development Framework
- Camden Planning Guidance, Sustainability (CPG3)

Finally, Part L of the Building Regulations – 2010 is the basis of the calculations and methodology used in this document.

2 Energy White Paper, "Creating a Low Carbon Economy", http://www.berr.gov.uk/files/file10719.pdf

3 The London plan – Spatial Development Strategy for Greater London, http://www.london.gov.uk/mayor/strategies/sds/london_plan/lon_plan_all.pdf

4 Sustainable Design and Construction – Supplementary Planning Guidance (SPG), http://www.london.gov.uk/mayor/strategies/sds/docs/spg-sustainable-design.pdf

2.1 London Plan Requirements

In July 2011 the Mayor published the replacement spatial development strategy for Greater London: The London Plan (2011). This part of the report summarises the relevant energy policies and the project response to each policy.

2.1.1 Carbon Dioxide Emission (Policy 5.2)

POLICY 5.2 Carbon Dioxide Emission

The new London Plan:

- Follows the energy hierarchy (Figure 3) in order to minimise the carbon dioxide emission.
- Requires total carbon emission reduction of 25% in comparison to a Part L compliant building.
- Explicitly asks that the calculation of the energy demand and carbon dioxide emissions from unregulated energy use to be carried out.
- Asks for the energy statements to follow energy assessment methodology (Figure 4)

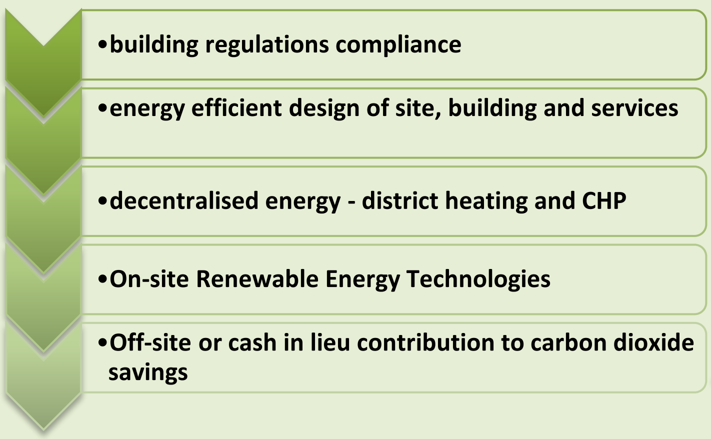


Figure 4 Energy Assessment Methodology

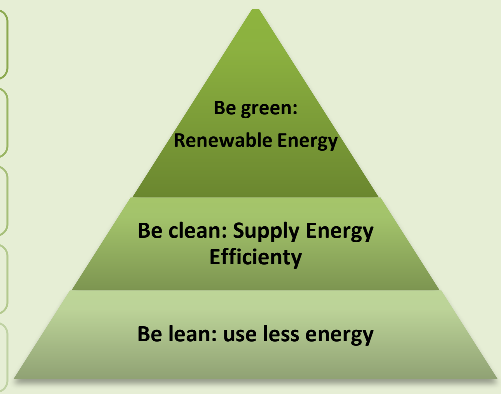


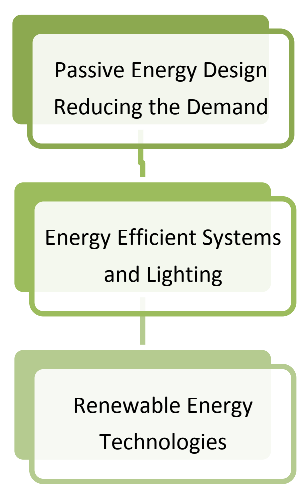
Figure 3 Energy Hierarchy

In order to design an energy efficient development, the design team has followed this hierarchy; i.e.

a. The development is designed to have highly efficient envelope and passive strategies have been incorporated in the design where possible.

b. Efficient building services and lighting are chosen for the development for reducing the energy consumption

c. Renewable Energy options are explored and the most feasible options are used in the development.



This report also covers the non-regulated energy use of the development based on a typical usage of the buildings category and lists a number of strategies in order to reduce this.

The report structure and content is organised based on the London Plan required Energy Assessment Methodology.

2.1.2 Decentralised Energy in development proposals (Policy 5.6)

POLICY 5.6 Decentralised Energy in Development Proposals

- Development proposals should evaluate the feasibility of Combined Heat and Power (CHP) systems, and where a new CHP system is appropriate also examine opportunities to extend the system beyond the site boundary to adjacent sites.
- The London plan requires all major developments to follow a decentralised energy hierarchy when selecting the energy system for the development.

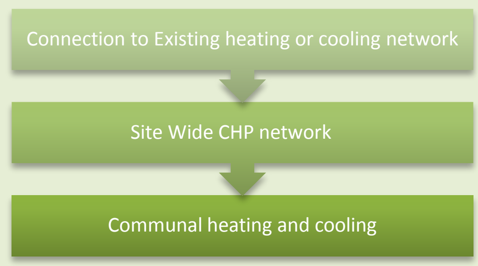


Figure 6 Decentralised Energy Hierarchy

The design team has explored opportunities for installation of decentralised energy system including CHP system. This report includes a summary of the findings.

2.1.3 Renewable Energy (Policy 5.7)

POLICY 5.7 Renewable Energy

- The London Plan Asks that within the energy hierarchy, part of the carbon emission reduction of the development, should come from on-site renewable energy generation where feasible.
- 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.
- Development proposals should seek to utilise renewable energy technologies such as: biomass heating; cooling and electricity; renewable energy from waste; photovoltaic; solar water heating; wind and heat pumps.

This report summarises the feasibility of different renewable systems and explains the output of the options that were chosen as a result of the feasibility studies.

2.1.4 Overheating and cooling (policy 5.9)

POLICY 5.9 Overheating and Cooling Policy

- Major Developments should reduce potential overheating and reliance on air conditioning systems in accordance with the cooling hierarchy (Figure 7)
- Major development proposals should demonstrate how the design, materials, construction and operation of the development would minimise the overheating and also meet its cooling needs.

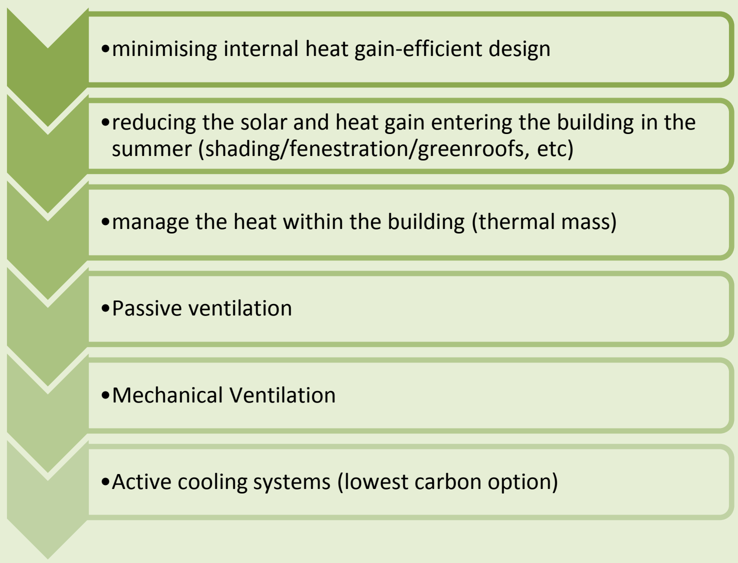


Figure 7 Cooling Hierarchy

Where appropriate, these strategies, which are implemented in order to reduce the overheating risk in the buildings, are covered in this report under passive strategies.

2.2 Camden Core Strategy

Camden Council adopted their Core Strategy in 2010 and subsequently released a set of planning guidance adopted in April 2011.

Camden POLICY CS 13 Tackling climate change through promoting higher environmental standards

- Policy CS13 – Tackling Climate Change though promoting higher environmental standards

Reducing the effects of and adapting to climate change

The council will require all development to take measures to minimise the effects of, and adapt to, climate change and encourage all developments to meet the highest feasible environmental standards that are financially viable during construction and occupation.

a. ensuring patterns of land use that minimise the need to travel by car and help support local energy networks;
b. promoting the efficient use of land and buildings;
c. minimising carbon emissions from the redevelopment, construction and occupation of buildings by implementing, in order, all of the elements of the following energy hierarchy:
   1. ensuring developments use less energy,
   2. making use of energy from efficient sources, such as the King's Cross, Gower Street, Bloomsbury and proposed Euston Road decentralised energy networks;
   3. generating renewable energy on-site;
d. Ensuring buildings and spaces are designed to cope with, and minimise the effects of, climate change.

The Council will have regard to the cost of installing measures to tackle climate change as well as the cumulative future costs of delaying reductions in carbon dioxide emissions

Local energy generation

The Council will promote local energy generation and networks by:

e. working with our partners and developers to implement local energy networks in the parts of Camden most likely to support them, i.e. in the vicinity of:

– housing estates with community heating or the potential for community heating and other uses with large heating loads;
– the growth areas of King's Cross; Euston; Tottenham Court Road; West Hampstead Interchange and Holborn;
– schools to be redeveloped as part of Building Schools for the Future programme;
– existing or approved combined heat and power/local energy networks and other locations where land ownership would facilitate their implementation.

f. protecting existing local energy networks where possible (e.g. at Gower Street and Bloomsbury) and safeguarding potential network routes (e.g. Euston Road);

Camden's carbon reduction measures

The Council will take a lead in tackling climate change by:

j. taking measures to reduce its own carbon emissions;
k. trialling new energy efficient technologies, where feasible; and
l. raising awareness on mitigation and adaptation measures.

2.3 Camden Development Policies

Camden Development Policies forms part of the council's Local Development Framework (LDF), the group of document that sets out Camden Planning strategy and policies.

DP22 . Promoting Sustainable Design and Construction

Under DP22, one of the main requirements to do with Energy Efficiency and LZC technology, is following:

e) expecting non-domestic developments of 500sqm of floor space or above to achieve "very good" in BREEAM assessments and "excellent" from 2016 and encouraging zero carbon from 2019

Sustainable design and construction measures

The Council will require all schemes to consider these general sustainable development principles, along with the detailed elements identified in the table below, from the start of the design process. Developments of 5 or more dwellings or 500sqm of any floor space should address sustainable development principles in their Design and Access statements or in a separate Energy Efficiency Statement, including how these principles have contributed to reductions in carbon dioxide emissions. When justifying the chosen design with regards to sustainability the following appropriate points must be considered:

Design	Fabric/Services
• the layout of uses • floor plates size/depth • floor to ceiling heights • location, size and depth of windows • limiting excessive solar gain • reducing the need for artificial lighting • shading methods, both on or around the building • optimising natural ventilation • design for and inclusion of renewable • energy technology • impact on existing renewable and low carbon technologies in the area • sustainable urban drainage, including • provision of a green or brown roof • adequate storage space for recyclable material, composting where possible • bicycle storage • measures to adapt to climate change • impact on microclimate	• level of insulation • choice of materials, including - responsible • sourcing, re-use and recycled content • air tightness • efficient heating, cooling and lighting systems • effective building management system • the source of energy used • metering • counteracting the heat expelled from plant equipment • enhancement of/provision for biodiversity • efficient water use • re-use of water • educational elements, for example visible • meters • on-going management and review

This document lists the energy efficiency strategies adopted for the development and demonstrates how above issues are addressed in Cartwright Gardens Student Accommodation.

3 Building Regulation Compliance

The proposal includes refurbishment of Hughes Parry Hall and redevelopment of the Garden Halls student accommodation. The refurbishment of the existing buildings requires compliance with Building Regulations Approved PartL1B. The new student accommodation buildings must comply with Building Regulations Approved Part L1A.

Meeting the requirements of Part L1A 2010 for the new development will be achieved through:

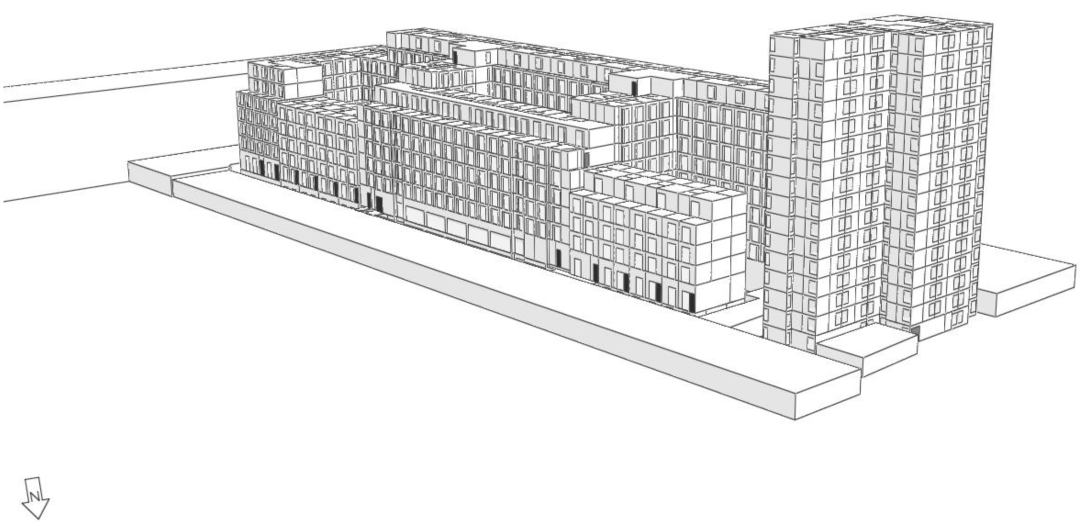
- **Efficient Thermal Elements and Controlled fittings:** the building fabric will be designed to improve on minimum Part L 2010 requirements.
- **Building Services and Lighting:** The new building services will be designed and specified to perform better than the minimum requirements detailed in Non-Domestic Building Services Compliance Guide, 2010 edition.

Meeting the requirements of Part L1B 2010 for the existing building will be achieved through:

- **Efficient Thermal Elements and Controlled fittings:** where feasible, the building fabric will be improved to reduce the energy demand of the building.
- **Building Services and Lighting:** The building services will be replaced and specified to meet current standards.

3.1 Building Energy Model

For the purpose of this study, the buildings are modelled IES-VE software- Version 6.4.0.11. The modelling and analysis have been completed by Mecserve's energy modelling team who are accredited energy assessors.[5]



[5] Nazli Dabidian; Low Carbon Energy Assessor accredited to work on Level 3, level 4 and level 5 Buildings; accreditation number: LCEA119469

3.2 Baseline Carbon Emission Rate

Although the building is comprised of a new part and a refurbished part (Hughes Parry Hall), both buildings are modelled together and compared against the higher standards of a new building. This is a conservative assumption as the refurbished Hughes Parry Hall is being compared against the targets for a new building. The client and the development team are keen to refurbish the existing building to very high standards in line with the new building. The target emission rate for the combined building based on Part L2A, 2010 is calculated as 1,452 tonnes.

4 Energy Efficient Design of Site, Building and Services

4.1 Passive Design Strategies

The first stage of the energy strategy is to reduce the energy demand as much as possible before considering active and renewable energy technologies. The aspiration is to build a high quality student accommodation scheme with an enhanced energy performance.

This will be achieved through:

- **Building Orientation**- The buildings' orientations are largely dictated by the shape of the site. Having said that, the internal layout of the building has been set out to maximise the number of rooms that can take advantage of solar gain and natural light. This has been achieved by arranging the buildings around a courtyard. This arrangement, also enables a natural ventilation strategy to work effectively.
- **Passive Solar Design and Daylight-** The make-up of the façade balances the proportion of solid wall to glazing in order to seek an optimum amount of daylight and winter solar heating, without excessive solar gain during the summer.
- **Thermal performance of the fabric**- the proposed building fabric exceeds the requirements set in the Part L regulations
- **Thermal bridges** - Appropriate construction details will be used to minimise the impact of thermal bridges within the building envelope in the new development. The refurbishment part of the development will be carried out carefully to reduce the impact of thermal bridging.
- **Air-tightness** - Using enhanced construction skills and rigorous detailing to reduce the air permeability of the buildings

The table below shows the proposed specifications for the fabric of the development including air permeability.

Table 4 Target Specifications

Fabric Specifications		Proposed Specification
Fabric U values [W/m2.K]	Roofs	0.2
	New Walls	0.25
	Ground floor	0.20
	Windows /Doors	2 (ground floor curtain walling) 1.4 (All other floors)
Air permeability [m3/m2.hr@50pa]		5

Achieving the above values will reduce the energy demand of the development in advance of adding any active energy efficiency measures or renewable energy systems to the development.

4.2 Energy Efficient Systems

After reducing the energy demand of the development, the next stage would be to use energy efficient building services, lighting and controls for the development. This will include:

- **Heating and Hot Water:** best practice design in the heating including highly efficient condensing boilers and very well insulated pipes is proposed for the development.
- **Cooling:** No cooling is proposed for the bedrooms or studios. Cooling will be limited to communal and function areas generally at ground floor level. Cooling may be installed for the ground floor flexible areas depending on the function. Therefore the thermal model includes cooling these areas
- **Ventilation:** the majority of the building is naturally ventilated with extract ventilation in bathrooms and kitchens.
- **Heat recovery:** where mechanical ventilation is installed, they will include heat recovery and demand control systems to reduce the energy associated with mechanical ventilation
- **Building services insulation:** The hot water tanks, pipes and ducts will be insulated to a high standard.
- **Lighting:** The lighting design will consider how to reduce power density for the required lighting level. Daylight control and occupancy sensors will be installed for lighting system in some areas Inclusion of enhanced controls will help reduce the energy consumption of the building further.

Table 5 Energy Efficient Systems (a summary of the energy efficient systems which will be specified)

<table>
<tr><th>System Specifications</th><th colspan="4">Efficient Building</th></tr>
<tr><td>Boiler Seasonal Efficiency</td><td colspan="4">95%</td></tr>
<tr><td rowspan="3">Ventilation</td><td colspan="4">Natural Ventilation to bedrooms</td></tr>
<tr><td colspan="4">Extract ventilation to bathrooms
(Local Specific Fan Power: 0.5 W/l/s)</td></tr>
<tr><td colspan="4">Common areas provided with central ventilation with 65% Heat Recovery:
(Central Specific Fan Power: 1.8)</td></tr>
<tr><td>Cooling</td><td colspan="4">VRV to front of house areas & DX units in Comms room (SCoP min 3.5; SEER min 4.5)</td></tr>
<tr><td>Pumps</td><td colspan="4">Variable Speed Pumps</td></tr>
<tr><td>Hot Water</td><td colspan="4">Boiler fed super insulated tanks</td></tr>
<tr><td>Controls</td><td colspan="4">BMS control, Temperature and time control within zones,
Weather compensation</td></tr>
<tr><td rowspan="9">Light fittings Efficacy (lm/W)</td><td colspan="4">Efficient lighting design in all areas</td></tr>
<tr><td>Bedroom</td><td>72</td><td>Office</td><td>65</td></tr>
<tr><td>Bathroom</td><td>85</td><td>Meeting room</td><td>65</td></tr>
<tr><td>Living</td><td>60</td><td>Comms room</td><td>60</td></tr>
<tr><td>Kitchen</td><td>70</td><td>Storage</td><td>55</td></tr>
<tr><td>Dining</td><td>70</td><td>Food preparation</td><td>60</td></tr>
<tr><td>Corridor</td><td>60</td><td rowspan="2">Eating and drinking</td><td rowspan="2">60</td></tr>
<tr><td>Lounge</td><td>55</td></tr>
<tr><td>Reception</td><td>55</td><td>Plantroom</td><td>70</td></tr>
<tr><td>Lighting Controls</td><td colspan="4">Occupancy controls in all communal areas and bathrooms, Manual controls in the bedroom (manual override where necessary), daylight sensors in lounge, office, eating and drinking areas</td></tr>
</table>

4.3 Overheating And Cooling policy

The project design has followed the overheating and cooling hierarchy as required by London Plan. (See paragraph 2.1.4)

- **Minimising internal heat gain-efficient design:** where possible the internal gains are minimised. This includes highly efficient design of light fittings and Selecting highly efficient A rate equipments to reduce the small power and internal gain
- **Reducing the solar and heat gain:** the areas of the windows are not excessive; in the rooms with higher solar gain, high performance solar control glazing is specified which prevents excessive solar heating during the summar, but does not reduce daylight/ winter solar gain excessively.
- **Manage the heat within the building (thermal mass):** the internal leaf of the walls has high thermal mass and the area of the light weight windows is not excessive, therefore the internal temperature will benefit from the wall's thermal mass where possible.
- **Passive ventilation**: Openable windows are being used to provide natural ventilation to the building where feasible.
- **Mechanical Ventilation:** Mechanical Ventilation is not proposed for the accomodation as above strategies will be sufficient to remove heat and provide fresh air to the units. Mechanical ventilation will be provided to kitchens and bathroom sin accordance with Approved Document Part F.
- **Active cooling systems (lowest carbon option)**: No Cooling is proposed for the student accomodation. Active cooling systems are provided to front of house areas not suitable for natural ventilation.

4.4 Energy Consumption and Carbon Emission of the Efficient Buildings

4.4.1 Carbon emission savings of the efficient buildings

Implementing all the passive and active energy strategies listed in sections 4.1, 4.1 and 4.3, the carbon dioxide emission of the new student accomodaiton buildings is reduced from 1,452 $kgCO_2/m^2$ to 1330. $kgCO_2/m^2$. Figure 8 demonstrates that the reduction in Carbon Emission of the buildings is 8.4%.

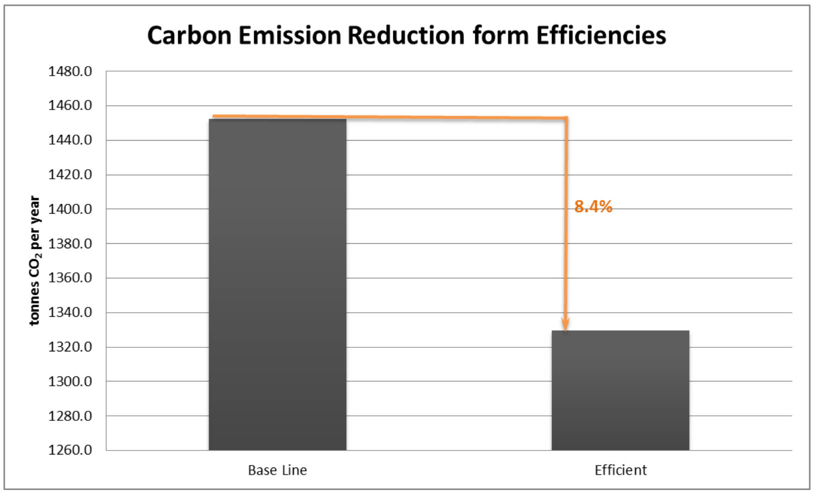


Figure 8 New Development, Carbon reduction due to efficiency measures

4.4.2 Breakdown of the regulated Energy Consumption & Carbon Emission

Based on the energy calculations completed for the development, The graphs below (Figure 9) demonstrate the breakdown of the regulated energy consumption and regulated carbon emission of the development after applying the efficiency measures listed in this report.

The most significant contributions are from Domestic Hot Water and Heating Respectively. Please note that the graphs do not include equipment loads. The non-regulated energy consumption and carbon emission is covered in section 4.5.

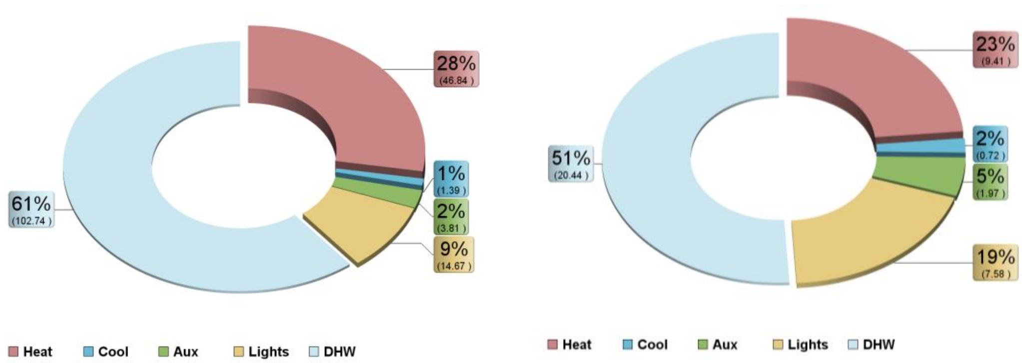


Figure 9 Breakdown of the Energy Consumption and Carbon Emissions for the development

4.5 Non-Regulated Energy Use

The London Plan (2011) requires that the energy demand and carbon dioxide emissions of the non-regulated end uses should also be calculated and reported in the energy assessments.

Based on the National Calculation Methodology, the total Carbon Emission of the non-regulated end users of the buildings is calculated. The total carbon emissions of the development from cooking and equipments is circa 400 tonnes per year.

Following strategies are proposed to reduce the non-regulated energy demand of the development:

- A rated appliance: The kitchens will be fitted out with highly efficient A rated appliances only.
- Installation of energy meters with display monitor for each unit to get the occupants more interested and involved in how energy is being used in their unit.
- Information will be provided to occupants which will explain the operations of energy centre and PV panels and how energy efficient behaviour will reduce the cost/carbon emissions of the development.

5 Decentralised Energy – District Heating

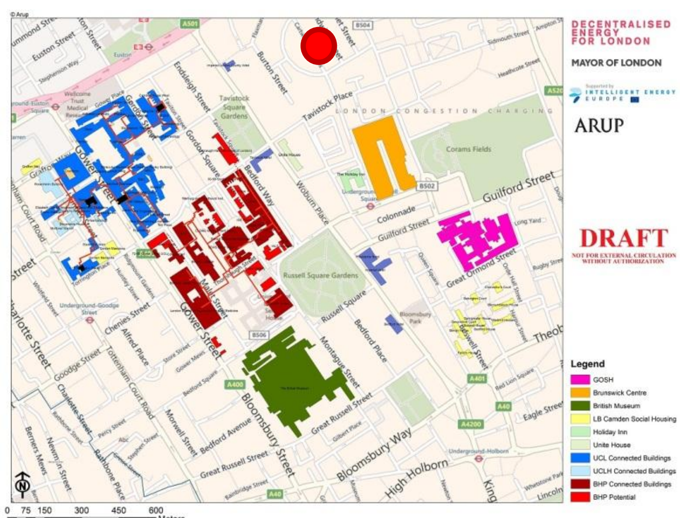
In accordance with the decentralised energy hierarchy, the connection to existing district heat networks, site wide Combined Heat and Power (CHP) and incorporation of CHP in the buildings has been considered for the scheme.

5.1 Existing District heating

There are a number of district heat networks in the local area. The development team have consulted with the parties responsible for these networks to investigate the feasibility of getting the student accommodation to an existing network.

Our discussions are summarised below:

- We initially spoke to Stephen McKinnell, the energy manager at SOAS who is responsible for the SOAS Energy network. He informed us that they are currently concentrating on investment in the central plant serving their existing network rather than expansion. They do have plans to extend the network, these plans are at their early stages and are in general terms aimed at extending the network south towards Great Ormond Street Hospital and the British Museum. Stephen refered us back to Harold Garner at Camden and Stuart Allison at Arup for a wider perspective.
- We spoke to Stuart Allison at Arup who are spearheading the masterplanning of the Bloomsbury heat network on behalf of the Decentralised Energy Body. Stuart confirmed that although the proposal was to extend the Bloomsbury network there is no fixed timescale in which to do this or any firm plan that it would extend towards our site. The Arup team are in dialogue with the operators of the decentralised networks in the area including the Argent, Kings Cross, Euston Road, UCL Gower Street and SOAS networks. We agreed that we would provide our baseline calculations to Arup so that any future considerations could take into account our scheme. Please find below the the map of the proposed Bloomsbury Area DH as it stands.



- Finally, we spoke to Harold Garner at Camden Council. He acknowledged that we had approached the right people in relation to the scheme. We outlined how we were designing the buildings with basement heating and hot water plant which would allow for a technically straightforward change to a district energy network connection at some point in the future should this become available.

Figure 10 below taken from the London Heat Map shows the location of the site and the location of the proposed Euston Road district heating network (red routes). The purple areas on the maps, shows the areas with potential for district heating network and the site is just outside the opportunity area.

Figure 10 London Heat Map and the location of the site

Connection to an expanded Bloomsbury district heating network may be possible in the future. However, currently there is no clear information available on completion date and details of the operation of the district heating. The building therefore, will have its stand-alone communal heating system, but will be designed to technically allow future connection to district heating network when the network becomes operational. Subject to technical and financial feasibility at the time and subject to commercial agreements, the client will connect the building to the district heating network in future.

5.2 Site Wide Combined Heat and Power

The site represents a good opportunity for installation of site wide combined heat and power. This will help in reducing the carbon emission of the site dramatically. The following graphs show the annual heating and hot water demand of the site based on the energy calculations.[6] The hot water demand included in the graph below is based on hourly estimation of hot water demand.[7]

[6] The figures demonstrated on the graphs are based on initial energy calculations only and the real M&E design figures may be slightly different for the development. The CHP will be sized based on the detailed design and heat loss/gain calculations at a later stage.

[7] The graph here (Figure 11) shows the hourly demand and ignores the hot water tank capacity. The next graphs includes the hot water tank capacity as well. The CHP is sized to be able to fill the Hot Water Tank continuously.

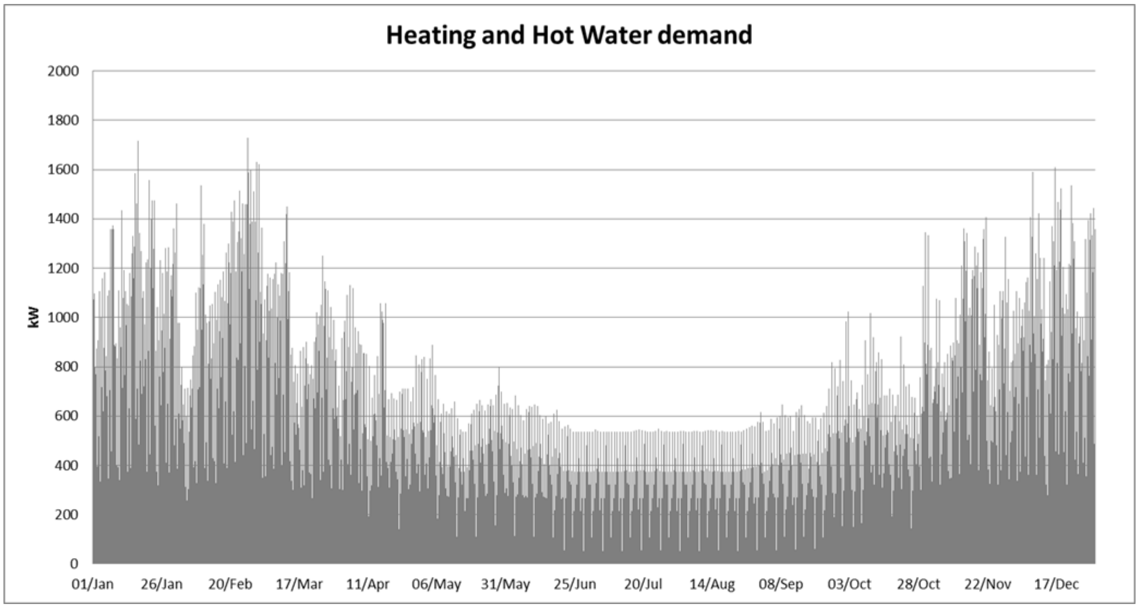


Figure 11 Annual Heating and Hot Water Load

It is recommended that three number CHP units should be installed for the site to allow the system to modulate according to heating/hot water demand. This will allow the system to match the demand closely and therefore to run for longer hours and save more carbon. Figure 12 shows the total heating and hot water requirement of the development throughout a year and it demonstrates how 3No.CHP units, with circa 109 kW heating output each[8], could meet the base demand of the development in winter. Under normal operation all three CHP units will work for more than 6500 hours per year whereby the first unit works almost continuously.

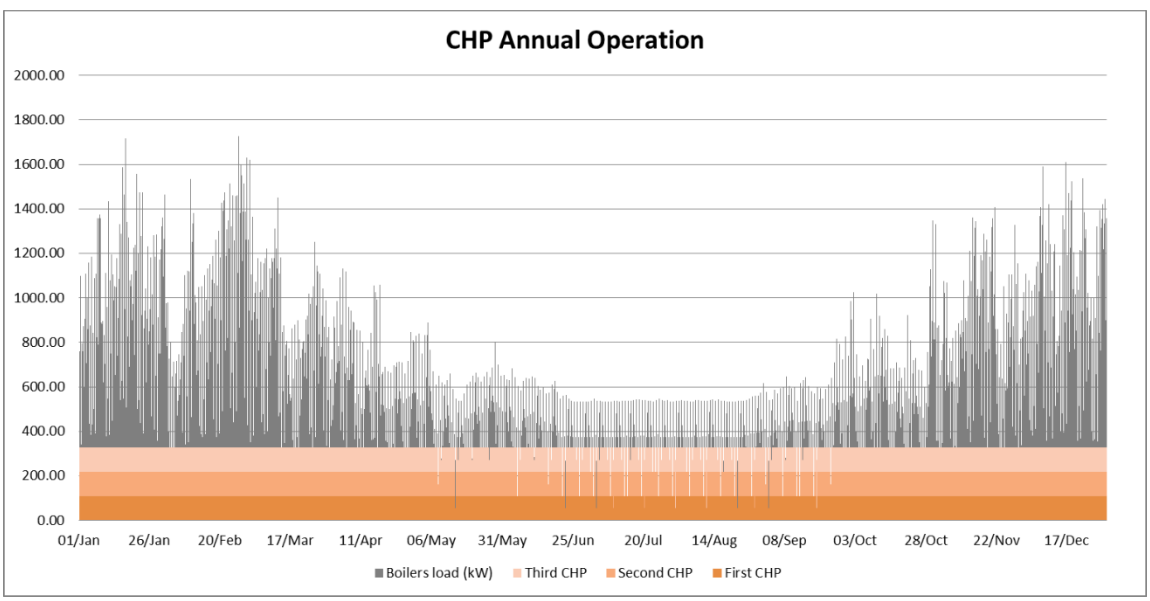


Figure 12 Annual Heating demand met by CHP units

[8] As noted before, the figures are based on initial energy calculation and not detailed M&E design. The appropriate size of CHP can be only determined after full heat loss analyses is completed for the site.

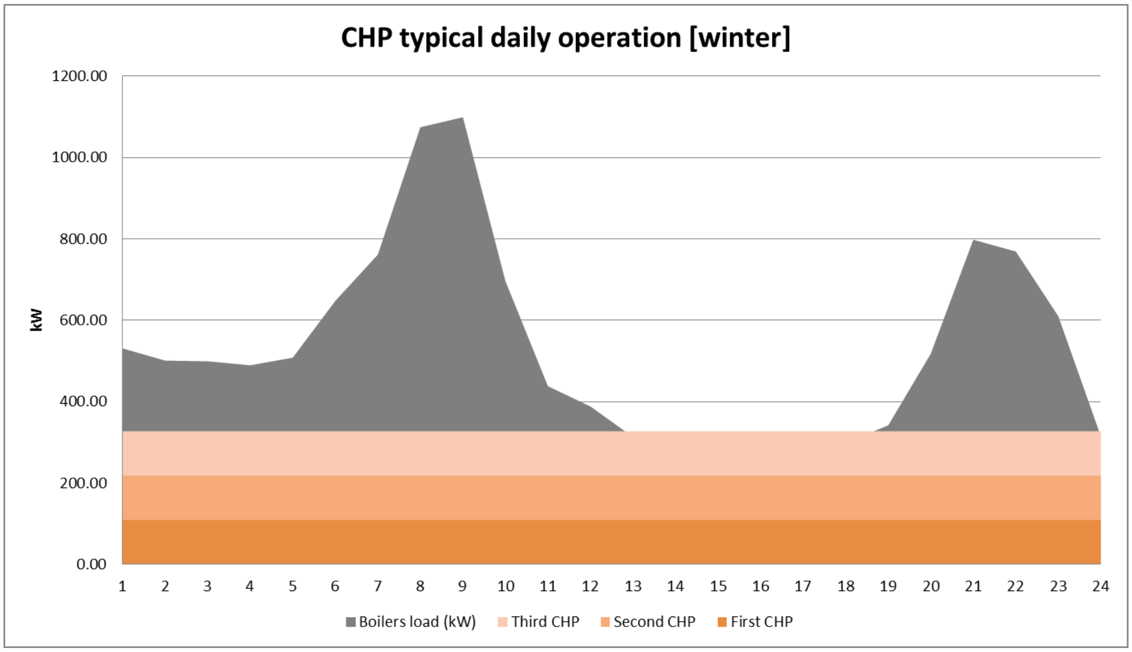


Figure 13 typical winter day CHP operations

Around 65% of the total annual heating/hot water requirement of the site will be provided through communal CHP system. Total CO_2 savings from this is approximately 311 tonnes per year.

Table 6 Total Carbon Emissions saved through CHP system

CHP Carbon Saving	Energy [MWh]	Carbon [Tonnes CO_2]
Heating output	2,099	462
Electricity output	1,348	713
Total Natural gas input (gross)	4,364	864
Saving		**311**

Provisionally, the scheme is designed such that the energy centre will be located in the basement of the building and will serve both buildings together. The buildings on the site, including Hughes Parry Tower and Garden Halls, will be connected to the central network.

5.3 Combined Heat and Power in the Buildings

Since Site Wide CHP is proposed for the site to cover the base line heating demand, small scale CHP will not be considered for the site.

6 On Site Renewable Energy Technologies

In order to further reduce emissions from the development in accordance with the local authority policies it is necessary to consider the introduction of renewable energy systems on site. A high-level assessment has identified the technology most appropriate to this site. This statement provides only brief commentary on technologies not considered appropriate in the appendix A.

6.1 Photovoltaic Panels

Installation of Photovoltaic panels on the roofs of the development is considered and a full shading analysis is completed for the site. Please see Appendix B which shows a summary of our shading analyses graphically.

To mitigate the effect of climate change and reduce the heat island effect and to increase biodiversity at the site, green roof is proposed for some blocks. (for further details of green roof please refer to Sustainability Statement by Mecserve and the Design and Access Statement and Drawings by the Architects). Figure 14 demonstrates a view of PV panels on the roof. Appendix C shows the *possible locations* for installation of PV panels. The details of the proposed PV panels will be confirmed at the detailed design stage by MCS accredited body responsible for design and installation of PV panels. The current layout is based on 10 degrees inclination and South-West / South-East facing panels.

The energy output of the PV panels will be either used to meet the demand of the development, or will be exported to the grid. Feed in Tariffs will be applicable to the installation according to current legislation and the PV panels will generate revenue each year.

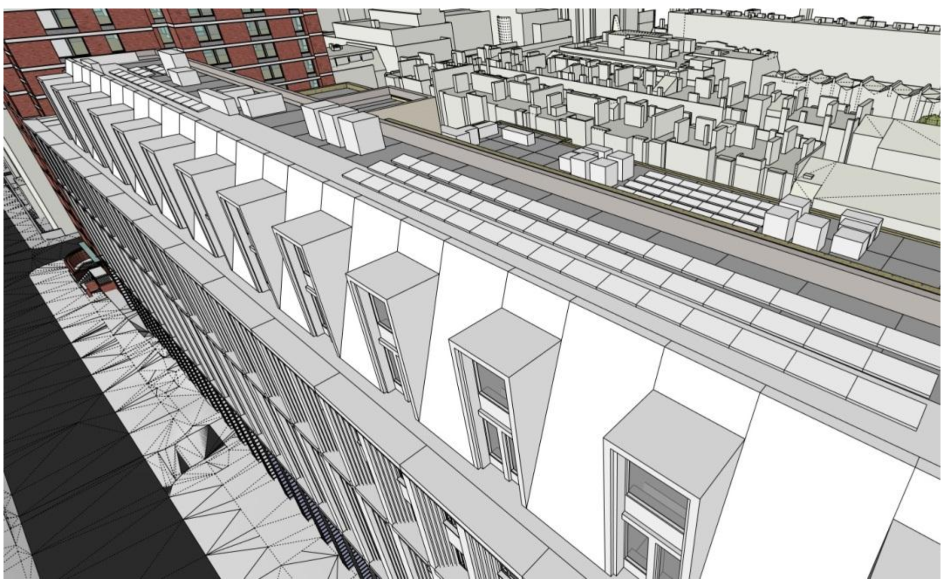


Figure 14 PV panel installation on the roof

A total of 250 PV panels are proposed to be installed on the roof. Overall, circa 400 m^2 of the roof area will be used for installation of PV panels. The total peak power generated by photovoltaic panels will be around 50 kW. The installation will result in a saving approximately 22.5 tonnes of carbon per year. Table 7 is a summary of the contribution of photovoltaic panel installation to the reduction in energy consumption and carbon emissions of the building.

PV panels [number of panels]	Per panel power [kWp]	Total Power [kWp]	Total generated electricity [MWh]	Total Carbon Savings [tonnes CO2/year]
250	200	50	42.5	22.48

Table 7 Photovoltaics' Energy generation and Carbon Reduction

6.2 Summary of the recommended Systems

Based on the feasibility study carried out (please refer to Appendix A for the summary of the study), it is recommended that photovoltaic panels would be the most suitable renewable technology for the site.

7 Conclusions

This energy statement outlines the key features and strategies adopted by the development team to reduce energy use and carbon emissions for the scheme. The strategy for reducing energy use and associated carbon emissions through the design of the scheme follows a three-step approach.

- Reducing the energy demand through passive design strategies and provision of high quality building envelope for all the blocks
- Reducing the energy consumption through best practice design of building services, lighting and control
- Installation of on-site Renewable Energy Technologies

Passive and active energy efficiency features include:

- High performance building fabric
- Excellent air tightness
- Efficient building services
- High efficiency lighting

For non-regulated energy use, energy efficiency features that are proposed include:

- A-rated appliances
- Installation of meters with user-friendly display screens for occupants

A site wide Combined Heat and Power system is proposed to meet the base heating and hot water demand of the development.

The scheme also incorporates renewable energy systems in the form of photovoltaic panels to provide electricity.

This energy performance statement has demonstrated that the new development has the carbon emissions reduction in excess of 25% compared to the Part L 2010 standards.

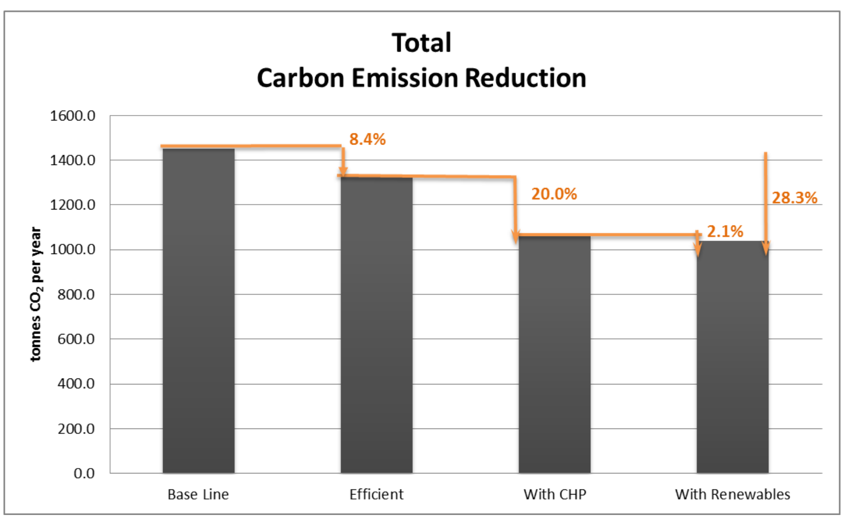


Figure 15 Total Carbon Emission Reduction for the site

A Summary of the carbon savings, that will be realised as a result of implementing the strategies recommended in this report can be found in the following table.

Regulated carbon dioxide savings		
	Tonnes CO_2 per annum	%
Savings from energy demand reductions	**123**	**8.4**
Savings from CHP	**266**	**20.0**
Savings from Renewable Systems	**22**	**2.1**
Total Cumulative Savings	**411**	**28.3**

Appendix A – Renewable Energy Systems not feasible for the site:

I. Biomass Heating

The scale of the development is large and it is located in central London, thus there are concerns with the supply chain and the reliability of supply throughout the life of project. The impact of frequent fuel deliveries on local traffic and noise should also be considered. There are also concerns within the local authority over air-quality issues associated with biomass boilers.

The issues outlined above, together with the fact that biomass boilers need very large fuel storages to reduce the frequency of deliveries, especially for this scale of development, means that we would not consider this option to be either appropriate or practical for the development.

II. Heat Pumps (Ground/Water/Air Source)

- **Ground Source Heat Pump**

Ground source heat pumps have been considered for the development. With a closed loop borehole system it would be possible to drop loops beneath the basement of the buildings. However, Ground Source Heat Pumps work best when there is both cooling and heating requirements throughout the year so the stored energy can be recovered in different seasons. If there is no balanced heating/cooling requirement throughout the year, the system life will be short and the system will lose its capacity over time. The majority of the develop requires no cooling and form the energy analysis the demand is driven primarily by domestic hot water and heating requirements. A ground source system would be complex, technically risky, costly and deliver limited carbon emissions savings.We would therefore not recommend this approach for the development.

- **Air Source Heat Pump**

Air-source or aerothermal heat-pumps work on the same principals as a ground-source heating system but extract heat or coolth from the air. The system uses electricity, and although considerable carbon can be saved when comparing with direct electric heating, the carbon reduction realised is not significant when comparing with gas fired system. For this reason, and also to avoid negative noise/visual impacts of the system, installation of air source heat pump is not recommended for this development.

III. Wind Turbines

The urban setting of the development means that the wind speed may not be consistent and reliable to generate the expected energy. Previous studies on wind turbine performance in urban climate have shown that air turbulence in the urban area will usually result in lower energy production than expected. Additionally installation of Wind Turbine might not be acceptable in a dense residential urban environment due to noise issues and aesthetic impacts. We would therefore consider wind turbines inappropriate for the site.

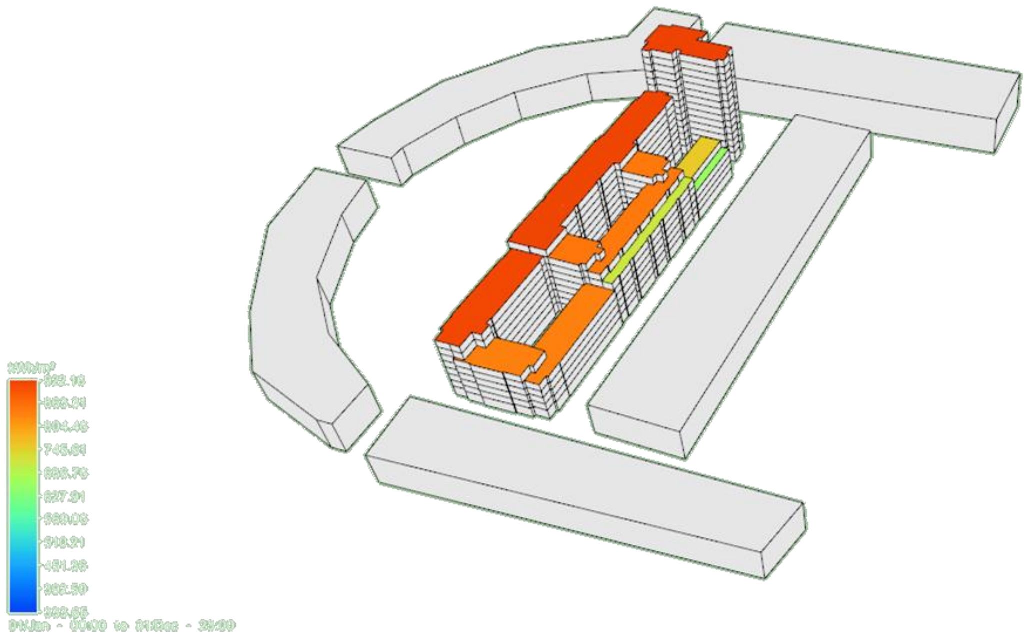
IV. Solar Hot Water System

The development has large hot water demand. However, since site wide Combined Heat and Power is proposed for the development, and since the system is sized to cover the base heating and hot water for the development, it is not possible to take full advantage of solar hot water panels. We do not, therefore, recommend installation of Solar Hot Water system for this development.

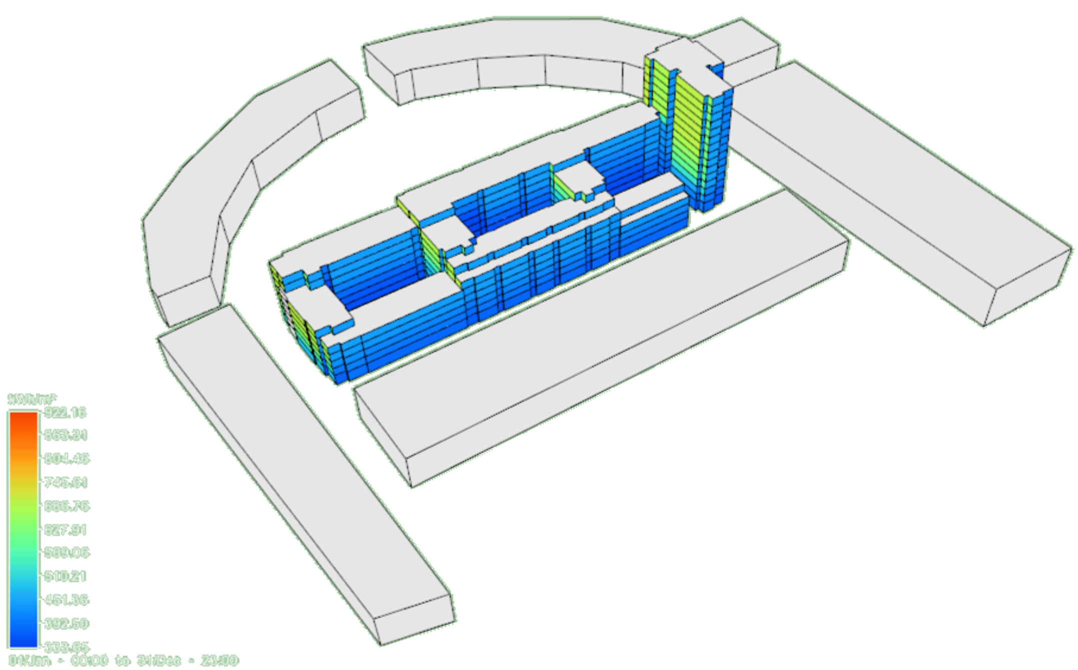
Appendix B – Insolation level on different surfaces

Cartwright Gardens Annual Shading Calculations

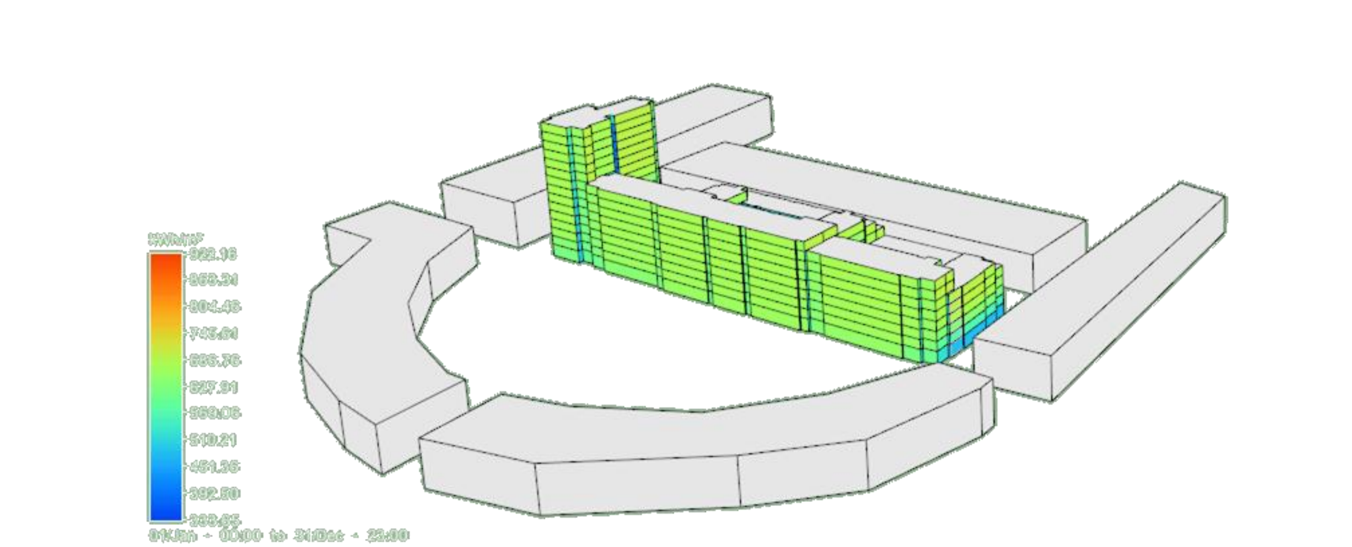
Roof: Some surfaces are appropriate for installation of solar panels



North Façade: Not recommended to install solar panels



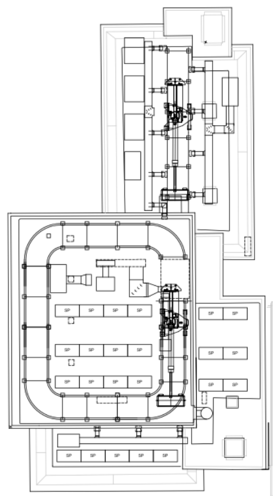
South facing façade: Not recommended to install solar panels



Appendix C – PV panels Layout on the roof

Cartwright Gardens – Potential areas for installation of PV panels

The Tower PV panels Layout



PV panels layout on the main building