Camden Lock Village

Energy Statement

Grontmij

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Contents

1. Executive Summary

Camden Lock Village is a mixed use development consisting of four individual sites with an overall total GEA of 49,360 m^2 including a residential, retail, market, leisure, offices and education accommodation.

Figure 1: Camden Lock Village Plan

The energy assessment has been carried out using the methodology outlined in the GLA 'Energy Planning - GLA Guidance on preparing energy assessments', September 2011.

The assessment has considered the Camden Lock Village development as a whole and addresses both Planning Policies and Building Regulations that will influence the solutions adopted for the development.

The combination of the optimised passive design measures, energy efficient plant selection and specification of onsite generation (CHP) result in an overall annual carbon reduction of 26.3% relative to the current 2010 Part-L target emission rate (TER) of regulated energy.

1.1 Policy Compliance Measures

Below is a summary of the main measures relating to developing the energy strategy which are proposed for the Camden Lock Village development and their application to the policy headlines of the 'London Plan, 2011' (LP), Camden Planning Policy (Core Strategy Development Policies Document, 2010).

(LP): Policy 5.1 & 5.2 - Climate Change Mitigation & Minimising Carbon Dioxide Emissions (SSP): Policy 3.4 – Energy Efficiency

- Enhanced building envelope thermal performance through the specification of 'better-than' Part-L minimum limiting parameters for fabric U-values and air permeability.
- The adoption of effective passive design techniques such as optimising façade solar performance to respond to orientation to limit direct solar gain whilst ensuring good levels of daylight within the occupied areas.
- An emphasis on building services system operational efficiencies and a comprehensive metering strategy enabling interrogation of electrical, gas and water usage.
- The installation of an intelligent 'building management system' to monitor and control the building's energy performance and comfort conditions.
- The installation of a combination of high efficiency chillers to satisfy the buildings' cooling load with opening window to all apartments to facilitate 'mixed-mode' natural cooling.
- The installation of energy efficient lighting with a high efficacy and intelligent controls, including presence detection and daylight dimming to greatly reduce the electrical consumption of the artificial lighting installation.
- The residential accommodation will be provided with low energy 'A' Rated domestic appliances.
- Excluding the contribution of low-carbon/renewable technology, the carbon emissions are 5.2% lower than Part-L of the Building Regulations 2010 through the use of good passive building design, energy efficient system selection and intelligent control methodologies. Including the contribution of low carbon / renewable technology it will exceed the current Building Regulations target by 26.3% and also exceed the London Plan Policy 5.2 target of 25%.

(LP): Policy 5.3 – Sustainable Design & Construction
(SCS): Policy 13 – High Environmental Standards

- The design has adhered to and ultimately been steered by the BREEAM and CfSH assessment frameworks to ensure high levels of sustainability are achieved. Credits would be awarded in all the principle sustainability sections: Management, Health &

Well Being, Reducing Energy Use, Reducing Water Consumption, Material Selection, Waste & Recycling, Ecological Enhancement and Minimisation of Pollution.

(LP): Policy 5.5 & 5.6 – Decentralised Energy Networks/In Development Proposals
(SCS): Policy 13 – High Environmental Standards

- Specification of onsite C/CHP 'Cogeneration' systems with thermal storage and stepped control to ensure peak efficiencies and allow the development to take advantage of the low-carbon benefits associated with combined heat and power.

- The London Heat Map has been used to establish that there are no existing district heating networks currently serving the area. The Camden Lock Village redevelopment communal heating systems will be installed with provision for future connection to a district heating network.

(LP): Policy 5.7 – Renewable Energy

- Renewables in the form of roof mounted photovoltaic cells (PV). Electricity produced from these cells will be distributed to the main electrical distribution boards for the buildings. The renewable energy produced by the photovoltaic cells will reduce the overall annual carbon emissions by a further 0.4% to give an overall site reduction of 26.3%.

- The photovoltaic cells have been located with consideration given to accessibility and the avoidance of any negative impacts on biodiversity.

(LP): Policy 5.8 – Innovative Energy Technologies

- The proposed communal heating systems would enable relatively simple 'heart transplant' replacement of central systems in the future at the end of their economic life with thermal plant which may use alternative fuels, potentially offering even greater carbon savings. For example hydrogen fuel cell technology, which may become economically and technically more feasible than it is presently.

(LP): Policy 5.9 – Overheating and Cooling

- Part-L2 Criterion 3 compliance with the building regulations has been achieved on all commercial building facade orientations where there will be mechanical cooling to maintain comfort conditions for commercial occupants by the use of high performance solar glazing with optimised shading systems.

- The residential accommodation facade design will limit excessive summertime solar gains by a combination of opaque building fabrics with low U-values and low air permeability rates, which exceed the Part-L Building Regulation requirements, together with good solar performance glazing and optimised shading systems. All apartments will have opening windows to facilitate 'mixed-mode' natural cooling.

1.2 Building Emission Rate - Savings against Part-L Target (TER)

The table below shows the carbon dioxide savings from each stage of the energy hierarchy for the whole development.

Table 1: Carbon Emissions after each stage of the Energy Hierarchy within each building (Tonnes CO_2)

	Carbon Dioxide Emissions (Tonnes CO_2 per Annum)						
	Site A	Site B		Site C		Site D	
	Retail / Restaurant	Residential	School	Residential	Office / Retail	Residential	Office / Retail
Building Regulations 2010, Part L Compliant Development	431	53	38	112	215	43	23
Lean Building	436	48	32	105	187	38	22
Clean Building	337	34	25	74	160	27	20
Green Building	335	34	25	73	159	27	20

Table 2: Carbon Emissions after each stage of the Energy Hierarchy Total (Tonnes CO_2)

	Site A
Building Regulations 2010, Part L Compliant Development	915
Lean Building	868
Clean Building	677
Green Building	674

Table 3: Regulated Carbon Dioxide Savings from each stage of the Energy Hierarchy

	Regulated Carbon Dioxide Savings	
	(Tonnes CO_2 per Annum)	%
Savings from Energy Demand Reduction	48	5.2%
Savings from C/CHP systems	190	20.8%
Savings from Renewable Energy	3	0.4%
Total Cumulative Savings	241	26.3%

The chart below shows the carbon dioxide savings from each stage of the energy hierarchy for the whole development.

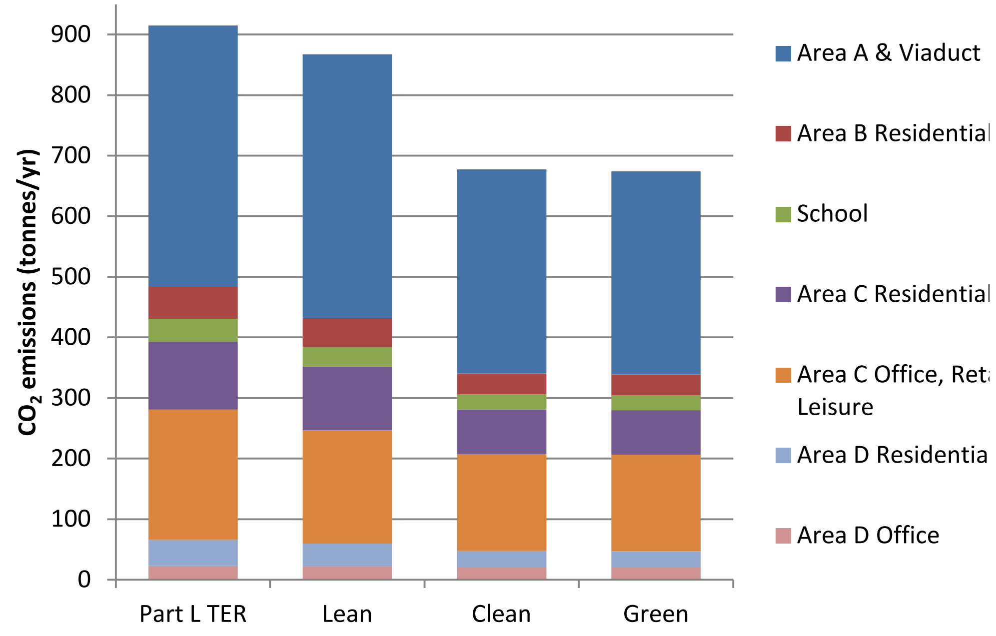

Figure 2: % reduction in annual CO_2 emissions relative to Part L TER for the whole development (Tonnes CO_2)

2. Introduction

This Energy Statement forms part of a full planning application for the Camden Lock Village development.

The Energy Statement should be read in conjunction with all other relevant planning submission documents and drawings, which include:

- Planning Statement
- Design and Access Statement
- Sustainability Statement
- BREEAM and Code for Sustainable Homes pre-assessment reports
- Environmental Impact Assessment
- Planning Drawings
- Statement of Community Involvement
- Landscape, Amenity Strategy
- Transport Statement

Camden Lock Village is a mixed use development consisting of four individual sites with an overall total GEA of approximately 49,360 m^2.

The four sites are outlined below;

- Area A - This development consists of two linked multi-floor blocks of flexible retail units on 3 levels and basement and additional retail units are located within railway arches. Level 2 contains workshops and roof top has restaurant areas. The blocks and arches have a combined GEA of approximately 14,377m^2. An enclosed restaurant is located on the top of each of the blocks. The retail development space is assumed to be split between retail (83%) and food outlets (17%). Both the retail and food spaces are largely open-air markets, with only 10% of each being enclosed and conditioned/heated.
- Area B - This development comprises two residential blocks comprising 42 apartments, with a total GEA of approximately 4,803 m^2 and a one form entry primary school, nursery and arches consisting of mixed light/general industrial units and a public cycle store with a total GEA of approximately 1,823 m^2. The school will also use No 1 Hawley Road which is a grade II listed building over three floors approximately 229 m^2. (It should be noted that though the demand forecast For 1 Hawley road is included in this assessment it is not included in the energy efficiency commitments contained in this report of the commitments in terms of U-Values or BREEAM Education Rating due to its listed status) It should also be noted that the school will be in outline with all matters reserved.
- Area C - This development consists of two separate residential blocks, namely building C1 and C2. Building C1 comprises local retail and flexible A1/B1/D1 space at ground floor and 4 levels of residential above, along Castlehaven Road. Block C2 comprises of two levels of commercial floor space within the central building and Part 5 and Part 7 storey levels of residential above. The proposal includes arches consisting light industrial units and two shared lower ground / basement floors which link the buildings which will be used for plant storage and class D2 use. The overall development space is 22,531 m 2 GEA.
- Area D - This development comprises a ground floor café, commercial space provided at ground and basement, and residential apartments above. The total floor area for Area D is approximately 5,597 m^2 GEA.

Figure 3: Camden Lock Village Masterplan

The site will be provided with an integrated Energy Strategy with communal heating systems incorporating combined heat and power plant.

As required by the most recent guidance from the GLA ‘Energy Planning - GLA Guidance on preparing energy assessments’, September 2011, a benchmark based on a 2010 Part L compliant building has been established through modelling with approved software.

The analysis has been undertaken for representative floors of the commercial and residential buildings in the development.

The Energy Hierarchy of 'Lean', 'Clean' and 'Green' has been followed from the outset in driving down energy demand and carbon emissions from the development.

Energy efficiency measures have been applied to establish the 'Lean' building energy demands and carbon emissions. It is shown that the "Lean" building emissions are less than those of the Part L 2010 Compliant baseline.

Methods of supplying this reduced demand 'cleanly' have been assessed. The potential for connecting into existing district heating or cooling network supplies has been investigated. The provision of energy supplies from onsite communal heating systems incorporating gas-fired combined heat and power systems coupled with absorption cooling has been addressed.

Various 'Green' on-site renewable energy technologies have been assessed as part of the design process

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3. Policy Context

3.1 Carbon Emissions Factors

Carbon emission factors are used to calculate the equivalent carbon dioxide emissions associated with different fuels. For example, 1 kWh of power from grid electricity will have a different environmental impact than 1 kWh of power from natural gas.

Table 4: Carbon Emission Factors

Fuel Type	$kgCO_2/kWh$
Natural Gas	0.198
Grid Supplied Electricity	0.517
Grid Displaced Electricity	0.529

3.2 Planning Policies

The planning policies relating to the Camden Lock Village Energy and Sustainability Statement are as follows:

3.3 National Planning Policy

The National Planning Policy Framework (2012) sets out the Government's planning policies for England and how these are expected to be applied. It sets out the Government's requirements for the planning system only to the extent that it is relevant, proportionate and necessary to do so. The framework must be taken into account in the preparation of local and neighbourhood plans, and is a material consideration in planning decisions.

Within the National Planning Policy Framework (NPPF) there is a presumption in favour of sustainable development, which should be seen as a golden thread running through both plan-making and decision-taking. For decision-taking this means approving development proposals that accord with the development plan without delay.

The NPPF also covers climate change and flooding. It notes that Planning plays a key role in helping shape places to secure radical reductions in greenhouse gas emissions, minimising vulnerability and providing resilience to the impacts of climate change, and supporting the delivery of renewable and low carbon energy and associated infrastructure. This is central to the economic, social and environmental dimensions of sustainable development.

It states that in determining planning applications, local planning authorities should expect new developments to:

- comply with adopted Local Plan policies on local requirements for decentralised energy supply unless it can be demonstrated by the applicant, having regard to the type of development involved and its design, that this is not feasible and viable
- take account of landform, layout, building orientation, massing and landscaping to minimise energy consumption

It also states that when determining planning applications, local planning authorities should:

- not require applicants for energy development to demonstrate the overall need for renewable or low carbon energy and also recognise that even small-scale projects provide a valuable contribution to cutting greenhouse gas emissions
- approve the application if its impacts are (or can be made) acceptable.

3.4 Regional Planning Policy

The documentation relating to regional planning policies are as follows,

- The London Plan, Chapter 5: 2011
- GLA 'Energy Planning - GLA Guidance on preparing energy assessments', September 2011
- Mayors Sustainable Design & Construction Supplementary Planning Guidance:2006

The Mayor of London published the current revision of the 'London Plan' in July 2011, this is the Spatial Development Strategy for Greater London. The Development Plans of all London Boroughs must eventually comply with the general requirements of the London Plan. The London Plan includes planning policies both for reducing energy consumption within buildings and, significantly, promoting the use of decentralised electricity generation and renewable energy. These policies cover the role of boroughs in supporting the Mayor's Energy strategy and the requirements of planning applications.

3.5 Local Planning Policy

The documentation relating to the local planning policies are as follows,

- Camden Council's Local Development Framework namely the Core Strategy and Development Policies document was adopted in November 2010 Policy DP22 – Promoting Sustainable Design and Construction is relevant to this report. The policy requires Code for Sustainable Homes (CFSH) Level 3 for residential and BREEAM 'Very Good' targeting 'Excellent' for non-domestic.

The policy also asks that buildings are deigned to avoid overheating and the use of air-conditioning to be avoided where possible. The policies in the London Plan 2011 are equivalent or more onerous in terms of energy use and carbon emissions so compliance with the London Plan will ensure compliance with Camden Council policies.

3.5.1 The London Plan

The London Plan recognises that energy efficiency should come before energy supply considerations and has suggested a simple strategy known as the Mayor's Energy Hierarchy. The system follows good practice in the design of low carbon buildings and comprises three distinct stages and order of application:

1 Use Less Energy **(Be Lean)**

2 Supply Energy Efficiently **(Be Clean)**

3 Use Renewable Energy **(Be Green)**

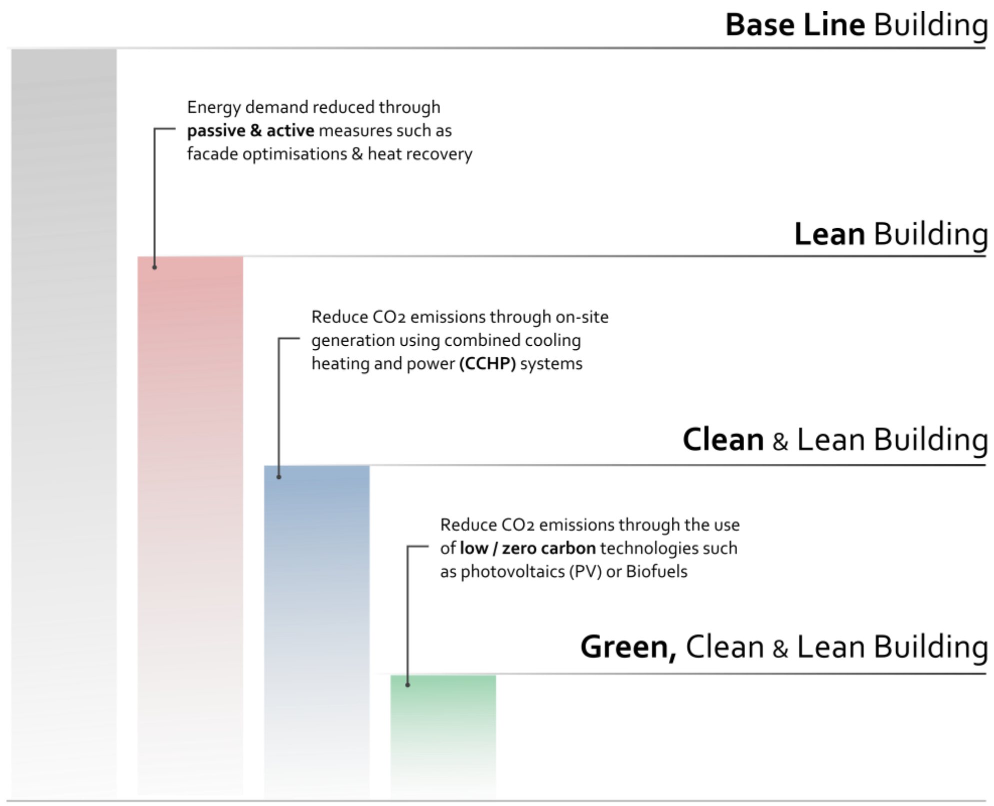


Figure 4: London Plan Methodology

This strategy puts energy efficiency/conservation measures first in order to reduce the demand for energy, 'Be Lean'. Following this, consideration must be given to supplying the resultant reduced energy demand as efficiently as possible, including the use of combined heat and power (CHP) and Tri-Generation (C/CHP), 'Be Clean'. Finally, sources of renewable energy should be examined, 'Be Green'.

Policy 5.2 – Minimising Carbon Dioxide Emissions, indicates current reductions of 25% for residential buildings and 25% for non-residential buildings should be targeted as an improvement on the 2010 Building Regulations Target Emissions Rate (TER) by application of the energy hierarchy framework.

As per Policy 5.6 of the London Plan, the mayor will expect all major developments to demonstrate that the proposed heating and cooling systems have been selected in accordance with the following order of preference:

1 Connection to existing heating or cooling networks

2 Site-wide CHP network

3 Communal heating and cooling

The London Heat Map Tool should be used to identify existing heating and cooling networks and proposals for future networks. Where future networks are identified, proposals should be designed to connect to these networks. Where CHP is to be installed in a new development, the feasibility of extending the system beyond the site should be investigated.

CHP systems should be designed to run efficiently and sized to optimise Carbon Dioxide emissions. Schemes that will be implemented in a phased development, where a number of energy centres are proposed, should seek to minimise the number of energy centres and explain how the energy strategy will be implemented across the development's phasing programme.

In Policy 5.7, The London Plan encourages application of renewable energy in developments where it is feasible and implemented within the framework of the energy hierarchy. GLA guidance indicates that renewable energy generation should be compatible with the measures implemented in stages one and two of the energy hierarchy and where CHP systems are proposed, renewable technologies proposed should compliment not compete with CHP.

The Plan, in Policy 5.8 also welcomes innovative energy technologies utilising alternative fuels, where feasible and encourages any provision made for the future Hydrogen Economy.

4. Assessment Methodology

As required by the most recent guidance from the GLA 'Energy Planning - GLA Guidance on preparing energy assessments', September 2011, a benchmark based on a 2010 Part L compliant building has been established through modelling with approved software tools for the commercial, educational and residential redevelopment.

The key plan of the development is shown below which highlights the proposed sites. Independent assessment methods have been used to model the residential units and the commercial and educational areas, as described in the following sections.

Figure 5: Camden Lock Village Masterplan

4.1 Commercial Buildings and School

Regulated energy use and the associated carbon dioxide emissions for the proposed commercial buildings have been calculated using dynamic thermal modelling software (TAS version 9.2.1.2). TAS is approved simulation software based on the National Calculation Method (NCM).

It is able to base its performance calculations upon incremental time steps as low as 30 minutes. This allows realistic variations in fabric thermal storage (thermal mass effects), weather conditions, occupancy, internal and solar gains to be taken into account and their implications upon building/plant operation to be modelled effectively.

Dynamic thermal simulation uses zone specific operational profiles (occupancy, lighting, ventilation and DHW demand) and HVAC plant performance data to effectively model and predict the energy performance of a building.

To accurately model the dynamic nature of the buildings thermal response, hourly recorded weather data is used in dynamic thermal simulations. Such weather data contains records of radiation, temperature, humidity, sunshine duration and additionally wind speed and direction.

A CIBSE Test Reference Year (TRY) for London has been used for this analysis as per the National Calculation Method requirements.

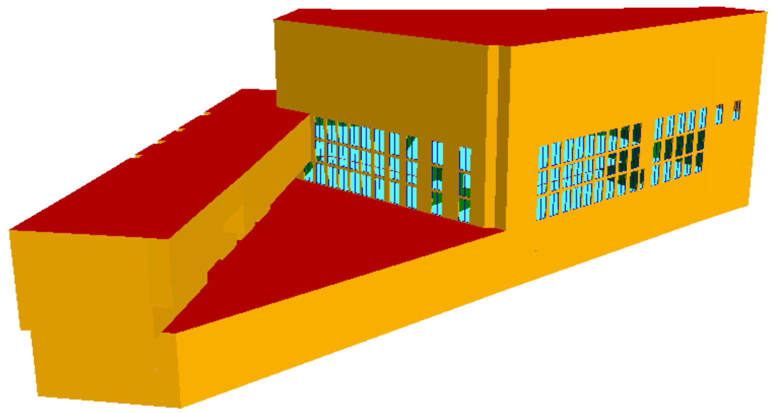


Figure 6: Typical Floor of TAS model for Commercial section of Area C

The school has been modelled assuming a sealed facade solution due to the anticipation that the internal noise levels will require it. The modelling has included no cooling within the school and that the heating and domestic hot water will be fed from the central energy centre.

4.2 Residential Buildings

The energy and the associated CO_2 emissions were calculated using the NHER Plan assessor software version 5.4.2 which is approved by the Building Research Establishment (BRE) for the Standard Assessment Procedure (SAP) calculations.

The Standard Assessment Procedure (SAP) is the UK Government's National Calculation Methodology for assessing the energy performance of new dwellings under the European Directive on the Energy Performance of Buildings (EPBD).

The procedure used for the calculation is based on the BRE Domestic Energy Model (BREDEM), which provides a framework for the calculation of energy use in dwellings. The procedure is consistent with the standard BS EN ISO 13790.

The Building Research Establishment Domestic Energy Model (BREDEM) is a method for estimating the energy used in dwellings for the provision of space and water heating, cooking, lights and appliances. It was based originally on technical energy monitoring work on hundreds of low energy homes in the Milton Keynes Energy Park in the late 1970s and early 1980s.

SAP is a methodology for calculating energy use and the associated CO_2 emissions. It does not set any standards or limitations on data. For SAP calculations dwellings have a standard occupancy and usage pattern, which are typical values of quantities that in practice vary substantially between dwellings of similar size and type.

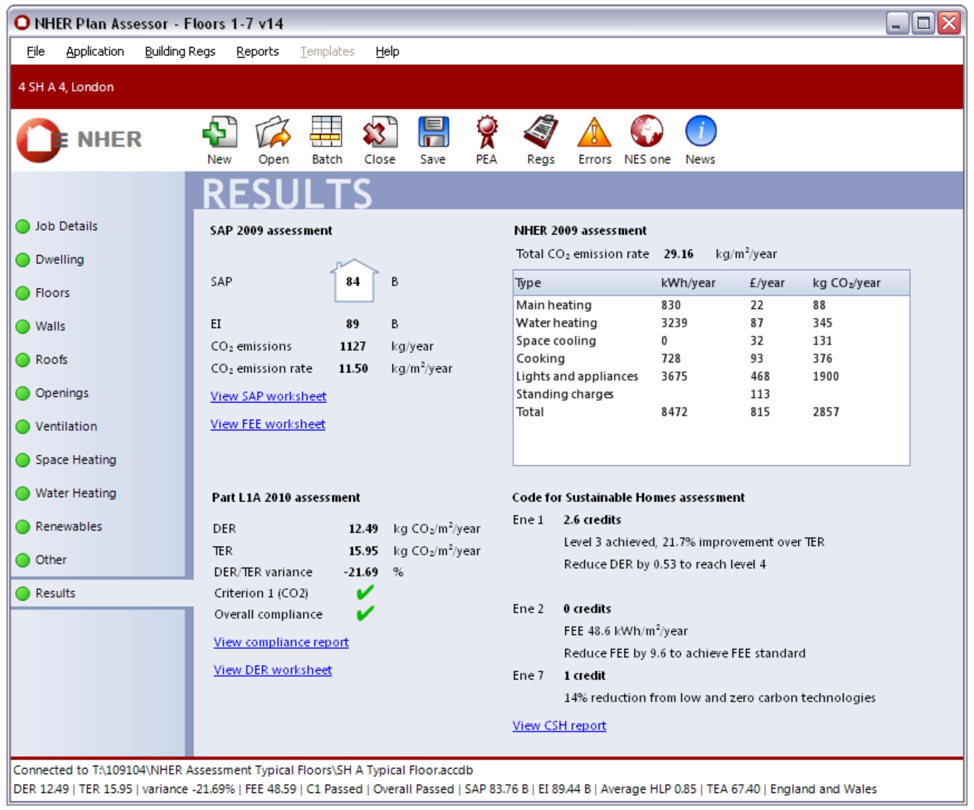


Figure 7: NHER Plan Assessor used to assess the Residential Buildings

4.3 Open Air Market Space

The open-air areas throughout the development (i.e. the open-air, unconditioned, retail & food outlets in the Area A are not required to be assessed against Building Regulations Part L and are not covered by the BREEAM methodology.

For this reason, the Part L calculations carried out for this document have not accounted for these spaces. However, in reality, the Open Air Market space will have some energy requirement; primarily electricity for lighting and small power.

In assessing the overall development loads for sizing the CHP, an allowance has been made for these electrical demands of the market retail.

5. 'Baseline' Building CO2 Emissions Results (TER)

The 'Baseline' building represents a development which just meets the minimum standards of CO2 emissions reduction (i.e. the Building Emissions Rate (BER) is equal to the Target Emissions Rate (TER) as defined by Part L of the Building Regulations 2010).

Table 5: 'Baseline' annual CO2 Emissions (Tonnes CO2)

	Carbon Dioxide Emissions (Tonnes CO2 per Annum)						
	Area A	Area B		Area C		Area D	
	Retail / Restaurant	Residential	School	Residential	Office / Retail / Leisure	Residential	Office / Retail
Building Regulations 2010, Part L Compliant Development	431	53	38	112	215	43	23

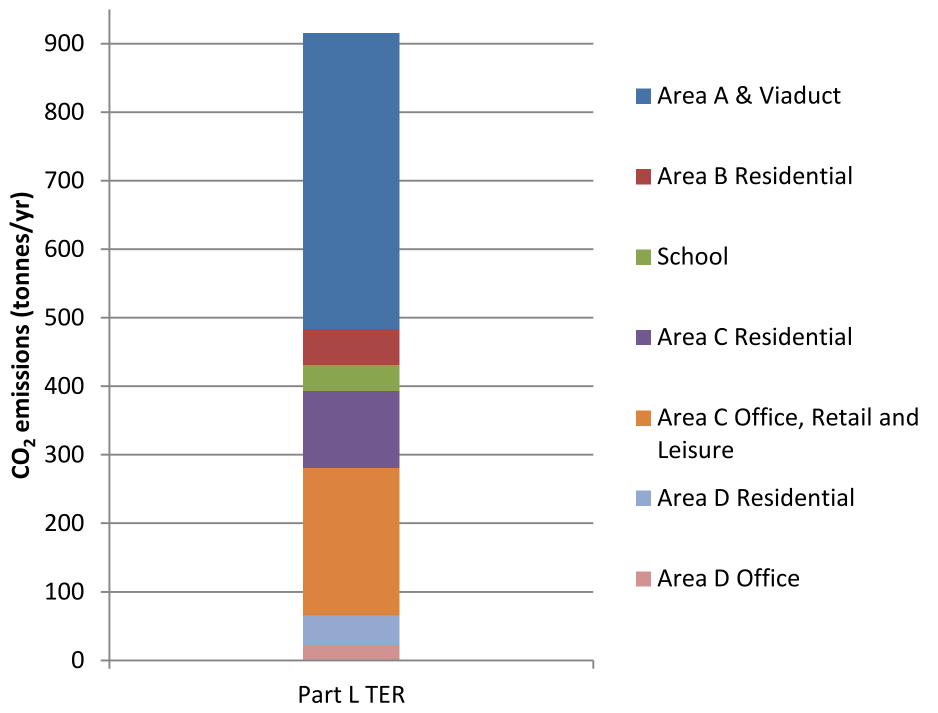


Figure 8: Annual CO2 emissions- Part L TER (Tonnes CO2)

6. Reducing Energy Demand: Be Lean

6.1 Passive Design Features: Regulated Energy Use

6.1.1 Building Envelope

Thermal Properties & Air Tightness

High performance building fabrics with low U-values and low air permeability rates, which exceed the Part-L Building Regulation requirements, will minimise uncontrolled heat losses. The targeted building fabric standards are set out in the following table. Residential facades will be developed with a target thermal bridge y-value of 0.05W/m²K.

Element	Minimum Standard U-Value Part L2A: 2010	Targeted U-Value for Commerical	Minimum Standard U-Value Part L1A: 2010	Targeted U-Value for Residential
Exposed Wall	0.35 W/m².K	0.35 W/m².K	0.3 W/m².K	0.18 W/m².K
Window	2.2 W/m².K	1.6 W/m².K	2.0 W/m².K	1.4 W/m².K
Exposed Ground Floor	0.25 W/m².K	0.25 W/m².K	0.2 W/m².K	0.18 W/m².K
Exposed Roof	0.25 W/m².K	0.25 W/m².K	0.2 W/m².K	0.13 W/m².K
Air Permeability	10 m^3/ m^2 / hour	5 m^3/ m^2 / hour	10 m^3/ m^2 / hour	3 m^3/ m^2 / hour

Table 6: U-V comparison between 2010 Standards & Camden Lock Village Standards

Optimisation - Residential

The external envelope of a building can act as an important climatic modifier, with a well-designed facade significantly reducing the buildings energy demand. The façade design will incorporate passive design principles appropriate to residential accommodation where heating and daylight demands need to be balanced. The facades will be developed to limit heat loss and solar gain whilst maximising daylight through optimising use of glazing with solid panels /solar shading.

A further consideration is the revised Building Regulations Part L scheduled for release in 2013. This is expected to introduce new Fabric Energy Efficiency Standards (FEES). Although the standards are not yet confirmed it is expected that they will reflect the recommendations of the Task Group for Zero Carbon Homes. Their report published in 2009 recommended the adoption of FEES for different dwelling types. The recommended targets are 39 kWh/m²/Yr (four storey apartment blocks and mid-terraced dwellings) and 46 kWh/m²/Yr (end terrace and detached dwellings). The report also suggested fabric element performance standards U values that would meet the FEES recommendations. The Camden Lock Village residential units' performance values will target these recommendations and therefore offer an element of future proofing for the project. It is worth noting that there is not currently a recommended FEES target for high rise residential apartments.

Façade Optimisation- Commercial Units

The high performance thermal properties and air tightness of the commercial buildings envelopes will ensure wintertime comfort conditions and limit heating requirements. However, due to the relatively intensive heat gains and lighting requirements in an commercial environment, there is typically a larger energy consumption associated to artificial cooling and lighting systems.

For the new commercial buildings at the lower levels of Area C and Area D and Area A, the design intent of the façade designs is to enhance natural daylight limit the reliance on mechanical cooling systems. Detailed thermal modelling analysis (using industry-recognised dynamic simulation software) has been used during the design process on an orientation by orientation basis to optimise the proportion of glazing, determine glazing solar performance and analyse the effectiveness of shading systems, thus ensuring good levels of natural daylight penetration whilst limiting unwanted solar gain.

The façade designs ensure that the cumulative summertime solar gains are compliant with the requirements of Building Regulations Part L2a, criterion 3. Furthermore, the design team have set their own peak cooling target of 100W/m2 for perimeter commercial zones. In addition to reducing energy use and limiting the reliance on cooling systems, this will ensure that commercial tenants can adopt a range of low energy, low intensity cooling Category 'A' fit-out systems.

6.2 Active Design Features: Regulated Energy Use

6.2.1 Building Energy Management System and Metering

A comprehensive Building Energy Management System ('BMS') will be installed to monitor and report on the overall energy consumption of the buildings. The system will highlight any out of range consumption figures and readings, allowing a preventative approach through interrogation and resolution of potential problems. The central energy generating and distribution systems will include continuous monitoring and reporting of the operating parameters to ensure that the systems are running to their peak 'as designed' efficiencies.

The commercial systems will include metering of energy usage on all floors, and per tenancy and will allow building owners / occupiers to view and interrogate where potential energy savings can be made throughout their buildings.

The school buildings will also include energy monitoring devices and display screens and interfaces so that the building can be used as an educational tool as well as reducing energy demand with the buildings.

All residential units will be provided with independent apartment energy management systems that will provide intelligent control of the apartment services systems. This will include the provision of smart real time metering of energy usage that will heighten user awareness of energy use and assist in making choices that effect energy usage

6.2.2 EC/DC Motors for Fan Coil Units

The current Part L Building Regulations set stringent efficiencies for the fans used in all air conditioning systems. Recent advances in fan motor technology have resulted in substantial reductions in energy consumption, an otherwise significant proportion of building energy use.

Where fan coil systems are proposed EC/DC (electronically commutated direct current) motors will be used in place of conventional AC motors. These will be also enable the use of variable air flow rate devices to reduce air flow when required and therefore reduce energy consumption.

6.2.3 Air Handling Energy Recovery

The energy required to heat or cool the incoming fresh air supply to the building will be significantly reduced by using efficient energy recovery systems controlled so as to minimise the demand for any heating and cooling of the fresh air supply.

The commercial ventilation systems will incorporate heat recovery via thermal wheels. Thermal wheels within the AHUs continuously rotate, allowing the storage of heat from the return air path to transfer to the incoming air stream. In winter, the warmer return air will transfer heat to the colder outdoor air raising the supply air temperature, thus reducing the amount of energy required to heat the incoming air to the required design conditions. In summer, the opposite occurs, with the incoming air stream likely to be of a higher temperature than the return air. In this case the thermal wheel will pre cool the incoming air which results in a reduction of energy required to cool the air to design conditions. These systems provide high heat recovery efficiently and will significantly reduce the building's overall heating and cooling demand.

The residential ventilation systems will be provided by local whole house ventilation units that provide filtered fresh air to each of the habitable rooms and extract vitiated, humid air from wet rooms. The units will incorporate integral heat recovery which will recover thermal energy from the air streams via high efficiency heat exchangers.

6.2.4 Low Energy Lighting (Commercial Buildings)

Lighting is typically responsible for about one quarter of the carbon emissions from commercial buildings.

Lighting throughout the occupied areas of the building will be controlled by PIR movement detectors which will monitor occupancy and switch off the lights when the area is vacant for a sustained length of time. In addition, lighting in perimeter commercial areas will include intelligent dimming that monitors the daylight factor and adjusts the lighting intensity accordingly. Daylight sensors will likely be combined with the PIR sensors to minimise the number of devices installed. Lighting in communal/lobby areas, stairwells and the basement will include timed control to ensure switching off to reduce energy consumption.

In addition the project team will investigate the option for the lighting types and spacing of the fittings in the commercial areas to be specified to provide a minimum intensity of background lighting CIBSE guidelines recommend 300-500lux on the working plane within occupied commercial environments where tasks are typically screen based. The project team will investigate the potential to reduce the general background lighting to 200lux with local task lighting could be specified to meet the required lux levels on the working plane. It is the intention that the task lighting could be specified as high efficiency 'LEDs'.

6.2.5 Low Energy Lighting (Residential Buildings)

In dwellings, the Part L regulations require that 75% of all fixed light fittings must be capable of accepting only low energy lamps. "Low energy lamps", (compact fluorescent or linear fluorescent) use about 80% less energy than conventional tungsten lamps for the same light output.

Conventional lighting accounts for about 16% of electrical energy consumption in dwellings, (CfSH). Throughout the residential units low energy fitting will be specified as first choice with the intention of utilising high efficiency LED lighting products within the interior lighting design philosophy.

6.2.6 Power Factor Correction

The Building Regulations Approved Document L2A identifies that the provision of power factor correction to the building electrical supply can provide significant savings in electrical consumption. A saving in electrical energy consumption of 1.5% is awarded for power factor correction to 0.9 and a saving of 2.5% awarded for power factor correction to 0.95 power factor. Camden Lock Village intends to have a power factor correction of 0.95 as a minimum.

6.2.7 High Efficiency Chillers

Mechanical cooling will be minimised through the use of passive design features as discussed earlier within this report.

All buildings will be served by centralised water cooled plant serving multiple buildings via common systems located under Area C. Intelligent multiple chiller sequencing operation will be specified to ensure that each chiller will operate at peak efficiency, given the required cooling load. (For example, 2 no. chillers may operate at part-load instead of 1 no. at peak load to maximise the seasonal efficiency ratio (SEER).

Water cooled chillers will be used in conjunction with adiabatic type cooling to exploit energy savings of wet bulb heat rejection. It is intended that the water cooled chillers will be selected to have an SEER of at least 8.0, whereas Part-L requires a minimum 2.5 SEER.

6.2.8 High Efficiency Variable Speed Drives

By varying the fan and pump speeds for the water and air distribution systems to match the building load profiles, fan and pump energy consumption will be considerably reduced. This will be maintained and controlled through constant monitoring via the intelligent Building Management System (BMS).

6.2.9 Automatic Monitoring and Targeting

The Building Regulations Approved Document L2A identifies that the provision of automatic monitoring and targeting with alarms for out of range values, can provide significant savings in energy consumption of the building services systems. A saving in energy consumption of 5% is awarded for complete installations that measures, records, transmits, analyses, reports and communicates meaningful energy management information to enable the operator to interrogate and manage the energy it uses.

6.3 Active Design Features: Unregulated Energy Use

6.3.1 Low Energy White Goods (Residential Buildings)

White goods include washing machines, dryers, dishwashers and fridge/freezers.

These items are responsible for about two thirds of electrical consumption in dwellings. Electrical consumption is responsible for roughly half the carbon emissions from a dwelling.

White goods are now provided with a certified energy label. These are rated A++, A, B and C with C being the least efficient. Data supplied by the Energy Advice Centre suggests that using A++ rather than C rated white goods would reduce electrical energy consumption in each dwelling by 800 kWh/year.

6.3.2 Low Energy Culture

Providing building users and operators with practical guidance on the importance and methods of energy efficiency can lead to effective, cost-free reductions in energy usage and carbon emissions. Savings can be expected in, for example:

- Operating comfort cooling systems efficiently
- Lighting Energy: a culture of 'Turn-It-Off'
- Small Power: avoiding monitors and PCs etc in stand-by mode
- Cooling / Heating Energy: widening 'acceptable' temperature range.

Training of operators and facility managers is particularly important to provide them with the skills and knowledge to implement and continue to improve an energy management programme.

For the residential units it is important that occupiers are given clear unambiguous information on the use and operation of their systems with an emphasis on how to maximise the potential for reducing energy through behaviour

The amount of energy that can be saved will be dependent upon the motivation of the occupants and the effectiveness of the awareness programmes. The Camden Lock Village development will actively encourage a low energy culture as part of its commercial and residential leasing strategy.

6.3.3 High Efficiency Vertical Transportation

Vertical transportation can be fitted with a number of energy saving measures to reduce their energy use both whilst moving and when in standby mode. These include:

- Controls that ensure that no more lifts are in use than required and that as few stops as possible are made
- Energy efficient lighting
- Control that switches off the lighting when the lift car is not occupied

6.4 'Lean' Building CO2 Emissions Results

The chart below summarise the anticipated CO2 emissions of the combined building systems with the 'Lean' building energy savings measures through good 'passive' and 'active' designs.

Table 7: 'Lean' annual CO2 Emissions (Tonnes CO2)

	Carbon Dioxide Emissions (Tonnes CO2 per Annum)						
	Area A	Area B		Area C		Area D	
	Retail / Restaurant	Residential	School	Residential	Office / Retail / Leisure	Residential	Office / Retail
Building Regulations 2010, Part L Compliant Development	431	53	38	112	215	43	23
Lean Building	436	48	32	105	187	38	22

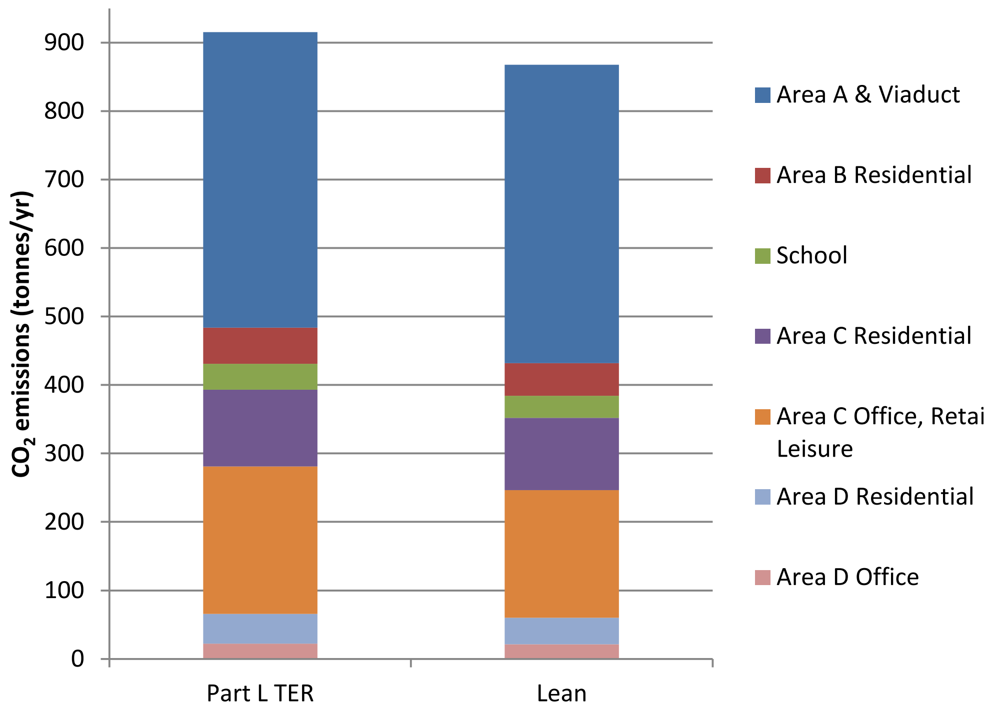


Figure 9: % reduction in annual CO2 emissions relative to Part L TER for the 'Lean' development (Tonnes CO2)

The anticipated saving through employing active and passive energy efficiency measures alone is 5.2%.

7. Clean Energy Supply: Be Clean

The London Plan states (Policy 5.5) that the Mayor expects 25% of the heat and power used in London to be generated through the use of localised decentralised energy systems by 2025.

As per Policy 5.6 of The London Plan, this report uses the following hierarchy when selecting the energy systems for Camden Lock Village development.

1. Connection to existing heating or cooling networks
2. Site Wide CHP network
3. Communal heating and cooling

7.1 Connection to Existing Heating / Cooling Network

The feasibility of connecting the development to a district heating network has been assessed, making reference to the London Heat Map. The following image is an extract of the London Heat Map for the area surrounding Camden Lock Village development site.

This indicates that there are no existing schemes in the area.

Currently, connection to a local district energy scheme does not appear to be feasible and a site wide heating network will be utilised instead.

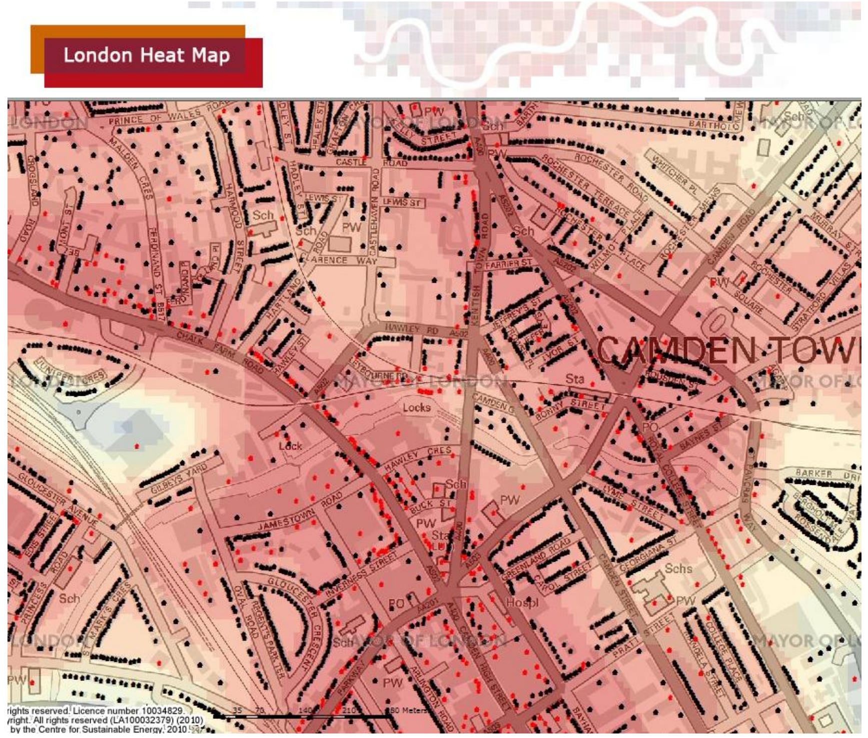


Figure 10: London Heat Map for the area surrounding Camden Lock

7.2 C/CHP Feasibility Study

The feasibility of providing heating and cooling energy for the buildings that make up the Camden Lock Village development has been assessed.

The buildings have been combined to be served by main plant in a configuration to avoid over sizing and hence underperformance of CHP systems.

CHP plant is sized to achieve high performance and will incorporate thermal storage to increase hours of operation, with high efficiency boilers to provide additional heat during periods of peak demand. The CHP is space heating and domestic hot water led and as such has been sized to meet the base winter load of 300kW.

During much of the year, the waste heat from the CHP units will be the primary source for heating & hot water. In the summer, there will be very little space heating requirement but a relatively constant domestic hot water demand. This will create a constant base heating demand.

Absorption cooling systems for the commercial areas has been considered. The absorption chiller has not been sized to match the CHP but has been sized to meet the base mid season cooling demand of 80kW therefore ensuring that the heat output is used for domestic hot water and space heating before it is utilised by the absorption chiller. The efficiency of the absorption chiller means that the developments CO_2 savings will be higher if the domestic hot water and the space heating demand is prioritized.

Appendix A shows the load profile analysis that has been carried out to optimise the size of the CCHP.

7.3 'Clean' Building CO2 Emissions Results

The chart below summarises the anticipated CO2 emissions of the combined building systems with the 'Lean' and 'Clean' building energy saving measures through good 'passive' and 'active' designs and the 'Clean' technologies proposed.

Table 8: 'Lean' & 'Clean' annual CO2 Emissions (Tonnes CO2)

	Carbon Dioxide Emissions (Tonnes CO2 per Annum)						
	Area A	Area B		Area C		Area D	
	Retail / Restaurant	Residential	School	Residential	Office / Retail / Leisure	Residential	Office / Retail
Building Regulations 2010, Part L Compliant Development	431	53	38	112	215	43	23
Lean Building	436	48	32	105	187	38	22
Clean Building	337	34	25	74	160	27	20

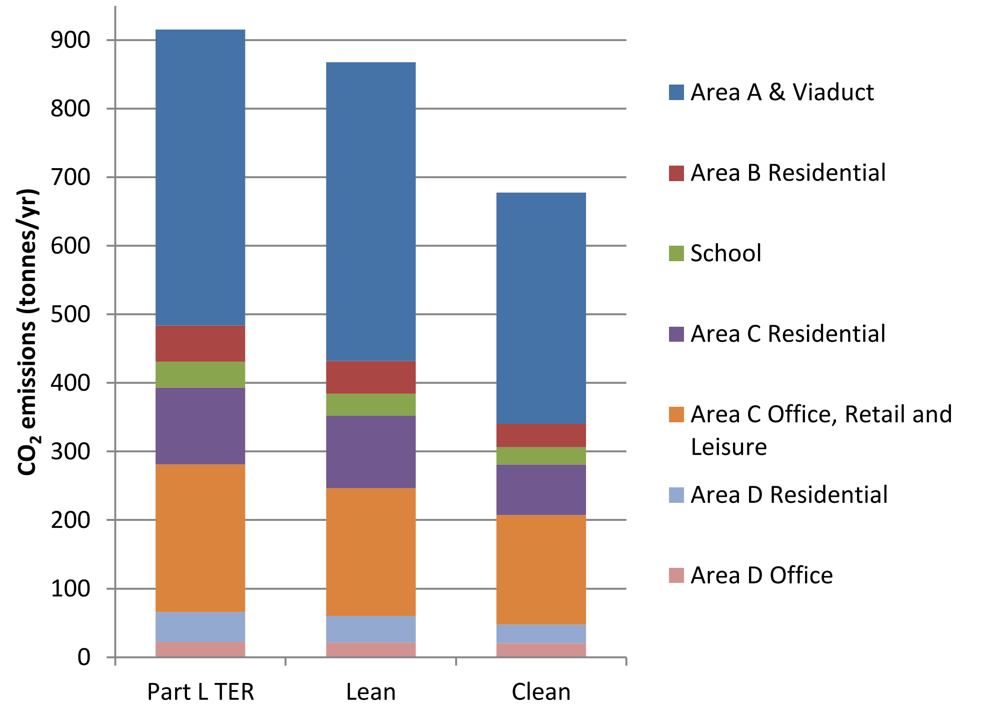


Figure 11: % reduction in annual CO2 emissions relative to Part L TER for the 'Lean' & 'Clean' development (Tonnes CO2)

The anticipated savings through employing lean and clean measures are 26.0%.

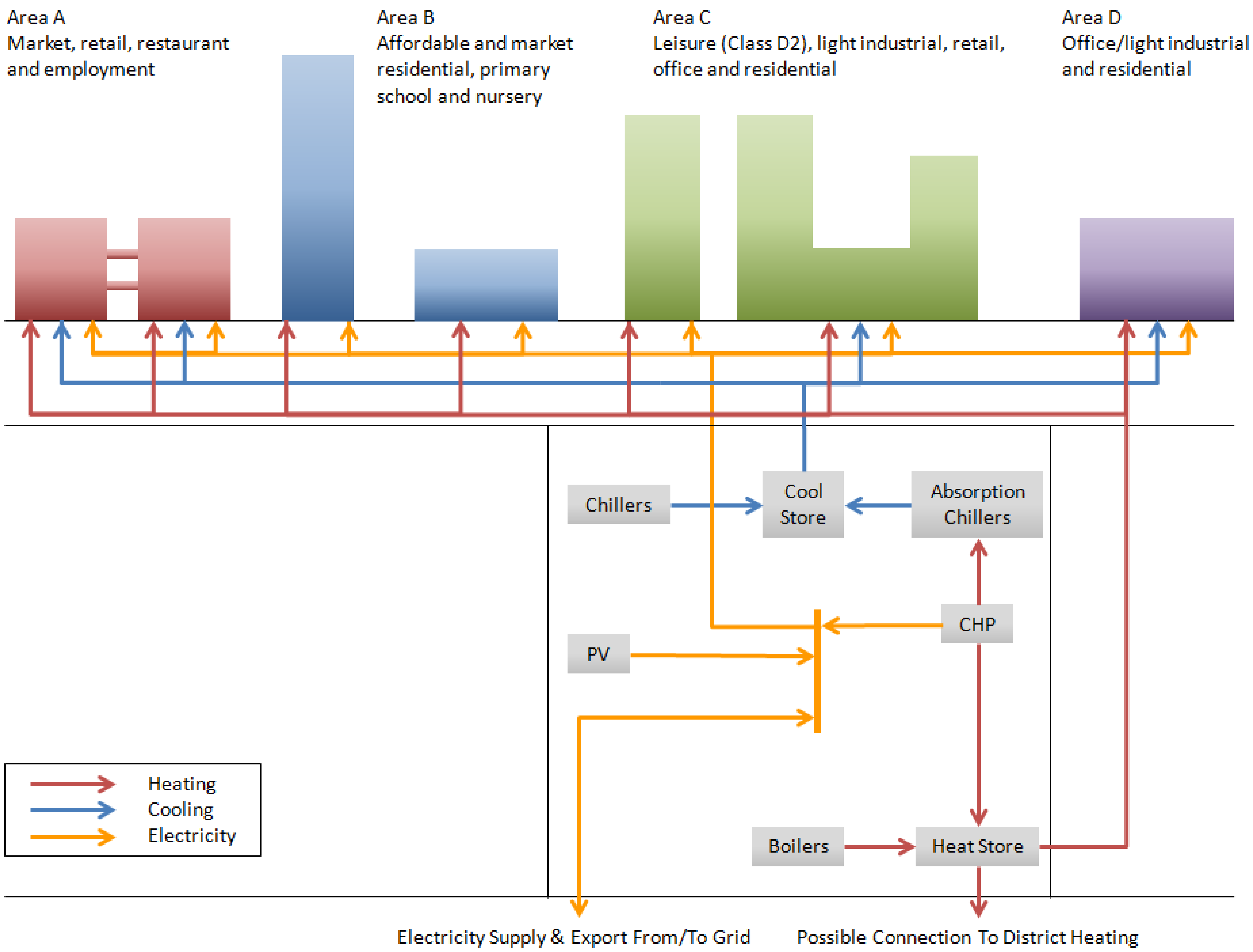


Figure 12: District Energy System Diagrammatic

8. Renewable Energy Supply: Be Green

The current version of the London Plan encourages developments to seek to reduce carbon dioxide emissions through the use of on-site renewable energy generation where feasible within the framework of the Energy Hierarchy. This reduction is measured against the energy efficient 'Lean' and 'Clean' design emissions.

The Plan also recommends the following renewable energy technologies are likely to offer the best potential in London buildings in terms of environmental, technical and economic feasibility:

- Biomass heating / cooling / electricity
- Renewable energy from waste
- Photovoltaics
- Solar hot water heating
- Wind turbines
- Ground source/ aquifer heat pumps

Each of these has been assessed and discussed shown within the following pages.

The London Plan also encourages the use of innovative energy technologies such as hydrogen fuel cell vehicles or anaerobic digestion. As well as the introduction of hydrogen supply and distribution infrastructure. These concepts have been discussed within this section of the report.

8.1 Biomass / Biodiesel CCHP

A common and sustainable type of biomass is wood in the form of small chips or pellets. These are produced as a waste product in the forestry industry. The fuel is burnt in specially designed boilers with high efficiency filters on the exhaust so that very low particulate emissions are achieved.

Although carbon dioxide is emitted in the exhaust gas, this originated from the atmosphere and stored within the tree by photosynthesis. As such, it is considered a 'carbon neutral' fuel. However, some fossil fuel will be expended in producing and transporting biomass which is why it has some associated carbon emission. The building regulations specify an emission rate of approximately one-seventh that of natural gas.

The key issues with biomass are fuel handling and storage, fuel availability, NOx emissions and ash disposal. The size of the installation and the frequency of fuel deliveries required would make biomass / bio-gas impractical for this site.

The use of biofuel is potentially technically feasible as a fuel source for CHP engines however at the current time there are concerns regarding the long term ethical sourcing of biofuels. In addition their high cost would be difficult to justify for use as a residential fuel.

Due to the high particulate matter (PM) and nitrogen oxide (NOx) emissions and the potential nitrous oxide (N_2O) biomass and biofuel installations may not meet the air quality requirements.

For these reasons neither biomass nor liquid biofuel driven CCHP are considered for the Camden Lock Village Development.

8.2 Renewable Energy from Waste

Generating energy from waste through anaerobic digestion, gasification or pyrolysis would not be appropriate for this development due to the relatively low levels of combustible waste produced on site.

8.3 Photovoltaic

Although the PV panels can provide only a fraction of the electrical energy required on this development, PV will be installed where possible to coordinate with the roofs and accessible amenity roof spaces on the development. Unfortunately the site does not have adequate roof space to incorporate the panels in order to provide a significant amount of energy.

8.4 Solar Hot Water Heating

Although solar water collectors could potentially be installed within the Camden Lock Village development they have been discounted due to the following reasons. The hot water they generate would reduce the potential base load of the CHP system. Also solar water heating panels need to be located at roof level in a generally south facing direction which the proposed site will be unable to provide to achieve any meaningful contribution to the site domestic hot water demand.

8.5 Wind Turbines

Wind turbines generate electricity directly from the energy in wind. This is then fed into the buildings electrical system via control gear. Recent measurements of a wind turbine on a London building has confirmed reports that wind turbulence around buildings greatly reduces energy output – typically half that suggested by manufacturers' literature which makes their viability within city sites very unlikely.

Due to planning restrictions on building heights within the sensitive viewing corridors the installation of wind turbines is not recommended for this project.

8.6 Ground Source / Aquifer Heat Pumps

A ground source heat pump system would be in direct conflict with this CHP, hence ground source heat pumps have not been proposed for this development.

The limitations imposed by the existing basements and difficulties of achieving acceptable separation on site would severely restrict the effectiveness of any aquifer system.

Also given the relatively small contribution to the site compared with the benefits of the CHP system it is not proposed to pursue this option for Camden Lock Village development.

8.7 'Green' Building CO2 Emissions Results

The chart below summarises the anticipated CO2 emissions of the combined building systems with the 'Lean', 'Clean' and 'Green' building energy saving measures through good 'passive' and 'active' designs, the 'Clean' technologies proposed and the proposed 'Renewable' technologies.

Table 9: 'Lean', 'Clean' and 'Green' annual CO2 Emissions (Tonnes CO2)

	Carbon Dioxide Emissions (Tonnes CO2 per Annum)						
	Area A	Area B		Area C		Area D	
	Retail / Restaurant	Residential	School	Residential	Office / Retail/ Leisure	Residential	Office / Retail
Building Regulations 2010, Part L Compliant Development	431	53	38	112	215	43	23
Lean Building	436	48	32	105	187	38	22
Clean Building	337	34	25	74	160	27	20
Green Building	335	34	25	73	159	27	20

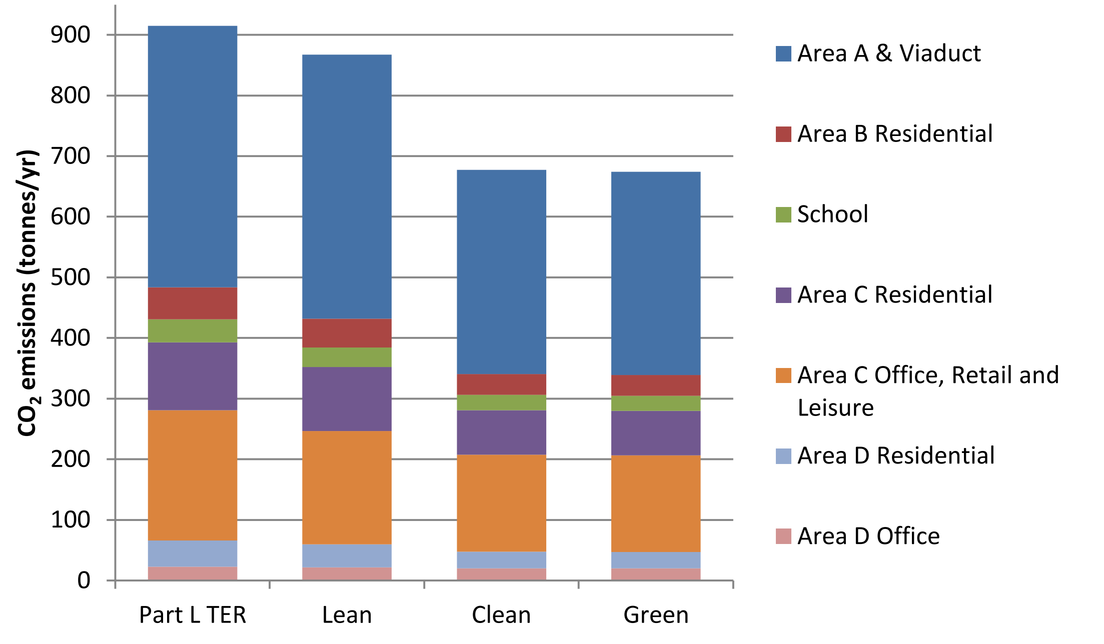
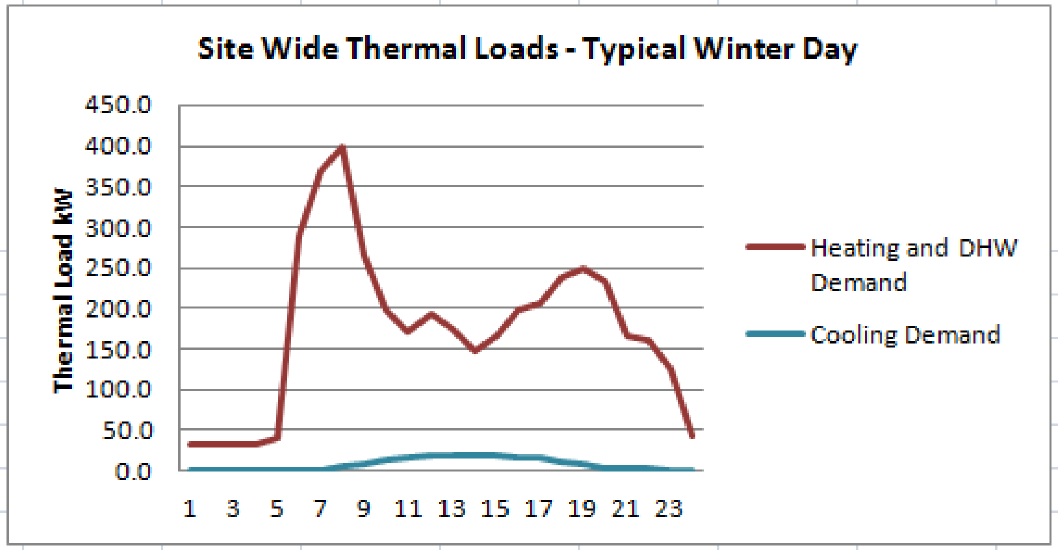


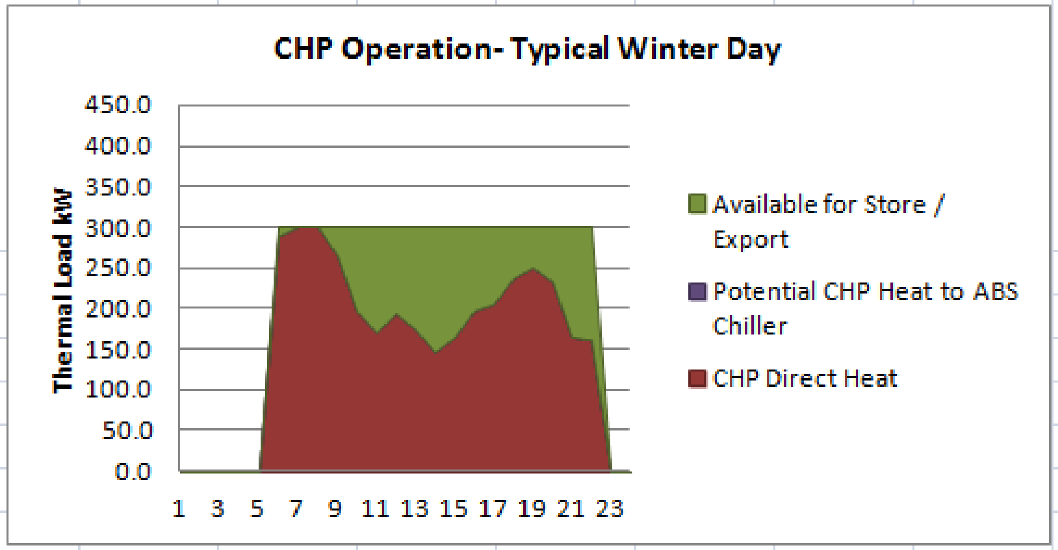
Figure 13: % reduction in annual CO2 emissions relative to Part L TER for the 'Lean', 'Clean' & Green development (Tonnes CO2)

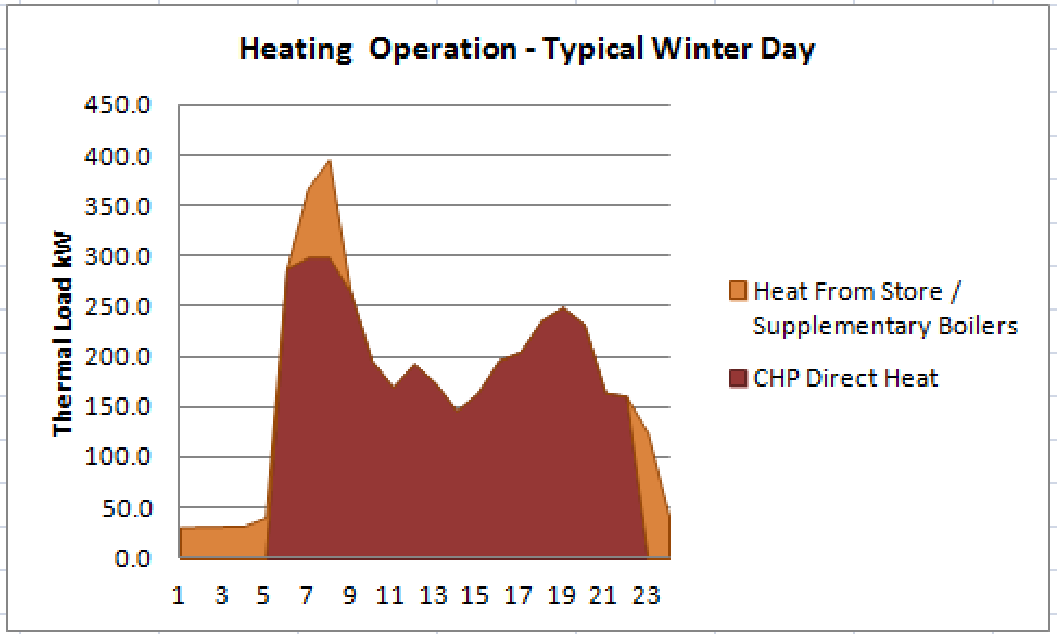
Appendices

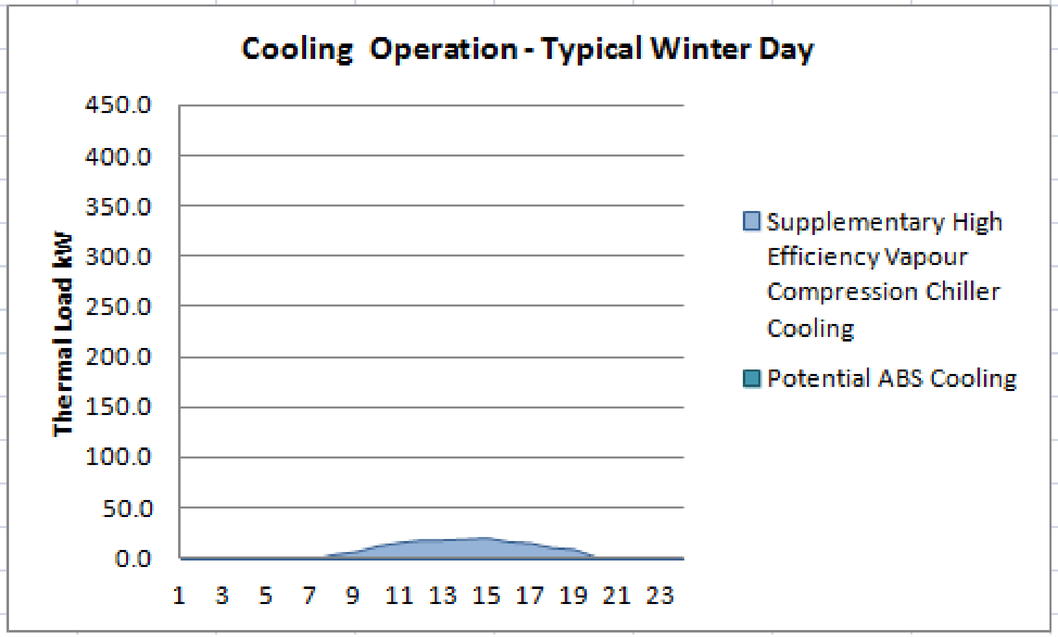
Appendix A - CHP Load Profiles

Camden Lock Village Winter Load Profiles for the sizing of Combined Cooling, Heating Power Plant

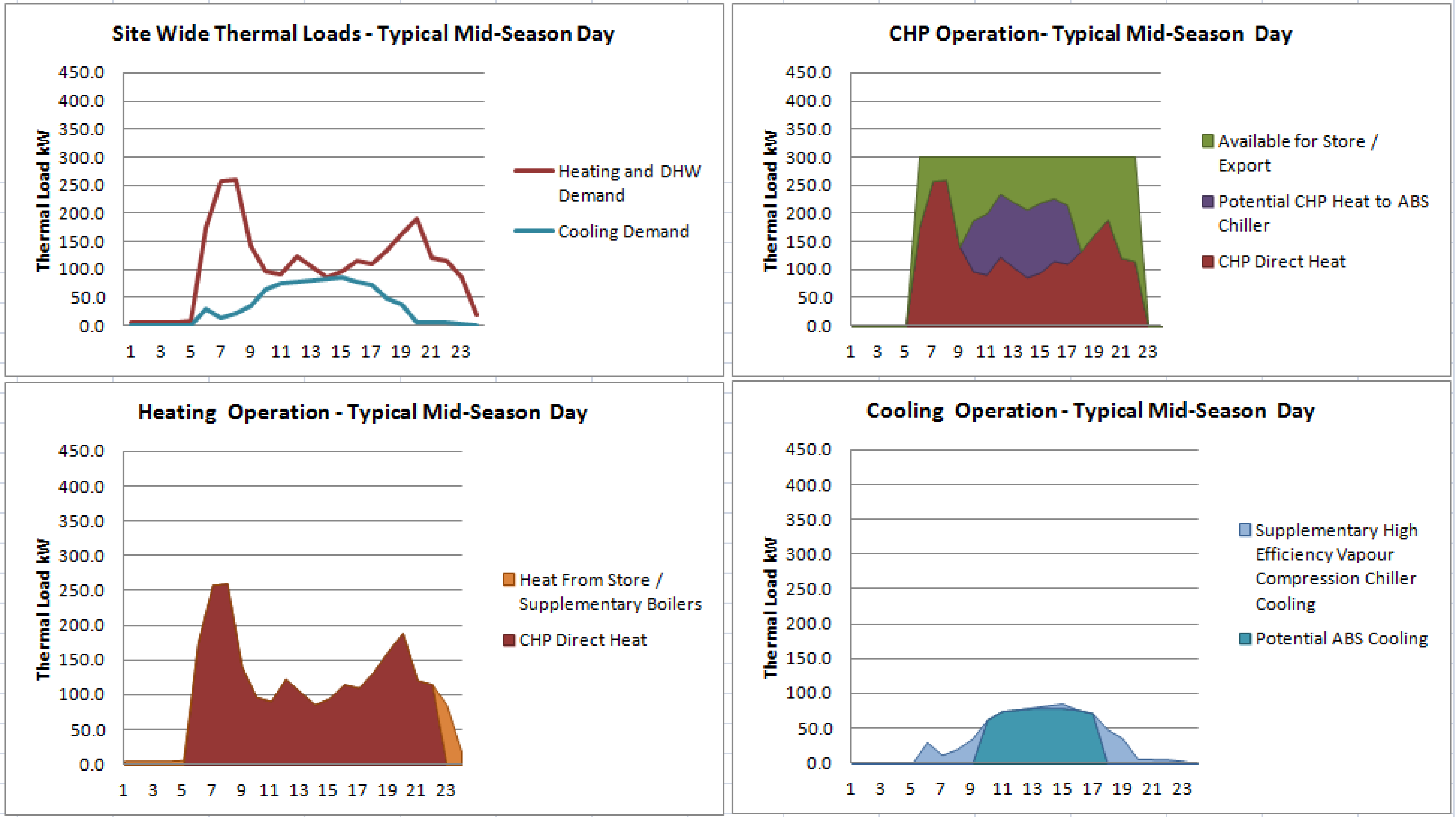








Camden Lock Village Mid-Season Load Profiles for the sizing of Combined Cooling, Heating Power Plant



Camden Lock Village Summer Load Profiles for the sizing of Combined Cooling, Heating Power Plant