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DEVELOPMENT OF CAMDEN SITES
KILN PLACE STAGE D ENERGY STRATEGY & CFSH REPORT

Ramboll QA Page

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EXECUTIVE SUMMARY

This document has been prepared in support of a planning application on behalf of EC Harris for the Proposed Development at Kiln Place, London Borough of Camden. This report reflects the recommendations from the meetings dated 02/10/2013 and 24/03/2014 between the Camden Energy Management Team and Ramboll UK. It has been agreed both by Camden Council & the Camden Energy Management team to achieve a Code for Sustainable Homes Level 4 accreditation under Part L 2010. The project has been registered under Part L 2010 Code for Sustainable Homes.

This concept for sustainability follows an 'insulate then generate' philosophy, focusing heavily on passive design measures that falls under the Lean savings in The London Plan (2011). A renewable feasibility study and an energy assessment have been undertaken post stage C.
The entire development achieves a cumulative savings of 28% reduction in carbon emission from the Part L 2010 level. This exceeds the buildings regulation of achieving 25% onsite reduction of Carbon emission. Table 1 and Figure 1 shows the cumulative carbon savings achieved on the entire development following the Energy Hierarchy as per The London Plan (2011) and Revised Early Minor Alterations to the London Plan (2013).

The key principles are stated below:

- The project would be adopting Building Regulations Part L 2010
- Code for Sustainable Home level 4 (Part L2010) – Design Stage Assessment has been attached in appendix C.
- Mayor Housing Standards for Social Rented and Lifetime Homes.

The Energy Strategy responds to the following planning policies:

- London Plan (July 2011) and revised early minor Alterations to London Plan 2013.
- Building Regulations (Part L 2010), meeting improvement of 25% over Part L 2010.

The Application Site will include the combination of energy efficiency and low carbon technologies:

- Passivhaus principles have been adopted where economically and practically viable after discussion with the design team.
- Improved construction U-values and Air Permeability beyond typical standards set out in Part L of the Building Regulations;
- Dwellings are to be ventilated using whole house mechanical ventilation with heat recovery with open able window to add additional ventilation.
- Energy efficient internal lighting;
- Efficient gas boiler
- SAP analyses have been undertaken using NHER version 5.4.2. Refer to Appendix B.
- Onsite electricity generation from renewable technology

Onsite Renewal Contribution

A feasibility study has been undertaken to establish the energy profile of the proposed development and the most appropriate solutions considered in terms of technical, practical and economic viability. Renewables Feasibility study was undertaken to understand the viability and practicality of each solution.

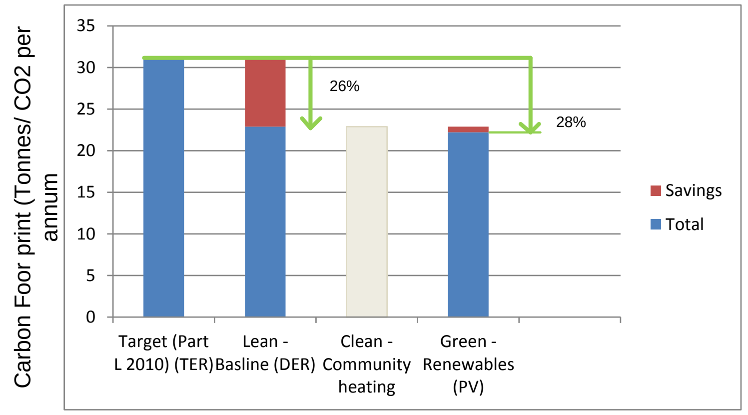
The entire development consist of sixteen (15) no of dwellings, which achieves a total improvement of 28% over Part L 2010, complying with Code for Sustainable Homes Level 4. Thus meets the requirements sets by the Camden Energy for this project.

The proposed efficient passive design strategies, air tightness (varies from 1.5 to 3 m³/hm²@50 Pa) depending on dwelling types, high efficiency condensing boiler and mechanical ventilation with heat recovery, achieves an onsite improvement of 26% over Part L 2010.
Photo Voltaic have been utilized as onsite renewable technology for selected number of dwellings where appropriate. Dwellings units on site 3, 4 and 5 requires a total of 2.4 kWp of photovoltaic panels, which equates to 18 m² of PV area (approx.), obtaining an onsite improvement of 3% over Part L 2010.

Dwelling unit site 6 does not require any photovoltaics but achieves a 25% reduction with passive design measures and the use of a high efficiency MVHR. Please refer to the energy analysis section for details. This integrated site wide low carbon design strategy provides a significant carbon reduction, and will not necessitate behavioural change on the part of the occupants or place an excessive maintenance burden on the facilities management team.

	Carbon Emissions (TCO_2/Annum)	Percentage Reduction compared to Part L 2010
	Part L (2010) (Regulated)	**% Improvement**
Baseline (Target Part L compliance)	31	-
Proposed Energy efficient measures	23	26%
Proposed Community Energy Scheme + CHP	0	0%
Energy efficient dwelling plus renewables	22	3%
	Total reduction from Target Part L	**28%**

Table 1: Shows the developments estimated carbon emission reduction following London Plan (2011 Energy Hierarchy)



Carbon Savings at the proposed development

Figure 1: Whole Site Carbon Emission Savings

1. INTRODUCTION

Camden Council is considering various ways to meet its commitment to deliver 'better homes' and sustainable communities by raising finance from building new homes on small plots of land on some of its housing estates. Some of the new homes will provide new, much needed, affordable housing and some will be sold to raise finance for the affordable homes and a surplus to invest in repairing and improving existing homes, community facilities and the estate environment.

Camden's Aspirations for the Kiln Place Development:
In response to Camden's aspiration to create a sustainable development, the opportunity exists to fully integrate these issues into the master plan right from the start by following these key principles:

Passive design emphasis
To take advantage of the site's specific environment - orientation, massing, solar access, solar shading and daylight.

Reduce, Reuse, Recycle
In order of preference, to minimise energy requirements, reuse water and recycle materials or waste.

Integrate and Educate
Integration of the site specific conditions (natural and man-made) and making connections, to contribute towards creating a distinct place and a strong sense of community and belonging.

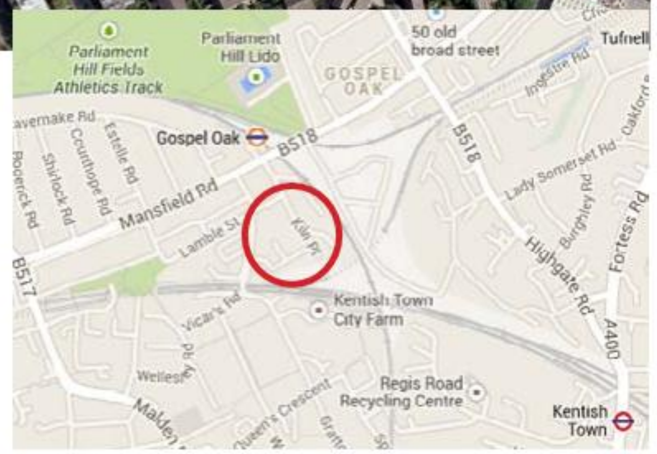
Collective approach
To engage and inspire lifestyle change with the local and wider community, new and existing.

Simple Operation
Systems that are simple to operate and run with minimal maintenance will be preferable to complex systems which should be avoided.

2. DESIGN BRIEF

Sustainability can be measured in various ways. The aim of the design brief for this development is to obtain, where possible, a site wide sustainability principle for the entire development. The entire development achieves a cumulative saving of 28% reduction in carbon emission from the Part L 2010 level. This exceeds the buildings regulation of achieving 25% onsite reduction of Carbon emission. Passivhaus u values and principles have been implemented where possible.

Aerial View of Gospel Oak - Kiln Place Estate shown in red boundary



Site Location Map

Figure 2: Indicative Site Plan for the development

3. SITE WIDE SUSTAINABILITY

a) Site Analysis

A starting point for creating sustainable buildings begins with proper site selection and a whole site approach to sustainable design. The location and orientation of the buildings affects a wide range of environmental issues, such as security, accessibility, energy consumption, the impact on local ecosystems, and the use and reuse of existing structures and infrastructures.

b) Sustainable planning

The aim for the new development is to achieve the optimum orientation to maximise solar gain during winter, whilst providing shade in summer months. Natural daylight can reduce the use of artificial light in domestic properties and play vital part in reducing energy wastage.

All units have open able windows as well as mechanical ventilation with heat recovery, to reduce the summer time overheating risk that is prevalent in the city of London due to, Urban Heat island effect.

Measures have been adopted to reduce pollution and improve air quality within the site. The focus will be on enhancing the ecology and biodiversity of the site.
Water conservation measures have been adopted where technically and practically feasible. Sustainable drainage system and surface water run off with paving have been adopted.

Due to the site's urban location, sustainable travel through encouraging cycling and walking will be encouraged. The site will adhere to the existing onsite recycling policy set by Camden Council.

Site wide sustainable drainage strategies have been undertaken. Please refer to the Drainage Strategy Report for further details.

c) Our Approach to Low Carbon Buildings

In the development we followed our simple three step approach in designing a low carbon building based on the Merton Rule.

The first step is to reduce a building's demand for energy. Passive design measures are those which involve designing to reduce the need for energy in the first place. They include aspects such as maximising natural daylight, thermal mass, air tightness (please refer to SAp DER worksheet for details) and ventilation so that the use of energy intensive artificial lighting and cooling systems are minimised. However, it is difficult to eradicate the need for energy entirely, as most spaces require appliances and consumables and heating during the winter.

The second step involves using the required energy as efficiently as possible, by providing efficient building services and high performance appliances. These are called active measures, as they actively work to reduce a building's energy consumption.

The final step is to generate energy from low or zero carbon technologies. This should only be considered as a final measure following the 'insulate then generate' philosophy. A feasibility study have been undertaken to establish the individual energy profile of the development and the most appropriate solutions have been considered in terms of practical, financial and commercial viability.

Green and Brown Roofs will be incorporated where appropriate in the next design stage.

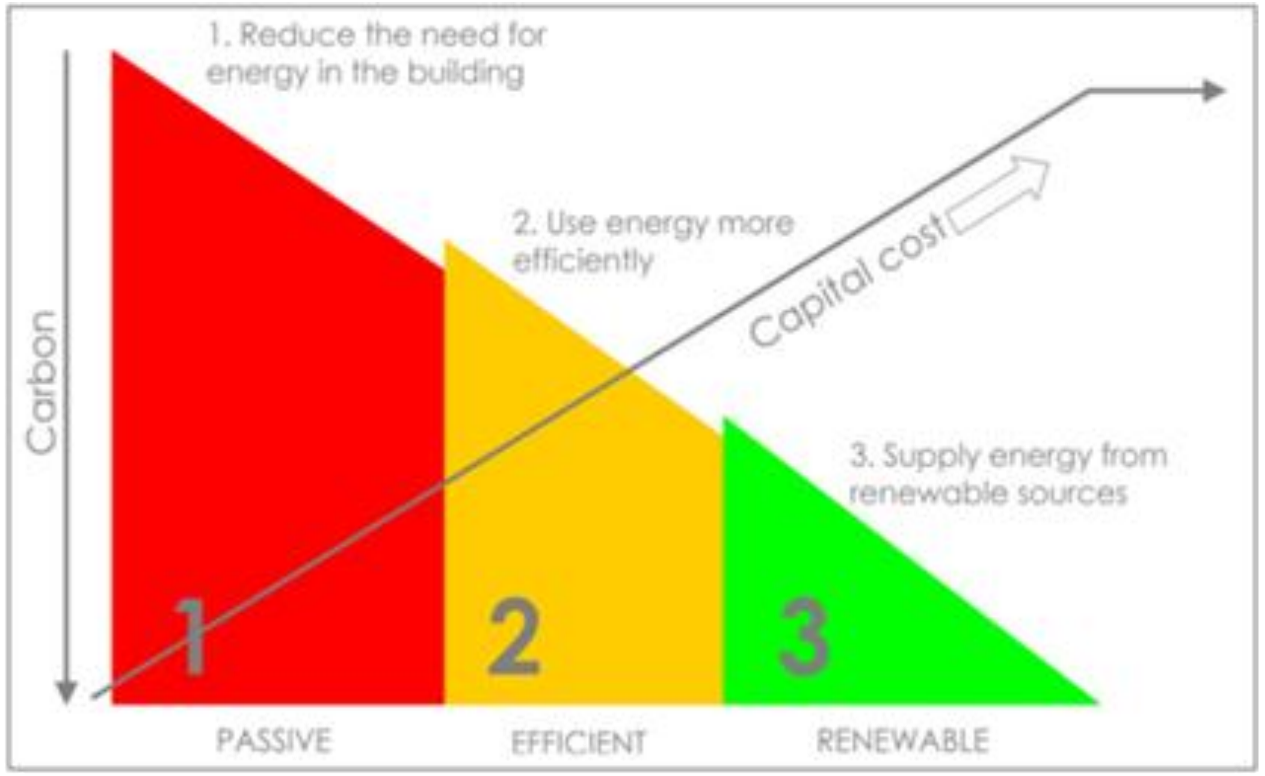


Figure 3: Three Step Process to low energy building

4. PLANNING POLICY AND CONTEXT

a. Policy Context

The following section relates solely to energy specific planning policies. Please refer to the Planning Statement for further details.

i. National Policy:

Planning and Energy Act 2008 (13th November 2008)
The Government's Energy Policy, including its policy on renewable energy, is set out in the Energy White Paper. This aims to put the UK on a path to cut its Carbon Dioxide emissions by some 50% by 2050, with real progress by 2020, and to maintain reliable and competitive energy supplies. As part of the strategy for achieving these reductions, the White Paper sets out:

- The Government's target to generate 10% of UK electricity from renewable energy sources by 2010; and
- The Government's aspiration to double that figure to 20% by 2020 and suggests that still more renewable energy will be needed beyond that date.

National Planning Policy Framework (March 2012) Meeting the challenge of climate change, flooding and coastal change

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.
Local planning authorities should adopt proactive strategies to mitigate and adapt to climate change, taking full account of flood risk, coastal change and water supply and demand considerations.
To support the move to a low carbon future, local planning authorities should:

- plan for new development in locations and ways which reduce greenhouse gas emissions;
- actively support energy efficiency improvements to existing buildings; and
- when setting any local requirement for a building's sustainability, do so in a way consistent with the Government's zero carbon buildings policy and adopt nationally described standards.

In determining planning applications, local planning authorities should expect new development 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 or viable; and
- Take account of landform, layout, building orientation, massing and landscaping to minimise energy consumption.

To help increase the use and supply of renewable and low carbon energy, local planning authorities should recognise the responsibility on all communities to contribute to energy generation from renewable or low carbon sources. They should:

- have a positive strategy to promote energy from renewable and low carbon sources;
- design their policies to maximise renewable and low carbon energy development while ensuring that adverse impacts are addressed satisfactorily, including cumulative landscape and visual impacts;
- consider identifying suitable areas for renewable and low carbon energy sources, and supporting infrastructure, where this would help secure the development of such sources;
- support community-led initiatives for renewable and low carbon energy, including developments outside such areas being taken forward through neighbourhood planning; and
- Identify opportunities where development can draw its energy supply from decentralised, renewable or low carbon energy supply systems and for co-locating potential heat customers and suppliers.

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 recognize that even small-scale projects provide a valuable contribution to cutting greenhouse gas emissions; and
- Approve the application if its impacts are (or can be made) acceptable. Once suitable areas for renewable and low carbon energy have been identified in plans, local planning authorities should also expect subsequent applications for commercial scale projects outside these areas to demonstrate that the proposed location meets the criteria used in identifying suitable areas.

Building Regulations (Part L 2010)
Approved Document Part L 2010 provides requirements and guidance on the Conservation of Fuel and Power in new Dwellings.
The new regulations for both Parts L1A and L2B are structured on 5 main compliance criteria:

- Comparison of actual building and target emission ratings;
- Limits on design flexibility;
- Limiting solar gain in summer;
- Building performance; and
- Providing information.

These criteria provide the backbone of the regulations. The main changes from the previous regulations that are determined by these criteria are stated below:
The building must show a 25% improvement on a notional building. In order to provide evidence of this improvement, a Standard Assessment Procedure (SAP) calculation is carried out on a notional building with fixed parameters and the actual building. SAP calculations are required at both the design stage and post construction stage. This enables energy efficiency measures to be incorporated at an early stage and to demonstrate that these have been incorporated.

b. Regional

The London Plan (July 2011)
Policy 5.2 Minimising Carbon Dioxide Emissions

Figure 4: Planning Policy Document

The London Plan was revised and published in July 2011 and Revised Early Minor Alterations to the London Plan were made in 2013 The Mayor states all boroughs should adopt the new London Plan where the developments will achieve a reduction in carbon dioxide emissions by the following the Energy Hierarchy:

Energy Hierarchy: 1. Be Lean, 2. Be Clean and 3. Be Green.

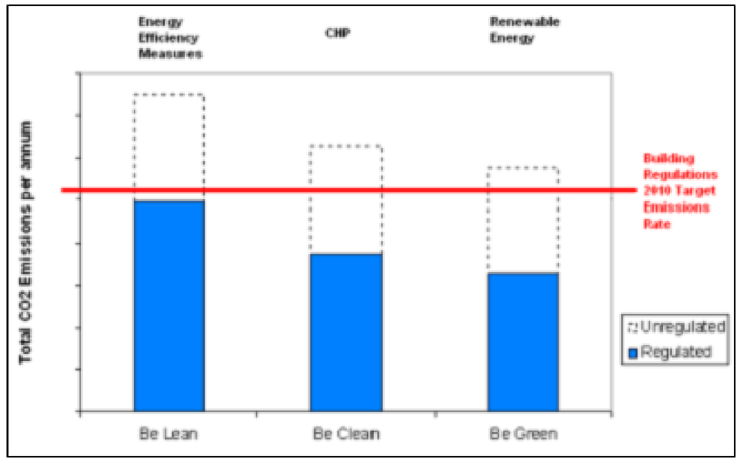


Figure 5: Energy Hierarchy; GLA Energy Team Guidance on Planning Energy Assessments

Figure 5 shows the energy hierarchy, which outlines a methodology under which the GLA requires sustainable building design to be assessed. The energy hierarchy first looks at reducing the energy demand of a building through passive design measures (Be Lean), then incorporating active energy measures through energy efficient servicing strategy, lighting and electrical controls, and community heating (Be Clean), and finally further reducing the carbon emissions through the use of on-site renewable energy technologies (Be Green).
The London Plan 2011 achieves a 25% improvement in site-wide CO_2 emissions. This 25% improvement may be achieved via any combination of passive measures, active-energy efficiency measures, and renewable energy technologies.
It provides freedom of design to the developer while providing a tangible sustainability target specific to the development that must be met. This has replaced the 20% renewable obligation previously in place under the London Plan 2008.
Energy:
The London Plan 2011 outlines a target for both domestic and non-domestic projects to achieve a 25% improvement on Part L 2010. For residential projects it translates to meeting Code for Sustainable Home (CfSH) level 4.
Future projects are encouraged to evaluate the incorporation of CHP into their developments, and consider the potential to extend such schemes beyond site boundaries to adjacent energy consumers. Following on from this goal, it is required that energy systems for all major developments be evaluated and designed with the following hierarchy in mind:

- Connection to an existing heating or cooling network
- Site wide CHP network
- Communal Heating and Cooling

This requirement has not changed since the 2008 London Plan.

c. Camden Core Strategy (2010-2025)
Camden's Core Strategy sets out the key elements of the Council's planning vision and strategy for the borough. It forms a central part of the Local Development Framework, a group of documents setting out our planning strategy and policies.

Policy CS13: Tackling climate change through promoting higher Environmental standards
13.8 The Camden Council encourages use of the Energy Hierarchy to reduce carbon emission to meet the London Plan 2011 and national target of 80% reduction of CO2 emissions by 2050.
13.11 Council encourages where feasible, new developments will be required to incorporate renewable energy generating plant to meet a proportion of the development's overall energy demand and meet a 20% onsite energy generation.
88% of Camden's overall carbon emission is from buildings. Therefore the Council encourages all buildings to be as energy efficient as possible following policy CS13 of the Core Strategy.
All new developments are to be designed to minimise carbon dioxide emissions. The most cost-effective ways to minimise energy demand are through good design and high levels of insulation and air tightness.
Camden council will encourage use of renewable energy installations that achieve good design solutions, particularly in sensitive areas, and that avoid detrimental effects on the surrounding area.
The Mayor of London has set a target that 25 per cent of the heat and power used in London is to be generated through the use of localised decentralised energy systems by 2025. In order to achieve this target the Mayor prioritises the development of decentralised heating and cooling networks at the development and area wide level, as well as larger scale heat transmission networks. Where feasible and viable new developments will be required to connect to a decentralised energy network or include CHP.

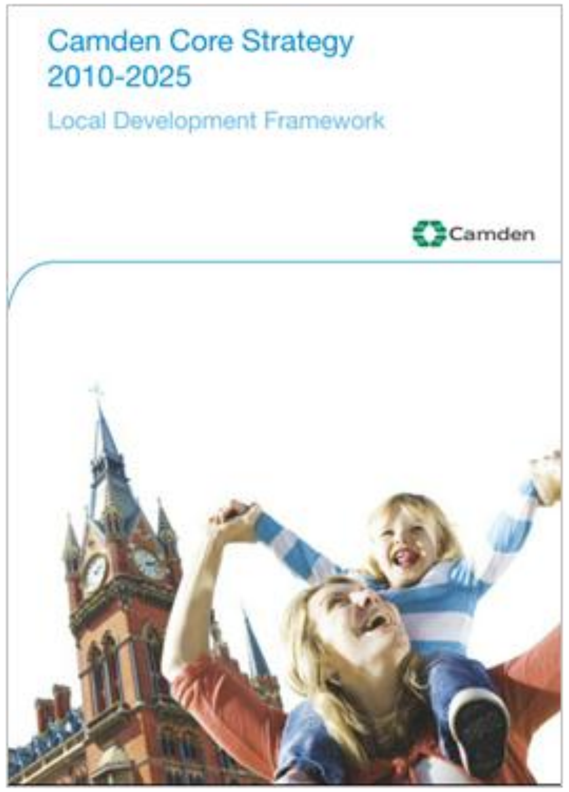


Figure 6: Camden Core Strategy 2010 – 2025

5. METHODOLOGY

This report draws on the information and approach set out in the London Plan (2011) and revised early minor alterations to the London Plan (2013), and the London Borough of Camden's Core Strategy. The levels of carbon dioxide emissions will be assessed against the targets within the London Plan policy and Part L of the Building Regulations (2010).

Part L Energy Demand
A Part L (2010) Standard Assessment Procedure (SAP) analysis has been conducted to calculate the Carbon Dioxide emissions for the following end uses: heating, hot water, cooling, fans, pumps and controls and lighting. The Dwellings have been modelled using NHER 5.4.2 and the results used appropriately to predict the total site energy consumption.

Various energy saving measures have been considered in terms of technical and economic feasibility and their effect on Carbon Dioxide emissions, for example building fabric, low energy lighting, natural daylighting and high efficiency boilers.

The measures outlined below have been used in the calculations, and exceed the requirements of Part L.

This section analyses the energy efficiency measures that have been considered at the feasibility stage of the design in order to minimise the energy demand and to achieve excellent building performance.

6. BASELINE EMISSIONS

The baseline carbon emissions for the proposed development are defined as the total emission rate for a building regulation compliant building. Target Emission Rates for dwellings have been used to calculate the regulated emissions, including space heating, hot water and lighting. Regulated Emissions for the residential area have been calculated using the approved Standard Approved Procedure (SAP) methodology. Sample dwellings have been analysed, covering the range of proposed dwelling layouts and orientations. The emissions from these dwellings are considered representative of the entire site, and have been averaged to establish a whole site energy estimate.

SAP worksheets are included in Appendix B.

6.1 Being Lean (efficiency Measures)

The Proposed Development will feature adequate passive energy saving measures to be in compliance with Part L (2010) of the Building Regulations. As the Proposed Development consists of residential and commercial properties, studies have been undertaken to demonstrate compliance with Part L 2010 for all buildings.

Passive and Energy Efficiency Measures:
Listed below are a number of energy saving measures which will benefit the development. These will be taken into account during the evolution of the design and have been incorporated into a thermal study analysis to estimate the energy demand. These measures will reduce the on-site energy used and hence the associated CO2 emissions.

Building fabric and air permeability	Minimum requirements of the Building Regulations	Proposed for the development
External walls U values (W/m2.K)	0.30	0.15
Party Wall U values (W/m2.K)	0.20	0.25
Roof (U values (W/m2.K)	0.20	0.10
Floor U values (W/m2.K)	0.25	0.10
Windows U values (W/m2.K)	2.00	1.00
Doors U values (W/m2.K)	2.00	1.00
Air permeability (m3/m2.h @50Pa)	10.00	2.0
Accredited Construction Details	y=0.15	y=0.08

Table 2: Residential Areas - Building fabric U values and air permeability

Lighting
Energy consumption from lighting is minimised via the following measures:

- Energy efficient light fittings have been specified throughout.
- The lighting will be occupancy controlled via master switch control (where feasible/practical).
- Lighting time clock control is specified for stairs/lobbies and all BOH corridors.
- All other areas will be facilitated either with central scene control or local switching facility to ensure lighting is used when required.

External lighting will be energy efficient and suitable to comply with the security and design requirements.

AVERAGE IMPROVEMENT: 26 % from Part L 2010.

Building design and envelope:

- The general internal layout is designed to ensure good daylight access for the building.
- Where feasible, each space is designed with open able windows to allow for natural ventilation.

Good U-values are used throughout the development's external elements to reduce the heat losses.

6.2 Being Clean (Low Carbon Technology Appraisal)

The London Plan requires all developments to demonstrate that heating, cooling and power systems have been selected to minimize carbon dioxide emissions. Decentralized energy production and heating and cooling networks are identified as the most cost-effective mechanism for delivering carbon dioxide reductions in London.

Heating system for Proposed Development:

CHP requires predictable and relatively constant loads for best performance, as well as an adequate plant area for the associated equipment. In its simplest form, it employs a gas turbine or an engine to drive an alternator, and the resulting electricity is used wholly or partially on-site. The heat produced during power generation is recovered, usually in a heat recovery boiler, and can be used to provide Domestic Hot Water (DHW) and/or space heating in buildings.

The 15 detached dwellings are situated in a site across six different locations, that have a very low heating demand for such application. Currently there is no site wide centralized heating system or a combined heat and power system. All dwellings are service by individual boilers. In discussion with Camden this technology was not preferred by the council due to their experience with the maintenance issues.

Residential

It has been discussed with the Client, Camden Council and the wider design team that individual gas supplies will be provided to the proposed dwellings to serve gas condensing boilers within each residential unit. The feasibility of this strategy has been outlined in the mechanical drawings. As the proposed properties are spread on the five different sites, it is more practical to have individual boiler per dwelling to make the maintenance more economically practical.
The route of gas distribution pipework will be carefully considered to ensure safety requirements are met and adequate space is provided for dwelling routes and meter locations. There is no intention to provide gas for cooking. Gas will be brought into ground floor level intake/meter room from the low pressure gas mains in the adjacent streets; the enclosure will be naturally or mechanically ventilated. The incoming gas meters shall have a pulsed output.

CHP Review for Kiln Place:

- In order for the heating application to replace conventional heating systems, the demand for heat must be continuous. Particularly attractive for facilities with a high continuous heating demand 7,000 – 8,000 a year. The longer the operating hours, the greater the economic and environmental benefit delivered to the end user
- To maximise energy efficiency, the energy centre of a CHP unit needs to be placed close to where heat will be used so thermal energy isn't lost during the storage process and through the network distribution
- Larger plant floor space required to accommodate thermal store/buffer vessel. This unit is to prevent frequent cycling of the CHP unit during periods of low thermal load, which could lead to premature engine failure and/or increased maintenance and part replacement costs

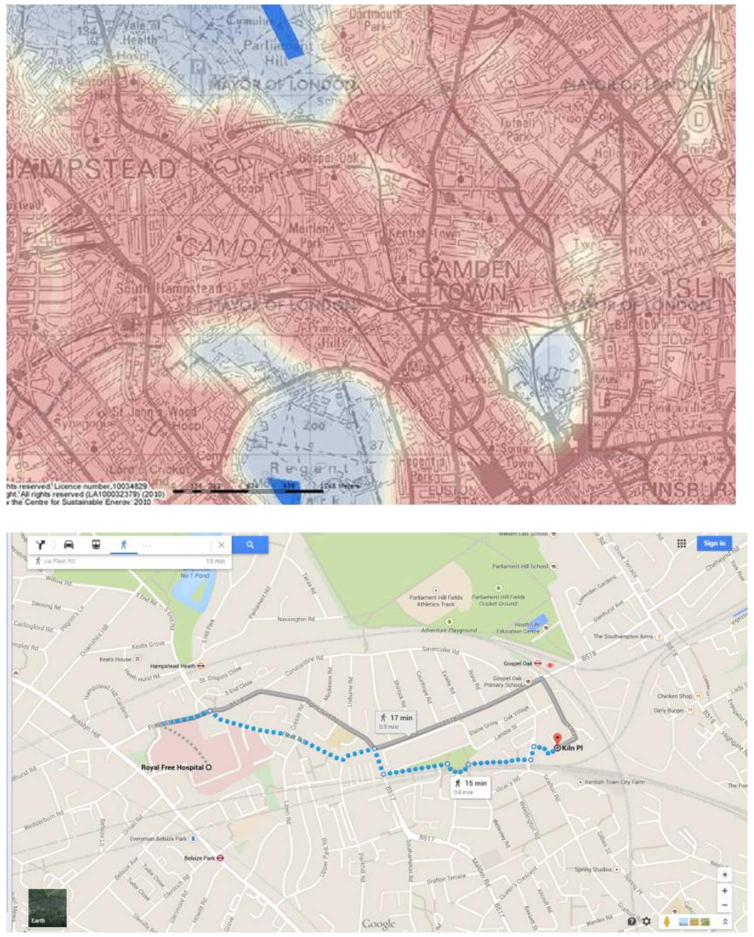


Figure 7: London Heat Map

- Not suitable for modulating electricity and thermal energy demand. During the summer months where the need for heating is reduced, whilst the electricity demand remains fairly constant
- Very few sites offer a financially viable proposition for exporting of low level electricity loads to the grid network
- Increased initial infrastructure and capital costing due to trenched distribution network to points of use
- A distributed control system ensures effective monitoring and operation, including remote control where appropriate. Interventions by site staff tend to be infrequent, and staffing levels can be low with only shift supervision required. Again this type of system tends to be used in plants that have relatively uncomplicated plant control requirements, such as those that operate continuously without changes in load or output.

Connecting to Community District Heating Scheme:

Royal free hospital is within connection distance (0.8 mile) to Kiln Place development. We have been informed, that the existing system is currently running close to full capacity and the thermal energy required for the space heating and water heating at the new developments exceeds this known capacity. Camden Council had stated that they had concerns over the reliability and maintenance surrounding the current plant and distribution network during the discussions. Thus the proposed development will not be connecting to the existing system at the Royal Free Hospital.

Kiln Place Heating Strategy:
Each dwelling will be serviced individually. Such a system is favoured because it offers:

- Low cost installation
- Reliability of services
- Ease for occupant control and monitoring

Apartments within Kiln Place will be served by independent gas fired condensing boilers, one located within each dwelling. Internal design conditions; CIBSE Guide B (Note: selected assuming there are no requirements for persons or properties with special heating needs)
Winter external design conditions; CIBSE Guide A

Main Plant

The heating system for each dwelling will be located in utility cupboards located within the dwelling demise. The system will supply the dwelling with Low Temperature Hot Water (LTHW) to serve heat emitters.
The individual heating systems will consist of gas fired boilers. The gas fried boilers will be configured in an arrangement to enable efficient matching of the buildings annual thermal and hot water load.

Gas Boilers

The main heating plant will be located within the utility cupboard of the house and will comprise a minimum of 1No. gas fired, high efficiency boiler with low NOx emissions. Boiler will be sized to provide a minimum of 110% of the total demand to enable them to supply the entire dwelling heating load to cope with peak loads.
Each boiler will be fitted with a boiler circulating pump (located within the boiler), pressure and temperature safety valve.

Ventilation
Residential

A combination of natural and mechanical ventilation methods are employed to serve the residential apartments. The exact requirements will be dependent on the energy calculations to be carried out in the next phase.

It is presumed at this stage that each apartment will require a high efficiency MVHR installation to ensure the properties meet the energy requirements of CFSH level 4 and in accordance with Part F of the building Regulations.

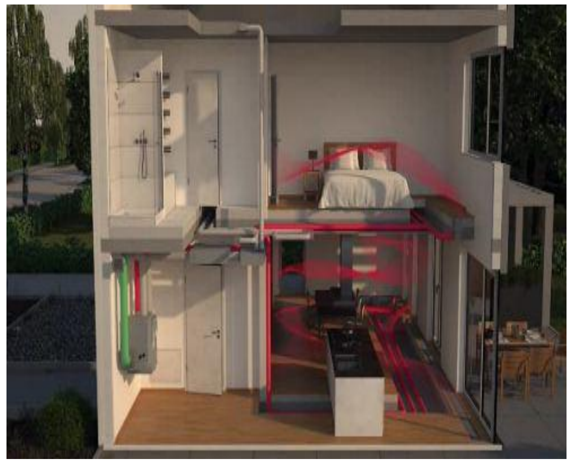


Figure 8: Concealed ductwork routing (a); MVHR application (b)

Each residential unit shall be provided with whole house mechanical heat recovery ventilation systems with a high efficiency (90% efficiency minimum). Fresh air will be provided via a Mechanical Ventilation Heat Recovery (MVHR) unit. The fresh air will be ducted from the MVHR in the ceiling voids in the property.

HVAC systems and controls

- All boilers will be high efficiency boilers.
- High efficiency heat recovery will be installed for all dwellings.
- All fans and pumps will operate with variable speed control.
- All fans and pumps will be high efficiency units.
- Hot water pipes, tanks and ducts will be insulated.
- Electric sub-metering is installed to monitor and target energy use within the development.
- 95% of all gas and electrical use will be metered. All major items of plant will also be sub-metered.
- Including cooling equipment, boilers, pumps and fans. The incoming gas and water mains will also be metered.
- The metering strategy is in alignment with CIBSE TM39.
- High electric power factor will be specified at least 0.95.

Conclusion:
Due to the limited potential benefit of CHP on this site, this technology is not recommended for this development and will not be taken forward.

6.3 Being Green (Renewable Appraisal)

Initial Overview of Renewables:
A feasibility study has been undertaken to consider the application of renewable technologies at the proposed development. All technologies appropriate to the site have been considered in terms of:

- Energy generated from LZC energy source per year
- Payback
- Land use
- Local planning requirements
- Noise
- Whole life cost and lifecycle impact
- Available grants and financial incentives

Baseline energy calculations indicate that energy demand at the site will be dominated by hot water and electricity. When converted into carbon, electricity becomes the principal contributor, responsible for over 60% of emissions.

Following pages show the renewable feasibility study undertaken to assess the viability of each technology, to obtain Code for Sustainable Homes level 4 for sample dwellings.

Wind Turbine:
Wind turbines harness the power of the wind to produce electricity through circular motion. They can produce electricity without carbon dioxide emissions, and range in outputs from watts to megawatts.

Recently the findings of the Warwick Wind Trials have found that even after sufficient adjustment of the usually referenced NOABL wind data to account for an urban setting, the actual output has been found to be half the electrical energy claimed by turbine manufacturers.

Wind Turbine on this site:
The site is in the middle of the city within residential area. The average wind speed of the site at 10 m is 4.8 m/s and at 20 m is 5.16 m/s. Small scale wind turbines not less than 6kW could be implemented on the highest point of the site, which might have structural implications.

Wind turbines are contentious in nature and may result in objection from both the residents at the residential development. This technology has been discounted at this stage, due to the reasons already stated.

Solar Thermal
Solar thermal collectors convert the sun's radiation into heat, which is transferred to a medium such as a water/glycol mix (to prevent freezing). Solar water heating is usually used for hot water generation, as this is a year round demand. It is not normally used for space heating as the greatest demand is in winter, when the sun's rays are weakest. Annual incident solar radiation in the London area is about 1100kWh. Ideally the collectors should be mounted on a South–facing roof, although Southeast and Southwest will also function successfully. The collectors need to be inclined at between 10-60° from horizontal – with 35° being the optimum.

Solar Thermal on this Site:
Solar hot water uses a heat collector, usually as panels on the roof in which liquid is heated by the sun. The fluid is used to heat up water that is stored in either a separate hot water cylinder or a twin hot water cylinder. There are two types of solar collector: flat plate and evacuated tubes, the latter being generally more efficient. There are a large number of manufacturers and suppliers, and an

examination of products from a number of manufacturers suggests that the average output is approximately 600kWh/m². Capital costs are approximately £600/m². Maintenance costs vary and mainly relate to replacement of parts. Solar thermal has been discounted as a result of the increased size of the systems requirement (hot water storage tanks, pipe work, insulation, etc). Also CO_2 emissions displaced by the solar thermal system will not be as efficient as those generated by other LCZ and renewable technologies.

Figure 9: Example of Solar Thermal System

Due to the limited potential benefit of Solar thermal on this site, this technology is not recommended for this development.

Ground Source Heat Pump (GSHP):

GSHP are a Low Carbon Technology, not a renewable system, as they require electricity to run the pumps and extract the energy from the ground, a minimum coefficient of performance (COP) of 2.2 is required to start carbon saving, with a recommended design COP of at least 3.5 to make the system cost-effective.

GSHP on this Site:

Ground source heat pumps (GSHP) could be implemented; however the feasibility depends greatly upon ground conditions and Environment Agency licensing. GSHP also provide low-grade heat which would be likely to require oversized radiators or underfloor heating. There is a risk that drilling or excavation could lead to pollution of groundwater or migration of contaminants (good practice guide for GSHP, Environment Agency). If the system serves both heating and domestic hot water then the SCOP is reduced making the system less efficient and resulting in fewer carbon savings. Also the limited external space would necessitate a vertical borehole system. This is likely to confer an excessive cost and disruption to site works.

Due to the limited potential benefit of GSHP on this site, the technology is not recommended for this development.

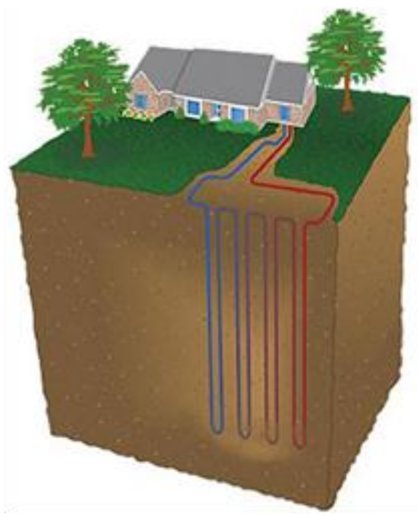


Figure 10: Example GSHP system

Combined Heat and Power on this Site:

Due to the limited potential benefit of CHP on this site, this technology is not recommended for this development and will not be taken forward as noted in previous section.

Photovoltaics

Using the sun to generate electricity was originally developed for space missions. Photovoltaic cells (PV cells) convert solar radiation directly into DC electricity. In London the estimated solar irradiation is between 1045 to 1140 kwh/m²/yr. PV uses energy from light to create electricity: when light shines on a PV cell it creates an electric field across the layers causing electricity to flow. Individual PV cells only provide a small amount of electricity, so they are generally grouped together into a module for convenience. PV is most suitable in urban environments because electricity is generated at the point of use, and the energy loss and costs associated with transmission and distribution are avoided.

Photovoltaics on this site

Dwellings on site 3, 4 and 5 will require Photo voltaic Panels (0.4 kWp) each dwelling to pass the Code level 4 compliance. Most of the roofs for the dwellings are overshadowed by existing building on the south side, which limits the efficiency of the PV panels. The total onsite PV required is 2.4 kWP which will generate 1339 kWh of electricity per annum and will save 7 TCO_2 / annum. The PV panels will be situated on the roof of the respected dwellings and all the energy and carbon savings will be directly accounted for. This will provide onsite carbon emission savings of 3% of CO_2/ annum.

Table 4, shows the carbon savings of the Entire Development showing as per Lean , Clean and Green as per the Energy Hierarchy. Figure 10 shows the dwellings that require PV Panels to pass the Code level 4 compliance.

A key advantage of PV in the urban environment is their potential to be integrated into the fabric of the building. Maintenance costs would be predicted to be low, requiring occasional cleaning and maintaining/ replacing tiles and inverters as necessary. There would be no noise or land take associated with the technology. There is little data about the life working time impact in terms of energy generation payback however a minimum of 10 years is estimated including FIT grants dependent upon size of scheme.

In terms of lifetime CO2 emissions, a life cycle analysis carried out by Parliamentary Office of Science and Technology indicates that life cycle CO2 emissions for UK photovoltaic power systems are estimated at 58gCO2eq/kWh (published in 2006 – subsequent improvements to technology may have reduced this figure). The most energy intensive phase of PV module production, accounting for 60% of the total energy requirement is the extraction of silicon from quartz sand at high temperatures.

PV size (kWp)	kWh/Annum	Area (m²)	$KgCO_2$/Annum
2.4	1339.104	18	708.386

Table 3: PV Calculation for the site

Model	Gas Demand (MWh)					Electricity Demand (MWh)								Carbon Dioxide Emissions (T)			Reduction compared to previous stage (%)
	Space heating	Hot water	Sub-total (Part L)	Other	Total	Space heating	Hot water	Cooling	Fans, pumps and controls	Lighting	Sub-total (Part L)	Other	Total	Elec. On-Site Generation	Total (Part L)	Total	
Target (Part L 2010) (TER)	82	35	117	0	117	7	0	0	2	6	15	0	15	0	31	31	31
Lean - Basline (DER)	44	41	84	0	84	0	0	0	6	6	12	0	12	0	23	23	26
Clean - Community heating	44	41	84	0	84	0	0	0	6	6	12	0	12	0	23	23	0
Green - Renewables (PV)	44	41	84	0	84	0	0	0	6	6	12	0	12	0.68	22	22	3
Proposed Development	44	41	84	0	84	0	0	0	6	6	12	0	12	0	22	22	28

Table 4: Carbon Savings of the Entire Development per Energy Hierarchy showing the Lean , Clean and Green Savings

Figure 11: Site plan showing the dwellings that will require PV for Code Compliance

7. CONCLUSION

The energy strategy put forward for the Proposed Development follows the Energy Hierarchy: Lean, Clean and Green.

Building orientation, spatial planning, thermal mass, fabric efficiency, air tightness and servicing strategy has been carefully considered in making the building Lean.
For the Clean measure, GLA requires a viability of CHP assessment on the site, which have been undertaken. The existing site does not have an existing CHP plant, thus no provision to connect to an existing CHP system. The new dwellings (15 no) heating and domestic how water demand, is very low for such technology to be economically viable on its own. Due to the practicality and technical issues in accordance with Camden's suggestion this technology has been discounted. Thus no savings have been counted under the Clean measure.

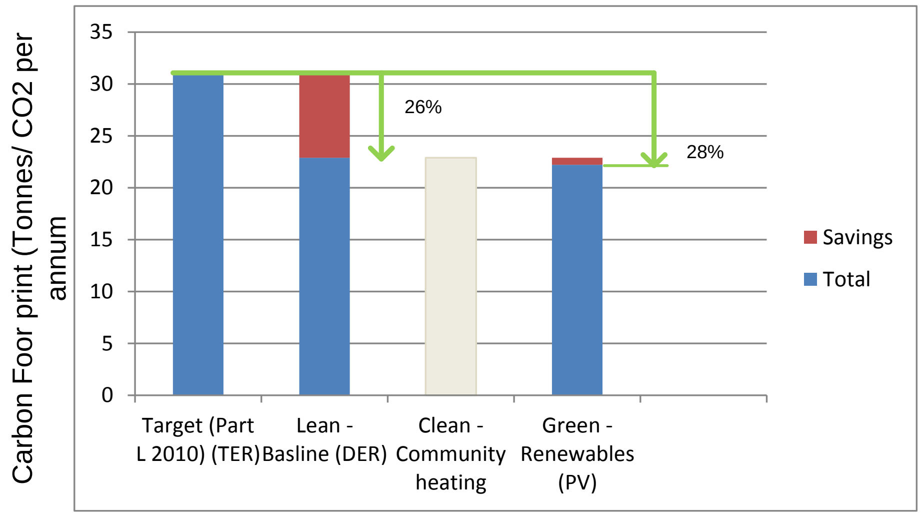
In order to Green the building an in-depth renewable feasibility study was undertaken. It was concluded that carbon reduction could be met (3%), with the application of renewable technology (e.g: PV) for number of dwellings to achieve code level 4.

This resulted in an accumulated savings of 28% on the entire development.

The following savings have been made on baseline emissions:
- 26 % from 'being lean' - Efficiency measures;
- 3 % from Green' being green'

Model	Gas Demand (MWh)					Electricity Demand (MWh)								Carbon Dioxide Emissions (T)			Reduction compared to previous stage (%)
	Space heating	Hot water	Sub-total (Part L)	Other	Total	Space heating	Hot water	Cooling	Fans, pumps and controls	Lighting	Sub-total (Part L)	Other	Total	Elec. On-Site Generation	Total (Part L)	Total	
Target (Part L 2010) (TER)	82	35	117	0	117	7	0	0	2	6	15	0	15	0	31	31	**31**
Lean - Basline (DER)	44	41	84	0	84	0	0	0	6	6	12	0	12	0	23	23	**26**
Clean - Community heating	44	41	84	0	84	0	0	0	6	6	12	0	12	0	23	23	**0**
Green - Renewables (PV)	44	41	84	0	84	0	0	0	6	6	12	0	12	0.68	22	22	**3**
Proposed Development	44	41	84	0	84	0	0	0	6	6	12	0	12	0	22	22	**28**

Table 5: Cumulative Carbon Savings across the entire development



Carbon Savings at the proposed development

	Carbon Emissions (tonCO2/Yr)	Percentage Reduction
	Part L (Regulated)	Part L
Baseline (Target Part L compliance)	31	-
Proposed Energy efficient measures	23	26%
Proposed Community Energy Scheme + CHP	0	0%
Energy efficient dwelling plus renewables	22	3%
	Total reduction from Target Part L	28%

Table 6: Cumulative Carbon savings across the entire development

7.1 Achieving Code for Sustainable Homes in Kiln Place Development

a. Code for Sustainable Homes:

The Current London Plan 2011 shows that 25% improvements in CO_2 emissions translate to a minimum Level 4 rating in the Code for Sustainable Homes (CfSH)

The Code for Sustainable Homes is an environmental assessment method for rating and certifying the performance of new homes. It is a national standard for use in the design and construction of new homes with a view to encouraging continuous improvement in sustainable home building.

The development scores 68.5 score, obtaining a Code for sustainable homes level 4 (2010).

b. Evaluation Methodology:

The code provides 9 measures of sustainable design:

- energy/CO_2
- water
- materials
- surface water runoff (flooding and flood prevention)
- waste
- pollution
- health and well-being
- management
- ecology

The Code assigns one or more performance requirements (assessment criteria) to all of the environmental issues. When each performance requirement is achieved, a credit is awarded (except the mandatory requirements with no associated credits). The total number of credits available to a category is the sum of credits available for all the issues within it. To achieve a Code level 4 a score of 68 is required. There are a number of mandatory credits and some tradable credits that will need to be achieved. The diagrams illustrate the methodology. There are Mandatory credits and Tradable credits shown in top right.

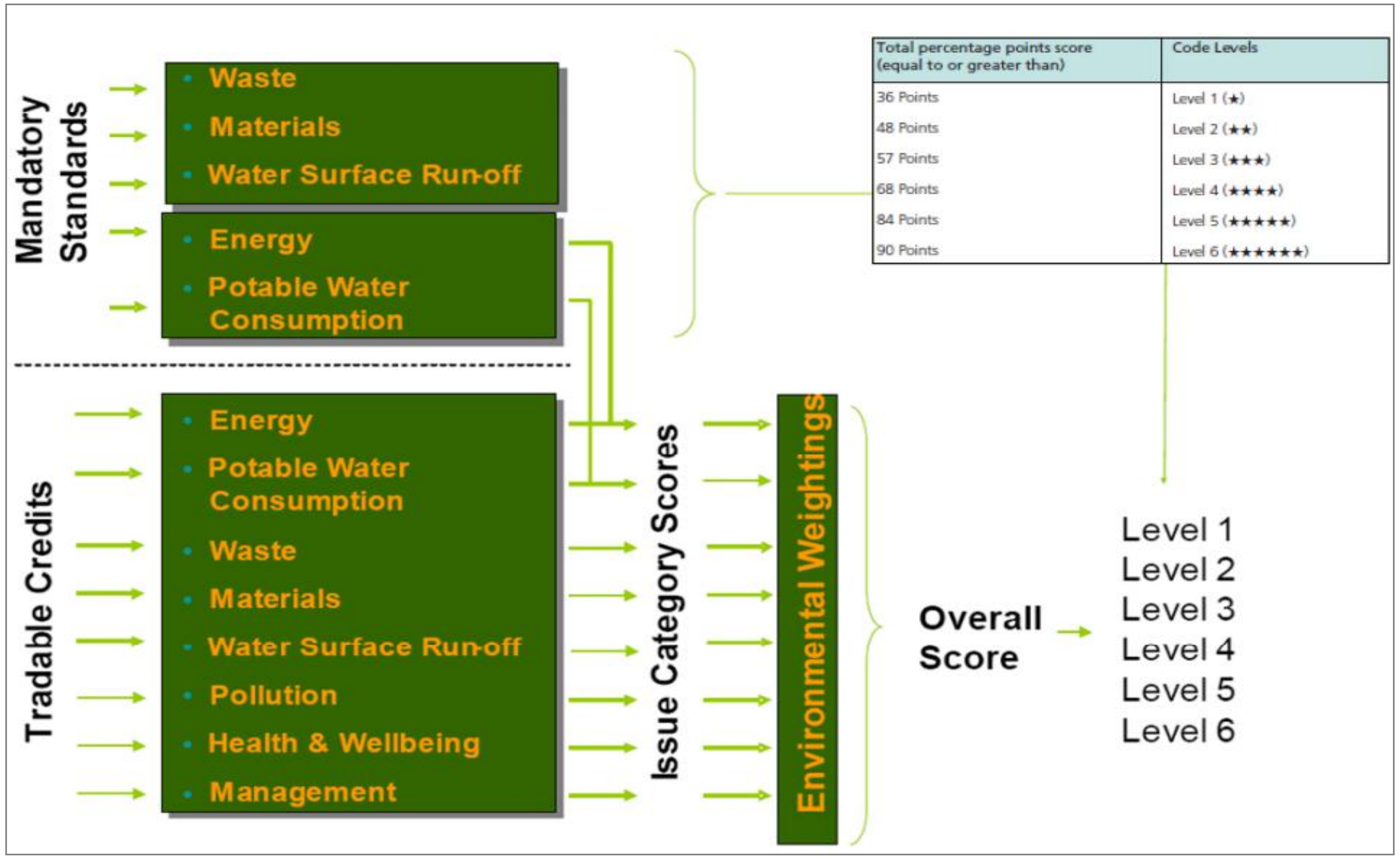


Figure 12: Mandatory and Tredable Credits in Code

c. Achieving Code Level 4 and complying with Camden Council Core Strategy Policy:

Energy efficient design requires an integrated approach to solar gain, access to daylight, insulation, thermal materials, and ventilation, heating and control systems.

Designing natural systems into new buildings can make the most of naturally occurring energy, such as the heat and light from the sun.

Making the most of sunlight

- Consider locating principal rooms that require warmth and daylight on the south side of buildings to benefit from the sun's heat. Within 30 degrees of south is ideal.
- Consider any overshadowing from adjoining or of adjoining buildings and spaces that will reduce the amount of solar gain.
- Consider the possibility of including renewable energy technologies, for example by including a flat or south facing roof for solar panels. Making the most of daylight.
- Maximize the amount daylight while minimizing the need for artificial lighting.
- Carefully design windows to maximize the amount of sunlight entering rooms to meet the needs of the intended use.
- Daylight is dependent on the amount of open, un-obscured sky available outside a window, the amount of sunshine and the amount of light reflected from surrounding surfaces.
- The size, angle and shape of openings together with room height depth and decoration determine the distribution of daylight.

Lighting

100% low energy lighting is mandatory. This will involve lighting linked to daylight and occupancy, to either dim or turn off lighting to reduce energy consumption. Absence sensors and motion sensors are recommended to reduce lighting wastage.

- In the average home, lighting accounts for around 20% of the electricity bill. In some developments it can be one of the highest energy consumers and can generate large amounts of heat that is wasted.
- High efficiency lighting with controlled sensors e.g. timers, movement sensors and photo sensors, which adjust the
- brightness of the light depending on the natural light level.
- Zoned lighting, heating and cooling with individual control

Preventing Overheating

Some developments may experience too much sunlight in the summer; therefore you should achieve a balance between benefitting from solar gain and preventing overheating. To prevent over heating following will be considered:

- Locate any spaces that need to be kept cool or that generate heat on the north side of developments.
- Use smaller windows on the south elevation and larger windows on the north.
- Use shading measures, including balconies, louvers, internal or external blinds, shutters, trees and vegetation. Any shading needs to be carefully designed to take into account the angle of the sun and the optimum daylight and solar gain.
- Include high performance glazing e.g. triple glazed windows, specially treated or tinted glass.
- Make use of overshadowing from other buildings.

Thermal Performance

The thermal performance of a building relates to the amount of heat that is retained inside and the amount that is lost to the outside air. Ensuring a high thermal performance is one of the most effective ways to ensure your development is energy efficient.

Consider how the insulation is attached to the building structure or walls. If a joint is badly insulated or if the material is penetrated by materials that conduct heat such as metal nails, it could cause cold patches and reduce the efficiency of the insulation. Ensure special attention is given to these potential heat loss areas to prevent cold bridging and potential points of condensation.

Thermal Buffers

Porches, atriums, conservatories, lobbies and sheltered courtyards are useful 'thermal buffers'. These features prevent excessive heat loss from doors and windows by providing a transition between the cold outside and the warm inside of a building.

Insulation is central to low energy construction but it must be installed without any gaps to ensure a building is air tight to reduce heat loss. In some buildings around half of all heat losses are due to air leakage throughout the building materials.

To achieve air tightness, buildings must be designed with a continuous seal around the internal materials to eliminate unwanted draughts. Once the seals are in place, they ensure that the insulation can function to its optimum performance, saving energy and drastically reducing carbon emissions for the lifetime of the building.

Mechanical Systems with Heat Recovery:

Mechanical systems are generally required by the Building Regulations to enable buildings to be occupied. These systems vary from simply extraction fans in kitchens and bathrooms to whole office cooling systems. The Council will expect applicants to consider the following when choosing mechanical systems:

Other energy efficient technology:

- Specifying appliances which are A+ rated. This needs to be confirmed by the client.
- Efficient mechanical services system or a building management system – computer systems which control and monitor a building's mechanical and electrical equipment. Their main aim is to control the internal environment, but in doing so can also reduce the energy consumption of a building.
- Using heat recovery systems which have been included as part of the strategy.

Energy monitoring, metering and controls should be used to inform and facilitate changes in user behaviour.

Water

Maximum indoor water consumption is 105 litres/person/day is mandatory. We are aiming to go for 90 litres/person/day

- Dual Flush Toilet (4/2 l)
- Low Flow Aerated showers (8 l/min)
- Aerated taps in all basins including kitchen (4.5 l)
- 140 litres bath (max)

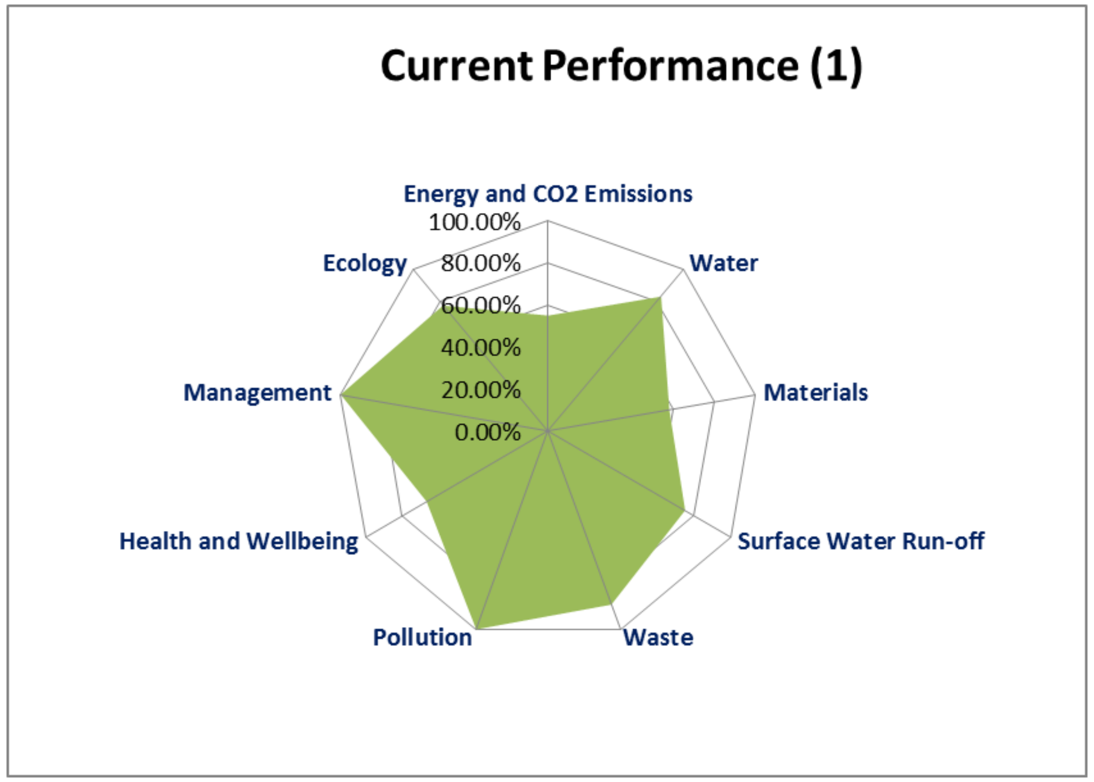
Surface Water runoff:

Where the pre-development peak rate of run-off for the site would result in a requirement for the post-development flow rate to be less than 5 l/s at a discharge point, a flow rate of up to 5 l/s may be used where required to reduce the risk of blockage.

d. Anticipated Code Rating and next Stage:

A Design stage assessment has been undertaken and the results of the latest SAP analysis have been incorporated. Currently the development achieves a code rating of Code for Sustainable Level 4, with a **score of 68.5%.** A conservative approach has been taken in credit allocation as there are updates that need to be confirmed by the design team as the design progresses. The Design Stage Assessment is incorporated in Appendix C.

Conclusion:
The development scores 68.5 score, obtaining a Code for sustainable homes level 4 (2010). Please refer to appendix C for the Design Stage Code Assessment.



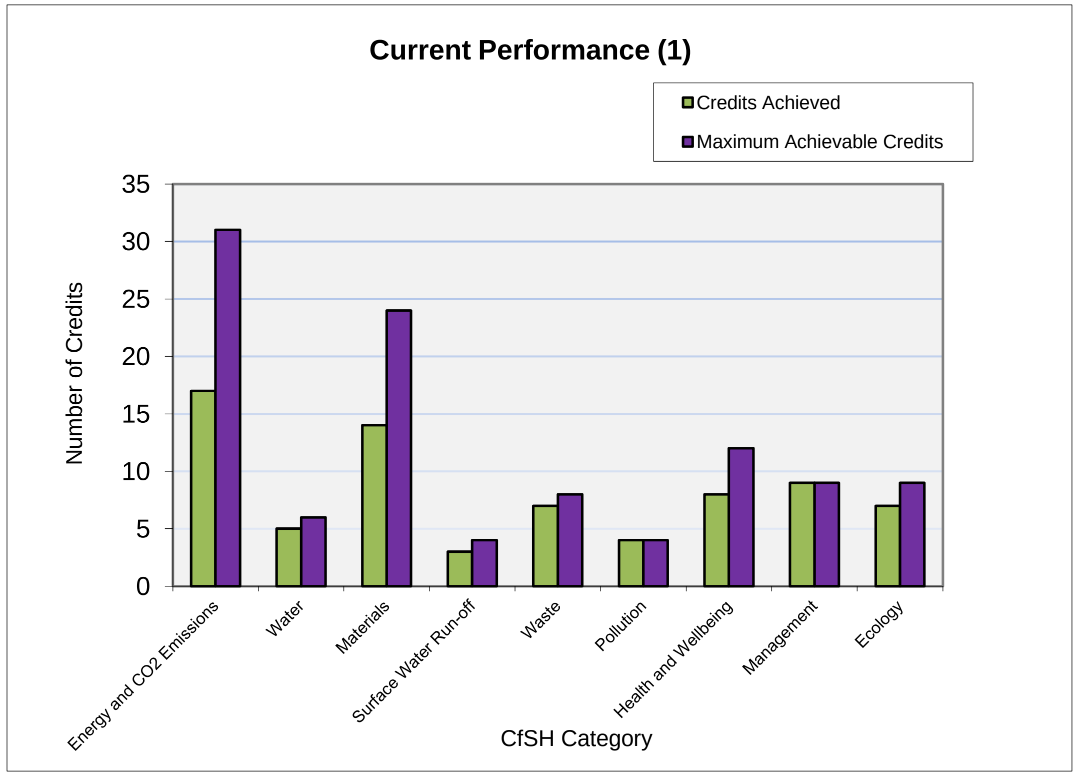


Figure 13: Code for Sustainable Homes Scoring for the projects