SKELLY&COUCH

Energy and Sustainability Statement

Revision 4.0 - 22/03/2016 – Planning

Project

1294 – Brill Place

On behalf of:

Skelly and Couch Ltd

Skelly & Couch Ltd

Building Environmental & Services
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Contents

Audit History

Rev	Date of Issue	Status	Issued By	Checked By	Summary of Changes
1.0	18/09/2015	Draft	GS	MS	
2.0	**08/12/2015**	**Planning**	**GS**	**MS**	
3.0	**09/12/2015**	**Planning**	**GS**	**MS**	Comments incorporated
4.0	**22/03/2016**	**Planning**	**GS**	**MS**	Updated to reflect planning decisions

1. Executive Summary

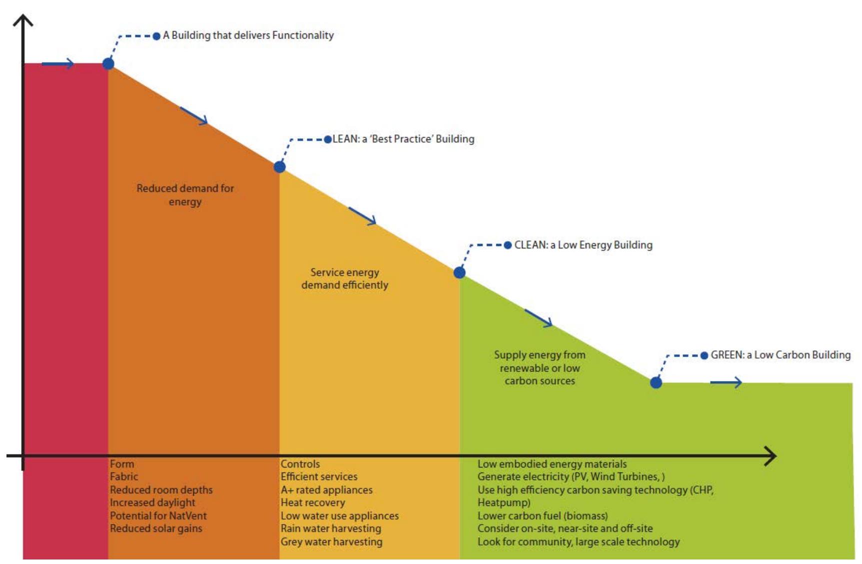
This report has been prepared by Skelly and Couch Ltd in support of the planning application for the proposed new building at Somers Town, in the London Borough of Camden.

The new building will be on current parkland within the site, but has been designed to minimise its environmental impact. The constrained site and innovative architectural solutions has inspired the design team to develop the scheme to have as low a carbon footprint as possible.

Skelly and Couch have been appointed as energy advisors. This document has been prepared to provide a formal analysis of the likely carbon emissions associated with the new build. Calculations have been undertaken to estimate carbon reductions under the energy hierarchy (Lean, Clean, Green) as per the London Plan, National Planning Policy Framework and Camden District Council guidance on preparing Energy Statements.

Carbon reduction measures and the scope and content of this report have been discussed with the architect and the client. Using the Lean Clean Green methodology, the proposals given herein have been developed during a dynamic design process and the most appropriate solutions outlined and examined. The current conclusions drawn from this are outlined below with the most innovative and suitable technology, gas absorption heat pumps and integrated solar technology being proposed as the most sustainable method of delivering the brief.

The graph below demonstrates the methodology employed.



Energy Efficiency – Be Lean

The following items have been adopted within the proposals to reduce carbon use, regardless of the final clean / green energy options selected:

- 100% use of low energy fixed lighting within the dwelling
- Use of a balanced whole house mechanical ventilation with heat recovery:
  - Rigid duct work/Insulated duct
  - Specific fan power (S.F.P) 0.8 (max)
  - Heat recovery @ >85% efficiency
- A very low building air permeability rate based on a pressurization test result of 3 (m3/m2.h@50Pa)
- Building Fabric with improved U values and Medium – High Thermal Mass
  - Thermal Bridging using approved thermal transmittance values
  - Glazing g-value of 0.36
- A highly efficient hot water storage system
  - Efficient Hot water generation
- Total Water use of not more than 105 litres/person/day
- Primary Heating System incorporating:
  - Central heating system with under floor heating
  - Time and temperature zone control
  - Weather compensator and boiler interlock
- Minimise overheating risk, and therefore minimize the need for cooling by use of mechanical ventilation.
- Use of night time ventilation to provide free cooling
- Heat recovery method from spaces providing heat to spaces requiring heat.
- Reducing heat gains by use of energy efficient lighting, and the control of solar gains with shading and high specification glazing
- Effective Building Energy Management System including sub metering and energy monitoring.
- Building user guide ensuring occupants apply and get the most from the low energy building

Particular attention has been given to achieving a high building fabric energy efficiency in line with Camden's targets.

It is estimated that significant savings are available from energy efficiency "Lean" measures at 8%, with the various energy strategies examined providing greater carbon reductions as shown relative to the reductions each option gives.

CHP/District Heating – Be Clean

This "Clean" option uses a district heating scheme with combined heat and power (CHP) technology. The hot water for the building shall be supplied by this method and it was seen that a carbon saving of 15% can be achieved.

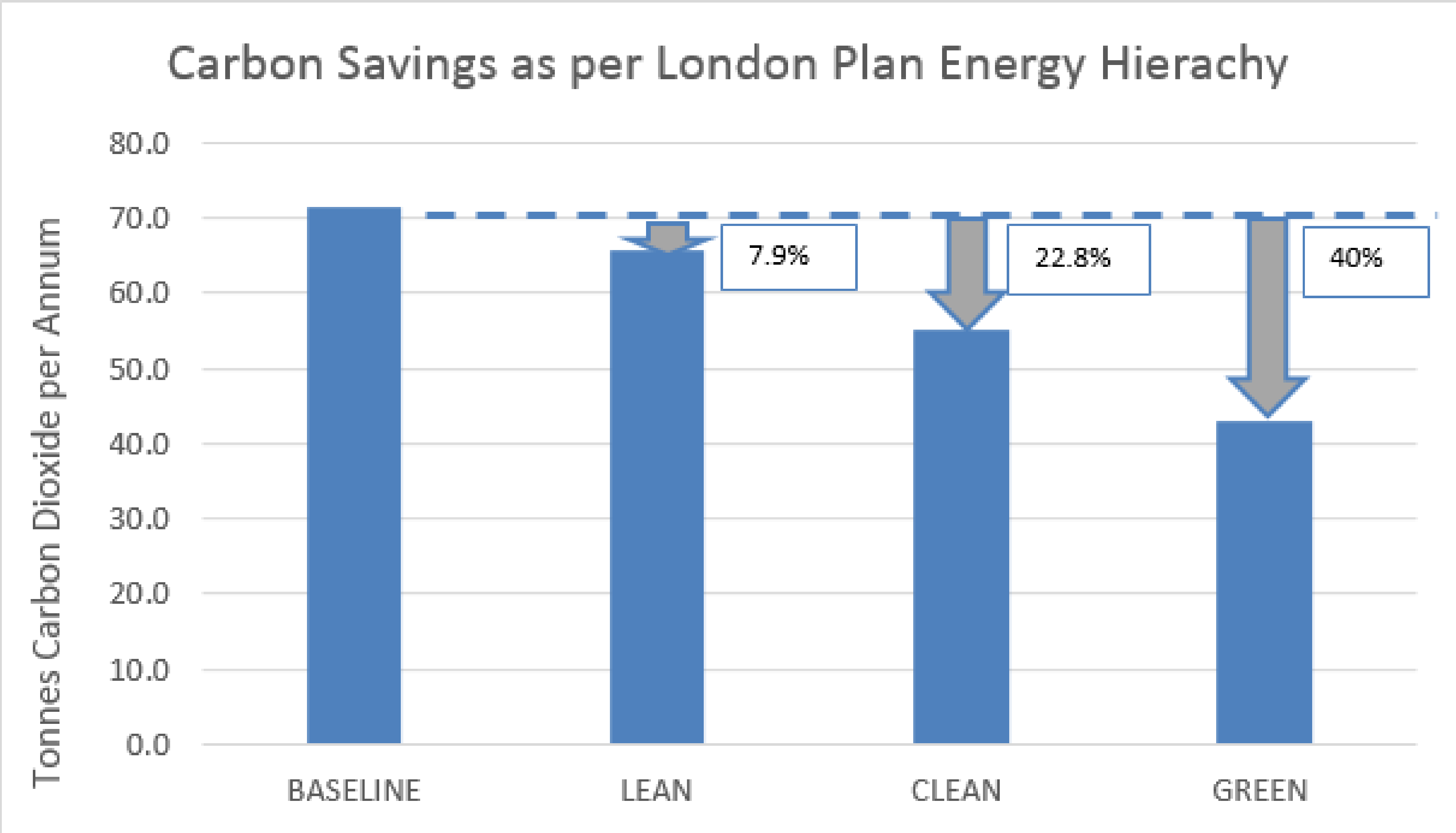
Renewables – Be Green

The renewable options chosen for Brill Place were integrated Photovoltaics PVs and Gas Absorption Heat Pump (GAHP) (Air Source). It was found that the combination of these technologies; GAHP providing the heating and PV providing electricity, when applied with the Lean building principles met and surpassed the carbon reduction targets for this project.

The following chart highlights the savings associated with the energy saving measures applied at each process.

Loading	TCO2/year	% Improvement
Baseline Emissions	71.4	0
Savings from Energy Efficiency	5.6	7.9%
Savings from CHP District Heating	10.6	14.9%
Savings from GAHP	6.4	8.9%
Savings from PVs	5.94	8.3%
TOTAL SAVINGS	28.6	40%

Loading	TCO2/year	
	Regulated	Unregulated
Baseline Emissions	71.4	23.5
Emissions after Energy Efficiency	65.8	23.5
Emissions after CHP	55.2	23.5
Emissions after renewables	42.9	23.5



The Energy strategy for Brill Place has the potential to not only meet the carbon targets of 35% CO_2 reduction and 20% by renewables but also surpass them. This, along with the other sustainability measures proposed shall produce a high performing building.

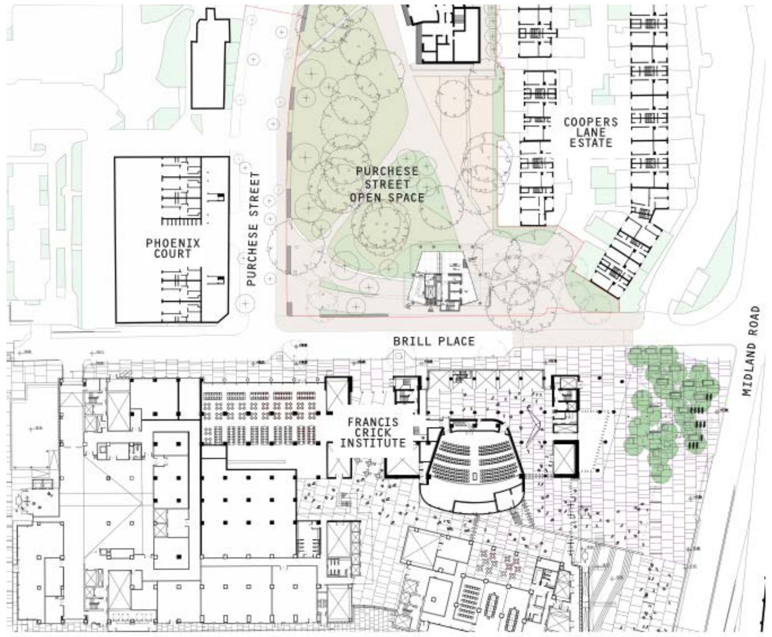
2. Introduction

Skelly and Couch have been appointed by dRMM Architects to conduct an energy assessment for the proposed residential property at Somers Town, an innovative new tower in the Borough of Camden, located in London. The proposed residential development at Brill Place aspires to be a low carbon project.

The approach chosen for this project was to identify the potential of the site and assess the latest innovative building services measures and processes, building methods and technologies available to achieve the most appropriate building for the clients brief. The sensitive nature of the site and the innovative architecture will be considered in order to propose the most sustainable solution meeting both the client's requirements and the planning targets as set out by the local authority.

2.1. The Site

The site is in Camden and is situated at Brill Place within a park near a residential area between Purchese Street and Midland Road.



The address of the site is :

Brill Place
Somers Town
London
NW1 1EL

Latitude: 51.532058, Longitude: -0.129265

The figures above show the sites mapped location and the figures below show the proposed building on the site.

The site is part of the Community Investment Programme (CIP). Sitting to the north of the Francis Crick Institute and on the southern boundary of the masterplan area, the brief is to design for a new standalone residential tower building as part of the aspirations of the CIP for Somers Town.

2.2. Key Project Objectives

The Key objectives for the Client and the Design team are:

- Contribution of the residential development to the masterplan for Central Somers Town
- To meet the client's cost objectives whilst using the highest levels of design and construction achievable within the cost constraints.
- To provide an attractive, pleasant, high quality building and residential environments that performs to the highest standards over the long term with minimum means.
- Design for activity at ground level and beneficial overlooking of streets and open space whilst maintaining privacy
- Considering non-residential uses at lower floor levels
- Integration with landscape design (by masterplanning and landscape team
- Design work to determine the most appropriate housing typology (e.g. residential tall building or terraced apartments etc.)
- Consider overshadowing in decisions about building height and massing
- To produce a building that is environmentally sensitive and responsive.
- A strong approach to environmental sustainability
- To provide 20% carbon savings over and above Part L 2014 from renewable energy generation.
- Address implications of neighbouring CHP facility granted planning approval
- To pursue the highest standards of health and safety on site and to suffer no accidents during the construction process
- To provide a building that is secure and safe.
- Inclusive design / adaptability of residential accommodation. To produce a building that conforms to all the requirements of the Disability Discrimination Act (DDA) and Part M of the Building Regulations.
- To provide a building that is easy to maintain.
- Arrangements for deliveries, refuse collection and vehicle drop off
- Car free development is anticipated – consider blue badge car club spaces
- Well integrated storage for bikes and bins

2.3. Design Strategy

The need to create a more sustainable built environment for future generations has led, in the last few years, to the introduction of a series of minimum design standards for sustainable design and construction of new and refurbished buildings.

As this is a new building there are a myriad of options to deliver an energy strategy to suit the client, the design teams aspirations and the council's planning policy requirements. The key drivers thereof have been considered and within this report the development of the final solution can be seen.

This Sustainable Buildings Statement has been created to accompany the planning submission for the proposed development at Brill Place. It demonstrates how the requirements of Climate Change policies in the Local Plan and any other relevant local climate change strategies have been met. In summary this includes:

- The reduction of carbon emissions using a variety of energy efficiency measures supplemented by the potential for renewable generation.
- The future adaption of the building for climate change
- The use of Sustainable Urban Drainage Techniques (SUDS), refer to separate flood risk and SUDS report (by others).

This report also includes a sustainability statement that addresses issues particularly in respect of its location and scale and identifies the environmental, social and economic implications of the development.

It should be noted that the figures within this report are based on assumptions clearly outlined, and therefore provide only a suggestion of the predicted energy use and associated carbon emissions, so should not be used for predicted billing or final target energy ratings.

It should also be noted that through the early stages of the design process the solutions provided for the energy strategy have been developed to align with the requirements of the environmental strategy and clients aspirations.

3. Planning Policy Context

Proposals at Brill Place will be in accordance with Camden Council planning guidance, as well as drawing from the Greater London Authority Policy. A summary of policies relating to sustainable development in Camden is provided below.

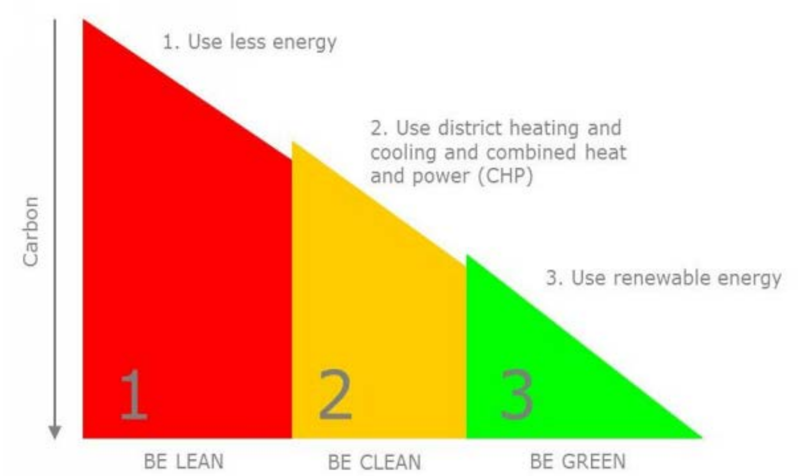
The Building Regulations Part L - Conservation of Fuel and Power are continually being updated in an attempt to improve the energy efficiency of new and refurbished building work that needs to be inspected by Building Control or an approved inspector.

The design will be registered under the new Building Regulations Part L 2013, which came into force on the 6th April 2014, which reduce the carbon emissions target for new buildings by approximately 9% compared to the previous 2010 target.

The relevant section of the Building Regulations Part L that addresses requirements for new built residential buildings is the Part L1A.

3.1. The London Plan (Including Further Alterations, FALP 2015)

Policy 5.2 Minimising Carbon Dioxide Emissions
This policy within the London Plan contains an energy hierarchy for minimising carbon dioxide emissions: 'be Lean, be Clean, be Green'. This hierarchy outlines a framework under which the GLA requires energy efficient building design to be approached. Firstly looking to reduce the energy consumption of a building through passive measures (be Lean), then supplying energy efficiently via building services (be Clean), and finally through the use of renewable energy technologies that supplement conventional fuels (be Green)



Policy 5.2 also outlines specific targets for carbon dioxide reduction in buildings. These targets are expressed as minimum improvements over the Target Emission Rate (TER) calculated under the Building Regulations Part L. The targets for residential buildings are as follows:

Year	Improvement on 2010 Building Regulations
2010-2013	25% (Code for Sustainable Homes Level 4)
2013-2016	40%
2019-2031	Zero Carbon

Clause 5.2 states that where the targets for carbon dioxide emissions reduction cannot be fully achieved on site, the shortfall may be provided off site, but only in cases where there is an alternative proposal identified and delivery is certain.

Policy 5.6 Decentralised Energy Networks
This policy confirms that the mayor expects 25 percent of the heat and power used in London to be generated through the use of localised decentralised energy systems by 2025. In order to achieve this target the Mayor prioritises the development and area wide levels, including larger scale heat transmission networks.

The policy encourages developments to evaluate the feasibility of Combined Heat and Power (CHP) systems, and examine opportunities to extend systems beyond the site boundary to adjacent sites.

Policy 5.7 Renewable Energy
This policy confirms that the Mayor seeks to increase the proportion of the energy generated from renewable sources, and expects that the projections for installed renewable energy capacity outlines in the Climate Change Mitigation and Energy Strategy and in supplementary planning guidance will be achieved in London.

All renewable energy systems should be located and designed to minimise any potential adverse impacts on biodiversity, the natural environment and historical assets, and to avoid and adverse impacts on air quality.

3.2. GLA Sustainable Design and Construction SPG (2014)

This is supplementary planning guidance which published on behalf of the Greater London Authority (GLA) and informs the overriding method for this energy strategy.

3.3. Camden Council Development Policies - Core Policies related to Energy.

Alongside the London Plan, the Core Strategy for Camden sets out the key elements of the council's planning vision and strategy for the borough, directly related to the Local Development Framework (LDF). The Core strategies outlined therein relevant to sustainability are as follows:

CS13 – Tackling climate change through promoting higher environmental standards

This policy is further referred to in Camden's Development Policies Document.

DP22 – Promoting sustainable design and construction

DP23 – Water

3.4. Camden Planning Guidance 3 - Sustainability

Camden Planning Guidance (CPG) 3 supports the policies outlined in the LDF. The guidance is particularly relevant to the items discussed within this report and informs the structure of this report.

The following are the key sections relevant to this development.

3.4.1. The Energy Hierarchy

This section covers the requirements of the energy statement and the associated methods.

The energy hierarchy

KEY MESSAGES
• All developments are to be design to reduce carbon dioxide emissions • Energy strategies are to be designed following the steps set out by the energy hierarchy

3.4.2. Energy Efficiency

This section covers how new buildings ensure they are as energy efficient as possible.

Energy efficiency: new buildings

KEY MESSAGES
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.

3.4.3. Decentralised Energy Networks and Combined Heat and Power

This section covers the Clean section of the energy hierarchy to ensure developments have done all they can to obtain an efficient supply of energy.

KEY MESSAGES
Decentralised energy could provide 20% of Camden's heating demand by 2020. Combined heat and power plants can reduce carbon dioxide emissions by 30-40% compared to a conventional gas boiler. Where feasible and viable your development will be required to connect to a decentralised energy network or include CHP.

3.4.4. Renewable Energy

Renewable energy

KEY MESSAGES
There are a variety of renewable energy technologies that can be installed to supplement a development's energy needs Developments are to target a 20% reduction in carbon dioxide emissions from on-site renewable energy technologies.

3.4.5. Water Efficiency

KEY MESSAGES
At least 50% of water consumed in homes and workplaces does not need to be of drinkable quality re-using water All developments are to be water efficient Developments over 10 units or 1000sq m should include grey water recycling

3.4.6. Sustainable Use of Materials

KEY MESSAGES
Reduce waste by firstly re-using your building, where this is not possible you should implement the waste hierarchy The waste hierarchy prioritises the reduction, re-use and recycling of materials Source your materials responsibly and ensure they are safe to health.

3.4.7. Sustainability Assessment Tools

KEY MESSAGES
A new build dwelling will have to be designed in line with the Code for Sustainable Homes The creation of 5 or more dwellings from an existing building will need to be designed in line with EcoHomes 500sq m or more of non-residential floorspace will need to be designed in line with BREEAM

It should be noted that where the development will be designed to the sustainability criteria as outlined in CPG3, the Deregulation Bill 2015 has formally removed the requirement for residential schemes to comply with Code for Sustainable Homes.

The team will however attempt to show that the development would have met the criteria in any case.

3.4.8. Brown Roofs, Green Roofs and Green Walls

KEY MESSAGES
All developments should incorporate green and brown roofs The appropriate roof or wall will depend on the development, the location and other specific factors Specific information needs to be submitted with applications for green/brown roofs and walls

3.4.9. Flooding

KEY MESSAGES
All developments are required to prevent or mitigate against flooding All developments are expected to manage drainage and surface water There is a hierarchy you should follow when designing a sustainable drainage system

3.4.10. Adapting to Climate Change

KEY MESSAGE
All development should consider how it can be occupied in the future when the weather will be different The early design stage is the most effective time to incorporate relevant design and technological measures.

3.4.11. Biodiversity

KEY MESSAGES
Proposals should demonstrate: • how biodiversity considerations have been incorporated into the development; • if any mitigation measures will be included; and • what positive measures for enhancing biodiversity are planned.

3.4.12. Local Food Growing

KEY MESSAGES
We encourage food to be grown wherever possible and suitable Rooftops and shared spaces such as gardens and parks provide opportunities for food growing

Note Sections 3.3.3 to 3.3.10 are covered in separate documentation.

3.5. Masterplan Specific Requirements

As part of the overall masterplan for the site the following additional specific targets have to be met.

Energy

All appliances specified to be A+ rated as a minimum

The new residential buildings to achieve a minimum 35% improvement on 2013 Part L of the Building Regulations by 2013 and be carbon zero from 2016

Materials

At least 50% of timber and timber products to be sourced from accredited Forest Stewardship Council (FSC) or Programme for the Endorsement of Forestry Certification (PEFC) source

All major building elements to achieve an area weighted average rating of A+ to be in the BRE Green Guide of Specification

Other

At least 10% of all new homes to designed to be wheelchair accessible, or easily adaptable for residents who are wheelchair users

All new homes to be built to Lifetime Homes standards

Site Wide Targets

- Surface water run-off rates to be reduced by at least 50% across the whole development with a target to achieve greenfield run-off rates
- Water - The water infrastructure to be designed to cope with a 1 in 100 year storm event

3.6. Sustainability Implementation Plan (SIP)

The sustainability Implementation Plan (SIP) provides guidelines for the design team to deliver sustainability across the Central Somers Town development. Atelier Ten are currently spearheading this element of work.

The list below defines the targets as set out by the SIP.

SITE WIDE TARGETS

- The development to achieve a minimum of 20% reduction in CO_2 emissions through on-site renewable energy generation
- 100% of internal and external light fittings to be energy efficient
- 100% of white goods to be A+ rated as a minimum
- 100% of energy uses to be monitored and recorded

RESIDENTIAL TARGETS

- All residential buildings to achieve a minimum 35% improvement on 2013 Part L of the Building Regulations
- All residential buildings to include appropriate clothes drying spaces (to reduce use of tumble driers)

NON-DOMESTIC TARGETS

- All non-domestic buildings to achieve a minimum 35% improvement on 2013 Part L of the Building Regulations
- All non-domestic buildings to achieve a minimum Energy Performance Ratio for New Construction (EPR_{NC}) of 0.375

SITE WIDE TARGETS

- 100% of the water used for irrigation to be provided from rainwater recycling
- 100% of the water uses to be monitored and recorded
- Surface water run-off rates to be reduced by at least 50% across the whole development with a target to achieve greenfield run-off rates
- The water infrastructure to be designed to cope with a 1 in 100 year storm event

RESIDENTIAL TARGETS

- Indoor potable water consumption to be reduced to a maximum of 105 litres/person/day
- At least 50% of water used for WC flushing, washing machines and vehicle washing to be from rainwater and/or greywater recycling

NON-DOMESTIC TARGETS

- Indoor potable water consumption to be reduced in order to achieve a minimum 12.5% improvement over BREEAM baseline performance
- At least 50% of water used for WC flushing to be from rainwater and/or greywater recycling

3.7. Targets Summary

There are clearly then a number of regulatory energy and sustainability targets to achieve. The summary of targets relevant to this report are tabled below:

3.7.1. Energy Targets

Regulatory Structure	Target (related to CO2)
Camden Planning Guidance 3	Decentralised Energy network to be considered
	20% reduction via renewables
	Meet Part L1A 2013 standards
	TFEE Target: CFSH 3 Credits (Ene 2)
GLA	Demonstrate the Energy Hierarchy has been adopted
SIP	35% improvement on Part L 2013

3.7.2. Sustainability Targets

Regulatory Structure	Target
Camden Planning Guidance 3	Water 105 l/person/day
SIP	Water 105 l/person/day

This report shall demonstrate how the building performs in relation to these targets. Showing that these targets are surpassed by the exemplary design proposed.

3.8. Summary of Regulatory and Planning Policy

3.8.1. The Building Regulations

The Building Regulations Part L - Conservation of Fuel and Power are continually being updated in an attempt to improve the energy efficiency of new and refurbished building work that needs to be inspected by Building Control or an approved inspector.

The design will be registered under the new Building Regulations Part L 2013, which came into force on the 6th April 2014, which reduce the carbon emissions target for new buildings by approximately 9% compared to the previous 2010 target.

The relevant section of the Building Regulations Part L that addresses requirements for new built residential buildings is the Part L1A.

3.8.2. Camden Council Requirements

Camden Council's current planning requirements related to sustainable development are outlined in the document entitled 'Camden Planning Guidance 3 – Sustainability Document' dated September 2013.

This document focuses on the provision of information on ways to achieve carbon reductions and more sustainable developments. It also highlights the Council's requirements and guidelines which support the relevant Local Development Framework (LDF) policies:

- CS13 – Tackling climate change through promoting higher environmental standards.
- DP22 – Promoting sustainable design and construction
- DP23 – Water

The council requirements are summarised below:

Energy hierarchy
All developments are to be designed to reduce carbon emissions

Energy strategies are to be designed following the steps set out by the energy hierarchy

Energy efficiency: new buildings
All new developments are to be designed to minimise carbon dioxide emissions by being as energy efficient as is feasible and viable

All new homes to achieve 50% of the un-weighted credits in the Energy category

Decentralised energy networks and combined heat and power
Where feasible and viable all new developments will be required to connect to a decentralised energy network or include CHP

When there is more than one occupier, use or building a community heating network will be expected.

Renewable energy
Developments are to target a 20% reduction in carbon dioxide emissions from on-site renewable energy technologies.

Water efficiency
Developments over 10 units or 1000 m^2 and/or intense water use developments will be required to include a grey water harvesting system unless it is demonstrated that this is not feasible.

Water efficiency of 105 litres per day

All new homes to achieve 50% of the un-weighted credits in the Water category of their CSH assessment

At least 50% of water consumed in homes and workspaces not to be of drinkable quality (e.g. from rainwater and/or greywater recycling)

Sustainable Assessment Tools
Any commercial space over 500 m^2 would need to comply with BREEAM Excellent standard.

The document refers to the code for sustainable homes which has since been withdrawn.

Sustainable use of materials
All developments should aim for at least 10% of the total values of materials used to be derived from recycled and reused sources. For major developments this value increases to 15-20%.

All new homes to achieve 50% of the un-weighted credits in the Materials category of their CSH assessment

Reduce waste
Code for Sustainable Homes. The Council's requirement for all new residential developments to meet Code for Sustainable Code standards has now been abolished

Time period	Minimum rating	Minimum standard for categories (% of un-weighted credits)
2010-2012	Level 3	Energy 50% Water 50% Materials 50%
2013 -2015	Level 4	
2016+	Level 6 'zero carbon'	

Brown roofs, green roofs and green walls
The council will expect all developments to incorporate brown roofs, green roofs and green walls unless it is demonstrated this is not possible or appropriate.

Flooding
Developments must not increase the risk of flooding, and are required to put in place mitigation measures where there is known to be a risk of flooding.

All developments are expected to manage drainage and surface water on-site as close as possible, using Sustainable Drainage Systems (SUDS).

Adapting to climate change.
All development is expected to consider the impact of climate change and be designed to cope with the anticipated conditions.

Biodiversity
Proposals should demonstrate

1. How biodiversity considerations have been incorporated into the development
2. If any mitigation measures will be included; and
3. What positive measures for enhancing biodiversity are planned

Local food growing
The Council encourages food to be grown wherever possible and suitable.

The rest of this section has been structured to tackle these main headings.

3.8.3. Masterplan Requirements

As part of the overall masterplan for the site the following requirements have been targeted.

Energy
All appliances specified to be A+ rated as a minimum

The new residential buildings to achieve a minimum 35% improvement on 2013 Part L of the Building Regulations by 2013 and be carbon zero from 2016

Materials
At least 50% of timber and timber products to be sourced from accredited Forest Stewardship Council (FSC) or Programme for the Endorsement of Forestry Certification (PEFC) source

All major building elements to achieve an area weighted average rating of A+ to be in the BRE Green Guide of Specification

Other
At least 10% of all new homes to designed to be wheelchair accessible, or easily adaptable for residents who are wheelchair users

All new homes to be built to Lifetime Homes standards

Site Wide Targets

- Surface water run-off rates to be reduced by at least 50% across the whole development with a target to achieve greenfield run-off rates
- Water - The water infrastructure to be designed to cope with a 1 in 100 year storm event

4. Methodology and Computational Energy Modelling

4.1. Calculation Methodology

The calculation methodology used for presenting carbon emission reduction draws on the approach set out by Camden Council and the Greater London Authority under the National Planning Policy Framework. Predicted levels of carbon dioxide emissions have been assessed using the government's Standard Assessment Procedure (SAP) which forms part of Part L of the Building Regulations.

Before any procedures were cemented, the team assessed options to reduce the carbon associated with the new dwellings in a number of ways. The figure to the right gives a depiction of the offset criteria investigated

Despite the option of offsite generation and carbon tax being available under the planning framework, it was decided that the on-site or point of use reduction is the most honest and feasible for this project.

The calculations are based on the information provided by dRMM Architects and the following drawings (received 08.10.2015 & 26.10.15)

Drawing Number	
372-TYP-248 (26.10.15)	372-ELE-400-GA ELEVATIONS (08.10.15)
372-TYP-25 (26.10.15)0	372-ELE-401-GA ELEVATIONS (08.10.15)
372-TYP-PL03 (26.10.15)	372-ELE-402-GA ELEVATIONS (08.10.15)
372-TYP- PL04 (26.10.15)	372-ELE-403-GA ELEVATIONS (08.10.15)
372-TYP- PL05 (26.10.15)	
372-TYP- PL06 (26.10.15)	
372-TYP- PL07 (26.10.15)	
372-TYP- PL08 (26.10.15)	
372-TYP- PL09 (26.10.15)	
372-TYP- PL10 (26.10.15)	
372-TYP- PL11 (26.10.15)	
372-TYP-PL12 (26.10.15)	
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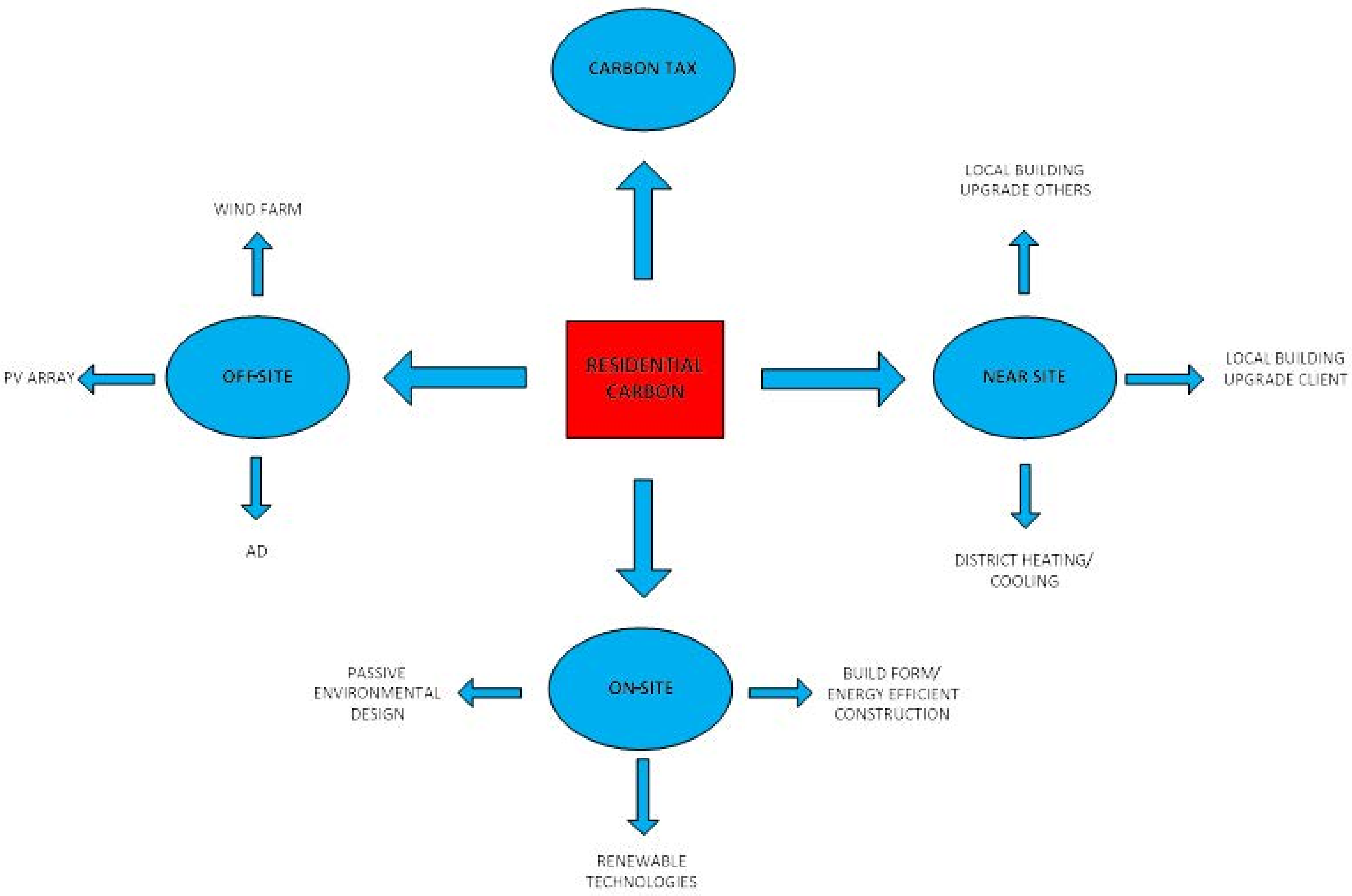
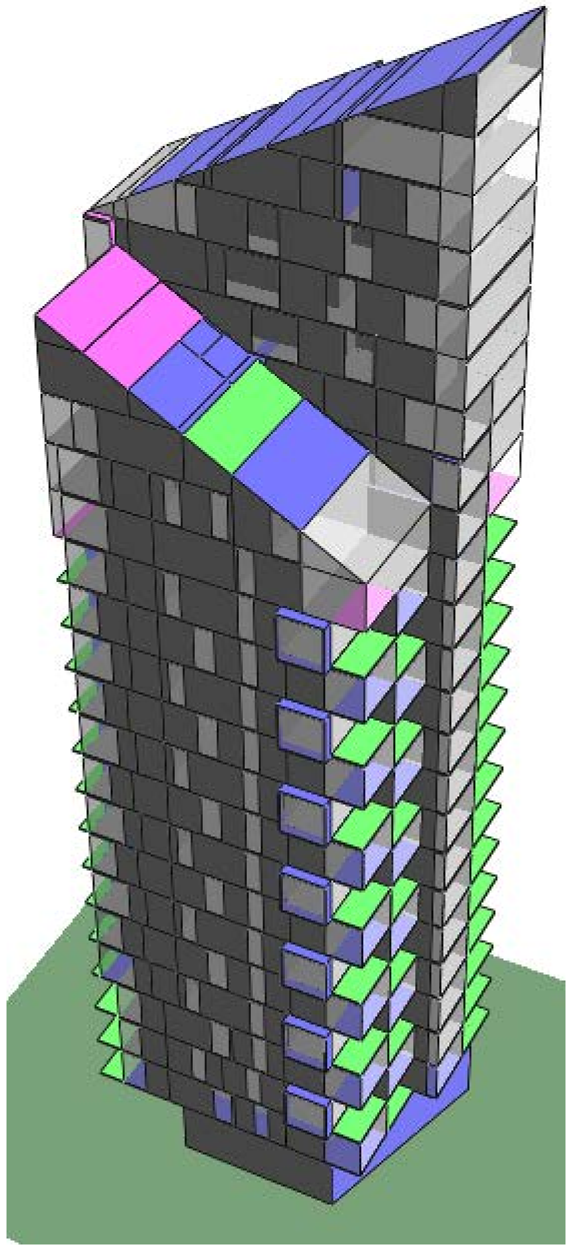
372-TYP-PL14v(26.10.15)	
372-TYP-PL15 (26.10.15)	



4.2. Computational Energy Modelling

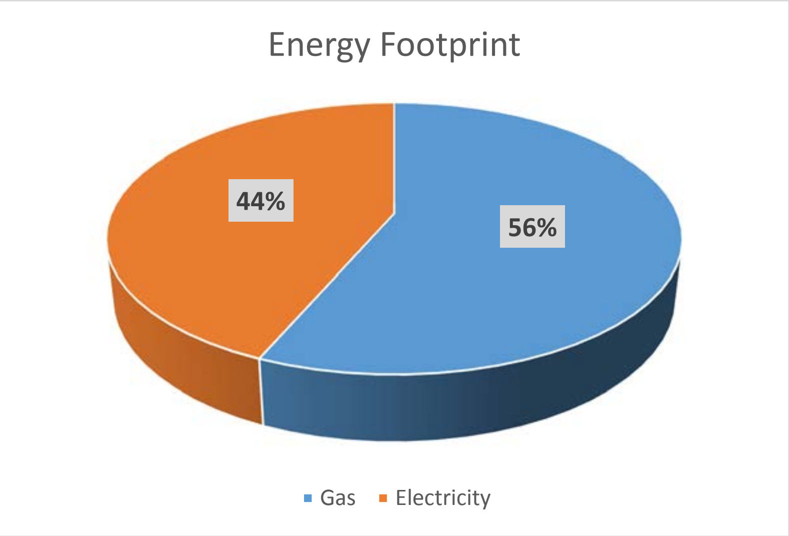
A virtual computational model of proposals at Brill Place has been created using IES Virtual Environment (Version 2014.2.1.0 VE Compliance 7.0.2.0) based on plans and elevations from the architect. The model uses dynamic simulation to estimate annual energy consumption, which has been used to develop a low carbon strategy for the site. This has been used in conjunction with JPA Designer SAP calculation software (SAP Version 9.92).

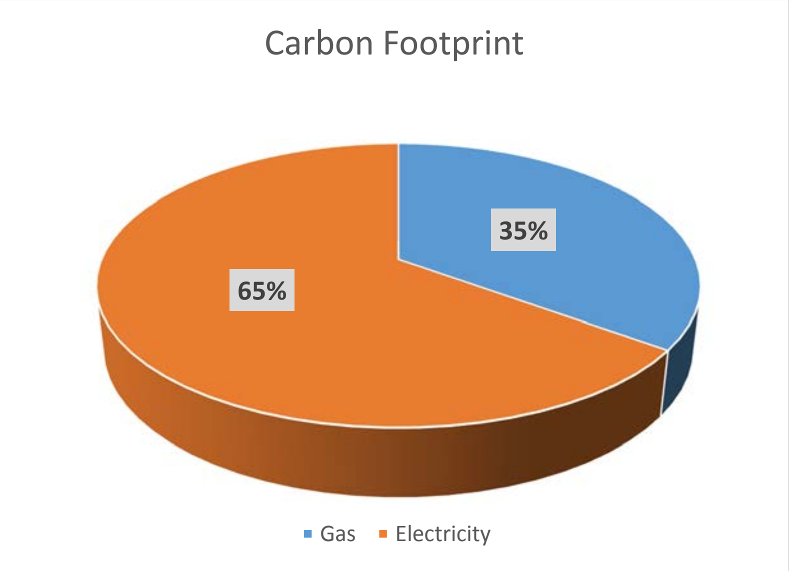


IES model South elevation

Within the model each dwelling has been assessed individually and the combined total building performance based on the amalgamation of the results of the dwellings following the National Calculation Methodology (NCM) templates developed by the Building Research Establishment (BRE).

The relative estimated energy and carbon footprint for the site is shown below.





In order to show how much carbon is related to the energy used, there is a carbon factor associated to the generation of energy with each particular fuel. Currently the carbon factors are as below:

Fuel	Carbon factor (kgCO2/kWh)
Gas	0.216
Electricity	0.519

These factors are taken from the latest Standard Assessment Procedure (SAP) 2012 documentation set by the Department for Energy and Climate Change (DECC) and are correct at the time of writing.

Due to these differing carbon factors relating to each of the associated fuels for energy uses, set here as gas and electricity for the baseline predictions, it can be seen that consideration needs to be given to every system consuming energy within the dwelling. A more detailed breakdown of the loads relating to the use is given in the baseline analysis.

These templates and related assumptions were kept the same for the baseline (worst case) run and for the various options studied making for a fair comparison of applied energy reduction measures.

4.3. Code for Sustainable Homes

Although this is no longer a planning requirement, the project will still aim to improve significantly on Code level 4. The fabric of the building will be designed to the highest performance standards to minimize operational emissions, with extensive use of renewable energy sources, within the constraints of the site, to achieve these goals.

Regarding the regulated operational energy and water use, Camden have requested that at least 20% of the energy will be provided by renewables and the water usage will be below 105 litters per person per day. The proposed development will be designed to meet these sustainability targets.

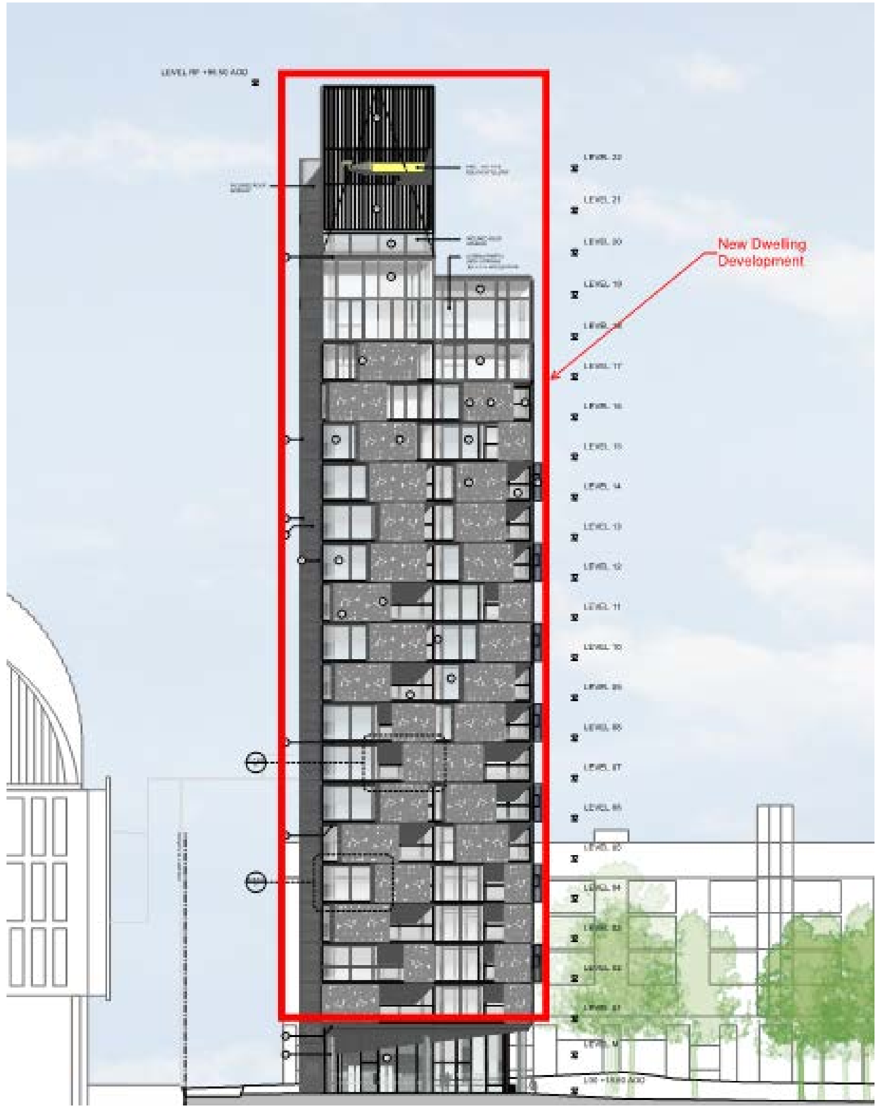
5. Baseline

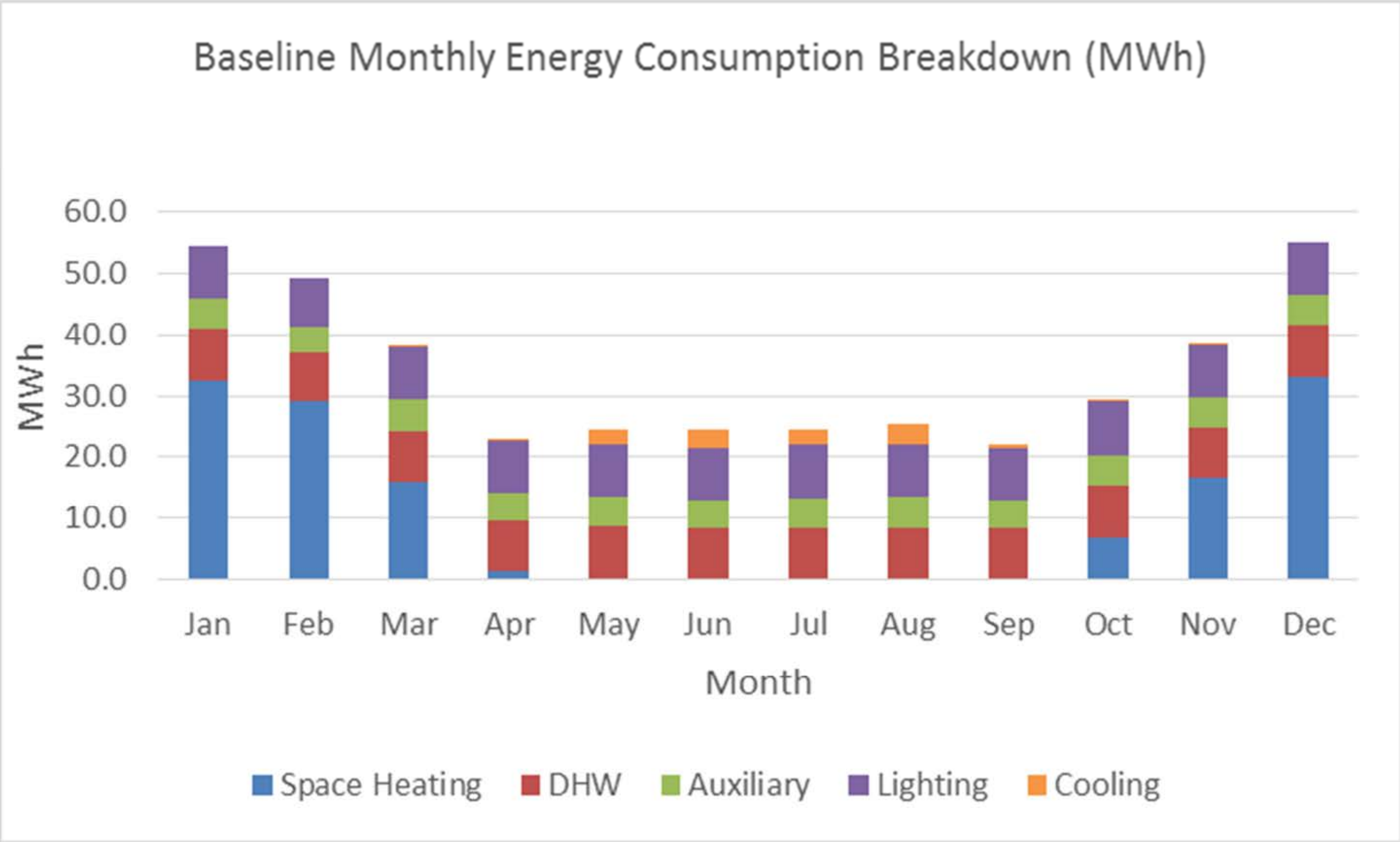
The predicted carbon baseline has been calculated as the energy consumption of the new dwelling development only, with no additional energy efficiency measures taken. Assumptions relating to the fabric and services have been determined form Part L 1A limiting parameters. This provides a baseline over which the energy efficiency improvements can be measured.

The estimated breakdown of the energy consumption of the building can be seen in the figure to the right:

Space heating and domestic hot water dominate the energy consumption of the building, with equipment and lighting becoming more important considerations when thinking about carbon reduction.

As can be seen the DHW load is relatively constant throughout the year.





5.1. Baseline / Notional Building Emissions

Compliance with the Criterions of Part L1A – Achieving an acceptable carbon emission rate can be assessed using the accredited software, IES and in conjunction JPA designer. The building is analysed using a relevant simulation method and results produced compare carbon emissions between the options related to the proposed building and a notional building.

The 'notional' building is intended to be an accurate representation of the intended design – the building as designed, but described within the limits of the government guidelines.

The notional building is a modified version of the proposed building, which has U-values, window sizes and service efficiencies determined by the 2002 Part L regulations. It is defined by the compliance software, and is not intended to be an accurate representation of the proposed building design but serves as a baseline against which the proposed improvement measures can be measured.

An annual simulation generates two carbon emission rates:

1) The TER – target emission rate. This is the carbon emission target for the building and is based on a dwelling of the same size and shape as the actual dwelling constructed to a concurrent specification as summarised in Table 4 of the Approved Document L1A.

-2) The BER – building emission rating. This is the figure generated by the actual building and must be lower than the TER for the building to comply and maybe subject to post construction testing.

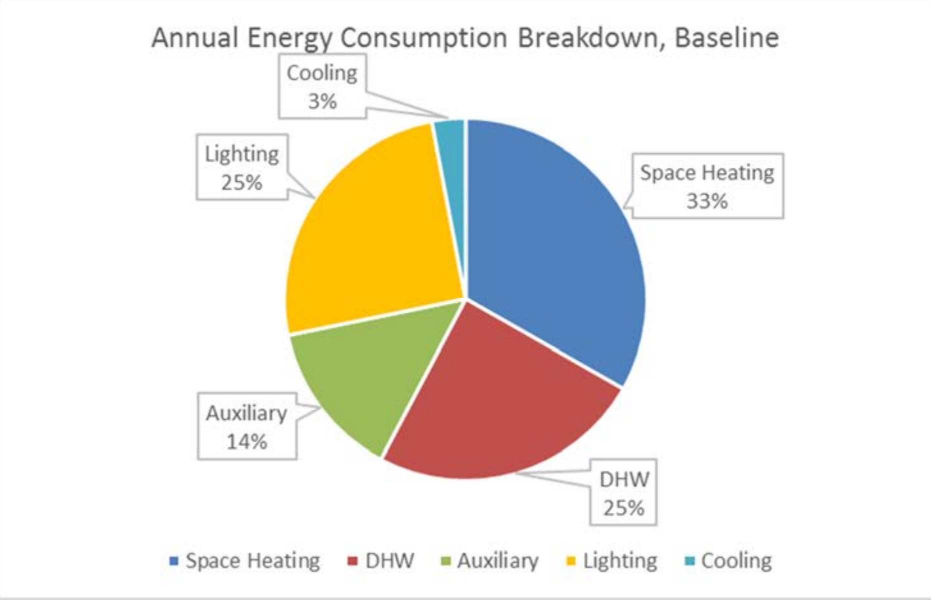
IES VE has been used to model the proposed dwelling and the energy model imported into the BRE approved software JPA Designer (version 6.03a1 SAP Version 9.92). SAP worksheets for the sample dwellings are provided in Appendix C.

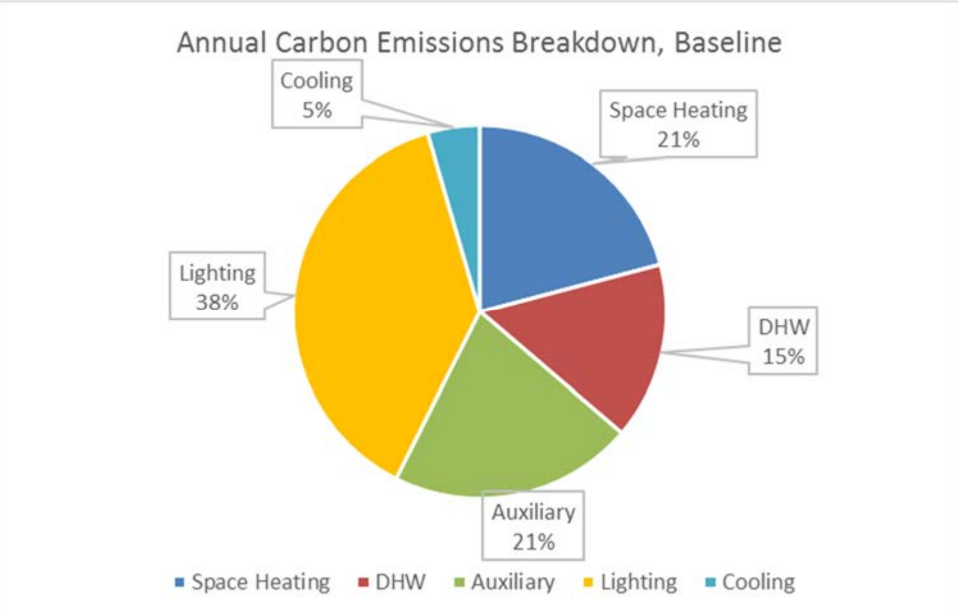
The performance of the actual designed building is then simulated incorporating 'Lean, Clean and Green' proposals to demonstrate a percentage reduction in carbon emissions for each stage of the energy hierarchy.

The predicted energy breakdown of the site can be seen in the figure to the right. The proportion of carbon related to each type of consumption indicates where savings can be targeted.

The breakdown of the results of the simulation carried out for the baseline study and be seen in figures to the right.

The results from the simulation show that the target baseline emissions 70.8 tonnes CO_2. It is against this figure that all carbon reduction strategies will be compared as under the Greater London Authority (GLA) guidelines.





The balance of energy between spaces within the building, shall be carefully considered to reduce overall consumption.

5.2. Cooling requirements

The table below presents the monthly cooling requirement for a penthouse apartment as calculated by the SAP software.

Space Cooling Requirements (kWh)		
June	July	August
333	362	307

8c. Space cooling requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
External temperaturers	-	-	-	-	-	14.60	16.60	16.40	-	-	-	-	
Heat loss rate W	-	-	-	-	-	2085.6	1641.82	1681.32	-	-	-	-	(100)
Utilisation factor for loss	-	-	-	-	-	1.00	1.00	1.00	-	-	-	-	(101)
Useful loss W	-	-	-	-	-	2078.2	1639.45	1676.98	-	-	-	-	(102)
Internal gains W	0.00	0.00	0.00	0.00	0.00	695.30	668.02	678.33	0.00	0.00	0.00	0.00	
Solar gains W	0.00	0.00	0.00	0.00	0.00	5083.2	4861.5	4299.7	0.00	0.00	0.00	0.00	
Gains W	-	-	-	-	-	5778.5	5529.5	4978.1	-	-	-	-	(103)
Fraction of month for cooling	0.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	(103a)
Space heating kWh	-	-	-	-	-	95.89	16.51	0.00	-	-	-	-	(98)
Space cooling kWh	-	-	-	-	-	2664.3	2894.2	2456.0	-	-	-	-	(104)
Total												8014.45	(104)
Cooled fraction												0.50	(105)
Intermittency factor	-	-	-	-	-	0.25	0.25	0.25	-	-	-	-	(106)
Space cooling requirement for month	-	-	-	-	-	333.03	361.77	307.00	-	-	-	-	
Space cooling (June to August)												1001.81	(107)
Space cooling requirement per m² (kWh/m²/year)												5.10	(108)

DER Worksheet from SAP software

6. Being Lean

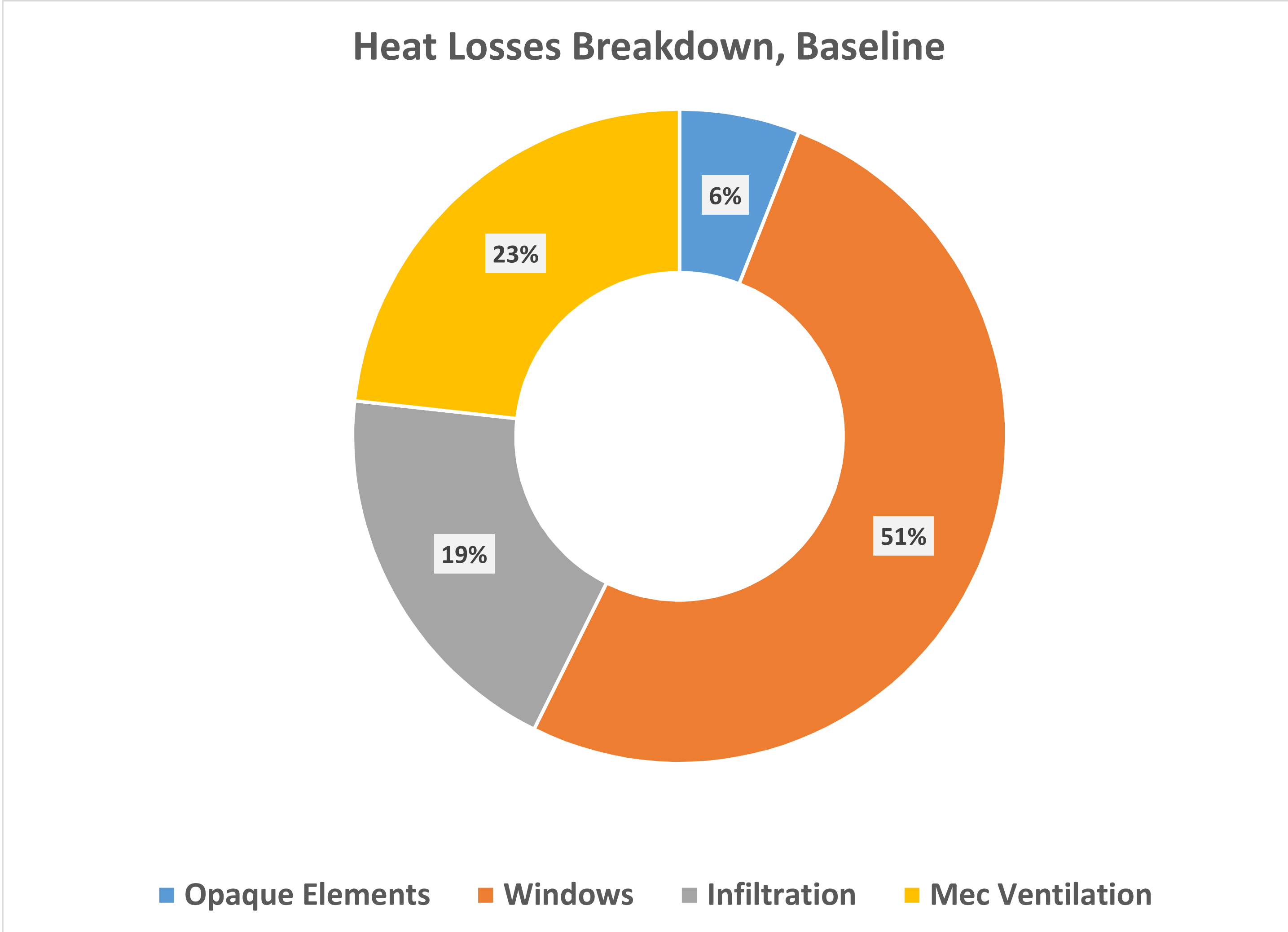
The first step in the energy hierarchy is to reduce the energy demand through passive design and efficient building services.

6.1. Building Fabric Enhancements

Predicted fabric losses are shown in the figure to the right giving areas where improvements can be most effective.

As can be seen the glazed element of the building has potential for savings.

The proposed building fabric improvements are presented in the table below with key elements such as the glazing strategy and how it relates to the fabric energy efficiency targets described in Appendix B.

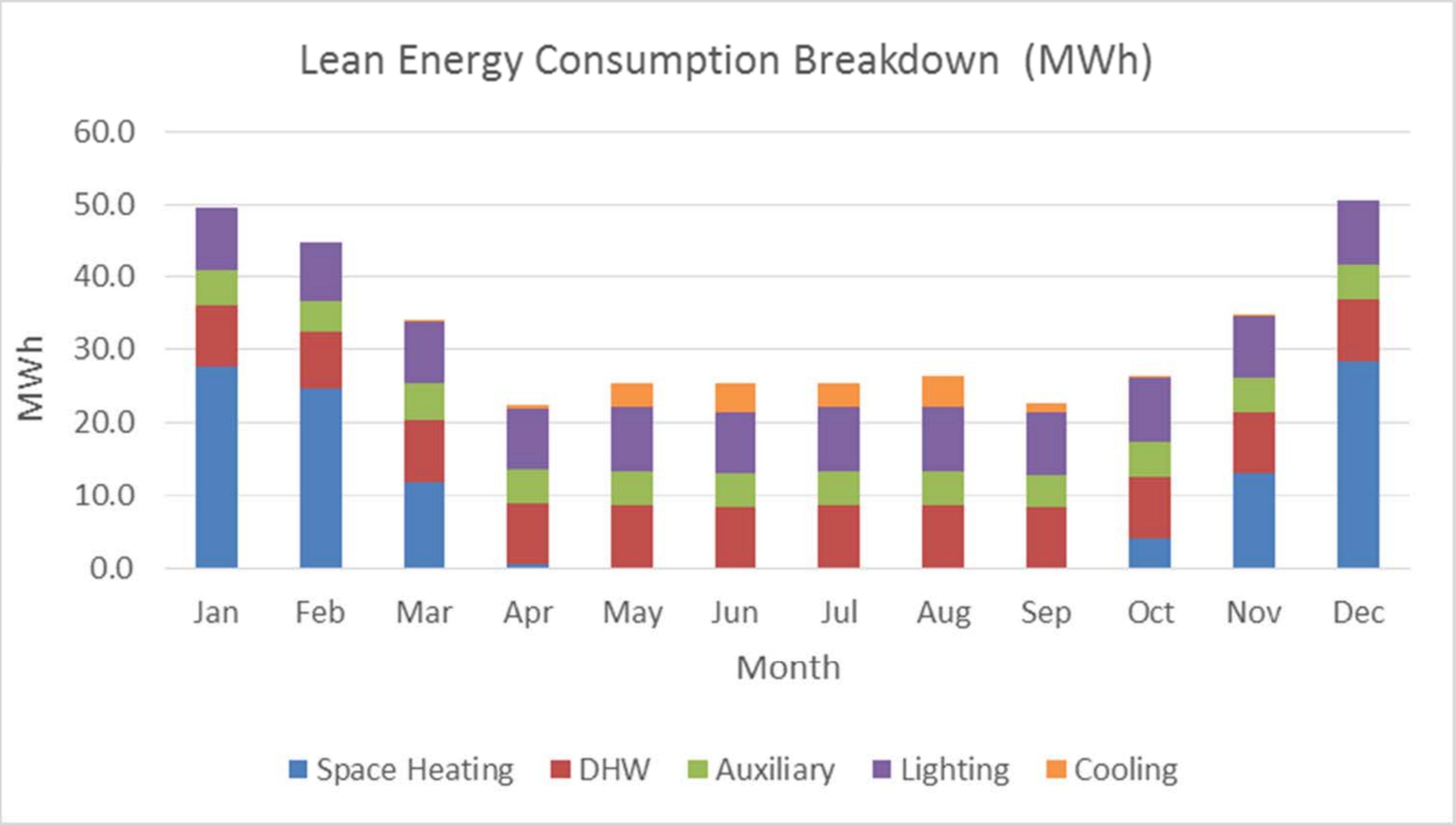


6.2. New Construction Philosophy

The new construction philosophy for Brill Place goes beyond Building Regulation standards aiming for exemplary levels of performance.

Building Element	B'Regs Limiting U-Value (W/m^2K)	Notional Building U-Values (W/m^2K)	Target U-Values (W/m^2K)
Roof	0.20	0.13	0.13
Walls	0.30	0.18*	0.15
Floors/Exposed Floors	0.25	0.13	0.13
Windows	2.00	1.5*	1
Rooflights	2.00	1.8	1

(*for a curtain wall system)



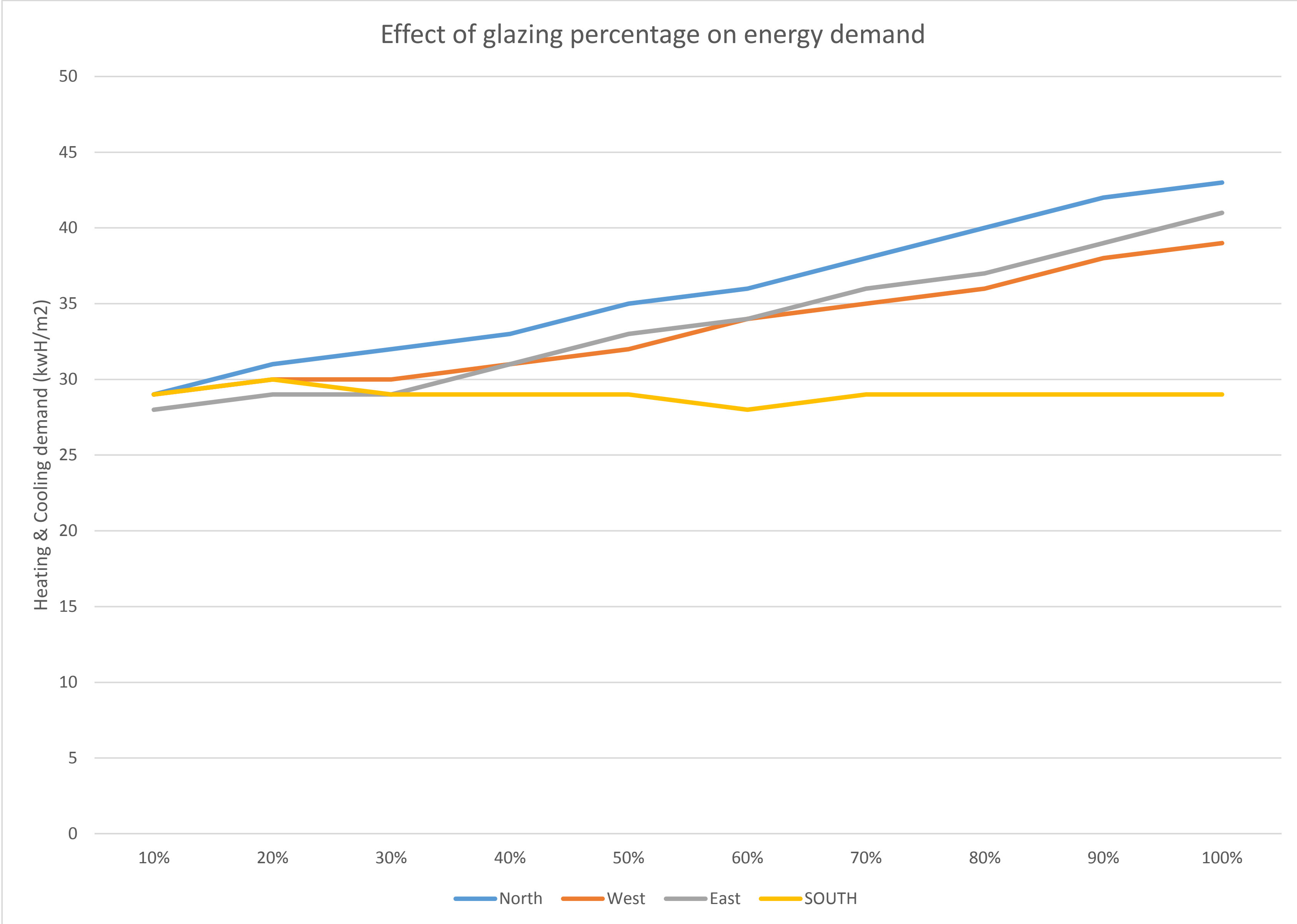
The application of the building fabric improvements over Part L standard shifts the building loads as in the graph top right.

Other Passive design measures to reduce energy consumption included in the design development are described below.

6.2.1. Glazing Optimisation and Fabric Energy Efficiency

During the early design process much work was done to optimise the glazing on the tower. This was to meet the Target Fabric Energy Efficiency (TFEE) requirements as set out by Camden.

The optimum glazing percentages for each orientation were discussed and a suitable ratio applied to balance function and energy efficient design. The process also enabled the team to minimise overheating and thermal losses. The chart to the right illustrates the findings. A more detailed breakdown of the study can be found in Appendix B.



The following table summarises the proposed U-Values of the building elements in order to meet the average whole building TFEE.

Building Element	U-Value (W/m^{2}K)
External Walls	0.13
Ground Floor/Exposed Floors	0.13
Roofs	0.13
Glazing	1
Rooflights	1

Average TFEE :	44.79
Average DFEE :	37.85
Compliance :	Pass

The targets set by Camden state 50% of the un-weighted credits under the Code for Sustainable Homes (CFSH) shall be met for the Energy credits. This involves the TFEE as it plays a part in achieving the target (ENE2). The TFEE has been met for each apartment and for the entire building.

During the design process an iterative approach was followed to optimise the ratio of glazed to solid elements of the façade in order to meet the requirements set out above.

6.2.2. Daylighting Study

The nature of the building form, with dual aspect apartments lead the team to carry out daylight analysis to enhance the potential for natural light dispersion throughout the dwellings. This was co-ordinated with the need to optimise the quantity of glazing on the façades of the building. The daylight factors in key rooms of the apartments were assessed and compared to accepted targets to gauge optimum daylight levels. The figure to the right shows an example of the daylight study for rooms within three apartments; two typical apartments Level 1 (1Bed), and Level 12 (2Bed) and one penthouse Level 23 (3Bed).

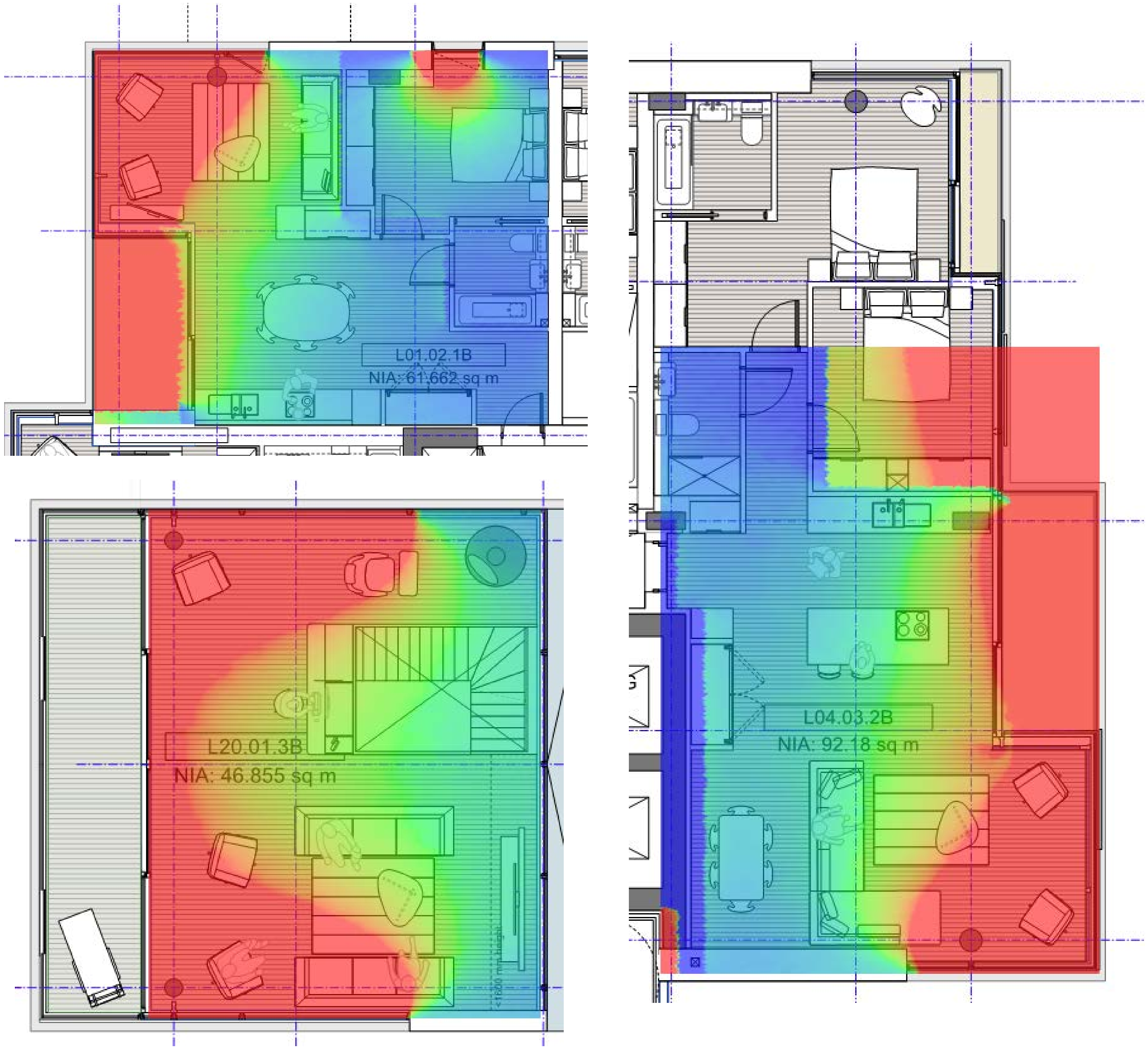
The benefits of optimising daylight include reducing the need for artificial lighting by showing that the daylight factor of each key space achieves in the region of 2% - 5%DF. This is considered to be well daylit and not requiring supplementary lighting for the majority of the day. (Camden Guidance)

The modelling showed that the living spaces of each apartment were over 5% DF.

L01.02.1B Living Room = 6.5%DF

L12.03.2B Living Room = 6.6%DF

L20.01.3B Living Room = 9.4%DF



6.2.3. Artificial Lighting Design

Energy consumption from lighting will be minimised via the following measures:

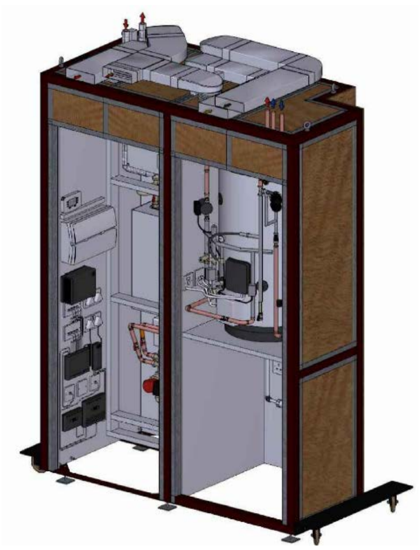
- Efficient lighting will be prioritised throughout, with a combination of compact fluorescent and LED fittings. 100% of all lighting will be energy efficient
- The target wattage across the total floor area of the dwelling shall be an average of 8W/m2
- Sophisticated controls will allow occupants to control and dim lighting on a room by room basis with the potential for daylight linking where appropriate
- In communal and circulation areas including externally, lighting will be controlled by timed switches
- Burglar Security lighting will have a maximum wattage of 150W, movement detection control devices (PIR) and daylight cu-off sensors
- Other security lighting with dedicated energy efficient fittings will be fitted with daylight cut-off sensors or timers

6.2.4. HVAC Systems and Controls

Energy consumption from heating, ventilation and air conditioning systems will be minimised via the following measures:

- All boilers will be high efficiency boilers (minimum 92% eff for gas condensing) the chosen technologies will be market leading
- All fans and pumps will operate on variable speed control
- Dwellings will have mechanical ventilation with heat recovery units, with a total unit specific fan power of no more than 0.8W/l/s and 90% heat recovery efficiency.
- Hot water pipes, tanks, calorifiers and ductwork will be insulated
- Electric sub metering will be installed to monitor energy use within each apartment. At least 95% of all gas and electrical use will be metered. All major items of plant will also be sub-metered including any cooling equipment, boilers, pumps and fans. The incoming gas and water mains will also be metered.
- All meters will provide pulsed output to the Building Energy Management System (BEMS) for automated metering and centralised monitoring of all water and energy use. The BMS will also ensure that the heating systems are highly responsive and operate at their optimal efficiency in maintaining internal comfort conditions.
- The metering strategy will be in alignment with CIBSE TM39
- High electric power factor will be specified at at least 0.95 efficiency

The proposed MVHR system for the dwelling at Brill Place would make use of energy cupboards (1 per apartment) similar to the type shown in the figure below.

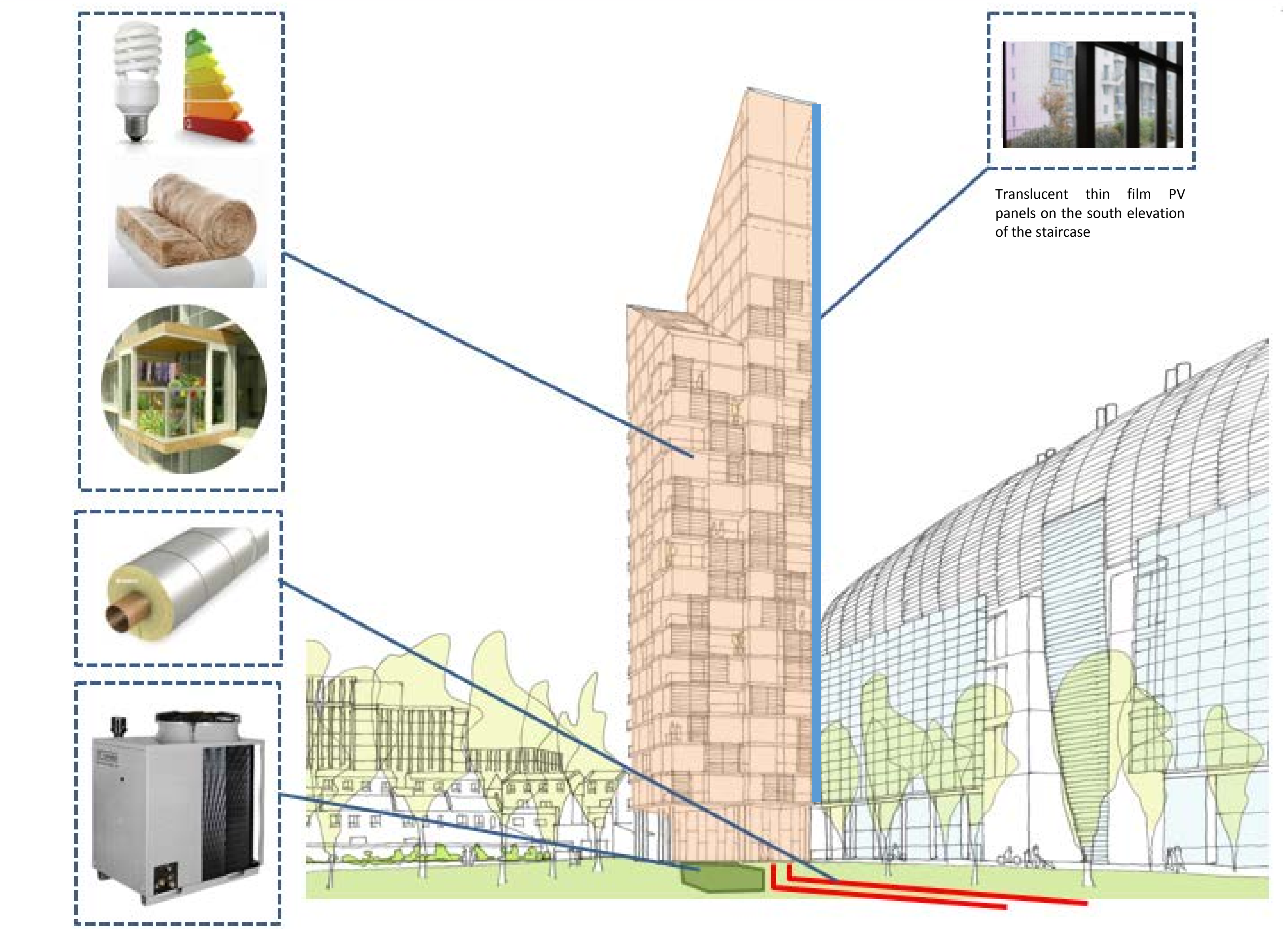


Reduce the demand for mechanical cooling and mitigate the risk of overheating by:

- Reducing heat gains through the use of energy efficient lighting, and the control of solar gains with shading and high specification glazing where required.
- Maximising the use of passive cooling techniques e.g thermal mass
- Providing openable windows to boost ventilation

Each system would serve the whole dwelling providing controlled services. The management and control system of these services is key to saving energy.

The image below shows the strategy highlighting where this approach is particularly relevant in the double height living area where the stack effect is employed.



6.2.5. Winter Gardens

It is proposed that winter gardens are used for the upper floors. Brill Place would utilise areas for winter gardens located in the building as shown in the figure opposite:

The image above displays the balcony winter gardens

The benefits from winter gardens include:

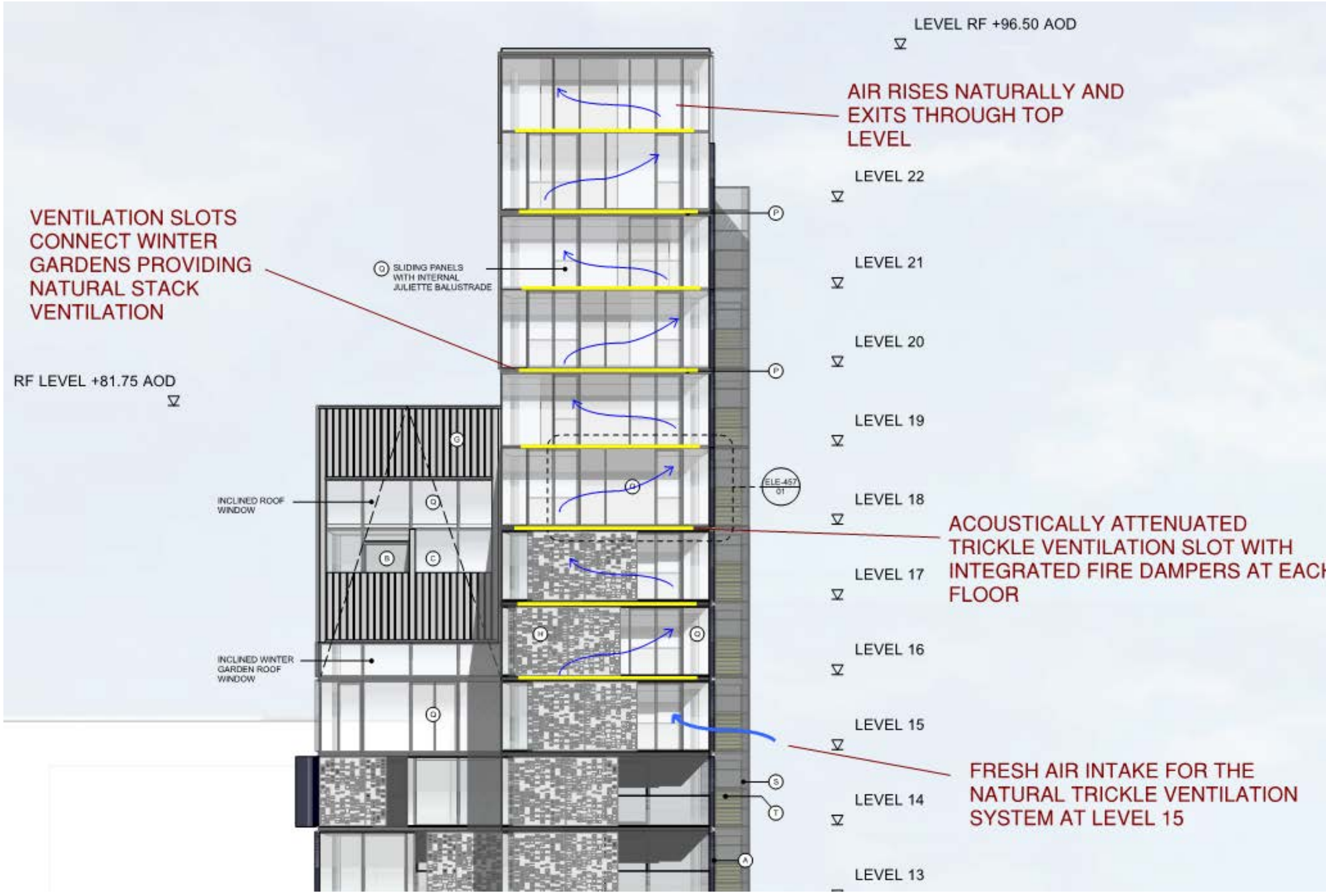
- Greening of Façade
- Improved insulation
- Reduced heat gain

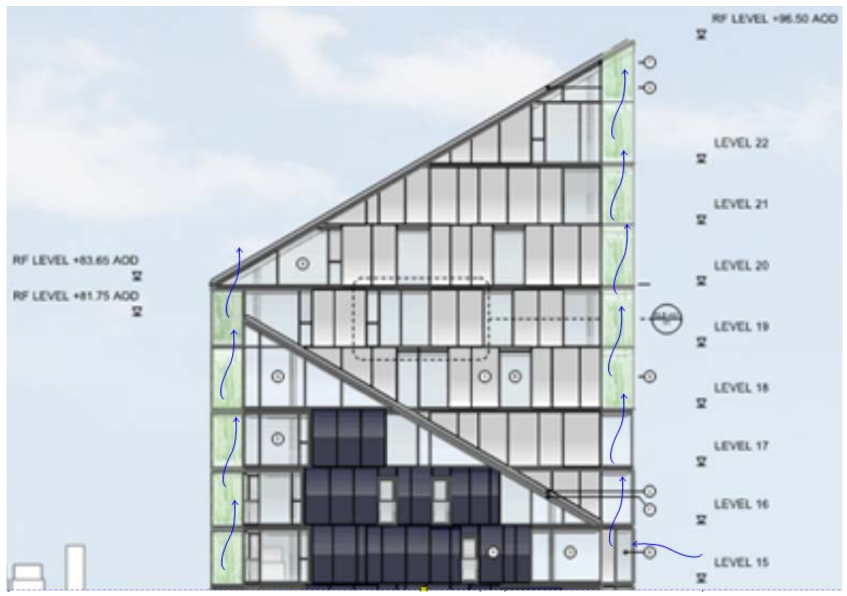
Winter gardens effectively condition the space via photosynthesis and evapotranspiration in particular reducing the effect of solar gain into the building and so provides an energy saving as less cooling is needed to provide comfort in the glazed spaces.

The proposal sees these spaces employed between the inner living space glazing and the outer glazing line. The upper and penthouse apartments shall have dedicated winter garden areas.

To overcome any potential air quality issues all winter gardens from Level 16 and above, including the winter garden in the eastern corner of Level 15 shall be sealed.

To prevent condensation and to ensure sufficient diluting air movement in the winter gardens, the use of a system incorporating natural trickle ventilation slots within the floor zone adjacent to the facade connects the winter gardens and provides natural stack ventilation. The fresh air intake for the natural ventilation system would be Level 15 (except one location at northeast corner of level 16). The image below illustrates the general principle of the proposed system.



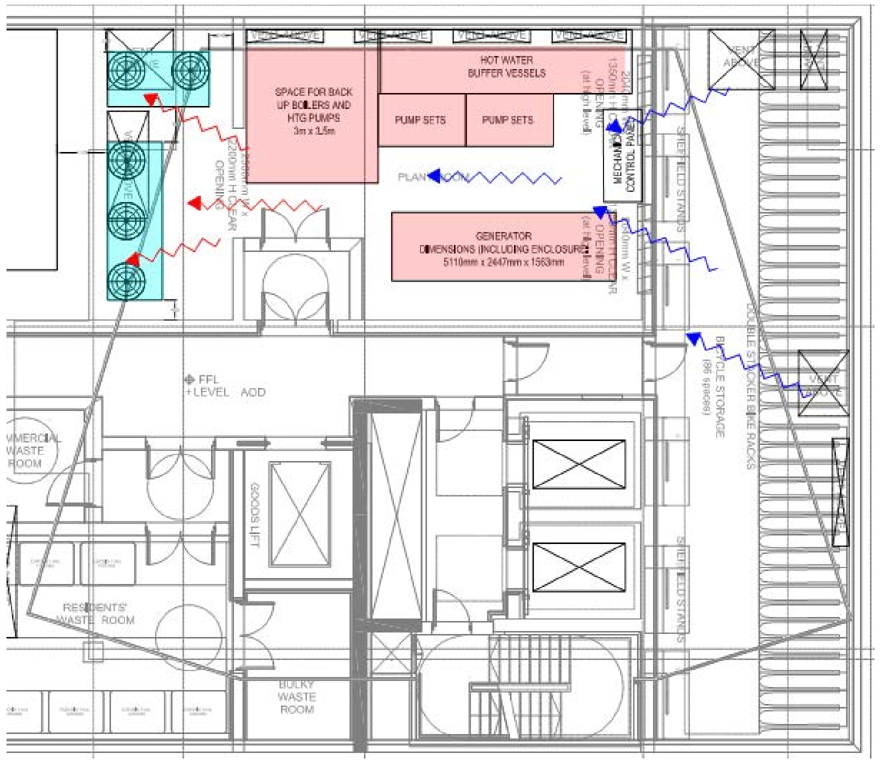


6.2.6. Heat Distribution and Transfer

Within the proposed building there are differing heat loads and requirements throughout the day. For example in the spring and autumn months the apartments at the bottom of the building where in shade may require heating whereas the apartments experiencing direct sun at the top of the building may require some additional cooling.

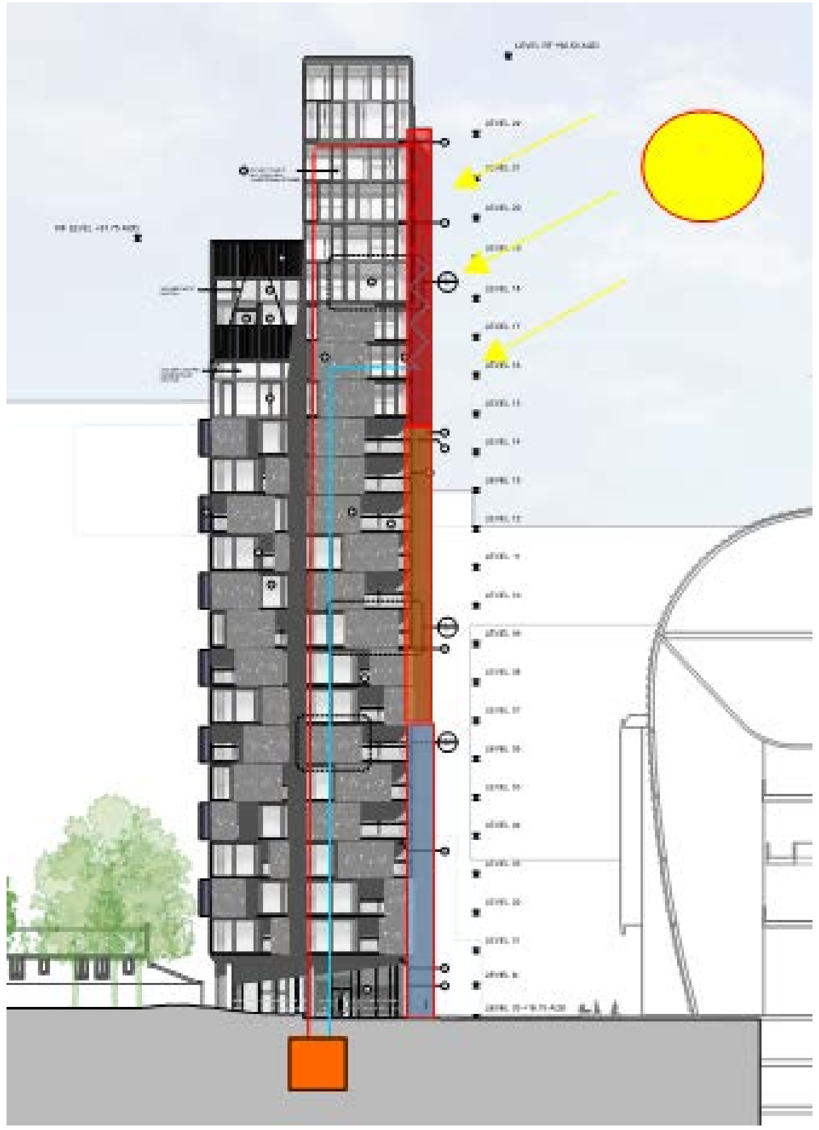
Proposals aim to transfer heat and coolth around the building as necessary to most efficiently distribute energy where needed.

An example of this is in the plant room where the heat producing plant is positioned in such a way that the natural airflow (in winter in particular) transfers heat to the Heat pumps making them more efficient and raising the COP.



The diagram above demonstrates the transfer of air in the proposed plant room layout, as the GAHP use the heat available in the plant room to transfer it to where required in the building.

The use of the southern stairwell as a solar chimney has also been investigated. This sees the solar heat collected at the top of the stairwell transferred via a heat exchanger to where it is needed. It is anticipated that around 60kW of heat can be used from this concept.



The diagram above shows the solar chimney concept as proposed at Brill place Tower.

6.2.7. Water Saving Measures

The option of low water use fittings, leak detection and metering as a method to help reduce the water use to the required 105litres/person per day has been proposed.

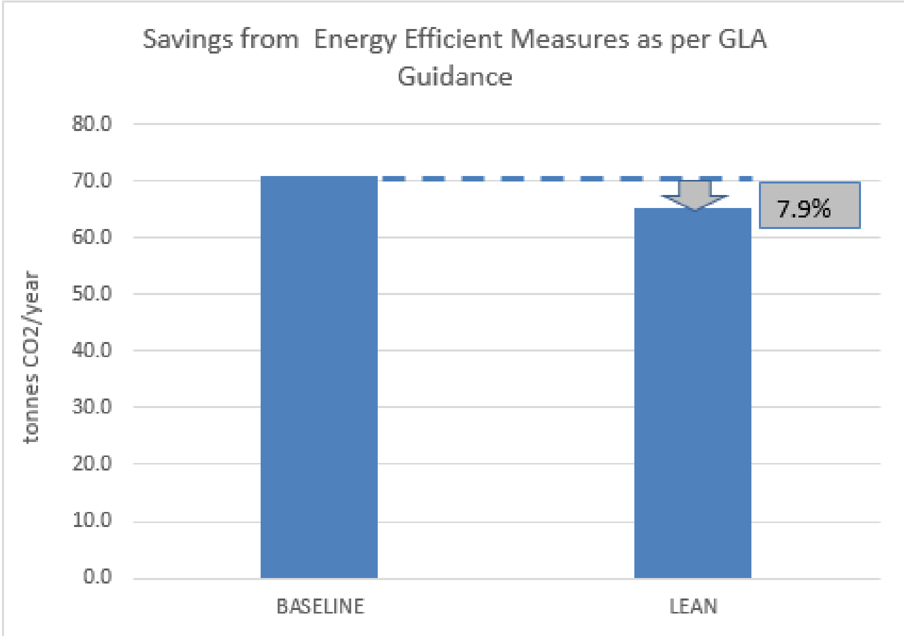
Due to the tight footprint of the site and the limited water saving achievable compared to financial outlay, grey water harvesting has not been considered feasible for this site.

The water saving measures are explored in more detail in section 10.

6.3. Lean Savings

The table below demonstrates the savings to be expected from the applications of Lean methods:

Lean Savings	TCO_2/year	% Improvement
Baseline Emissions	71.4	n/a
Savings from Building Fabric Enhancements and MVHR	5.6	7.9%



Through the energy saving measures outlined, it is predicted the 'lean' measures proposed will reduce carbon emissions by 7.9% compared to the baseline building.

7. Being Clean

The second step of the energy hierarchy concerns itself with supplying energy efficiently.

The principle priority under the Camden guidelines is to establish CHP feasibility or connection to a de-centralised energy network.

The following steps will be required to consider once a development has been designed to be as energy efficient as possible. (Energy hierarchy – Stage 1)

- Investigating the potential for connection into an existing or planned decentralised energy scheme and using heat in a carbon efficient manner
- Installing a combined heat and power plant (CHP or CCHP), including exporting heat where appropriate
- Providing a contribution for the expansion of decentralised energy networks
- Strategic sites are to allow sufficient accessible space for plant equipment to support a decentralised energy network
- Designing the development to enable its connection to a decentralised energy network in the future.

7.1. Decentralised Energy Networks/ District Heating

The use of a centralised heating and domestic hot water system requires a central servicing strategy to provide the hot water and heat to each property within the development. This is typically termed community, or district heating. The district heating plant essentially works like a large scale domestic central heating system and could offer hot water for providing both space heating, domestic hot water and optional chilled water for cooling via an absorption chiller should there be a demand for local commercial premises. CHP technology is often used in site-wide strategies with the heat distributed within a loop which runs around the site, allowing connection to all areas with a heat demand.

Usually, in such systems, the hot water provided is circulated through an underground network via well insulated pipes. Typically, customers are connected to the network via a pair of pipes with isolating valves, differential pressure regulation and a heat meter. These replace a conventional boiler. Radiators are fed directly from the pipe network and domestic hot water is produced via heat exchangers connected to the pipes. Occupants could either pay a service charge for the heat used or can be separately metered on their use.

Such a scheme would help achieve the Authority's requirement in regards to decentralised energy networks.

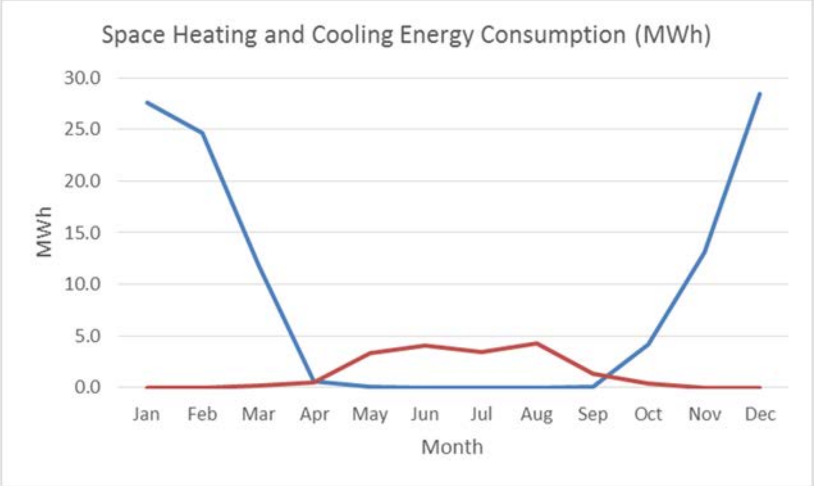
In general, the suitability of a development to connect to a district heating network depends on whether it fulfils the following criteria

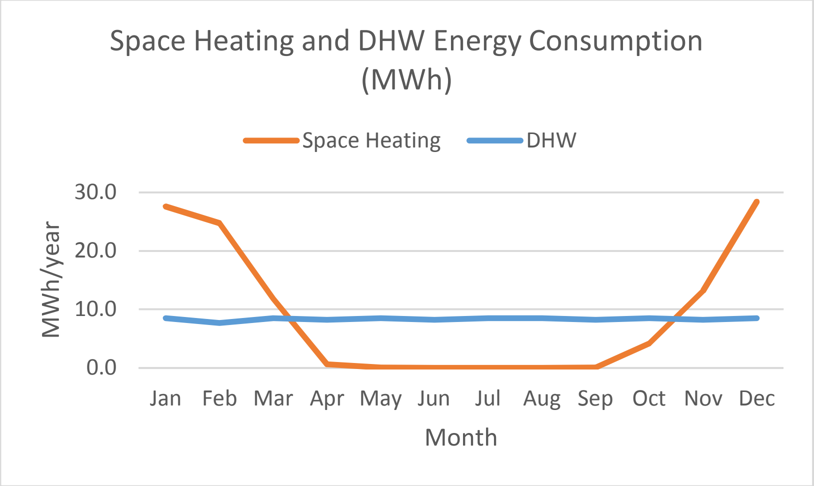
- High and constant throughout the year heating demand
- Mixed energy demands – a range of electricity and heating demands throughout the day; and
- Located close to an existing or emerging district heating network.

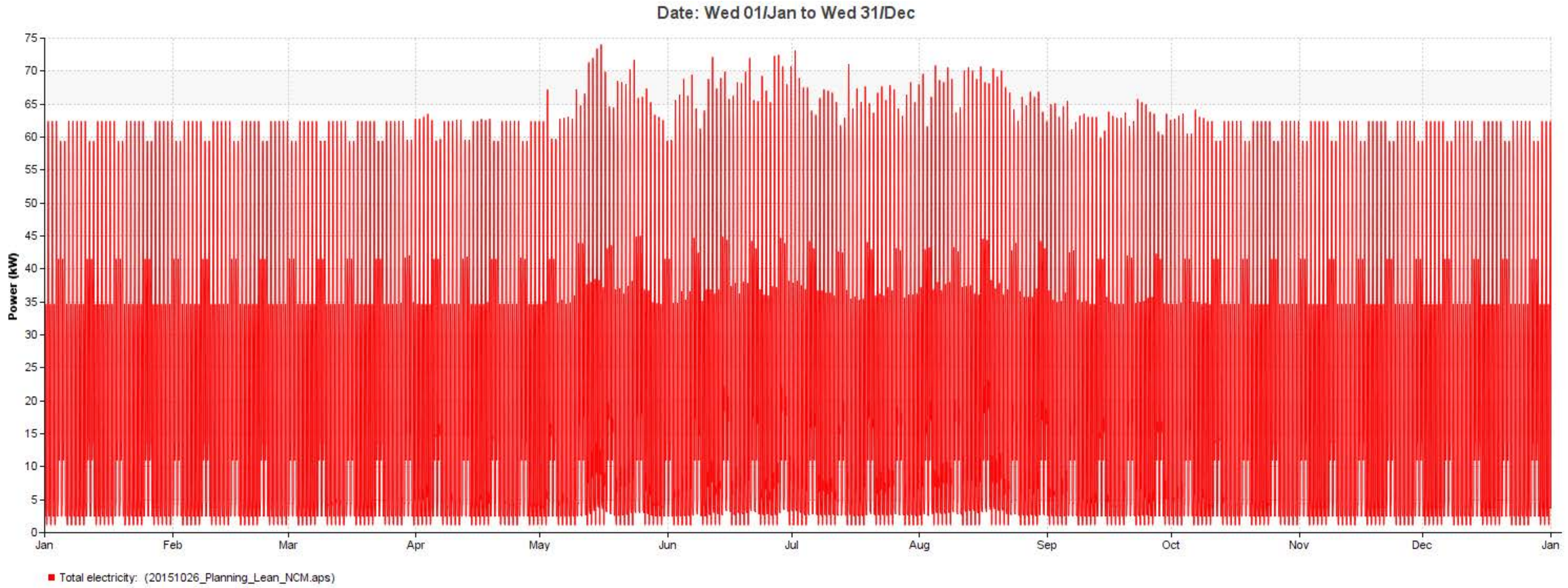
The graphs below present the demand for heating, cooling, hot water and electricity

As it can be seen from the graphs, while there is a demand for electricity and hot water throughout the year, there is no or very small demand for heating during the period from April to September.

Also, the graph at the bottom clearly illustrates the contribution of the mechanical cooling supplied to the penthouses into the electric energy load during the summer months.







The pictures below illustrate the developments within 1 km radius of an existing or emerging network and developments within 500m radius of a potential network respectively. Brill Place is located within those boundaries.

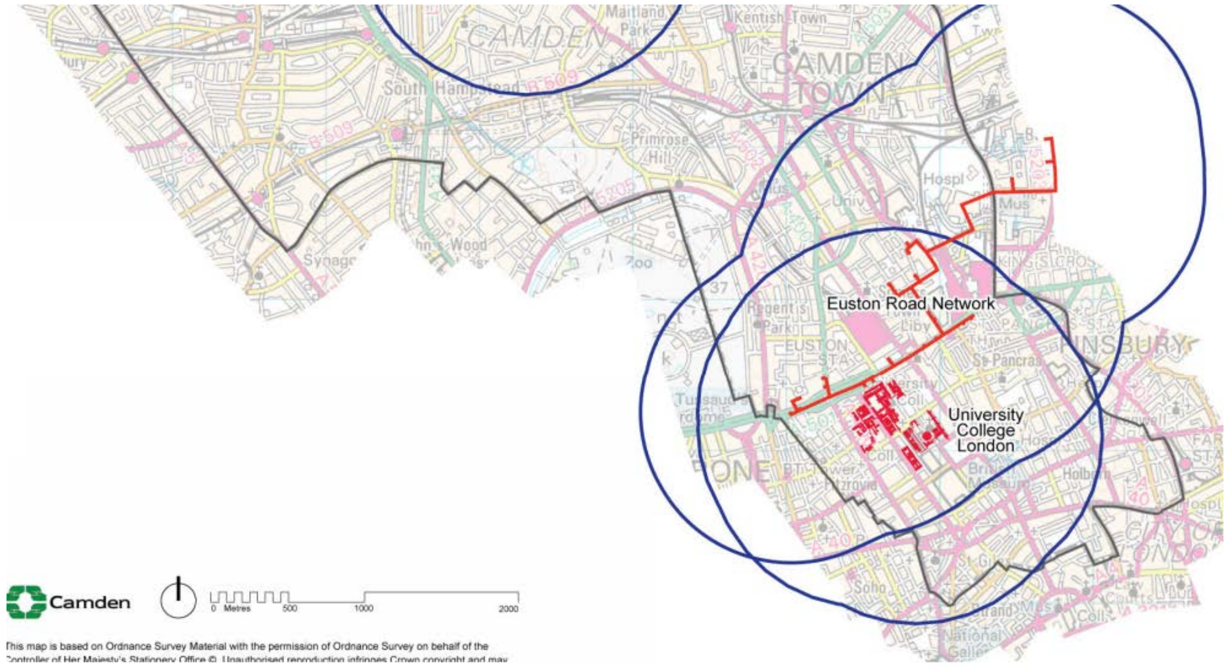


Figure 1: Developments within 1 km radius of an existing or emerging network

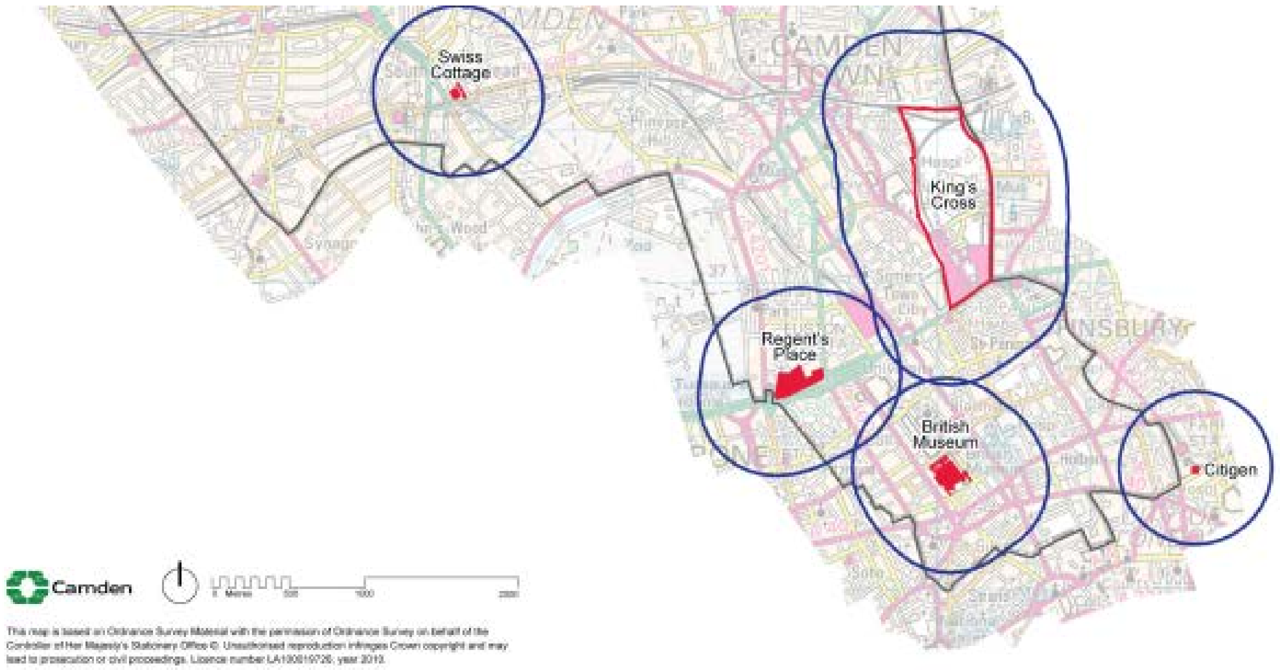


Figure 2: Developments within 1 km radius of an existing or emerging network

The proposed development will be located next to the Phoenix Court Energy Centre which will be sized to have a 850 kWe capacity CHP and it is due to be completed in 2017. The carbon saving potential varies from 430 up to 630 tonnes of CO_2 for 250 and 365 days of operation per year respectively (based on an 8 hours operation per day)

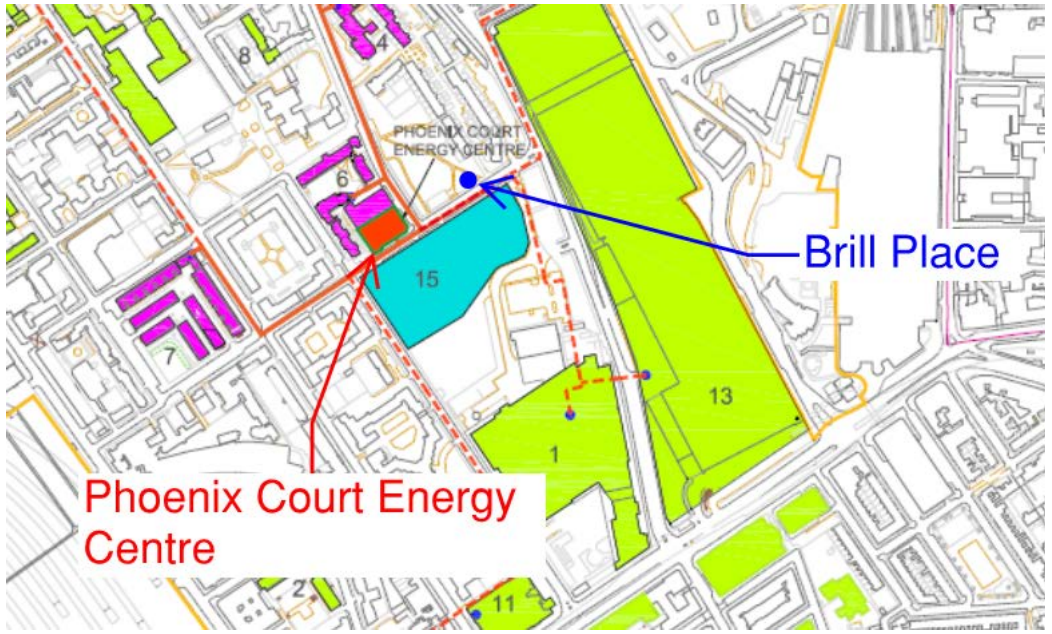


Figure 3: Location of Energy Center

A future connection to this energy centre is proposed.

7.2. Combined Heat and Power CHP

Combined Heat and Power (CHP) is the simultaneous generation of both usable heat and electrical power from the same source. In its simplest form, CHP employs a gas turbine or an engine to drive an alternator, and the resulting electricity can be used 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 and/or space heating in buildings.

CHP requires predictable and relatively constant heat demand for good performance and needs to be assessed in terms of feasibility. There is no justification for over-sizing CHP systems, and the unit needs to be carefully matched to the demands of the development.

In order to size the CHP adequately and so give appropriate carbon savings figures, the load profile of the heating and domestic hot water needs to be established to identify the base load.

CHP is not an all-purpose solution and its suitability needs to be checked carefully.

The key factors in the decision to install CHP include:

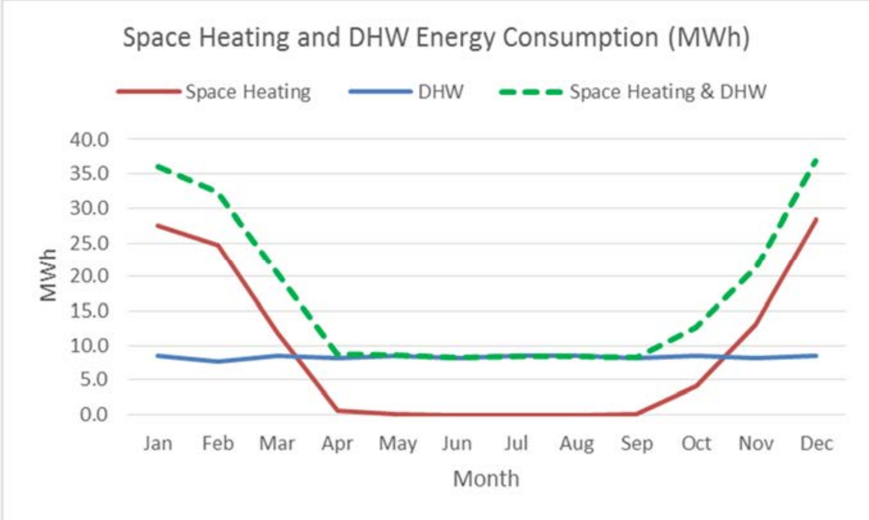
- Running time: in order to be cost effective the system ideally needs to run for a minimum of 4,500 hours/year.
- Total capital costs
- The total running costs and life cycle costs.
- The ability to use the heat generated by the CHP system.

7.2.1. CHP Strategy Justification

The team undertook a feasibility study to assess the incorporation of a centralised CHP plant on the site. The chosen strategy is to supply the hot water load of the building from the heat produced by the CHP/District Heating Scheme. The heat load of the building shall be supplied by other means, potentially a renewable source.

The reason for this is due to the combined heat load profile of the building. As can be seen in the figure opposite, the heating load of the building varies considerably during the year whereas the hot water load remains relatively constant. The summer heating load, as expected, is near zero.

As CHP engines run most efficiently when they don't turn down or vary their output, preferably running at constant speeds for as long as possible, adding the heating load to the CHP would not be good practice for this project. The engine will only run efficiently if a replacement load during the summer months, matching the winter heating load, is found. Adsorption cooling is one way of using heat in the summer should a constant load be found. However, at this stage, due to the unpredictability of the use of commercial space and the relatively low cooling load of the residential apartments, the design does not warrant this technology.



It has therefore been proposed that Brill Place uses the CHP engine to supply the hot water load only.

The carbon savings associated with this CHP strategy have been based on information provided in the "Developer Information File Note" by ARUP.

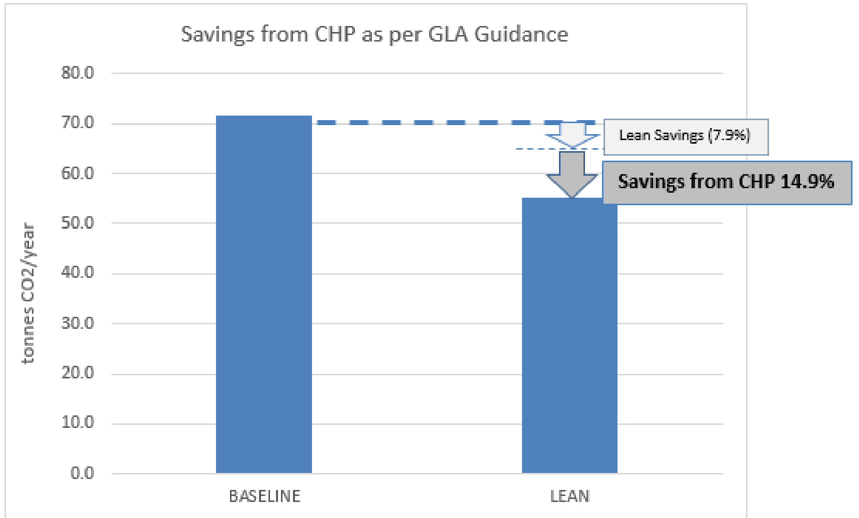
The table below summarises carbon savings and the amount of photovoltaics that would be required if both space heating and DHW were provided by the district heating network and makes a comparison with the final proposed strategy. With Option 2 being selected at the time of writing. More details can be found in Appendix D.

The predicted carbon savings for option 3 are higher than the ones in Option 2.

LZC Technology Option	Annual CO_2 savings	Total CO_2 emissions	Improvement over OPTION 1	Renewables Target (20%)		Predicted PVs Cost (£)	Predicted Total Cost (£)
				% met from GAHP	Additional PV required (m^2)		
OPTION 1: District Heating with CHP+Boilers for DHW & Space Heating (ARUP's carbon figures)	22.5	48.9	-	0	618	£143,000	
OPTION 2: District Heating with CHP + Boilers for DHW. GAHP for Space Heating (ARUP's carbon figures)	22.9	48.6	2%	12%	260 m2	£60,000	
OPTION 3: (S&C Proposed Energy Strategy): District Heating with CHP for DHW. GAHP for Space Heating	28.7	42.1	28%	12%	260 m^2	£60,000	

Lean Savings	TCO_2/year	% Improvement
Baseline Emissions	71.4	n/a
Savings from CHP	10.64	14.9%

The savings associated with the application of CHP as described can be seen in the table and graph below. A total of 14.9% can be saved.



8. Being Green

The third step of the energy hierarchy is to evaluate the potential for Low and Zero Carbon Technologies. (LZCTs). The table in Appendix A summarises the available technologies and their potential application at Brill Place.

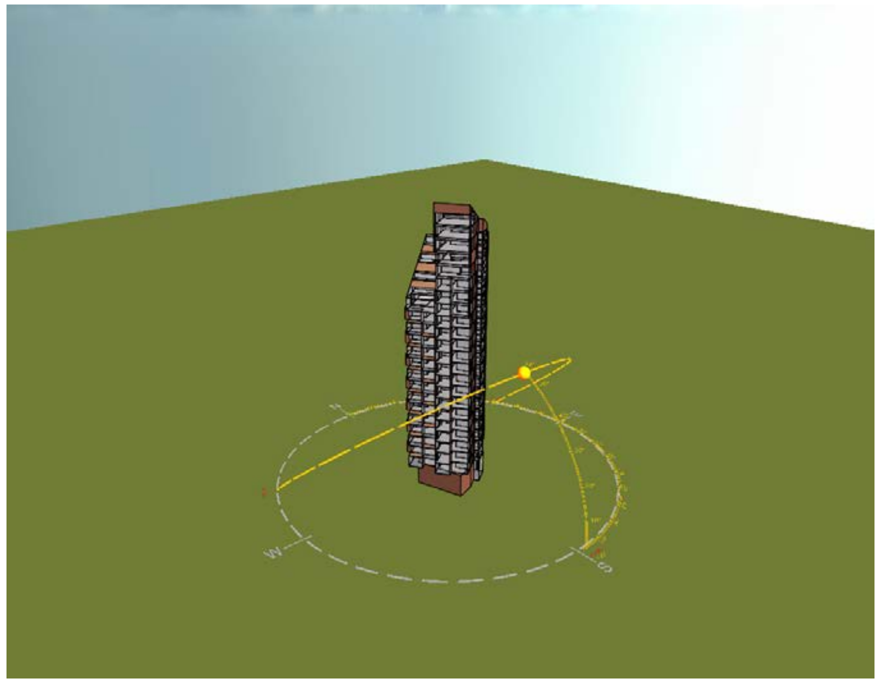
The predicted energy profile indicates that concentrating on space heating, domestic hot water and lighting loads will provide significant carbon savings.

Certain technologies can be dismissed without further investigation as they are simply inappropriate for the building or site. Being a visually sensitive site, wind turbines for example are unlikely to be approved.

The design team has favoured the use of Gas absorption heat pumps and PV, with the potential of being building integrated so this technology is being considered as a discrete solution.

Whilst not strictly renewable, the use of a gas absorption heat pumps located in the basement plant room has been selected as the technology for Brill Place.

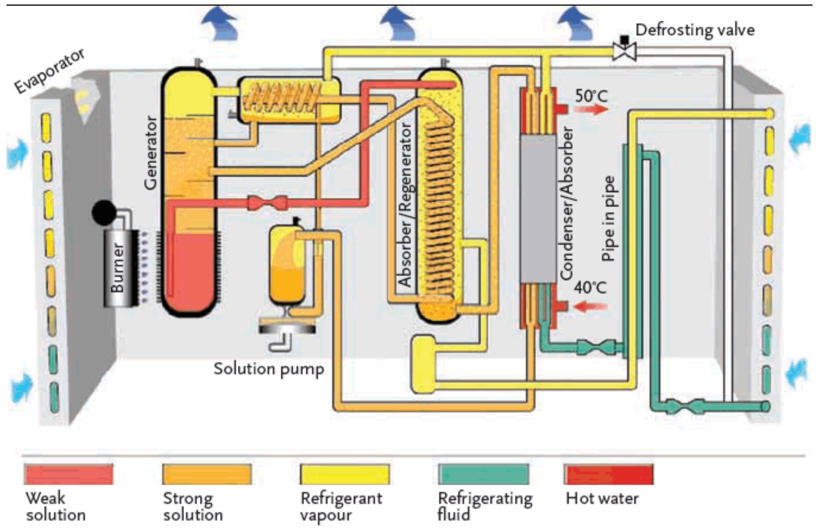
It shall be seen that these technologies alone combine to meet the carbon reduction requirements set out by Camden with the option of further reducing the carbon footprint by employing larger PV areas upon the building.



These are explored further in the following sections.

8.1. Gas Absorption Heat Pumps

The inclusion of gas absorption heat pumps has been considered for Brill Place due to the space restrictions and high efficiency values being achieved by positioning the units in the basement and utilising borrowed heat from surrounding heat producing equipment.

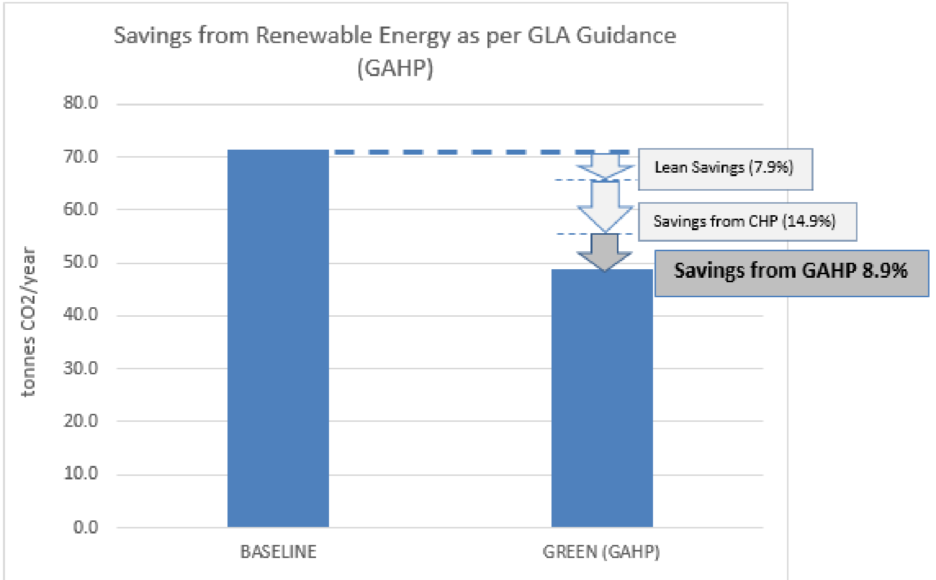


The image above shows the function of the heat pump in heating mode.

An efficiency of 150% is assumed based on manufacturers' data. This will provide a peak output of around 35kW heating per heat pump.

The breakdown of savings are shown in the table below.

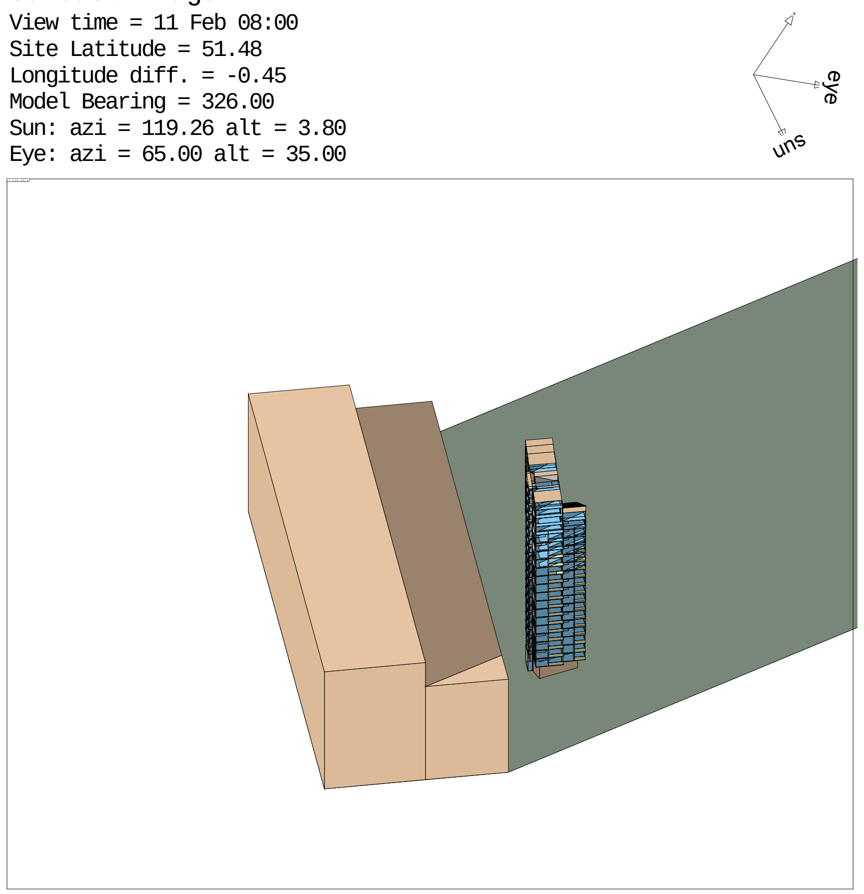
Loading	TCO2/year	% Improvement
Baseline Emissions	71.4	n/a
Savings from GAHP	6.4	8.9%



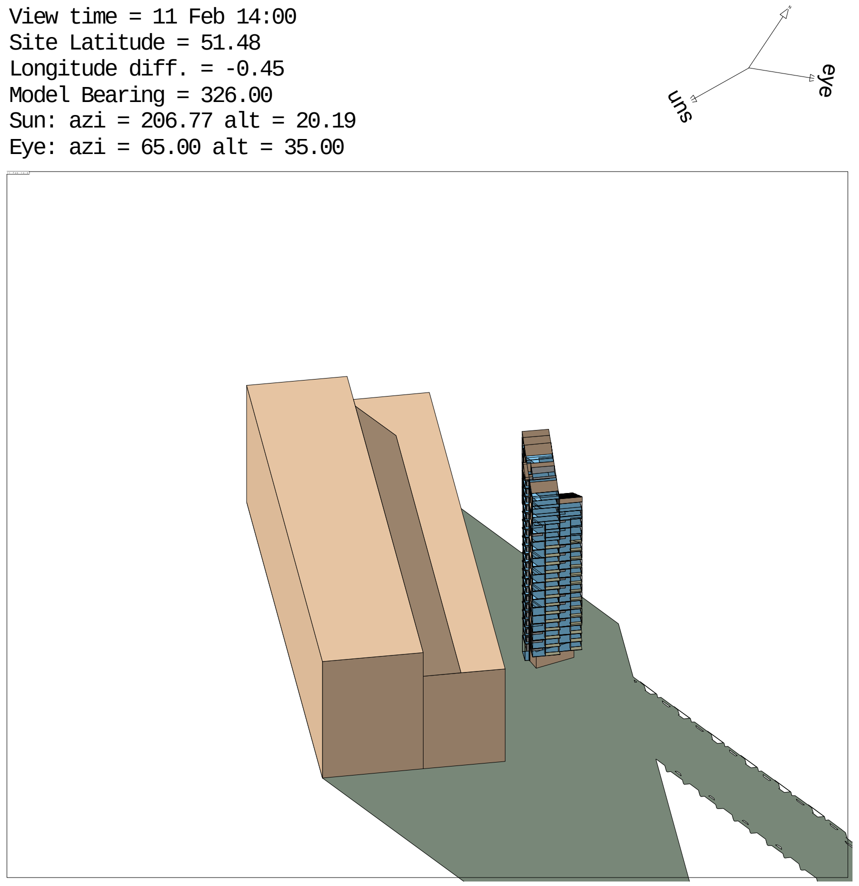
8.2. Photovoltaics (PV)

Photovoltaics is considered an appropriate renewable technology for the development. The upper facade areas receive little over shading from neighbouring buildings or trees. The sunpath analysis carried out shows the amount of sunlight received. With a typical day in February AM and PM being displayed below.

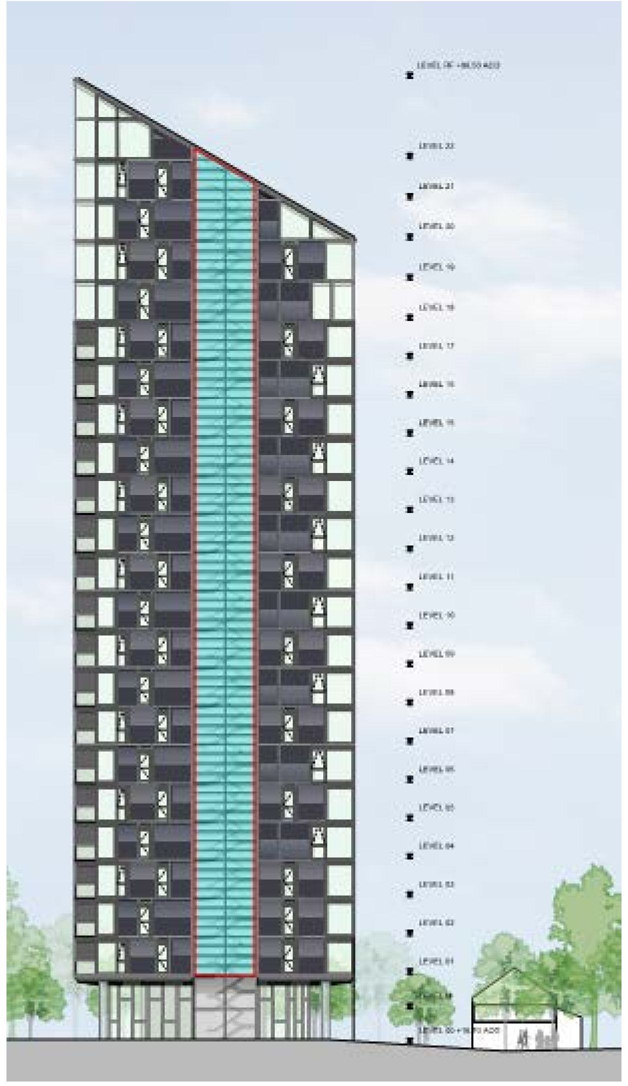
Suncast image:
View time = 11 Feb 08:00
Site Latitude = 51.48
Longitude diff. = -0.45
Model Bearing = 326.00
Sun: azi = 119.26 alt = 3.80
Eye: azi = 65.00 alt = 35.00



Suncast image:
View time = 11 Feb 14:00
Site Latitude = 51.48
Longitude diff. = -0.45
Model Bearing = 326.00
Sun: azi = 206.77 alt = 20.19
Eye: azi = 65.00 alt = 35.00



The figure below shows the proposed locations of the PV arrays (in blue) on the proposed building integrated into the stairwell glazing.



An example of glazing integrated PV is shown opposite.

		West	SW		South	SE		East
		270°	240°	210°	180°	150°	120°	90°
Vertical	90°	56	64	69	71	71	65	58
	80°	63	72	77	80	79	74	65
	70°	69	78	85	87	86	80	70
Roof	60°	74	84	90	93	92	86	76
Pitch	50°	78	88	95	97	96	89	80
[Deg]	40°	82	90	97	100	98	92	84
	30°	86	93	98	100	98	94	86
	20°	87	93	97	98	97	94	88
	10°	89	92	95	96	95	93	90
Horiz	0°	90	90	90	90	90	90	90

The amount of PVs needed is related to Camden's Council requirements to achieve a minimum of 20% reduction in CO2 emissions through on-site renewable energy generation.

The reduction of carbon emissions achieved by GAHPs alone (without the implementation of any fabric efficiency measures) is 8.3 CO_2 tonnes per year which equates to an 11.6% reduction over the baseline (71.4 tonnes CO_2).

The cells will be south facing, receiving annual solar radiation in the region of 850kWh/m2. The combined potential area for the PVs with no shading is approximately 160m^2. Utilising a factor of 0.69 to account for orientation and inclination (see table on bottom left), the total façade area required is approximately 260m^2.

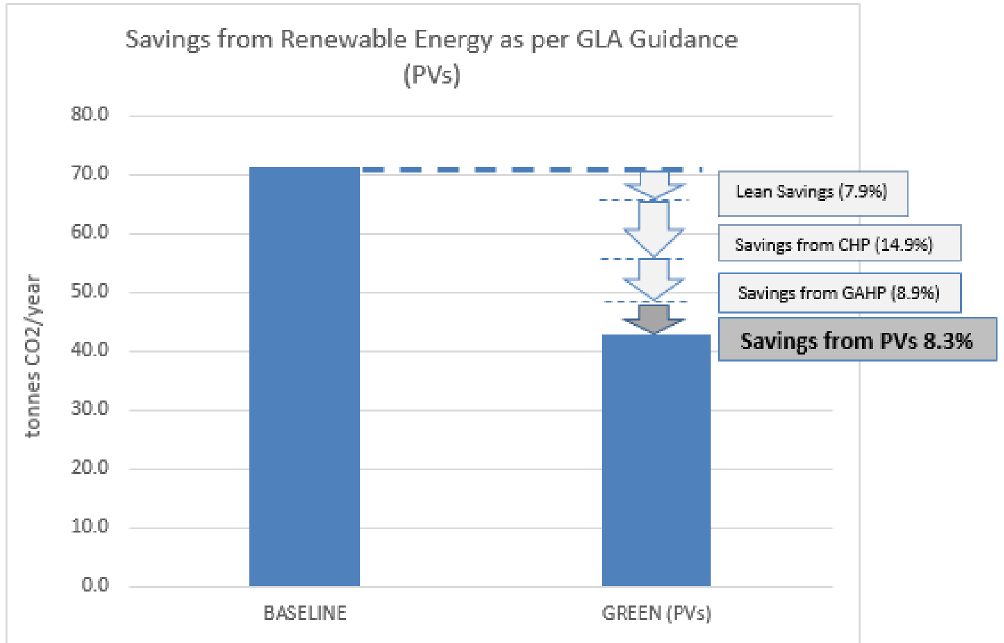
Due to the fact that the lower levels of the glazed staircase will be overshadowed by the Crick Institute for a considerably large amount of time yearly, standard poly/monocrystalline cells would only be efficient from level 8 and above. The table below shows the potential savings.

Green Savings (PVs)	TCO_2/year	% Improvement
Baseline Emissions	71.4	n/a
Savings from PVs	5.94	8.3%

The integrated PVs would save in the region of 5.94 tonnes of CO_2 per year as a minimum.

For visual continuity, the technology of thin film photovoltaics is proposed on the whole south elevation of the glazed staircase. The advantages of this technology include visual uniformity as well as minimum impact on the PVs' efficiency as the effect of overshadowing is less critical. Due to the increased effective area available the carbon savings from this t[illegible]s.

Transparent thin film photovoltaic cells (Polysolar)



8.3. Renewables (Green) Saving

The 'Green' proposal then for Brill Place is to combine these two renewable technologies within the building, to meet the 20% renewables and 35% CO_2 improvement target. The following tables show a breakdown of the savings.

The building's emissions after the "Lean" and "Green" energy measures is 60.1 tones CO2/year and this has been used as the baseline emissions over which the 20% target needs to be met. The combined savings from the implementation of the renewable energy technologies as described above is 12.1 tonnes CO2/year, resulting in a 20% saving.

In the first table (opposite top) the savings from renewable energy are expressed following the GLA guidance as below:

Savings from Renewable Energy = Carbon Dioxide Emissions after CHP – Carbon Dioxide Emissions after Renewable Energy

In the second table (opposite bottom) the percentage of carbon savings is estimated using as a baseline the building emission's after the implementation of "Lean" and "Clean" measures.

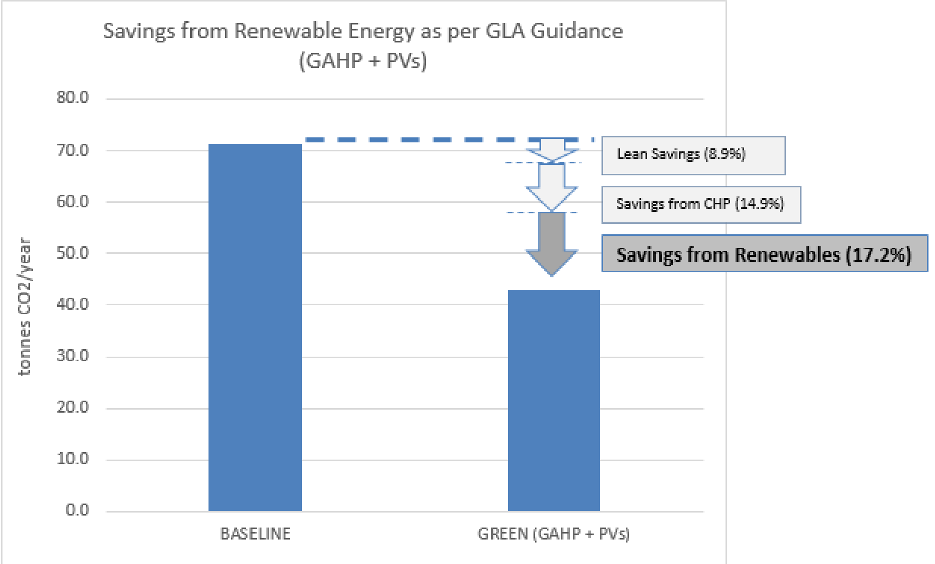
Savings from Renewable Energy= Carbon dioxide emissions after CHP – Carbon dioxide emissions after renewable energy The amount of PVs required to meet the 20% renewables target was calculated on this basis.

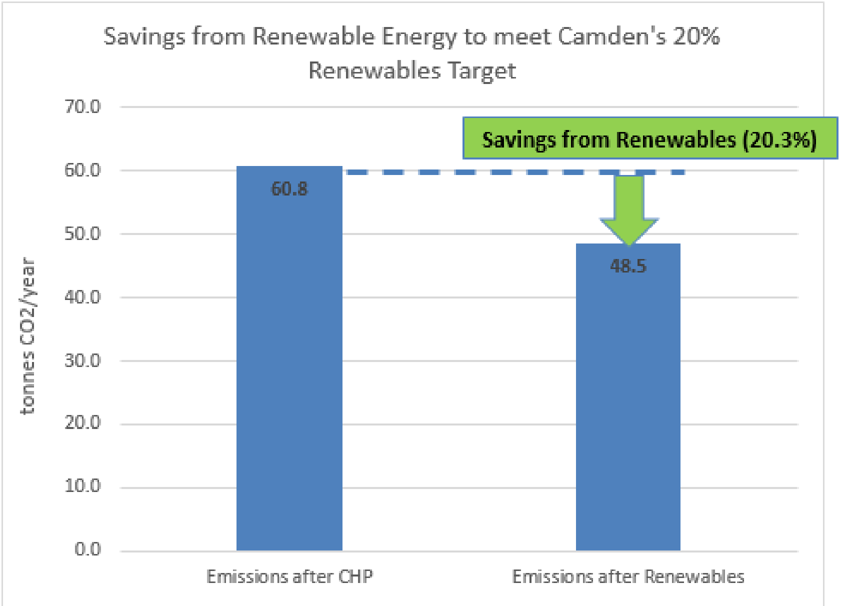
Green Savings	TCO_2/year	% Improvement
Baseline Emissions	71.4	n/a
Savings from GAHP	6.4	8.9%
Savings from PVs	5.9	8.3%
Total Savings	12.3	17.2%

Savings from Renewables as per GLA guidance

Green Savings	TCO_2/year	% Improvement
Emissions after CHP	60.8	n/a
Savings from GAHP	6.4	10.5%
Savings from PVs	5.9	9.8%
Emissions after Renewables	48.5	20.3%

Savings from Renewables calculated to meet Camden's 20% renewables target





9. Summary of Strategy and Conclusions

This report has provided an analysis of the likely energy consumption and carbon emissions associated with the new tower at Brill Place. We have undertaken calculations as per the London Plan and the Camden Council Methodology in line with Part L and SAP, with baseline emissions estimated for the new dwelling.

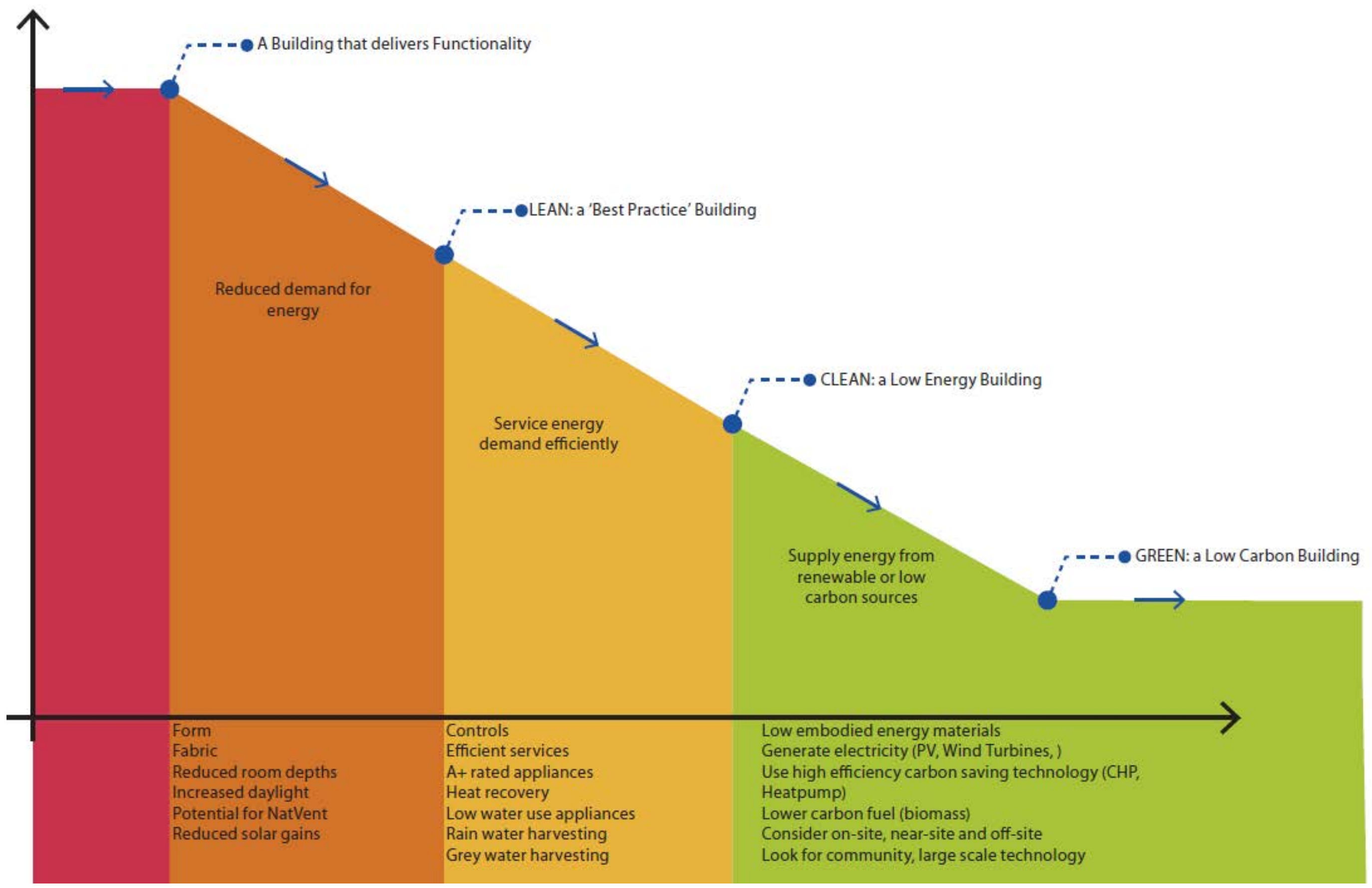
It has been shown that substantial carbon savings are achieved through 'Lean' measures: using efficient building fabric constructions along with using appropriate plant with super-efficient systems, including MVHR and energy efficient lighting and controls ensures that the building is as energy efficient as possible before applying the energy supply systems.

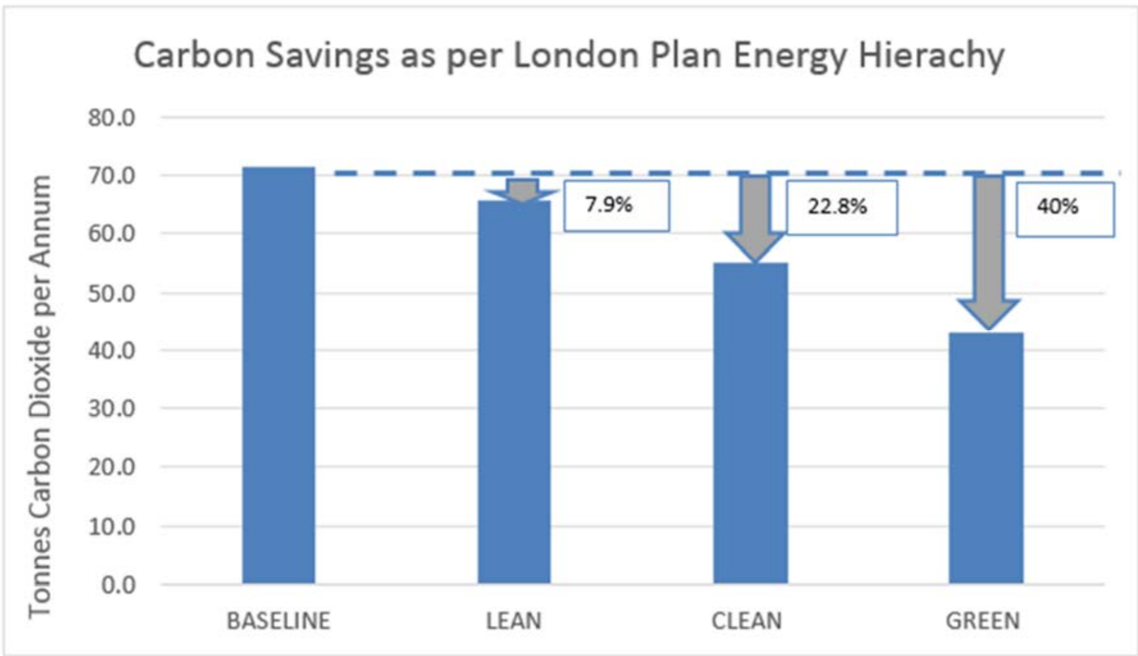
The Clean measures applied include a CHP Powered District heating Scheme, supplying the hot water for the project.

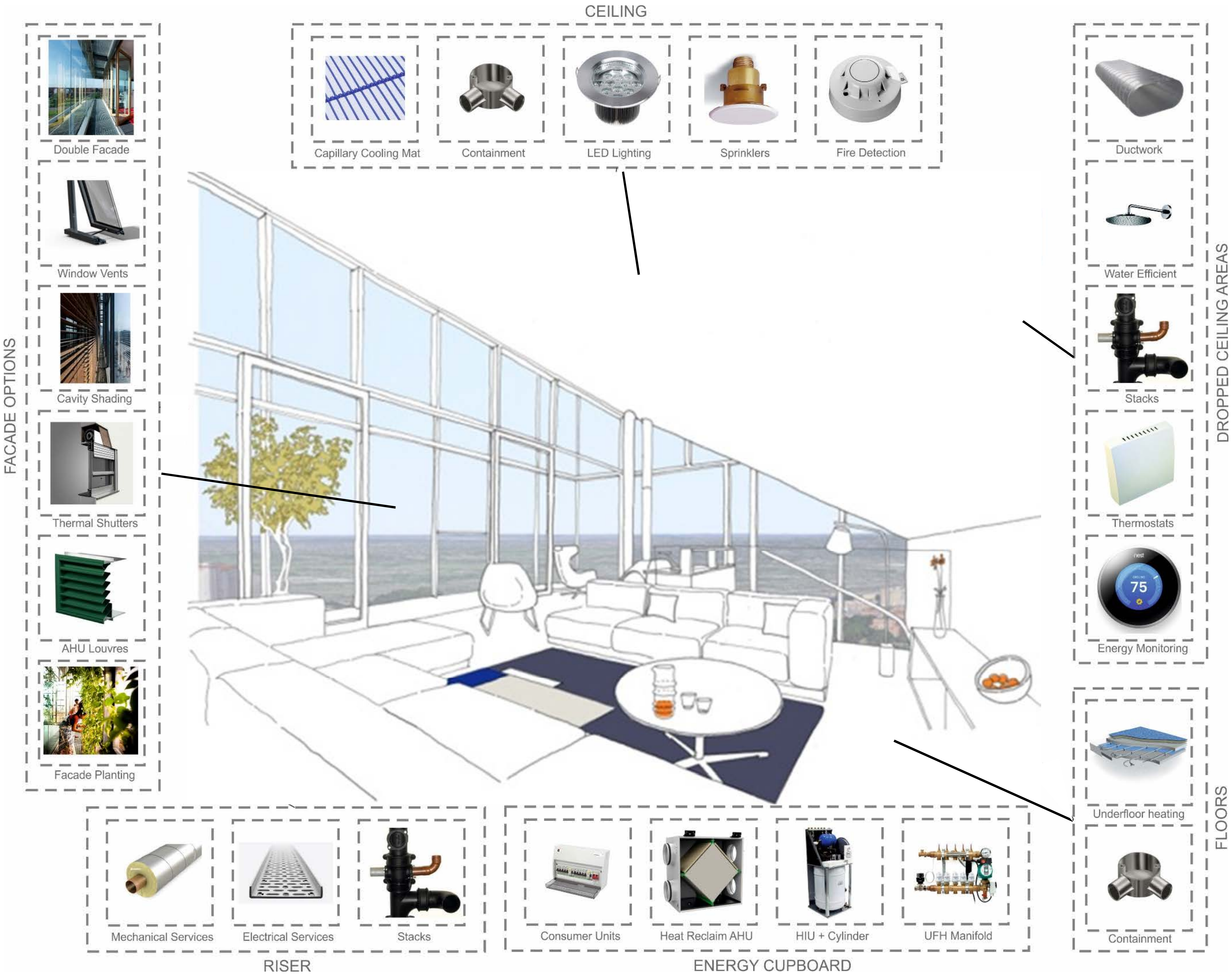
Gas absorption heat pumps and careful positioning of PV's is proposed for the new dwelling with key technologies as shown in the figure below.

The Graph below shows the reduction measures for this project, which equate to a 40% carbon saving from the baseline position.

It is noted that the current strategy leaves the heating load to be met by renewable means, going some way to meeting the renewable targets. Should the heating load be required to be met solely by CHP, an additional renewable technology will be required to meet the targets.






CEILING
Capillary Cooling Mat
Containment
LED Lighting
Sprinklers
Fire Detection
FACADE OPTIONS
Double Facade
Window Vents
Cavity Shading
Thermal Shutters
AHU Louvres
Facade Planting
DROPPED CEILING AREAS
Ductwork
Water Efficient
Stacks
Thermostats
75
Energy Monitoring
FLOORS
Underfloor heating
Containment
RISER
Mechanical Services
Electrical Services
Stacks
ENERGY CUPBOARD
Consumer Units
Heat Reclaim AHU
HIU + Cylinder
UFH Manifold

10. Water Efficiency

The planning guidance on water use specifies that the dwelling shall not use more than 110litres per person per day. However, in order to comply with the SIP, a target of 105litres per person per day has been set.

Water saving technologies will be incorporated into the sanitaryware in order to reduce domestic water consumption to achieve this standard. The following design features will be considered in order to ensure that the dwelling uses water efficiently to achieve this:

- Reduced construction water use
- Recycling Showers
- Low flow non-concussive taps
- Low flow dual flush WCs
- Flow limiters on appliances
- Sanitary shut off linked to PIR on WC water supplies
- A leak detection system on the incoming main supply.
- Metering to the following:
  - o The main incoming cold water supply
  - o Cold Water Supply to the main hot water calorifer.

The image to the right is an example of the water calculation for a typical unit.

The predicted water consumption currently achieved is 104.3 l/p/day falling within the targets set.

Installation type	Unit of measure	Capacity/flow rate	Use factor	Fixed use (litres/person/day)	Litres/person/day
WC (single flush)	Flush volume (litres)	0	4.42	0	0
WC (dual flush)	Flush volume (litres)	6	1.46	0	8.76
	Part flush volume (litres)	4	2.96	0	11.84
WCs (multiple fittings)	Average effective flushing volume (litres)		4.42	0	0
Taps (excluding kitchen/utility room taps)	Flow rate (litres/minute)	5	1.58	1.58	9.48
Bath (where shower also present)	Capacity to overflow (litres)	140	0.11	0	15.4
Shower (where bath also present)	Flow rate (litres/minute)	8.5	4.37	0	37.145
Bath only	Capacity to overflow (litres)	0	0.5	0	0
Shower only	Flow rate (litres/minute)	0	5.6	0	0
Kitchen/utility room sink taps	Flow rate (litres/minute)	8	0.44	10.36	13.88
Washing machine	Litres/kg dry load	6.5	2.1	0	13.65
Dishwasher	Litres/place setting	1.25	3.6	0	4.5
Waste disposal unit	Litres/use	0	3.08	0	0
Water softener	Litres/person/day	0	1	0	0
	Total calculated use (litres/person/day)				114.66
	Contribution from greywater (litres/person/day)				
	Contribution from rainwater (litres/person/day)				
	Normalisation factor				0.91
	Total water consumption (CfSH) (litres/person/day				**104.3**

11. Climate Change Adaption

This section describes what considerations have been given to ensuring that the development will be capable of adapting to the future impacts of climate change.

This response will also incorporate the requirements as set out in the new draft Local Plan under policy CC1 Planning for Climate Change Adaptation which include the following:

11.1. Flooding

See section 12

11.2. Drought

See section 10

11.3. Overheating

This section summarises how the proposals mitigate overheating in possible future climates and are able to provide adequate conditions without the need for active cooling.

The building is designed as a set of domestic properties and the use of these dwellings are not expected to change throughout the lifetime of the building. The structure/building fabric shall be designed to withstand the burden of weather / increase pressure/hazards associated with climate change including:

- Solar radiation
- Temperature variation
- Water/Moisture
- Wind
- Precipitation (rain and snow)
- Extreme weather conditions: high wind, flooding, driving rain, snow, rainwater ponding)
- Subsidence/ground movement.

11.3.1. Design Features

The development is designed to be resilient to, and adapt to the future impacts of, climate change through the inclusion of the following adaptation measures:

- the layout, building orientation, construction techniques and materials and natural ventilation methods used to mitigate against rising temperatures;
- the use of multi-functional green infrastructure including internal and external planting for urban cooling
- Use of passive and active design methods in line with the cooling hierarchy including:
  - Using high performance glazing that lets in a high proportion of daylight but cuts out a significant portion of the sunlight
  - Using overhangs and deep reveals to the windows on the south façade to provide some natural shading
  - A well-insulated and air tight building envelope
  - Any exposed thermal mass available
  - Energy efficient lighting and equipment
  - The capability of using outside air via opening windows
  - Maximising cross ventilation
  - Using night-time ventilation through secure and effective openings
  - Planting and making use of the natural vegetation around the building
  - Recessed balconies
  - Solar control shading screens

With the application of thermal mass and the versatile ventilation strategies, the environmental conditions within the building are not anticipated to fluctuate outside acceptable limits. The anticipated change in global temperatures will have limited impact on the energy consumption of the building as the building fabric and control strategies linked to the heating and cooling systems shall be designed to compensate any dramatic variations.

11.3.2. Overheating Analysis

Under Camden's CPG3 and the latest set of GLA guidelines new dwellings should be tested against the following criteria:

- SAP Overheating Criteria
- GLA/TM49: 2014 Design Summer Years for London. Whereby modelling should be conducted using the following design weather data:
  - 1976: a year with a prolonged period of sustained warmth
  - 1989: a moderately warm summer (current design year for London)
  - 2003: a year with a very intense single warm spell.

In order to show the buildings performance against these criteria dynamic thermal modelling has been carried out and assessed using the TM52 performance assessment procedure.

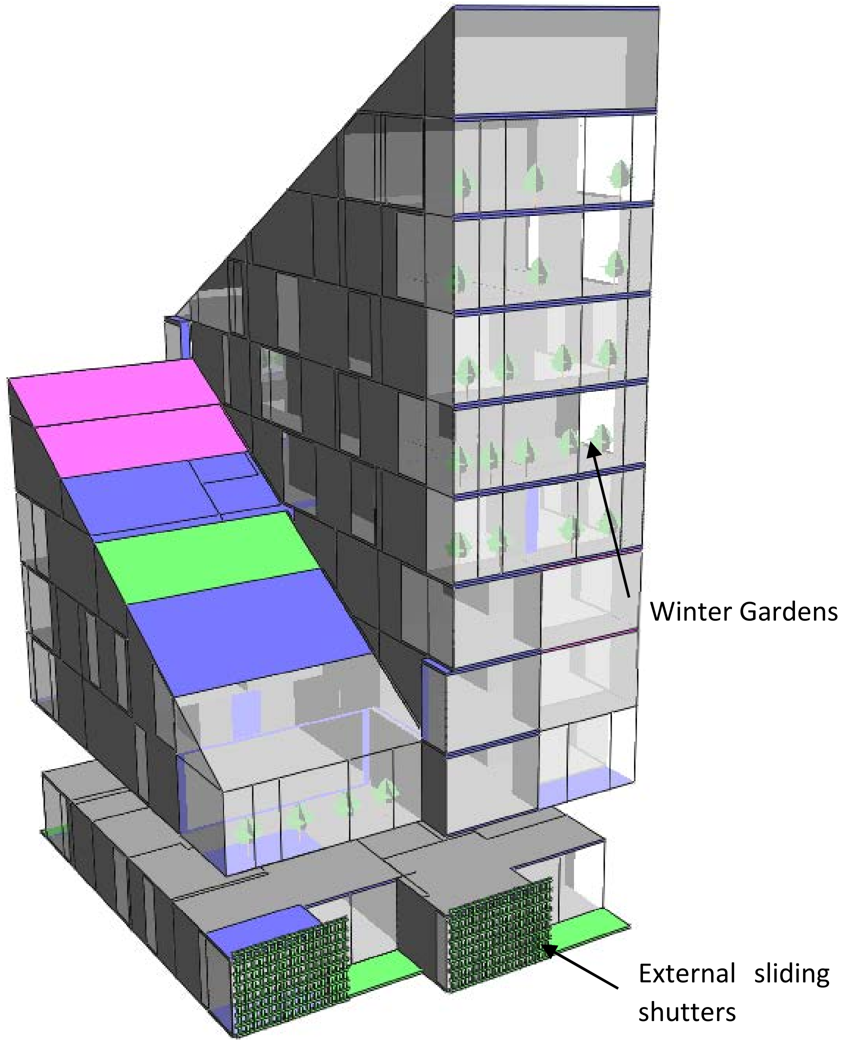
11.3.3. Results

A selection of typical apartments was examined against the criteria set out above. Typical apartments include the penthouses at top levels and three apartments of a typical floor (Level 13). All the selected apartments are from Level 13 and above and there is minimal or no overshadowing benefit at all from the neighbouring Crick Institute.

The overheating risk as part of the SAP calculation for all the apartments was found to be "medium".

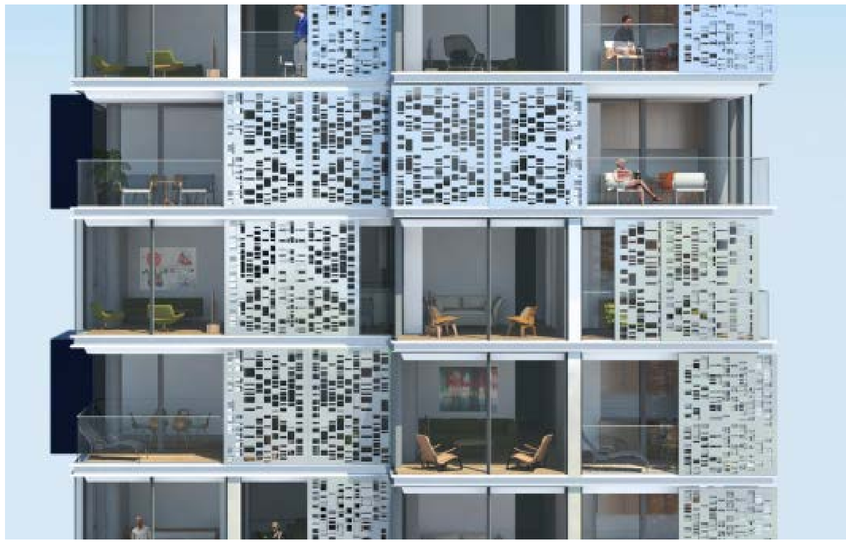
The TM49 overheating analysis was conducted using the dynamic thermal modelling software IESVE.

To simulate the effects of external shading provided by shutters for the typical floor, the shutters were physically drawn into the model. In addition to that, all rooms were modelled with internal venetian blinds and natural night time cooling. However, it was not possible to model the effects of evaporative cooling provided by the winter gardens in the software used.



The results are presented in the table opposite.

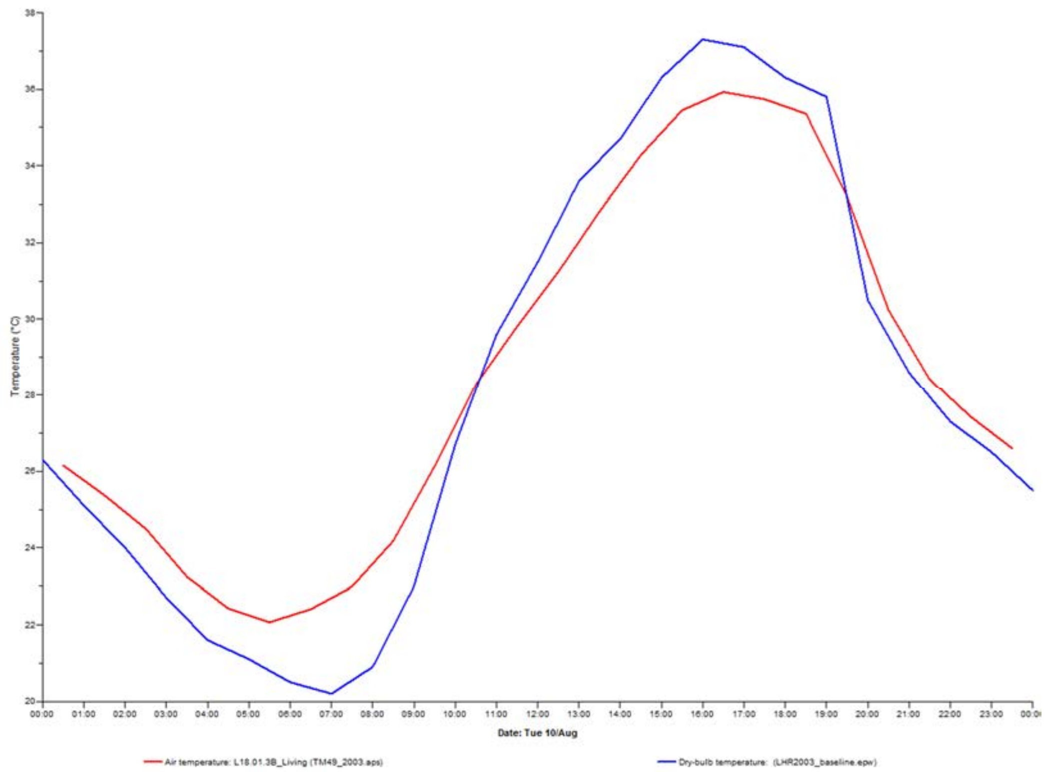
It can be seen that there are a number of apartments where the living areas (lounge/kitchen) fall below the TM 49 requirements for the years of 1976 and 2003It should be noted that with the sustained high temperatures of these years, passing criterion 2 and 3 is incredibly difficult as maintaining air temperatures below external levels without artificial cooling and an MVHR strategy is required. The graph to the right demonstrates that although the temperatures in the internal spaces are high (red), when compared to the external temperatures (blue), at the warmest time of the day, a positive difference is achievable. The effect of winter gardens and the natural ventilation strategy within these spaces however, should further mitigate the high internal temperatures should these exceptionally warm days occur.



External sliding façade shutters

			1976				1989				2003			
Typical Floor Flats	Room	Orientation	1	2	3	Result	1	2	3	Result	1	2	3	Result
1 Bed Flat	Lounge/Kitchen	SW	FAIL	FAIL	FAIL	**FAIL**	PASS	FAIL	PASS	**PASS**	PASS	FAIL	FAIL	**FAIL**
	Bedroom 1	NW	PASS	PASS	PASS	**PASS**	PASS	PASS	PASS	**PASS**	PASS	PASS	PASS	**PASS**
2 Bed Flat (SW)	Lounge/Kitchen	SW	PASS	FAIL	PASS	**PASS**	PASS	PASS	PASS	**PASS**	PASS	PASS	PASS	**PASS**
	Bedroom 1	NW	PASS	PASS	PASS	**PASS**	PASS	PASS	PASS	**PASS**	PASS	PASS	PASS	**PASS**
	Bedroom 2	NW	PASS	PASS	PASS	**PASS**	PASS	PASS	PASS	**PASS**	PASS	PASS	PASS	**PASS**
2 Bed Flat (NE)	Lounge/Kitchen	NE	PASS	FAIL	PASS	**PASS**	PASS	PASS	PASS	**PASS**	PASS	PASS	PASS	**PASS**
	Bedroom 1	NE	PASS	PASS	PASS	**PASS**	PASS	PASS	PASS	**PASS**	PASS	PASS	PASS	**PASS**
	Bedroom 2	NE	PASS	PASS	PASS	**PASS**	PASS	PASS	PASS	**PASS**	PASS	PASS	PASS	**PASS**
Penthouses														
Level 15 Penthouse	Lounge/Kitchen	SW	PASS	FAIL	PASS	**PASS**	PASS	PASS	PASS	**PASS**	PASS	FAIL	FAIL	**FAIL**
	Bedroom 1	NE	PASS	PASS	PASS	**PASS**	PASS	PASS	PASS	**PASS**	PASS	PASS	PASS	**PASS**
	Bedroom 2	NE	PASS	PASS	PASS	**PASS**	PASS	PASS	PASS	**PASS**	PASS	PASS	PASS	**PASS**
	Bedroom 3	NW	PASS	PASS	PASS	**PASS**	PASS	PASS	PASS	**PASS**	PASS	PASS	PASS	**PASS**
Level 18 Penthouse	Lounge/Kitchen	NE	FAIL	FAIL	FAIL	**FAIL**	PASS	FAIL	PASS	**PASS**	PASS	FAIL	FAIL	**FAIL**
	Lounge	NE	PASS	FAIL	PASS	**PASS**	PASS	FAIL	PASS	**PASS**	PASS	PASS	PASS	**PASS**
	Bedroom 1	SW	PASS	PASS	PASS	**PASS**	PASS	PASS	PASS	**PASS**	PASS	PASS	PASS	**PASS**
	Bedroom 2	SW	PASS	PASS	PASS	**PASS**	PASS	PASS	PASS	**PASS**	PASS	PASS	PASS	**PASS**
	Bedroom 3	SW	PASS	PASS	PASS	**PASS**	PASS	PASS	PASS	**PASS**	PASS	PASS	PASS	**PASS**
Level 20 Penthouse	Lounge/Kitchen	SW	FAIL	FAIL	FAIL	**FAIL**	PASS	PASS	PASS	**PASS**	PASS	FAIL	FAIL	**FAIL**
	Lounge	SW	FAIL	FAIL	FAIL	**FAIL**	PASS	PASS	PASS	**PASS**	PASS	FAIL	FAIL	**FAIL**
	Bedroom 1	SW	PASS	PASS	PASS	**PASS**	PASS	PASS	PASS	**PASS**	PASS	PASS	PASS	**PASS**
	Bedroom 2	SW	PASS	PASS	PASS	**PASS**	PASS	PASS	PASS	**PASS**	PASS	PASS	PASS	**PASS**
	Bedroom 3	NE	PASS	PASS	PASS	**PASS**	PASS	PASS	PASS	**PASS**	PASS	PASS	PASS	**PASS**

CIBSE TM49 Analysis results

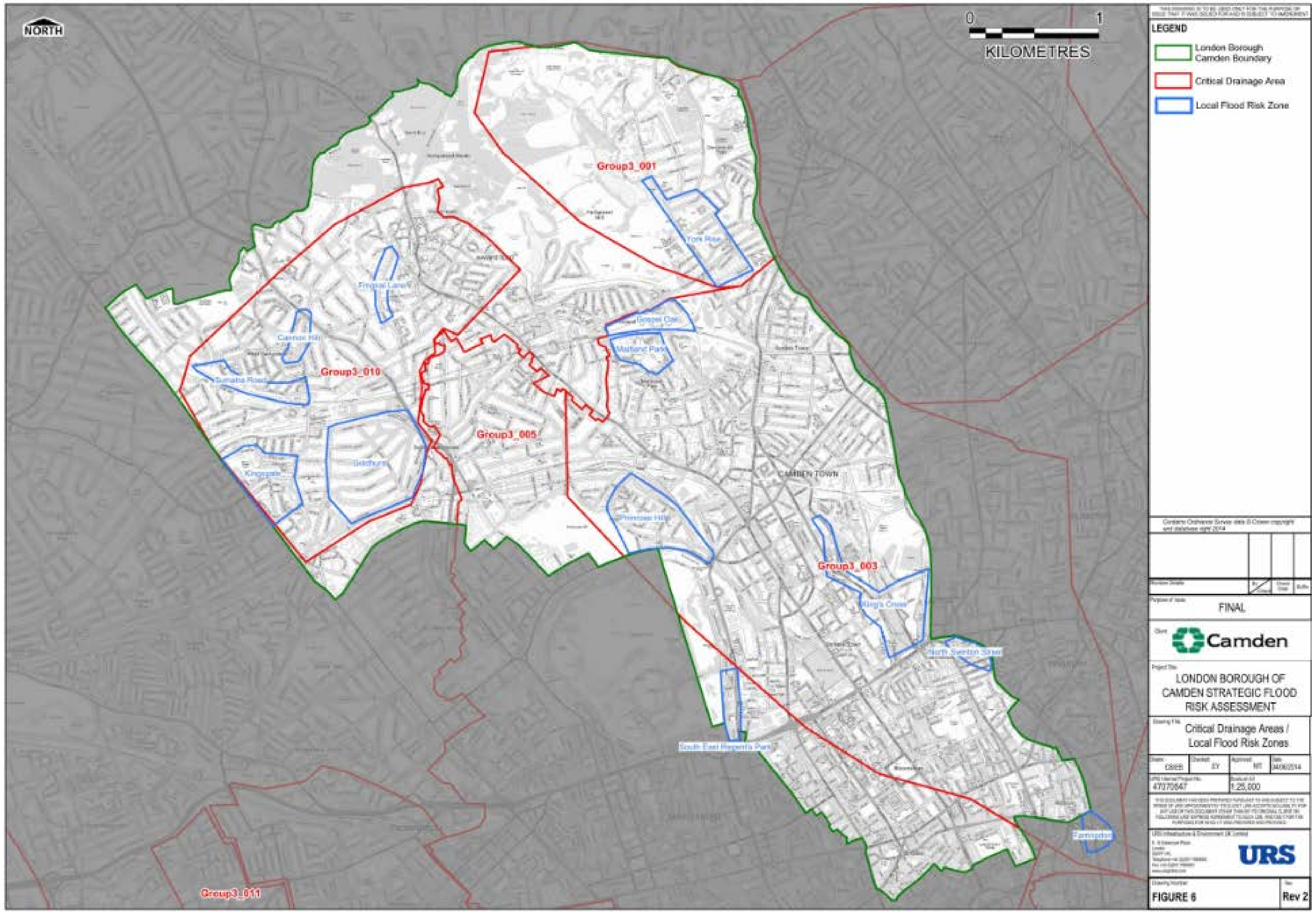


12. Surface Water Run Off and Flooding

In accordance with national policy (PPS25, Building Regulations 2000 (Part H) and CIRIA C697) and regional policy (Camden Development Policy DP23), the management of surface water has also been considered as part of this FRA to mitigate against any increase in surface water runoff from the development proposals.

For more information refer to the flood risk assessment submitted as a separate report within the submission.

The map to the right shows that the Brill Place site is not in a local flood risk zone.



13. Materials Waste and Recycling

The design teams shall specify that the building contractor source their materials from responsibly sourced supplier and encourage them to provide EMS and timber certification certificates for the main building components. The contractor will be encouraged to adopt a site waste management plan and divert as much waste as feasible from landfill. In addition, consideration should be given to:

- Use of recycled materials
- Embodied energy
- Life cycle of materials and components

14. Pollution

The mitigation of all forms of pollution, from new or existing, influencing the site will be considered in the design. This will include but not be limited to:

- Contaminated Land assessment,
- Keeping noise levels within standard ranges,
- Limiting plant noise,
- Reducing light pollution,
- Low-GWP insulation,
- Low-GWP refrigerants with recovery and leak detection,
- Air quality assessment,
- Clean MV air supply, fine air filtering for NV,
- CO_2 monitoring.
- NO_x filtering

14.1. NO_x Filters

All MVHR units within the apartments will be fitted with an indoor air quality filtration system which combines particulate and gas filters to remove pollutants.

The filters will be designed to bring outdoor air pollutant levels within the guideline exposure limits as set out in the World Health Organisation Air Quality Guidelines and the associated Directives prior to entering an occupied space.

Indoor Air Quality Filtration System

Additionally, cooling will be provided to all apartments from level 15 and above as recommended by the Air Quality Report eliminating thus the need for opening windows to mitigate summer overheating.

Refer to the Air Quality Report for further information.

15. Ecology

Brill Place's ecological value can be maximised with the sensitive application of good landscaping and vegetation to improve biodiversity.

Nesting birds, if present on site, could potentially be affected so vegetation clearance should be undertaken outside the main UK nesting bird season. An invasive plant check should be carried out prior to works starting as colonisation of some species is relatively quick.

Appendix A – Low and Zero Carbon Technologies Feasibility Study

Appendix B – Fabric Energy Efficiency Requirements Memo

Appendix C – SAP Worksheets

Appendix D – LZC Options Summary