HOARE LEA

Energy Statement Addendum - Plot 3. London.

ISG.

SUSTAINABILITY
ENERGY STATEMENT

REVISION 05 – 19 FEBRUARY 2021

Audit sheet.

Rev.	Date	Description of change / purpose of issue	Prepared	Reviewed	Authorised
00	23/10/2020	Update after design team comment	WN	GK	MC
01	03/11/2020	For issue	WN	GK	MC
02	19/11/2020	Update after comment from Expedition	WN	GK	MC
03	30/11/2020	Amended to reflect change to title and date	WN	GK	MC
04	09/12/2020	Update to introduction	WN	GK	MC
05	19/02/2021	Update based on CBC comments	KG	WN	MC

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Contents.

Introduction.

Planning permission 2019/2879/P was granted in March 2020 for the redevelopment of 256 Grays Inn Road to provide a dementia and neurology research centre along with academic space for University College London (UCL). This Energy Statement Addendum has been prepared by Hoare Lea in connection with the planning application to amend the above permission to extend the basement of the new academic building, known as Plot 3.

The first phase of the approved development comprises the partial redevelopment of the former Royal Free Hospital (Plot 1) to deliver a world-leading medical research facility to tackle dementia and neurological diseases. Work on site is currently underway on Plot 1.

Subsequent phases of the approved development comprise the refurbishment of the grade II listed Eastman Dental Clinic (referred to as Plot 2) and the erection of a new building on the site of the Levy Wing (referred to as Plot 3) to deliver additional academic space for UCL. This academic space will complement the University's vision for creating a world class environment for education and academic research. The proposed development would also deliver a comprehensive landscaping scheme to open up new publicly accessible spaces within the site, and new public connections across it.

This planning application relates to the proposal to extend the basement of the Plot 3 building underneath the public realm area in the centre of the site to provide two lecture theatres for the academic use. UCL has identified a requirement for larger lecture theatres than would be delivered in the approved scheme. It also reflects UCL's intention to bring the delivery of the Plot 3 basement works forward at the same time as the Plot 1 basement works to deliver the development in a more efficient and less disruptive way.

This planning application also proposes a small extension to the basement of the Plot 1 building to allow for the provision of a sprinkler tank.

This report forms an addendum to the Energy Statement submitted with the original planning application and sets out how the proposed amendments affect the detail and conclusions of the original report. This addendum should be read in conjunction with the original report and the Plot 1 energy addendum.

Planning context.

The site wide energy strategy for the approved development delivered an overall 22% reduction in carbon emissions beyond the Part L 2013 baseline (based on SAP 2012). As part of the original application, it was demonstrated that the development delivered an inherently energy efficiency solution compared with other recent developments of a similar nature and that other comparable developments also had gas as their primary heating fuel as a result of their high heating loads and requirements for resilience.

The Energy Strategy was agreed with LB Camden. Whilst agreement with the GLA energy team was not reached, it was found on balance to be acceptable with reference to the heritage constraints, the medical research and healthcare requirements, the substantial public benefits the development would deliver, and the package of measures that was secured to reduce carbon energy. These measures included:

- Incorporation of the measures to achieve an overall 22% (SAP 2012) and 14% (SAP 10) reduction in carbon emissions beyond the Part L 2013 baseline;
- Further details of how carbon emissions will be reduced from renewable energy technologies a target reduction of at least 6% (SAP 2012) and 8% (SAP 2012) for Plot 1, and 19% (SAP 2012) and 17% (SAP 10) in for Plot 3 in carbon emissions using low and zero carbon technologies.
- Separate metering of all low and zero carbon technologies to enable the monitoring of energy and carbon emissions and savings;
- A building management electronic system to monitor heating/cooling and the hours of use of plant;
- Measures to enable future connection to a local energy network;
- A pre-implementation design-stage review certifying that the measures incorporated in the Energy Efficiency and Renewable Energy Plan are achievable and satisfy the aims and objectives of the Council's strategic policies on carbon emissions reduction;
- Post construction review that the measures incorporated in the Energy Efficiency and Renewable Energy Plan have been achieved and will be maintainable in the future management and occupation; and
- Monitoring and reviewing.

The additional floorspace associated with the proposed extension to the Plot 3 basement would obviously increase the energy demand of the development. In bringing this proposal forward, the design team has worked hard to find improvements in carbon emission savings. The result is that, despite the increase in energy demand, it is possible to deliver a slight improvement on the carbon emission. As approved, the Plot 3 building achieves a carbon reduction of 24.6% (SAP 10). As now proposed, this would increase slightly to 24.7% (SAP 10). Across the site, the carbon emission reductions would improve slightly from 14.4% to 14.7% (SAP 10).

This report sets out the detail of the additional energy demand and how the carbon emission reductions would be achieved. It also explains why the proposed amendments do not offer an opportunity to revisit the energy technologies used in the development.

The development as amended would be subject to the same heritage constraints and the same medical research and healthcare requirements, and would deliver the same substantial public benefits, as the approved development. The same package of measures relating to delivery, management, monitoring and reviewing of carbon energy would be secured. As with the approved development, the remaining carbon emissions up to 35% would be offset through a financial contribution.

The revised approach to energy represents a minor change from the approved Energy Strategy that is proportional to the changes being proposed to the approved development. All reasonable opportunities to maintain and improve the energy performance of the development have been taken.

Executive summary.

This report forms an addendum to the Energy Statement submitted with the original planning application and sets out how the proposed amendments affect the detail and conclusions of the original report. This addendum should be read in conjunction with the original report.

The Proposed Development.

The Site at 256 Grays Inn Road is 1.207 ha in area, and is bounded to the west by Grays Inn Road, to the north by the Calthorpe Project and the New Calthorpe Estate, to the east by Langton Close, and to the south by Trinity Court and St Andrew's Gardens. The main part of the site is currently occupied by the Eastman Dental Hospital, which is due to vacate the site and relocate to a new development at Huntley Street. The Eastman Dental Hospital is made up of a group of buildings comprising:

- The former Royal Free Hospital (Plot 1)
- The Grade II listed Eastman Dental Clinic (Plot 2)
- The Levy Wing (Plot 3)

This addendum primarily addresses Plot 3.

Table 1: Area schedule.

Space Use	Floor Area
Office and University	6934.5 m^2

Planning submission.

Planning permission 2019/2879/P was granted in March 2020 for the redevelopment of 256 Grays Inn Road to provide a dementia and neurology research centre along with academic space for UCL. This Energy Statement has been prepared as part of the pre-application discussions on a forthcoming application to amend the above permission to extend the basement of the new academic building, known as Plot 3.

Drivers.

A policy review has been undertaken and is outlined in Appendix B. As a summary, planning policy and UCL's aspirations applicable to Plot 3 include:

National drivers: Approved Document Part L of the Building Regulations
Part L of the Building Regulations is the mechanism by which government is driving reductions in the regulated CO_2 emissions from new buildings. The assessment of Plot 3 against policy targets has been carried out using Building Regulations Part L 2013.

Regional drivers: Greater London Authority (GLA) policy
This Energy Strategy follows the Mayor's energy hierarchy: 'be Lean, be Clean, be Green' as detailed in the Greater London Authority (GLA) London Plan. Calculations demonstrating the energy requirements and associated CO_2 emissions for the development have been carried out using Building Regulations approved software.

SAP 10 carbon factors have been utilised in line with GLA Energy Assessment Guidance issued in October 2018.

Local drivers: London Borough of Camden
The Camden Local Plan (2017) Camden Planning Guidance on Energy efficiency and adaption (March 2019) align with the Mayor's energy hierarchy 'be Lean, be Clean, be Green'.

UCL
UCL has a vision for its estate to perform at the highest levels of excellence and efficiency.

Energy strategy summary.

The Energy Strategy has been developed using a 'fabric first' approach through the 'Be Lean', 'Be Clean', 'Be Green' energy hierarchy.

Be lean
Plot 3 is anticipated to achieve up to an 10.9% reduction in CO_2 emissions (equivalent to 8 tonnes) beyond the Building Regulations Part L 2013 'baseline' through the inclusion of an efficient building fabric as well as energy efficient lighting and ventilation.

Table 2: Be lean results summary.

Be Lean Result	10.9% Reduction over Part L baseline

Be clean
An investigation into the availability of existing and proposed district heating networks has been carried out for Plot 3, as described within the main section of this report. Given that there are no available district heat network connections that can be utilised and the relative merits of installing a CHP are negligible due to the decarbonisation of the UK electricity grid, there are no further CO_2 savings at the 'Be Clean' stage of the energy hierarchy. Plot 3 will incorporate site-wide infrastructure to enable a potential future connection if a district heat network becomes available.

Table 3: Be clean results summary.

Be Clean Result	0.0% Reduction over Part L baseline

Be green
On-site solar PV panels are proposed to further reduce CO_2 emissions. Through the inclusion of these systems, in addition to high efficiency gas boilers, it is anticipated that Plot 3 will achieve a total reduction in CO_2 emissions of 13.8% beyond the Part-L 2013 'baseline' (equivalent to 10 tonnes).

Table 4: Be green results summary.

Be Green Result	13.8% Reduction over Part L baseline

Proposed energy strategy.

The energy strategy for Plot 3 will minimise energy use and CO_2 emissions through the incorporation of a thermally efficient shell, efficient lighting and ventilation, as well as on-site solar PV systems which will maximise opportunities for energy recovery, reuse and generation.

Carbon dioxide emissions after each stage of the energy hierarchy

The following table illustrates both the regulated and unregulated carbon emissions for the whole development.

Table 5: Carbon emissions after each stage of energy hierarchy.

	Approved Plot 3		Proposed Plot 3	
	Regulated Tonnes CO_2/year	Unregulated Tonnes CO_2/year	Regulated Tonnes CO_2/year	Unregulated Tonnes CO_2/year
Part L baseline	63.0	73.1	70.9	83.4
Be lean.	58.2	73.1	63.2	83.4
Be clean.	58.2	73.1	63.2	83.4
Be green.	47.5	73.1	53.4	83.4

Regulated carbon dioxide savings from each stage of the energy hierarchy

Table 6 summarises both the tonnes of carbon emission savings, and the percentage savings compared to the London Plan target for the approved and proposed Plot 3. It should be noted that the relative carbon emissions reduction is greater for the proposed Plot 3, but due to its increased area, the absolute shortfall and therefore offset payment are slightly greater.

Table 6: Regulated carbon emissions savings from each stage of the energy hierarchy.

	Approved Plot 3		Proposed Plot 3	
	Tonnes CO_2/year	Percentage	Tonnes CO_2/year	Percentage
Savings from Be lean.	4.8	7.6%	7.7	10.9%
Savings from Be clean.	0.0	0.0%	0.9	0.0%
Savings from Be green.	10.7	17.0%	9.8	13.8%
Total reduction:	15.5	24.6%	17.5	24.7%
Target reduction:	22.1	35.0%		
Annual shortfall / surplus	-6.5	10.4%		
Carbon offset payment Rate (£/tco2)	£1,800		£1,800 & 2,850	
Offset payment	£11,786		£16,757	
BRUKL Area (m^2)	6,076.5		6,934.5	

Through the measures outlined in the energy strategy, it is anticipated that a 24.7% achieved beyond the Part L 2013 baseline. The calculated savings in regulated carbon emissions for Plot 3 are summarised in Figure 1.

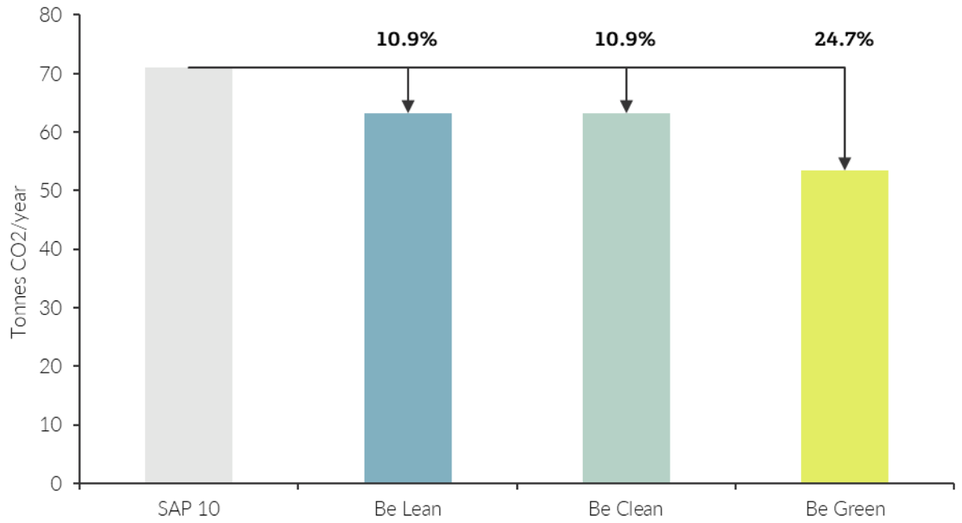


Figure 1: Regulated carbon targets and emissions summary.

Plot 3 extension results

Table 7 compares the annual emissions the Proposed Development against the Approved development submitted to GLA, the offset payment has been calculated based on a target reduction of 100% and the higher rate of £95 per tonne as proposed by Camden council to meet the new London plan requirements.

Table 7: Plot 3 extension carbon offset payment

	Approved Plot 3	Proposed Plot 3
Total Emissions	47.5	53.4
Increase	5.9	
Target reduction	100%	
Carbon offset payment Rate (£/tco2)	£2,850	
Offset payment	£16,757	

Plot 1 & Plot 3 results

Table 8 compares the sitewide carbon reductions of the Proposed Development against the Approved development submitted to GLA.

Table 8: Sitewide regulated carbon emissions savings from each stage of the energy hierarchy using SAP 10 carbon factors.

	Approved Plot 1 & 3		Proposed Plot 1 & 3	
	Tonnes CO_2/year	Percentage	Tonnes CO_2/year	Percentage
Savings from Be lean	13.5	4.7%	16.5	5.6%
Savings from Be clean	0.0	0.0%	0.0	0.0%
Savings from Be green	27.9	9.7%	27.0	9.1%
Total reduction	41.5	14.4%	43.5	14.7%
Target reduction:	100.7	35.0%		
Annual shortfall / surplus	59.2	20.6%		
Carbon offset payment Rate (£/tco2)	£1,800		£1,800 & 2,850	
Offset payment	£106,629		£123,386	
BRUKL Area (m^2)	25,989		26847.0	

Total offset payment

The table below shows the total estimated offset payment calculation as proposed by Camden council.

Table 9: Plot 3 extension carbon offset payment.

	Approved Plot 1	Approved Plot 3	Plot 3 Extension
Offset payments	94,843	11,786	16,757
Total offset payment	123,386		

BREEAM ENE01.

A total of 5 ENE01 credits can be achieved under BREEAM New Construction 2018 based on the proposed energy strategy. A minimum of 4 credits are required for a BREEAM 'Excellent' rating.

Overheating risk assessment & Criterion 3 check.

It is anticipated that all areas of Plot 3 achieve compliance with Part L2A 2013 Criterion 3. The development of the design has followed the cooling hierarchy principles as a means of reducing the amount of solar and internal gains, reducing the risk of overheating, and subsequently reducing the demand placed upon the systems to condition the space. This will result in a reduction of the cooling demand of Plot 3 by approximately ~20% over the notional building as illustrated in Table 10 overleaf.

Table 10: Cooling demand.

Space Use	Area weighted cooling demand (MJ/m^2)	Total cooling demand (MJ)
Actual	54	375,216
Notional	67	466,723

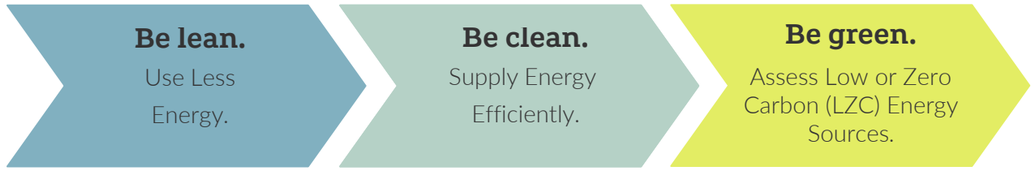
Outcomes.

It is anticipated that up to a 24.7% reduction in CO_2 emissions will be achieved beyond the Building Regulations Part L 2013 'baseline' through the provision of energy efficiency measures and on-site renewables. This represents an improvement on the 24.6% reduction achieved in the consented scheme. Plot 3 has been designed in reference to best practice industry recognised environmental assessment methodologies, namely the energy and CO_2 reduction targets set by UCL, GLA and the London Borough of Camden. Plot 3 takes all reasonable opportunities to maintain and improve the carbon emission reductions and delivers a slight improved on the performance of the approved development.

1. Approach.

1.1 Approach to the strategy.

This Energy Strategy proposes recommendations regarding the approach to reducing carbon dioxide (CO_2) emissions and optimising energy efficiency within the development. The Energy Strategy has been developed using a 'fabric first' approach through the 'be Lean', 'be Clean', 'be Green' energy hierarchy.



It is anticipated that after 'be green' an additional stage of the energy hierarchy will be introduced in the near future: be Seen - monitor, verify and report on energy performance in-use. This stage of the energy hierarchy is proposed to be included in the emerging London Plan policy and energy assessment guidance. The 'be seen' stage endorses the disclosure of the development's energy use with annual energy consumption being displayed on a public online platform accompanied by the predicted energy performance at the design stage.

This approach will demonstrate how developments are performing in-use and will underpin progress in reducing carbon emissions, operational running costs and will encourage the industry's route to achieving zero carbon buildings.

1.2 Definitions and limitations.

Definitions

The following definitions should be understood throughout this statement:

- **Energy demand:** the 'room-side' amount of energy which must be input to a space to achieve comfortable conditions. In the context of space heating, this is the amount of heat which is emitted by a radiator, or other heat delivery mechanism.
- **Energy requirement:** the 'system-side' requirement for energy (fuel). In the context of a space heating system using a gas boiler, this is the amount of energy combusted (e.g. gas) to generate useful heat (i.e. the energy demand).
- **Regulated CO_2 emissions:** the CO_2 emissions emitted as a result of the combustion of fuel, or 'consumption' of electricity from the grid, associated with regulated sources (those controlled by Part L of the Building Regulations).

Limitations

The appraisals within this statement are based on Part L calculation methodology and should not be understood as a predictive assessment of likely future energy requirements or otherwise. Occupants may operate their systems differently, and / or the weather may be different from the assumptions made by Part L approved calculation methods, leading to differing energy requirements.

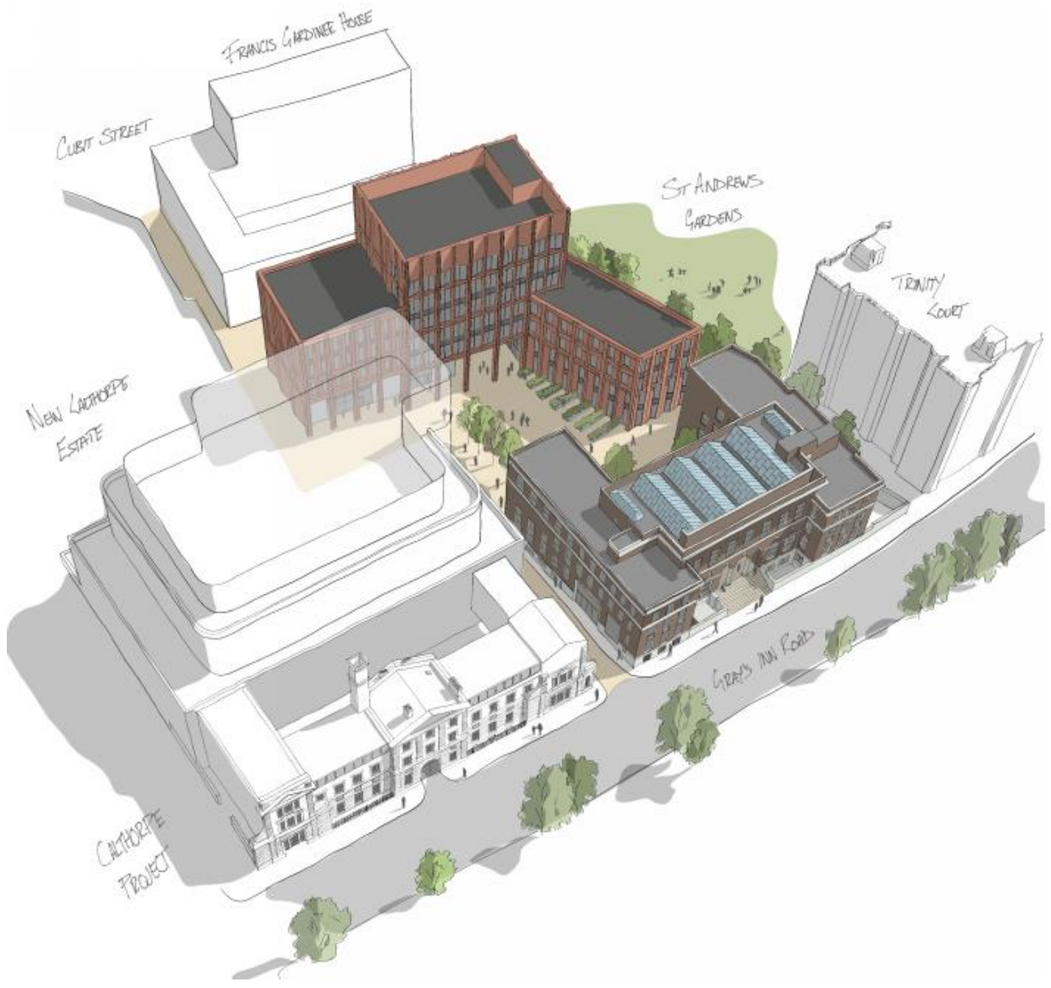


Figure 2: 3D rendered view of the Proposed Development showing local site context.

2. Drivers.

A policy review has been undertaken and is detailed in Appendix A. As a summary, planning policy documents applicable to Plot 3 are outlined within this section.

2.1 Planning.

Planning permission 2019/2879/P was granted in March 2020 for the redevelopment of 256 Grays Inn Road to provide a dementia and neurology research centre along with academic space for University College London (UCL). This Energy Statement Addendum has been prepared by Hoare Lea in connection with the planning application to amend the above permission to extend the basement of the new academic building, known as Plot 3.

Table 11: Planning submission carbon reduction breakdown.

	Carbon savings (% reduction from Part L baseline)
Savings from Be lean	7.6%
Savings from Be clean	0%
Savings from Be green	17.0%
Total reduction	24.6%

2.2 National policy.

Building Regulations: Approved Document Part L

Approved Document Part L (2013, England edition) is the Building Regulation relating to the conservation of fuel and power in buildings other than dwellings.

Part L of the Building Regulations is the mechanism by which government is driving reductions in the regulated CO_2 emissions from new buildings.

There are four criteria in Part L2A when demonstrating compliance. To gain compliance, only Criterion 1 and parts of Criterion 4 (which states that Building Emissions Rate remains consistent from design through to construction) are regulation and therefore mandatory. The approaches to meet the other criteria are 'reasonable provision' and alternative proposals are permissible. This should be checked with the Building Control Body (BCB) to confirm that they meet the energy efficiency requirements.

2.3 Regional policy.

2.3.1 Overview

The current London Plan was adopted in 2011 but has since been revised with minor and further alterations to form the current London Plan in March 2016.

The London Plan is the strategic plan for London, setting out an integrated social, economic and environmental framework for the future development over the next 15-20 years. It provides the London-wide context within which individual boroughs should set their local planning policies and sets the policy framework for the Mayor's involvement in major planning decisions in London.

2.3.2 Chapter 5 – London's Response to Climate Change

This chapter sets out a comprehensive range of policies to underpin London's response to climate change, including underlying issues of resource management. These policies cover climate change mitigation and adaption, waste, aggregates, contaminated land and hazardous substances.

Table 4 below details the current carbon targets set by the London Plan as set by Policy 5.2 – Minimising Carbon Dioxide Emissions.

Table 12: Current London Plan Carbon Targets (Policy 5.2).

Building Use	Target
Non-residential	35% reduction in regulated emissions against the Part L 2013 Baseline (with any shortfall to be met via offset payment).

2.3.3 Energy Guidance October 2018

The GLA issued updated Energy Assessment Guidance in October 2018. The guidance confirms that planning applications are encouraged to use SAP 10 carbon factor for grid electricity (0.233 $kgCO_2/kWh$) for all applications referable to GLA, from January 2019.

This corresponds to a 55% reduction in emissions related to grid-supplied electricity compared to the current Part L (2013) carbon factor (0.519 $kgCO_2/kWh$). Any applicants proposing to use the 2013 Part L / SAP 2012 emissions factors will be required to provide justification for this.

In the Energy Assessment Guidance (October 2018) Gas CHP is no longer explicitly mentioned in the second stage of the energy hierarchy (Be Clean) and will not be considered appropriate unless justification can be provided - including demonstration that air quality emission limits are not exceeded. Alternative low carbon heating technologies are expected to be considered in place of CHP.

Applications proposing direct electric strategies (resistance heating) will not normally be approved as they do not offer suitable carbon emissions reductions and can result in high heating bills for occupants.

2.3.4 New London Plan (DRAFT)

The draft London Plan was launched for consultation in December 2017. It was laid before the London Assembly on 6 February 2020. The final London Plan was expected to be adopted in March 2020. However, on 13th March 2020, exercising his powers to direct changes, the Secretary of State issued a letter to the Mayor of London in which he set out his consideration of the Mayor's 'Intend to Publish' London Plan. As a next step, the Mayor will have to consider the Secretary of State's response and take the statutory steps to finalise the Plan. It is, therefore, expected that this may lead to further delays to the publishing of the New London Plan.

Key policy targets, contained in the latest available version of the Draft New London Plan, include:

Table 13: Carbon Emission Targets proposed under emerging London Plan (Policy SI2).

	Target
All Major Developments	Zero Carbon for regulated emissions against Part L 2013 Baseline (i.e. 100% reduction in carbon emissions)
Minimum Target	35% reduction in regulated emissions against the Part L 2013 Baseline to be met on-site with remainder to be met via offset payments.
Non-residential	15% reduction in regulated emissions against the Part L 2013 Baseline from the Be Lean stage (i.e. energy efficiency measures only)

2.3.5 Updated Energy Guidance October 2020

The GLA issued updated Energy Assessment Guidance in April 2020 to set out what is expected for compliance with the draft London Plan.

Emerging guidance updates from the GLA include:

- All referable planning applications to calculate and reduce whole life-cycle carbon emissions to fully capture a development's carbon impact.
- Developments are required to 'be seen' to monitor and report its energy performance post-construction to ensure that the actual carbon performance of the development is aligned with the Mayors net zero carbon target.

2.4 Local policy.

London Borough of Camden Local Plan (2017)

The council has a strategic objective of achieving wider sustainability and adopts policies that will enable it to achieve this objective.

Table 14: Key local policy requirements within the London Borough of Camden Local Plan.

Policy	Summary
Camden CC1: Climate Change Mitigation	– Follow the Energy Hierarchy (Be Lean – Be Clean – Be Green) and be as energy efficient as is feasible and viable – Demonstrate how London Plan targets for carbon dioxide emissions have been met – Ensure that the location of development and mix of land uses minimise the need to travel by car and help to support decentralised energy networks – All proposals that involve substantial demolition must demonstrate that it is not possible to retain and improve the existing building – All developments are expected to optimise resource efficiency – Major developments will be required to install appropriate monitoring equipment
Camden CC2: Adapting to Climate Change	Development is required to be resilient to climate change by adopting appropriate climate change adaptation measures such as: – the protection of existing green spaces and promoting new appropriate green infrastructure; – not increasing, and wherever possible reducing, surface water runoff through increasing permeable surfaces and use of Sustainable Drainage Systems; – incorporating bio-diverse roofs, combination green and blue roofs and green walls where appropriate; and – measures to reduce the impact of urban and dwelling overheating, including application of the cooling hierarchy. – Any development involving 500 m^2 or more of any additional floorspace is required to demonstrate the above in a Sustainability Statement. The Council will promote and measure sustainable design and construction by: – ensuring development schemes demonstrate how adaptation measures and sustainable development principles have been incorporated into the design and proposed implementation; – expecting non-domestic developments of 500 m^2 of floorspace or above to achieve "Excellent" in BREEAM assessments and encouraging zero carbon in new development from 2019.

2.4.1 Supplementary planning documents

A summary of the most pertinent SPD is included in Table 15. Please refer to Appendix A for a wider review.

Table 15: Summary of requirement contained within the Camden Planning Guidance on Energy Efficiency and Adaption (2019).

Document	Summary
Camden Planning Guidance on Energy Efficiency and Adaption (2019)	– Energy statements should demonstrate how a development has been designed following the steps in the energy hierarchy. – Natural 'passive' measures should be prioritised over active measures to reduce energy. – Carbon dioxide reduction target for new developments to make a 35% improvement on the current 2013 Building Regulations, (following the recommendation of the GLA). – All new major developments in Camden are expected to assess the feasibility of decentralised energy network growth – Where feasible and viable developments will be required to connect to a decentralised energy network or include CHP. – Developments are to target a 20% reduction in carbon dioxide emissions from on-site renewable energy technologies. – BREEAM target of 'Excellent' with 60 per cent of Energy credits achieved. – All developments are expected to consider the impact of climate change and be designed to cope with the anticipated conditions. – Development would minimise overheating and also meet its cooling needs.

2.5 UCL.

UCL's 20-year strategy (UCL 2034) lists a sustainable estate amongst its key enablers and importantly that its estate "lives up to the world-leading status of its research and education in sustainable built environments".

UCL has a vision for its estate to perform at the highest levels of excellence and efficiency. The 2013 Environmental Sustainability Strategy presents UCL's vision to become a leader in the field of sustainability in all that they do, including the sustainable development and use of the estate by creating a campus which supports UCL's academic, research and enterprise activities in a sustainable way.

2.5.1 UCL Sustainable Building Standard (2016)

The Sustainable Building Standard (SBS) details UCL's ambitious requirements for the delivery of a sustainable built environment, including the minimum standards and targets required for all new build, refurbishment, fit-out and minor works projects. Key requirements are set out below:

- 40% reduction in CO_2 emissions relative to current Building Regulations (2013).
- Achieve a BREEAM rating of at least 'Excellent', with the aim of 'Outstanding' where possible.
- Achieve the minimum level building energy performance for an 'Excellent' BREEAM rating

Since the planning application was submitted UCL have updated their Sustainability Building Standards (2020(their future property development. It demonstrates best practice for other public sector bodies and property developers.

2.5.2 BREEAM ENE01

The UCL Sustainable Building Standard requires Framework requires each building to target the BREEAM Excellent requirements for energy (ENE01) under the BREEAM 2018 New Construction scheme. For an 'Excellent' rating, a minimum of 4 credits must be achieved

In order to calculate the number of Ene 01 credits obtained, BREEAM uses an overall energy performance ratio (EPR_{NC}). The EPR_{NC} is based on Part L calculations, and is the sum of:

- The heating & cooling demand energy performance ratio (EPR_{ED}), associated with the fabric performance.
- The primary consumption energy performance ratio (EPR_{PC}), which incorporates the benefits of using efficient systems.

- The CO_2 energy performance ratio (EPR_{CO2}), which also takes into account the renewable energy used in the building

2.6 Grid decarbonisation.

Recent progress in the energy sector has seen emissions associated with electricity consumption reduce drastically, however this is not reflected in the current Building Regulations which were last updated in 2013. Building Regulations are unlikely to be updated before 2020, increasing the gap between compliance and reality.

The carbon factor for grid-supplied electricity in the current Building Regulations (2013) is 0.519 $kgCO_2/kWh$; as can be seen in the graph below, this is a fair reflection of the performance of the grid at that time. However, in response to legally-binding targets established in line with the Paris Agreement, significant progress has been made in decarbonising the electricity grid over the past six years.

At the end of 2017, the Department for Business, Energy, and Industrial Strategy (BEIS) reported the carbon factor of electricity as having fallen to 0.229 $kgCO_2/kWh$; a 55% reduction compared to that in Part L, 2013. The consequence of this is a discrepancy between emissions calculated using current building regulations methodology from electrical plant and any technologies which offset grid electricity (such as solar PV) compared to the reality of their performance. This leads to the risk that buildings could be specified with technologies with the objective of reducing CO_2 emissions which, in fact, may not offer any real benefit in practice.

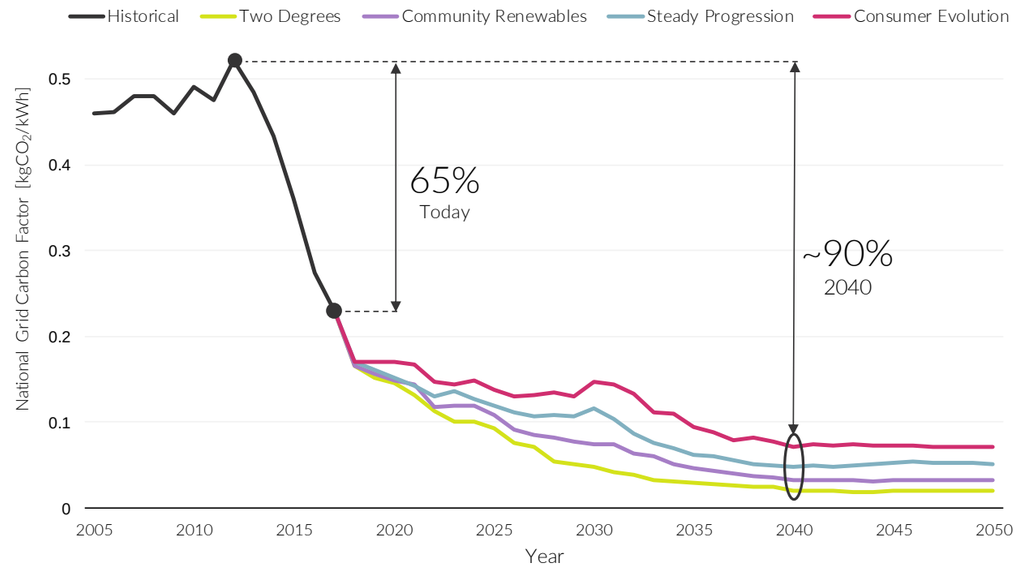


Figure 3: Historic and future projected carbon factor for the National Grid (8% transmission and distribution losses are included).

2.7 Summary.

Plot 3 will have a reduced effect on climate change by reducing CO_2 emissions associated with energy use in line with national and local policy as stated within Building Regulations Part L, as well as UCL's aspirations and GLA and London Borough of Camden policy. As principal targets, Plot 3 is targeting:

- Taking all reasonable opportunities to maintain (or improve) on-site CO_2 reductions (regulated emissions) compared to the 24.6% achieved for Plot 3 in the approved development.
- Maximising a reduction in CO_2 emissions from energy efficiency measures at the 'Be Lean' stage
- Attaining the minimum level building energy performance for an 'Excellent' BREEAM rating

3. Cooling and overheating.

3.1 Cooling hierarchy.

The London Plan Policy 5.9 (Overheating and Cooling) requests that developments should reduce potential overheating risk and reliance on air conditioning systems. A 'cooling hierarchy' is provided and Plot 3 has sought to follow this hierarchy to limit the effects of heat gains in summer:

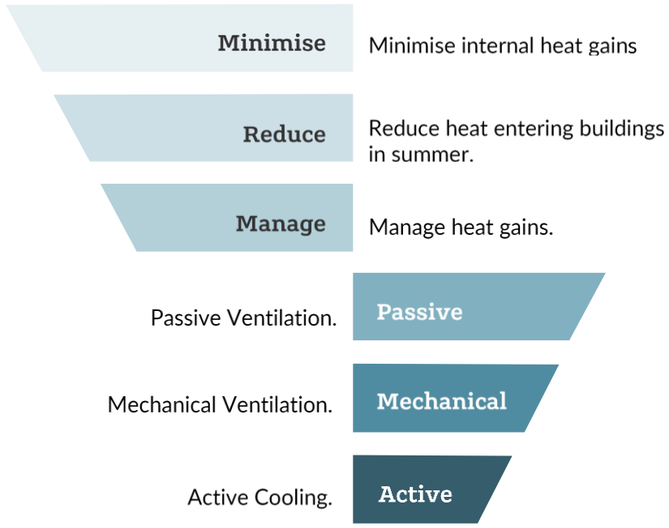


Figure 4: Cooling hierarchy.

3.2 Mitigation strategy.

The following mitigation methods are incorporated within the design of Plot 3.

Minimising internal heat generation through energy efficient design

The following mitigation methods will be implemented to minimise the internal heat generation through energy efficient design at Plot 3:

- Energy efficient lighting (such as LED or CFL) with low heat output which will significantly reduce the amount of heat loss from each fitting, and the subsequent heat gain in each space;
- Insulation to heating and hot water pipework and minimisation of dead-legs to avoid standing heat loss (from pipework)
- Energy efficient equipment with low heat output to reduce unnecessary heat gain

Reducing the amount of heat entering the building in summer

The following mitigation methods are incorporated within the design of Plot 3 to reduce the amount of heat entering the building in summer:

- Glazing ratio responding to orientation, space use and daylight requirements (please see Figure 22 and Table 34 for further details)
- Low g-value glazing to limit solar heat gains
- Blinds will be specified to limit solar heat gains
- Solar shading from the trees within St. Andrews Gardens will benefit the south-east elevation
- Figure 6 shows early stage solar shading consideration based on the solar irradiance analysis undertaken in Figure 5

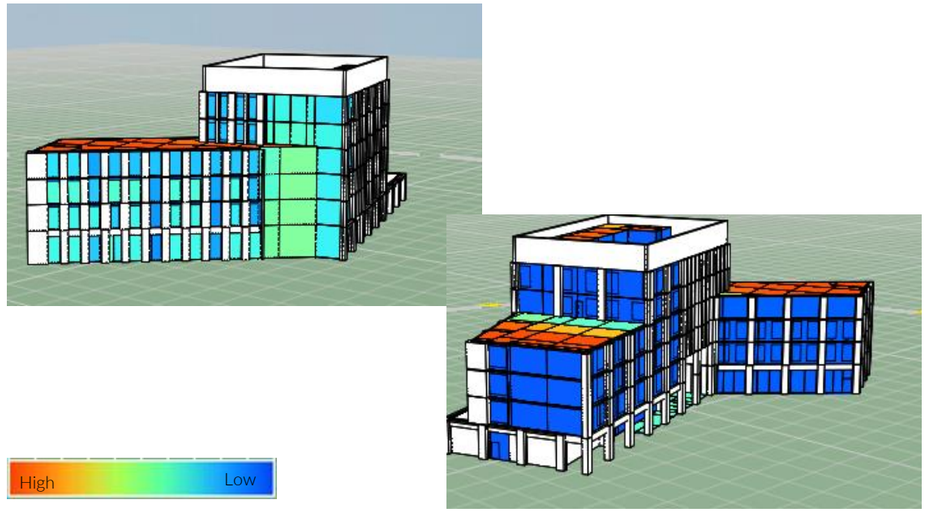


Figure 5: Solar irradiance study.

Figure 6: Shading recommendations.

Thermal mass
As per UCL Sustainable Building Standard, design teams must explore the potential to exploit the thermal mass of the building structure to help moderate internal environment conditions and minimise heating and cooling requirement, reduce reliance on mechanical systems (including plant and system sizing) and optimize energy performance.

Thermal mass reduces the peak temperatures by absorbing thermal energy and gradually releasing it to the ambient when the air temperature drops. In order for thermal mass to be effective in reducing overheating adequate ventilation is required to allow it to release the heat during the night in order to be able to capture more thermal energy during the hot hours of the following day. This is achieved by the use of night-time cooling (i.e. allowing for natural ventilation during the night to cool down the thermal mass).

Plot 3 will make use of its thermal mass which shall help absorb excess heat within the building. This combined with using the mechanical ventilation system for night-time cooling (when external conditions allow) to recharge the coolth effect of the structure, will allow a degree of 'free cooling' for peak-lopping high temperatures during the day.

Passive ventilation
Passive ventilation was considered for Plot 3 through the use of openable windows. However, this approach was discounted due to the high occupant density and requirements for low noise conditions within the spaces.

Mechanical ventilation
Mechanical ventilation is an important element of building services, to maintain good indoor air quality throughout the day by providing fresh air and extracting vitiated air. Providing fresh air minimises the risk of stale and stagnant air and limits the risk of condensation and mould growth as well as benefitting the occupants physical and mental wellbeing. Heat recovery mechanisms will be provided to save heating energy.
Mechanical ventilation plant will be located away from pollution sources at roof level. It is anticipated that the design flow rates specified will aid the regulation of internal temperatures in summer months.

Active cooling
As the final step active cooling is specified, in order to keep internal temperatures within acceptable limits. The façade and building services have the flexibility to enable a fan coil unit cooling solution with high efficiency air cooled chillers.

3.3 Overheating risk assessment.
The cooling hierarchy principles have been followed as a means of reducing the amount of solar and internal gains, reducing the risk of overheating, and subsequently reducing the demand placed upon active systems.

3.4 Part L Heat gain check.
It is anticipated that Plot 3 will achieve compliance with the Building Regulations Part L 2013 Criterion 3 and limit the effects of heat gains in summer months and reduce the demand on active cooling systems.

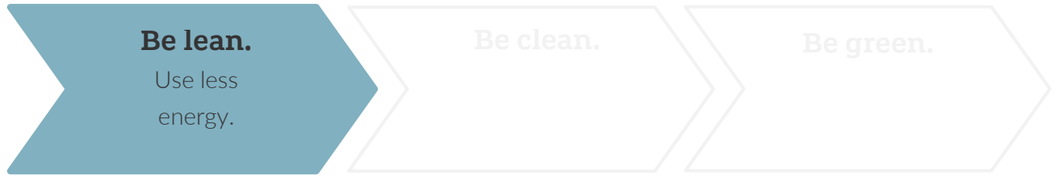
3.5 Cooling demand reduction.
The table below compares the cooling energy demand of Plot 3 against the notional building built to Part L2A parameters. The mitigation measures described above result in a reduction of the cooling demand by approximately ~20%.

Table 16: Cooling demand.

Space Use	Area weighted cooling demand (MJ/m^2)	Total cooling demand (MJ)
Actual	54	375,216
Notional	67	466,723

4. Be lean.

Passive design and energy efficiency measures form the basis for the reduction in overall energy demand and carbon emissions for Plot 3. This energy strategy aims to reduce the energy demand initially by optimising the envelope and building services within the development.



4.1 Passive design and energy efficiency features.

Passive design measures are those which reduce the demand for energy within buildings, without consuming energy in the process.

These are the most robust and effective measures for reducing CO_2 emissions as the performance of the solutions, such as wall insulation, is unlikely to deteriorate significantly with time, or be subject to change by future property owners. In this sense, it is possible to have confidence that the benefits these measures will continue at a similar level for the duration of their installation. Appendix D details the target fabric and system performance parameters.

	Fabric performance A 'fabric first' approach will be taken in order to reduce the energy demand and CO_2 emissions from Plot 3. The overriding objective for the façade design of each building will be to achieve the optimum balance between providing natural daylighting benefits to reduce the use of artificial lighting, the provision of passive solar heating to limit the need for space heating in winter and limiting summertime solar gains to reduce space cooling demands. Thermal Insulation Plot 3 will seek to utilise efficient thermal envelopes. Heat losses and gains will be controlled by the optimisation of the fabric of each building, i.e. ensuring appropriate levels of glazing to control winter heat loss and summer heat gain. Reducing the thermal transmittance of the building envelope where appropriate will help to reduce both heating and cooling requirement and result in lower energy requirements. Glazing Energy & Light Transmittance Elevations will be developed with a suitable approach to fenestration and glazed areas, and glazing specification (light transmission and solar control) to ensure an appropriate balance between the benefits of passive solar heating in winter months whilst limiting the likelihood of high internal temperatures in summer, as applicable to each building type (see section 5).
	Mechanical ventilation It is anticipated that high-efficiency mechanical ventilation with heat recovery will be adopted for all building areas. Mechanical ventilation is an important addition to the building services to maintain good indoor air quality by providing fresh air and extracting vitiated air. Providing fresh air minimises the risk of stale and stagnant air and limits the risk of condensation and mould. Coupled to a heat exchanger, the warmth in extracted air can be recovered and delivered to the supply air. In this mode, the ventilation system reduces space heating and cooling demand.
	To reduce the electrical energy associated with fan usage, plant and systems will be optimised to achieve low specific fan powers.
	Domestic hot water (DHW) system To limit the demand for hot water, all spaces will include the use of water-efficient fixtures and fittings including WCs with low flush volume, flow reducers in the taps of wash hand basins and aerated shower heads, to limit overall water consumption in line with Building Regulations Part G. Water consumption requirements in environmental assessment methods such as BREEAM will be considered further during detailed design stages.
	Natural daylight and lighting strategy In the context of office and education usages, lighting tends to provide a significant contribution to regulated CO_2 emissions. As such, the implementation of energy efficiency lighting design is paramount to reducing overall emissions for these spaces. Therefore, it is anticipated that Plot 3 will be supplied with high efficiency lighting installations representing best practise. Full lighting control systems including daylight linkage and presence detection will also be incorporated. As well as reduced energy requirement that will be achieved by implementing these strategies, the contribution to the cooling requirements and internal heat gains will be reduced. This will further reduce the total energy requirements and CO_2 emissions of the building. Figure 7 provides high level daylight analysis, showing that perimeter rooms with shorter depth achieves good daylight levels.  Figure 7: Daylight analysis.

4.2 Be lean results.

The following is an appraisal of the anticipated energy requirements and resultant CO_2 emissions that could arise as a result of Plot 3, after the inclusion of the passive design and energy efficiency measures described previously.

The results presented below are based on the Building Regulations Part L 2013 calculations for Plot 3, benchmarked against notional Part L 2013 buildings, using SAP 10 carbon factors. This is in accordance with the approach outlined in the GLA Energy Assessment Guidance.

It is anticipated that overall, Plot 3 will achieve up to an 10.9% reduction in annual regulated CO_2 emissions beyond the requirements of the Building Regulations Part L 2013 through improvements to the building fabric and energy efficiency measures (i.e. before any benefit from low or zero carbon technologies).

Energy and carbon performance
Plot 3 is expected to achieve Part L 2013 compliance via Be Lean measures, i.e. prior to the consideration of any LZC technologies. The annual regulated energy requirement of Plot 3 is summarised in Table 17.

Table 17: Summary of development energy demand by use category.

	Space Heating	Cooling	Auxiliary	Lighting	Hot Water	Unregulated electricity	Unregulated gas
	MWh/year	MWh/year	MWh/year	MWh/year	MWh/year	MWh/year	MWh/year
Non Domestic	52	128	59	56	87	367	0

Figure 8 provides a summary of the regulated system side fuel requirement and CO_2 emissions breakdown at the Be Lean step of the energy hierarchy. It can be can see that for both metrics, the demand is dominated by hot water following by auxiliary systems (e.g. mechanical ventilation, fans and pumps) and lighting. Space heating, cooling and hot water demands make up approximately 60% of both the energy demand and CO_2 emissions.

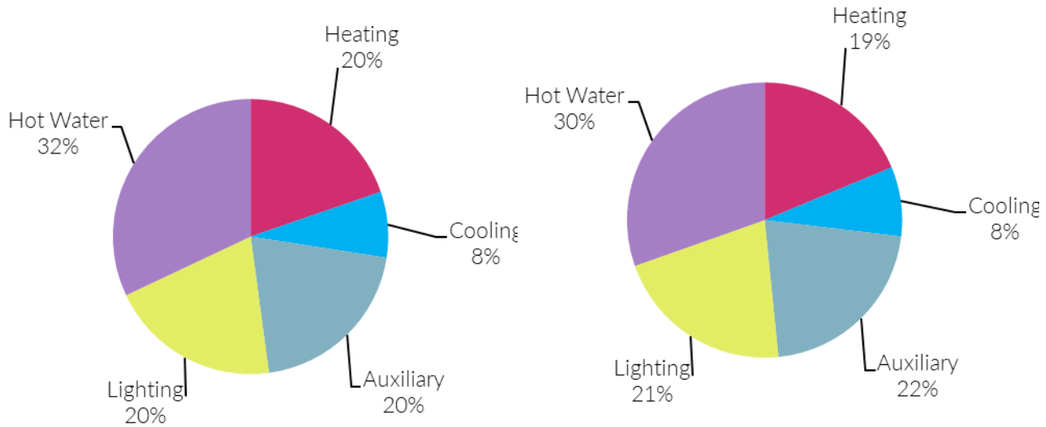


Figure 8: Energy breakdown (left) and carbon emissions (right).

4.3 Be lean summary.

At the 'Be Lean' Stage, Plot 3 is anticipated to achieve an 10.9% reduction in CO_2 emissions beyond the Building Regulations Part L 2013 'baseline', with SAP 10 carbon factors, as shown by Table 18 and Figure 9. This will be realised through the inclusion of an efficient building fabric which will reduce the space heating demand as well as enabling natural light which will reduce the reliance on artificial lighting. The building services strategy will include mechanical ventilation with heat recovery to further reduce energy consumption and CO_2 emissions. Appendix C details the target fabric and system performance parameters.

It is acknowledged that the Intend to Publish London Plan, which is not yet adopted, states that Non-domestic developments should achieve at least a 15% improvement on Building Regulations from energy efficiency (Be lean). However, it should be noted that a 3.3% saving has been achieved beyond the 7.6% achieved at planning submission.

Table 18: Anticipated 'Be lean' carbon reduction.

Development Emission Rate:	63.2 tCO_2/year
Target Emission Rate:	70.9 tCO_2/year
Percentage Reduction:	10.9%

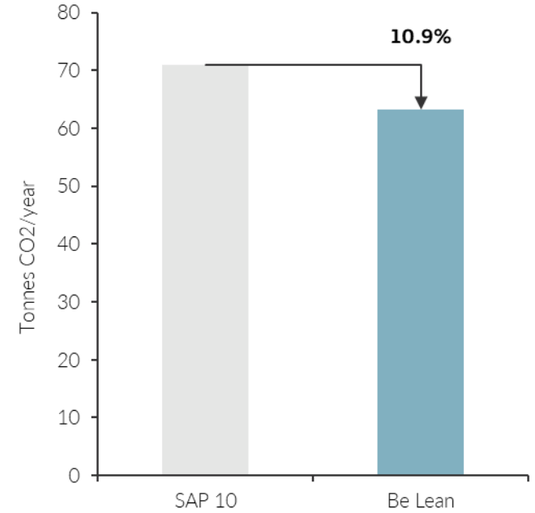


Figure 9: Be lean results summary.

5. Be clean.

This stage of the energy hierarchy refers to the use of heat networks or on-site Combined Heat and Power (CHP) in order to provide energy and reducing consumption from the national grid and gas networks, through the generation of electricity, heating and cooling on-site.

Be lean. | **Be clean.** Supply energy efficiently. | Be green.

5.1 Development demand.

Plot 3's approximated thermal demand has been initially calculated to be 58% compared to 42% for electrical demand.

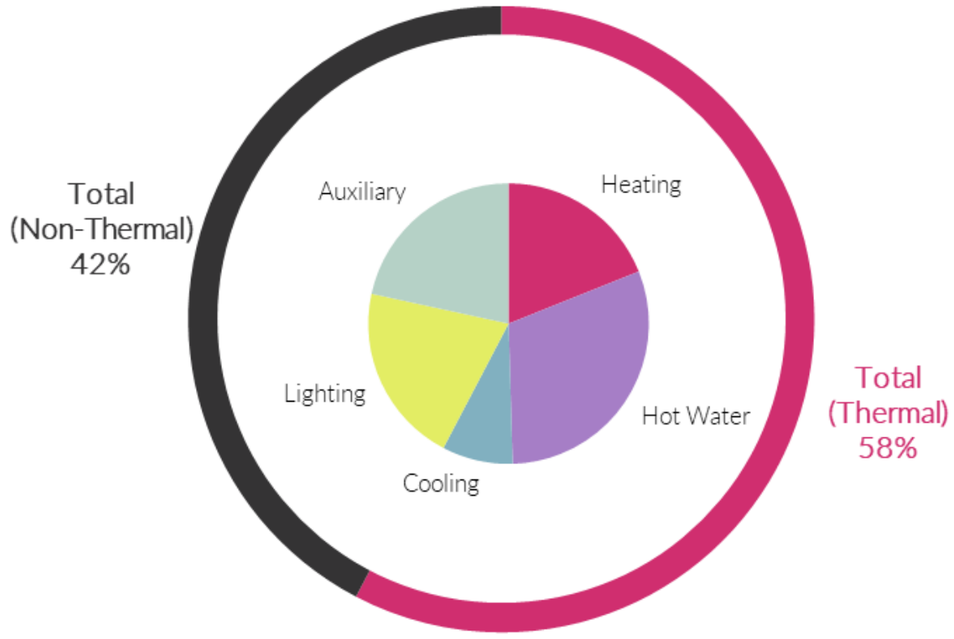


Figure 10: Thermal and electrical demand chart.

5.2 Be clean: network and technologies.

In line with policy aspirations, the following sections summarise the consideration given to the efficient supply of low-carbon energy, the proximity to existing and proposed heat networks and justification for why the proposed energy strategy has been implemented.

The majority of central London is identified as a Heat Network Priority Area, i.e. areas where heat density is sufficient for heat networks to provide a competitive solution for supplying heat to buildings and consumers. Plot 3 is located within an area of moderate heat density, as identified by the London Heat Map (http://www.londonheatmap.org.uk). It shows the proximity of Plot 3 to existing and potential district heating networks.

At the time of planning submission (early 2019), No existing district energy scheme is in place within the vicinity of the development.

The heat map shown in Figure 11 indicates that while the site is in a medium heat load density area, there is no identified potential network in the immediate surrounding area. However, in the interest of future proofing the project to account for any potential future developments in terms of district heating networks, the infrastructure shall be designed to allow a district heating network to be readily connected into the development's low loss header. Furthermore, it is envisaged that the upgrade path to remove combustion from the building in the future would be to replace boilers with electric boilers if district heating solutions were unable to be provided.

1. Mount Pleasant
2. Great Ormand Street
3. Citigen (London) Ltd (Existing)
4. Citigen (London) Ltd (Proposed)
5. National Union of Teachers HQ
6. Bunhill
7. Euston Road (Proposed)

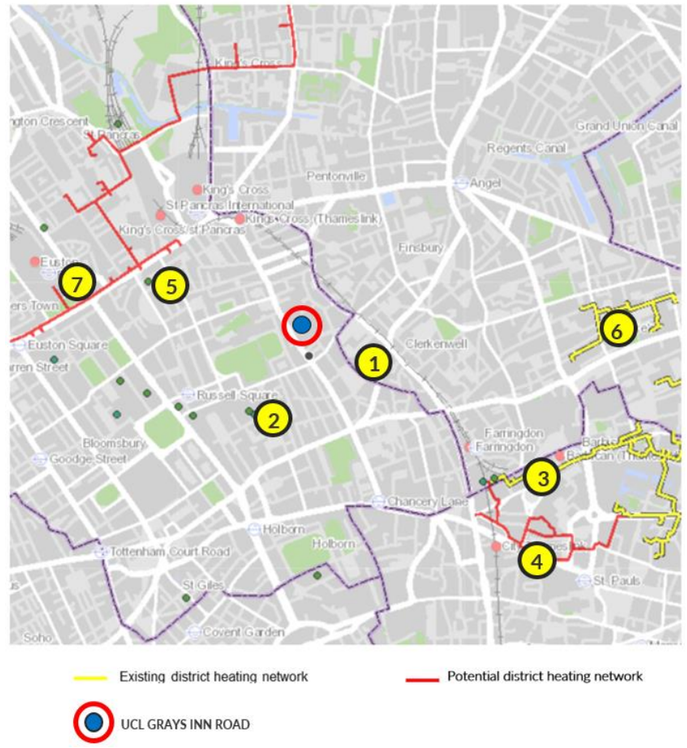


Figure 11: Existing and potential district heating connections to the Site as of early 2019.

5.3 Be clean summary.

An investigation into the availability of existing and proposed district heating networks has been carried out for Plot 3. Initial examination of the London Heat Map at the time of planning submission confirmed that there were no available connections that can be utilised.

Additionally, the relative merits of installing a CHP are negligible in this scenario as, due to the decarbonisation of the UK electricity grid, the amount of CO_2 offset by the generation of on-site electricity is significantly reduced. Therefore, there are no further CO_2 savings at the 'Be Clean' stage of the energy hierarchy.

	**Decentralised Energy Networks (DEN)** An early review of the London Heat Map was conducted to identify the availability of existing and proposed district heating networks that may exist nearby to the scheme. This exercise has found that there are no existing networks within the vicinity of the site. Provisions will be made to enable future connection to a district network should one be technically and economically viable in the future.
	**Combined heat and power (CHP)** Changes to the carbon factor of grid electricity have meant that previously favoured systems such as Combined Heat and Power (CHP) are becoming much less carbon efficient. In fact, CHP systems are now expected to lead to greater carbon emissions than conventional gas-fired boilers due to their lower efficiency. In contrast, electric systems are far more likely to achieve substantial carbon emission savings. Furthermore, CHP engines are an on-site source of particulate pollutants which will adversely affect local air quality. In light of grid decarbonisation and increased focus on air quality, CHP is not proposed.

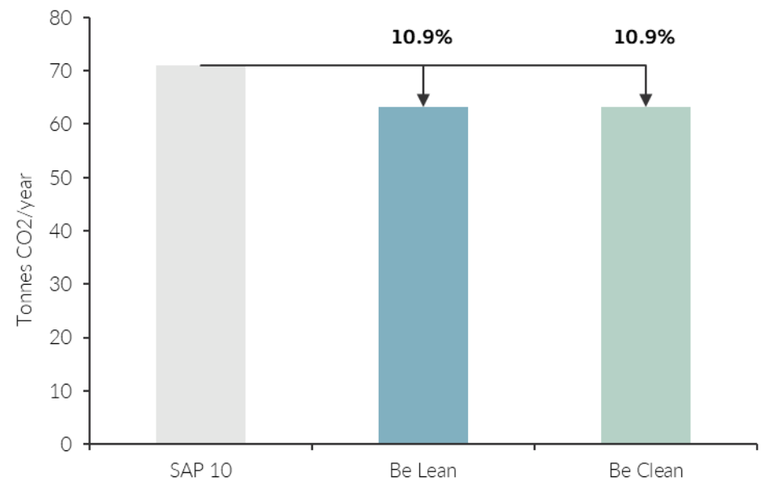


Figure 12: Be clean results summary.

6. Be green.

The final step of the energy hierarchy explores the feasibility of Low and Zero Carbon (LZC) technologies to allow for the production of renewable energy onsite in order to offer a further reduction in carbon emissions.

Be lean. Be clean. **Be green.**

Assess 'low or zero carbon' (LZC) energy sources.

6.1 Low and zero carbon (LZC) technology assessment.

Renewable technologies harness energy from the environment and convert this to a useful form. Many renewable technologies are available. However, not all these are commercially viable, suitable for conservation areas or appropriate for Plot 3.

Figure 13: Carbon reduction per LZC technology assessed.

	Air source heat pump Air source heat pumps use thermodynamic principles to convert heat from the air into useable heat within the building. Unlike some other sources of renewable energy, heat pumps do require energy (typically electricity or gas) to pump and compress refrigerant through the system. However, under the Renewable Energy Directive 2009/28/EC they are classified as renewable technologies provided that the final energy output significantly exceeds the primary energy input required to drive the heat pump. Suitability to Plot 3: Please refer to Section 7 for the discussion of air source heat pumps. On the basis of noise and siting concerns, air source heat pumps are not proposed Plot 3.
	Photovoltaics Photovoltaic panels harness energy from daylight and convert this into useful energy in the form of electricity. A PV system requires viable roof space in order for the system array to be installed and function effectively. Suitability to Plot 3: Based on initial scoping by a PV specialist, it intended that a PV output of 35,600 kWh/year can be achieved, with an indicative rooftop array included in Appendix D. These values are based 126 no. 385 W panels with a size of 1776 mm x 1052 mm x 35 mm. Options for including the use of solar microinverters to facilitate the deployment of panels in shaded areas have been explored. Solar PV panels are proposed for Plot 3.
	Solar thermal Solar Thermal Panels are similar to PV Panels in that they harness energy from solar. This technology, however, converts solar into thermal energy that can offset the demand on hot water generation systems. Suitability to Plot 3: Given the energy demands of the developed, available roof space has been prioritised for solar PVs. Therefore, solar thermal is not proposed for the development.
	Given the prioritisation of PV panels, solar thermal is not a proposed technology for Plot 3.
	Ground source heat pumps Ground Source systems work to extract heating or cooling energy from the ground. They are generally slightly more efficient than air source systems, as the ground temperature is more stable over the course of the year relative to air temperature. There are four common varieties of ground source systems: – Vertical, open loop, direct cooling (i.e. without heat pump) – Vertical, open loop, with heat pump – Horizontal, closed loop, with heat pump – Vertical, closed loop, with heat pump Suitability to Plot 3: Please refer to Section 7 for the discussion of ground source heat pumps. Due to the cost and surrounding buildings, ground source heat pumps are not currently considered a feasible option for Plot 3 and are therefore not proposed.
	Water source heat pump Water source heat pumps use bodies of water, such as rivers, lakes or oceans to provide heating or cooling energy to a building. Plot 3 is not within the vicinity of a suitable water body and as such water source heat pumps are not deemed suitable.
	Wind turbine For efficient operation and to yield high energy output, wind turbines require a smooth laminar flow of air. Suitability to Plot 3: Plot 3 is located within a dense urban environment therefore the wind flow profile is erratic and consequently, is not conducive to high annual yields. If wind turbines were to be incorporated on the roof this could result in unacceptable vibration and resonance being felt within occupied spaces. The turbines are also likely to generate noise which may be a nuisance to neighbouring residential properties. This scenario is likely to result in the turbines being switched off. Therefore, given the complexities of installing this technology, the use of micro wind turbines is not proposed at Plot 3.

6.2 Assessment summary.

The feasibility of on-site renewable energy technologies has been assessed, and PV panels have been found suitable.

Plot 3 will also utilise high efficiency gas boilers (95.6%) for space heating and domestic hot water generation.

The energy strategy is anticipated to result in carbon emission reductions of approximately 24.7% compared to a Part L 2013 baseline.

6.3 Air quality.

In line with policy requirements, high efficiency gas boilers will be specified for Plot 3. NOx emissions will be limited to 40 mg/kWh.

Table 19: Air quality impacts.

Energy source	Total fuel consumption – non-residential (MWh/year)
Grid electricity	102 137 (without PV displacement)
Domestic/communal gas boilers	141
Gas CHP	-
Connection to existing DH network	-
Other gas use (e.g. cookers)	-

6.4 Be green summary.

Through the measures outlined in the Be Green stage, it is anticipated that overall, approximately 24.7% reduction in CO_2 emissions can be achieved beyond the Part L 2013 baseline inclusive of all proposed measures.

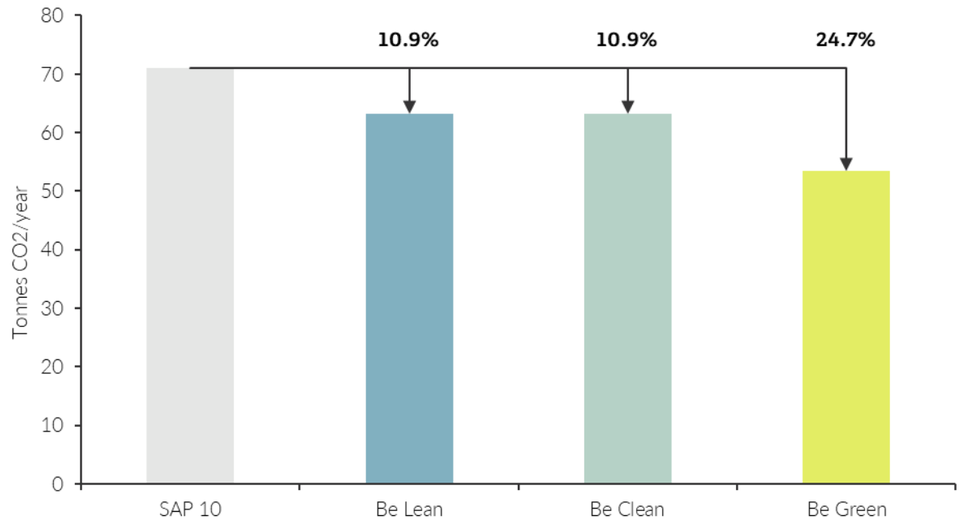


Figure 14: Be green results summary.

7. Heat pump statement.

7.1 Introduction.

Plot 3's current energy strategy for heating and cooling utilises gas-fired boilers and air-cooled chillers. As part of the design air and ground source heat pumps were considered for a source of heat for the scheme as these offer carbon saving benefits, particularly as the electrical grid decarbonises. These technologies were however discounted due to site constraints as described below.

7.2 Ground source heat pumps.

The site's ground conditions are such that drilling into the aquifer would result in a contamination issue, and this may additionally result in an impact on the long-term behaviour of the soil. This element was investigated in detail for the site and a significant risk was identified. Ground source heat pumps would be economically unfeasible for the building.

7.3 Air source heat pumps.

Due to planning constraints regarding noise, height and massing of the building, the utilisation of air source heat pumps were discounted at the original design stage.

7.3.1 Equipment space requirements.

Air source heat pumps require significant external space for heat rejection. The enlarged basement does not provide the external space required. Within the constraints of the existing planning scheme there is no opportunity to locate additional heat rejection equipment with the exception of the most northly roof, all other roof areas are fully utilised with other services equipment and photovoltaic panels. The siting of ASHPs on the most northly roof would be problematic due to the external visibility of the large equipment, the impact on the building's massing, and also due to the immediate proximity of the surrounding residences and the associated noise sensitivity of these buildings.

Figure 15: Roof area allocation.

7.3.2 Noise emissions.

Plot 3 is immediately bounded by noise sensitive receivers (private and student residences) to the north and to the east, and is within the range of further noise sensitive receivers to the south and west. To allow the overall plant noise limits for the site to be achieved at all noise sensitive receivers, noise limits have been apportioned to each of the plots individually. Plot 3's noise emissions are heavily constrained due to its location in relation to the nearby residences and by the significant required noise emissions associated with Plot 1's laboratory plant.

Typical sound power levels from air source heat pumps are in the region of L_{wA} 85 dB. To serve a building of the size of Plot 3, at least 3 units would be required. Locating this number of units on the northern roof of the building would result in a noise level of approximately 58 dB(A) at the most affected receiver (residences at R5 in the image below) from the ASHPs. This is 20 dB higher than the plant noise limit set at this receiver.

Proprietary attenuation packages for this type of plant are limited in performance to 8 – 10 dB(A), falling significantly short of the required attenuation to meet the criteria. Therefore, significant additional measures would be required, such as the provision of unreasonably tall solid screens and additional attenuation to already heavily attenuated plant items. These measures would have a major impact on the height and massing of the building in this location. During pre-application discussions on the original application, this part of the building was reduced in height to reach a massing that would be acceptable in terms of townscape and daylight. Therefore, the use of ASHPs at Plot 3 has been discounted.'

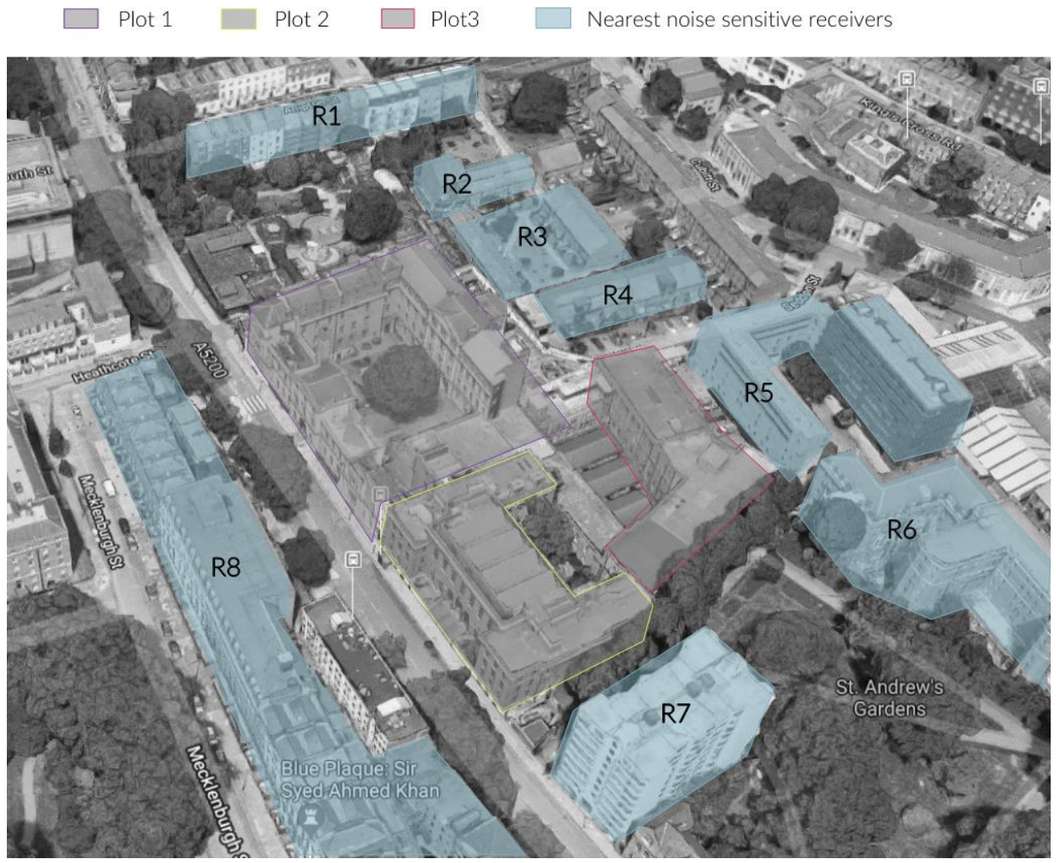


Figure 16: Nearest noise sensitive receivers relative to Plot 3.

8. Summary of Stage 3 design review.

8.1 Energy and carbon considerations.

Following the Stage 3 design changes, the design team have reviewed the fabric and systems parameters and introduced improvements to the building design to minimise the lighting, heating, cooling and domestic hot water demand which include:

- High performance glazing, sensible glazing ratio to balance heat losses, heat gains and daylight ingress
- Efficient Mechanical Ventilation with Heat Recovery
- Fabric air permeability improvement upon Building Regulations Part L (2013) requirements
- High efficiency gas boilers
- Insulated pipework and ductwork to minimise heat losses and gains
- Building Management System (BMS)
- Energy efficient lighting (such as LED or compact fluorescent) with low heat output
- Lighting controls – Daylight dimming to perimeter occupied spaces and occupancy controls
- Variable speed pumps to minimise energy consumption for distribution of services

8.2 Summary.

Based on the Stage 3 design and review with the design team, the inputs coloured in pink have been updated whilst ~~scored~~ inputs have been removed. All other parameters used within the Stage 3 design remains unchanged.

Table 20: Target building fabric performance parameters.

Exposed Floor U-value (W/m^2K)	Ground: 0.20 0.15 Basement: 0.20 0.15
Basement Wall U-value (W/m^2K)	0.20 0.12 (Ground contact walls)
External Wall U-value (W/m^2K)	0.18
Roof U-value (W/m^2K)	Upper floors: 0.18 Plant: 0.18 Basement: 0.15
Glazing U-value (W/m^2K)	Windows: 1.30 (g value: 0.36) Curtain Walling: 1.10 (g value: 0.36)
Opaque curtain walling U-value (Inc. frame) (W/m^2K)	0.80
Air Permeability ($m^3/h.m^2$) @ 50Pa	3.00

Table 21: System parameters per space type.

Heating, cooling and ventilation plant	
Heating plant	Condensing Gas Boiler SCOP: 0.956
Cooling plant	Air-cooled chillers PSEER: 8.92 5.79
Ventilation	AHU 01: SFP 2.0 W/(l/s); HR eff 80% 75%
	AHU 02: SFP 1.8 W/(l/s); HR eff 80% ~~AHU 03: SFP 2.0 W/(l/s); HR eff 80%~~ MVHR 01: SFP 1.4 W/(l/s); HR eff 80% MVHR 02: SFP 1.6 W/(l/s); HR eff 80%
System zones	
Office, Collaborative Spaces & Reception	FCUs (SFP 0.3W/(l/s)) + Mechanical ventilation (AHU 01)
Lecture Theatre	Displaced Ventilation (SFP 0.3W/(l/s)) + Mechanical ventilation (AHU 02) + Demand-controlled ventilation linked to CO_2 sensors
GF - L4 WCs & Kitchenette	LTHW rads + ~~AHU 03~~ MVHR 01
B1-2 WCs & Showers	LTHW rads + ~~AHU 03~~ MVHR 02
Circulation	LTHW rads only

Table 22: DHW system parameters.

Domestic Hot Water (DHW) system	
Generator	Condensing Gas Boiler (from main system) SCOP: 0.956 Kitchenettes served by electric POU
Storage	Plate heat exchanger (66% efficient with no storage) ~~Storage volume: 960 litres~~ ~~Storage losses: 0.0040 kWh/(l²day)~~ Secondary loop length: 664 700 m Secondary circulation losses: 8 W/m Time switch in secondary circulation

Table 23: Lighting input parameters.

Lighting Efficiency	
Luminaire Efficacy	Office: 100 120 lm/W) Collaborative Space: 100 110 lm/W Reception: 100 110 lm/W Lecture Theatre: 100 110 lm/W WCs: 65 90 lm/W Showers: 65 90 lm/W Kitchenette: 65 100 lm/W Circulation: 65 100 lm/W Store: 65 100 lm/W Plant: 65 90 lm/W
Display Lamp efficacy	15 60 lm/W
Lighting Controls	
Manual on/ Auto off	Office, Collaborative Space & Meeting Room
Auto on/off	Kitchenette, Circulation, WCs & Showers

Lighting Efficiency	
Manual on/off	Reception, Lecture Theatre, Plant & Stores.
Daylight dimming	All perimeter areas

Table 24: PV parameters. Proposed PV based on calculation from specialist.

Annual Output (kWh/year)	40,200 35,600

8.3 Results.

Following the Stage 3 design review, the relative regulated carbon emissions for Plot 3 were compared against the approved Plot 3 with additional basement levels (assuming identical system and fabric performance). Table 25 and Figure 17 capture these changes and demonstrates that the review undertaken by the design team was successful in achieving additional carbon savings.

Table 25: Comparison to approved Plot 3 with basement carbon reduction.

	Approved scheme with basement (% reduction from Part L baseline)	Proposed (% reduction from Part L baseline)
Savings from Be lean.	6.6%	10.9%
Savings from Be clean.	0%	0%
Savings from Be green.	14.4%	13.8%
Total reduction.	22.0%	24.7%

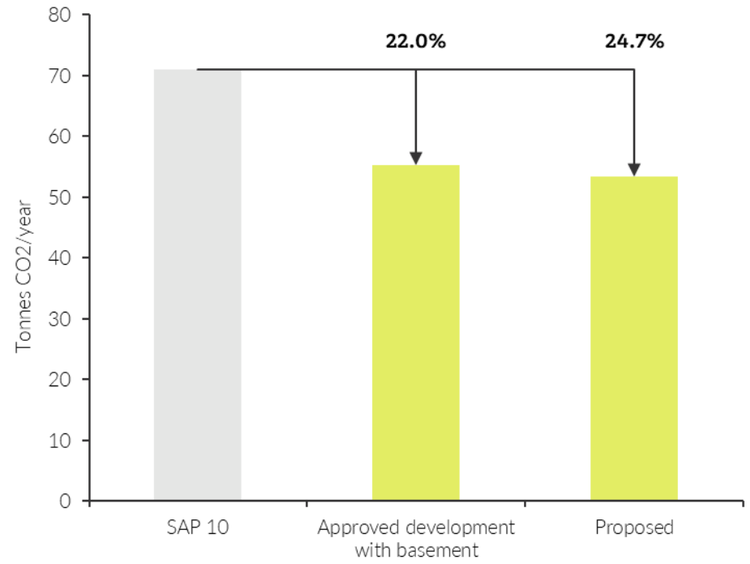


Figure 17: Design team energy efficiency improvements.

9. Conclusion.

This Energy Statement has been prepared on behalf of ISG, to provide a technical response to Stage 3 design changes, including two new basement levels, for the new development at Plot 3 of the 256 Grays Inn Road site. It demonstrates that at Stage 3 and subsequent to planning permission, ISG and the design team have given due consideration to the principles of energy and sustainability, and how these could be implemented for Plot 3.

A policy review has identified a number of key targets relating to energy that Plot 3 will be required to achieve, in addition to targets established at planning submission. The carbon emissions from regulated energy uses at Plot 3 have been compared with the GLA London Plan emissions targets.

9.1 The energy strategy.

The energy strategy for Plot 3 will minimise energy use and CO_2 emissions through the incorporation of a highly efficient shell, efficient lighting and ventilation, which will maximise opportunities for heat recovery and reuse and solar PV panels for on-site electricity generation.

The following table provides a summary of the energy strategy for Plot 3. All calculations have been undertaken using SAP 10 carbon factors.

Table 26: Energy strategy summary.

Be lean	10.9% betterment achieved against Part L baseline. High energy efficient building fabric and building services have been utilised to reduce carbon emissions and energy demand through good practice passive measures.
Be clean	'Be clean' measures have been deemed unfeasible. Incorporation of an onsite district heating and a CHP system has been deemed to be unsuitable as it would offer little to no benefit to Plot 3, therefore a CHP technology has been discounted. Provisions will be made to enable future connection to a district network should one become technically and economically viable in the future.
Be green	A further 13.8% betterment achieved through LZC technologies, equating to a 24.7% reduction beyond the Part-L baseline. Utilisation of high efficiency gas boilers and solar PV panels to further reduce carbon emissions.

Plot 3 results

Regulated carbon dioxide savings from each stage of the energy hierarchy

Table 27 summarises both the tonnes of carbon emission savings, and the percentage savings compared to the London Plan target for the approved and proposed Plot 3. It should be noted that the relative carbon emissions reduction is greater for the proposed Plot 3. The offset payment for the proposed

Table 27: Regulated carbon emissions savings from each stage of the energy hierarchy.

	Approved Plot 3		Proposed Plot 3	
	Tonnes CO_2/year	Percentage	Tonnes CO_2/year	Percentage
Savings from Be lean.	4.8	7.6%	7.7	10.9%
Savings from Be clean.	0.0	0.0%	0.9	0.0%
Savings from Be green.	10.7	17.0%	9.8	13.8%
Total reduction:	15.5	24.6%	17.5	24.7%
Target reduction:	22.1	35.0%		
Annual shortfall / surplus	-6.5	10.4%		
Carbon offset payment Rate (£/tco2)	£1,800		£1,800 & 2,850	
Offset payment	£11,786		£16,757	
BRUKL Area (m^2)	6,076.5		6,934.5	

Through the measures outlined in the energy strategy, it is anticipated that a 24.7% achieved beyond the Part L 2013 baseline. The calculated savings in regulated carbon emissions for Plot 3 are summarised in Figure 18.

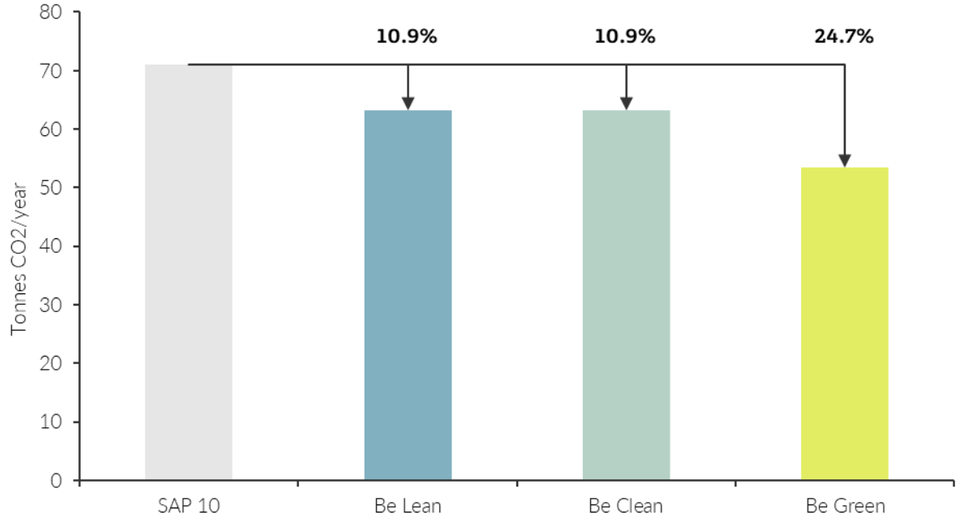


Figure 18: Regulated carbon targets and emissions summary.

Plot 3 extension results

Table 28 compares the annual emissions the Proposed Development against the Approved development submitted to GLA, the offset payment has been calculated based on a target reduction of 100% and the higher rate of £95 per tonne as proposed by Camden council.

Table 28: Plot 3 extension carbon offset payment.

	Approved Plot 3	Proposed Plot 3
Total Emissions	47.5	53.4
Increase	5.9	
Target reduction	100%	
Carbon offset payment Rate (£/tco2)	£2,850	
Offset payment	£16,757	

Plot 1 results

Table 29 shows carbon reductions of the approved Plot 1.

Table 29: Regulated carbon emissions savings from each stage of the energy hierarchy.

	Approved Plot 1	
	Tonnes CO_2/year	Percentage
Savings from Be lean.	8.8	3.9
Savings from Be clean.	0.0	0.0
Savings from Be green.	17.2	7.7
Total reduction:	20.6	11.6
Target reduction	79.0	35.0
Annual shortfall / surplus	52.7	23.5
Carbon offset payment Rate (£/tco2)	£1,800	
Offset payment	£94,843	
BRUKL Area (m^2)	19,912.5	

Plot 1 & Plot 3 results

Table 30 compares the sitewide carbon reductions of the Proposed Development against the Approved development submitted to GLA.

Table 30: Sitewide regulated carbon emissions savings from each stage of the energy hierarchy using SAP 10 carbon factors.

	Approved Plot 1 & 3		Proposed Plot 1 & 3	
	Tonnes CO_2/year	Percentage	Tonnes CO_2/year	Percentage
Savings from Be lean	13.5	4.7%	16.5	5.6%
Savings from Be clean	0.0	0.0%	0.0	0.0%
Savings from Be green	27.9	9.7%	27.0	9.1%
Total reduction	41.5	14.4%	43.5	14.7%
Target reduction:	100.7	35.0%		
Annual shortfall / surplus	59.2	20.6%		
Carbon offset payment Rate (£/tco2)	£1,800		£1,800 & 2,850	
Offset payment	£106,628		£123,386	
BRUKL Area (m^2)	25,989.0		26847.0	

Total offset payment

The table below shows the total estimated offset payment calculation as proposed by Camden council.

Table 31: Plot 3 extension carbon offset payment

	Approved Plot 1	Approved Plot 3	Plot 3 Extension
Offset payments	94,843	11,786	16,757
Total offset payment	123,386		

9.2 BREEAM ENE01.

A total of 5 ENE01 credits can be achieved under BREEAM New Construction 2018 based on the proposed energy strategy. A minimum of 4 credits are required for a BREEAM 'Excellent' rating.

9.3 Overheating risk assessment.

It is anticipated that all areas of the Proposed Development achieve compliance with Part L2A 2013 Criterion 3. The development of the design has followed the cooling hierarchy principles as a means of reducing the amount of solar and internal gains, reducing the risk of overheating, and subsequently reducing the demand placed upon the systems to condition the space. Particular attention has been given to the façade design for is in order to achieve the optimum the glazing ratio and g-value, striking a balance between daylight, summer solar gain and winter heat loss. The framework of overhangs and shading on all façades have been designed and integrated with the purpose of reducing the overheating risk posed to the development. This will reduce reliance on active cooling.

9.4 Outcomes.

It is anticipated that up to a 24.7% reduction in CO_2 emissions will be achieved beyond the Building Regulations Part L 2013 'baseline' through the provision of energy efficiency measures and on-site renewables. This represents an improvement on the 24.6% reduction achieved in the consented scheme. Plot 3 has been designed in reference to best practice industry recognised environmental assessment methodologies, namely the energy and CO_2 reduction targets set by UCL, GLA and the London Borough of Camden. Plot 3 takes all reasonable opportunities to maintain and improve the carbon emission reductions and delivers a slight improved on the performance of the approved development.

Appendix A: Planning policies.

Current policy Framework
The policies considered when preparing this strategy are contained in the London Plan (GLA, 2015) and the London Borough of Camden local policies.

The Proposed Development constitutes a 'major development' (>10 dwellings and/or >1,000 m^2 of non-residential floor space) and is therefore subject to the policies of the GLA, contained within the London Plan.

National policy.

Approved Document Part L
Part L of the Building Regulations is the mechanism by which government is driving reductions in the regulated CO_2 emissions from new buildings.

Current Requirements: Part L 2013
Part L has five key criteria which must be satisfied as follows:

- Criterion 1 - Achieving the Target Emission Rate (TER)
- Criterion 2 - Limits on design flexibility
- Criterion 3 - Limiting the effects of solar gains in summer
- Criterion 4 - Building performance consistent with the Building Emission Rate (BER)
- Criterion 5 - Provision for energy efficient operation of the building

Criterion 1 requires that the building as designed is not predicted to generate CO_2 emissions in excess of that set by the Target Emission Rate (TER) calculated in accordance with the approved Standard Assessment Procedure (SAP) 2012. Part L (2013) requires the following reductions:

a. A 6% aggregate reduction in CO_2 emissions beyond the requirements of Part L 2010 for dwellings; and
b. A 9% aggregate reduction in CO_2 emissions beyond the requirements of Part L 2010 for non-domestic buildings.

Criterion 2 places upper limits on the efficiency of controlled fittings and services for example, an upper limit to an external wall U-value of 0.35W/m^2.K (non-domestic buildings).

A Fabric Energy Efficiency Standard (FEES) has been introduced for new buildings although no definitive targets have been set in this regard. Part L 2013 requires the following Fabric Energy Efficiency performance targets to be met:

- Target Fabric Energy Efficiency (TFEE). The TFEE is calculated for the building, based upon an elemental recipe of efficiency parameters, applied to the geometry of the building in question. This would generate a notional value which would then be relaxed by 15% to generate the TFEE

Criterion 3 requires that zones in non-residential buildings are not subject to excessive solar gains. This is demonstrated using the Simplified Building Energy Model (SBEM) or Dynamic Simulation Method (DSM) for non-residential buildings.

London Plan policy.
The following policies of the London Plan (2016) have informed this strategy.

Policy 5.2: Minimising CO_2 Emissions
As of October 1st 2016, Policy 5.2 requires new-build domestic homes to be 'zero carbon' (equivalent to reducing regulated CO_2 emissions by 100%). Non-domestic development are to reduce CO_2 emissions by 35% beyond the Building Regulations Part L (2013) Target Emission Rate (TER). A minimum of a 35% reduction of CO_2 emissions is expected to apply for planning for domestic developments, with the remainder provided through a carbon offset payment to the relevant borough.

Policy 5.6: Decentralised Energy in Development Proposals
Policy 5.6 requires development proposals to evaluate the feasibility of Combined Heat & Power (CHP) systems and where a new CHP system is appropriate, examine opportunities to extend the system beyond the Site boundary. Developments should select energy systems on the following hierarchy:

c. Connection to existing heating or cooling networks
d. Site wide CHP network
e. Communal heating and cooling

Where future network opportunities are identified, proposals should be designed to connect to these networks.

Policy 5.7: Renewable Energy
Policy 5.7 requires that developments should provide a reduction in expected CO_2 emissions through the use of on-site renewable energy generation, where feasible.

Policy 5.9: Overheating and Cooling
Policy 5.9 requires that development proposals reduce potential overheating & reliance on air conditioning systems, demonstrated in consideration of the following cooling hierarchy:

f. Minimisation of internal heat generation through efficient design
g. Reduction of external heat gains through consideration of orientation, shading, albedo, fenestration, insulation, and green roofs & walls
h. Management of internal heat gains through exposed thermal mass
i. Passive ventilation
j. Mechanical ventilation
k. Active cooling

Development proposals should demonstrate how the design, materials, construction and operation of the development would minimise overheating and also meet its cooling needs.

Draft London Plan

Policy GG6 Increasing Efficiency and resilience
- Improve energy efficiency, movement toward low carbon, circular economy. Target of zero carbon city by 2050.
- Buildings/infrastructure resilient against a changing climate, efficient use of water, reduction of impact from natural hazards such as flooding and heatwaves
- Avoid contribution to the heat island effect.
- Safe and secure environments, resilient against impacts such as fire/terrorism etc.
- Stakeholder contributions taken from all relevant public, private, community sectors.

Policy D1 London's form and characteristics
- Developments should optimise density and connectivity, be inclusive and use street spaces that have well defined public and private realm, provide outlook, privacy and amenity, be safe and secure, provide spaces for social interaction, play relaxation and physical activity.
- Provide and facilitate active travel with convenient and inclusive pedestrian and cycling routes.
- Mitigate or prevent the impacts of noise and poor air quality.
- Development design should respond to local context by delivering developments of appropriate scale, appearance and shape that responds successfully to the character of the local area.
- Be of high quality architecture that includes flexibility and appropriate building lifespan, delivering attractive robust materials that will mature well.
- Respect/enhance the heritage assets
- Maximise opportunities for urban greening to create attractive resilient places that effectively manage surface water.
- Achieve comfortable indoor and outdoor environments.

Policy E1 Offices
- New office developments of varying sizes in new, refurbished and mixed us development types to be supported. This should be based on the anticipated demand for office floorspace to 2041 (100% increase by 2041).
- Spatial development areas should be supported by development works for offices.

Policy SI2 Minimising Greenhouse Gas Emissions
A. Major development should be net zero-carbon. This means reducing carbon dioxide emissions from construction and operation, and minimising both annual and peak energy demand in accordance with the following energy hierarchy:

2. Be lean: use less energy and manage demand during construction and operation.
3. Be clean: exploit local energy resources (such as secondary heat) and supply energy efficiently and cleanly. Development in Heat Network Priority Areas should follow the heating hierarchy in Policy SI3 Energy infrastructure.
4. Be green: generate, store and use renewable energy on-site.

As a minimum, energy strategies should contain the following information:

a. A calculation of the energy demand and carbon dioxide emissions covered by Building Regulations and, separately, the energy demand and carbon dioxide emissions from any other part of the development, including plant or equipment, that are not covered by the Building Regulations (i.e. the unregulated emissions), at each stage of the energy hierarchy.

b. Proposals to reduce carbon dioxide emissions beyond Building Regulations through the energy efficient design of the site, buildings and services, whether it is categorised as a new build, a major refurbishment or a consequential improvement.

c. Proposals to further reduce carbon dioxide emissions through the use of zero or low-emission decentralised energy where feasible, prioritising connection to district heating and cooling networks and utilising local secondary heat sources. (Development in Heat Network Priority Areas should follow the heating hierarchy in Policy SI3 Energy infrastructure).

d. Proposals to further reduce carbon dioxide emissions through the generation and use of on-site renewable energy, utilising storage technologies where appropriate.

e. Proposals to address air quality risks (see Policy SI1 Improving air quality). Where an air quality assessment has been undertaken, this could be referenced instead.

f. The results of dynamic overheating modelling which should be undertaken in line with relevant Chartered Institution of Building Services Engineers (CIBSE) guidance, along with any mitigating actions (see Policy SI4 Managing heat risk).

g. Proposals for demand-side response, specifically through installation of smart meters, minimising peak energy demand and promoting short-term energy storage, as well as consideration of smart grids and local micro grids where feasible.

h. Proposals for how energy demand and carbon dioxide emissions post-construction will be monitored annually (for at least five years).

i. Proposals explaining how the site has been future-proofed to achieve zero-carbon on-site emissions by 2050.

j. Confirmation of offsetting arrangements, if required.

k. Proposals to minimise the embodied carbon in construction.

l. Analysis of the expected cost to occupants associated with the proposed energy strategy.

B. Major development should include a detailed energy strategy to demonstrate how the zero-carbon target will be met within the framework of the energy hierarchy and will be expected to monitor and report on energy performance.

C. In meeting the zero-carbon target a minimum on-site reduction of at least 35 per cent beyond Building Regulations is expected. Residential development should aim to achieve 10 per cent, and non-residential development should aim to achieve 15 per cent through energy efficiency measures. Where it is clearly demonstrated that the zero-carbon target cannot be fully achieved on-site, any shortfall should be provided:

5. Through a cash in lieu contribution to the relevant borough's carbon offset fund, and/or
6. Off-site provided that an alternative proposal is identified and delivery is certain.

D. Boroughs must establish and administer a carbon offset fund. Offset fund payments must be ring-fenced to implement projects that deliver greenhouse gas reductions. The operation of offset funds should be monitored and reported on annually.

Policy SI3 Energy Infrastructure
A. Boroughs and developers should engage at an early stage with relevant energy companies and bodies to establish the future energy requirements and infrastructure arising from large-scale development proposals such as Opportunity Areas, Town Centres, other growth areas or clusters of significant new development.

B. Energy masterplans should be developed for large-scale development locations which establish the most effective energy supply options. Energy masterplans should identify:

7. major heat loads (including anchor heat loads, with particular reference to sites such as universities, hospitals and social housing)
8. heat loads from existing buildings that can be connected to future phases of a heat network
9. major heat supply plant
10. possible opportunities to utilise energy from waste
11. secondary heat sources

12. opportunities for low temperature heat networks
13. possible land for energy centres and/or energy storage
14. possible heating and cooling network routes
15. opportunities for futureproofing utility infrastructure networks to minimise the impact from road works
16. Infrastructure and land requirements for electricity and gas supplies
17. Implementation options for delivering feasible projects, considering issues of procurement, funding and risk, and the role of the public sector.

C. Development Plans should:

18. Identify the need for, and suitable sites for, any necessary energy infrastructure requirements including upgrades to existing infrastructure
19. Identify existing heating and cooling networks and opportunities for expanding existing networks and establishing new networks.

D. Major development proposals within Heat Network Priority Areas should have a communal heating system

20. The heat source for the communal heating system should be selected in accordance with the following heating hierarchy:
    a. connect to local existing or planned heat networks
    b. use available local secondary heat sources (in conjunction with heat pump, if required, and a lower temperature heating system)
    c. generate clean heat and/or power from zero-emission sources
    d. use fuel cells (if using natural gas in areas where legal air quality limits are exceeded all development proposals must provide evidence to show that any emissions related to energy generation will be equivalent or lower than those of an ultra-low NOx gas boiler)
    e. use low emission combined heat and power (CHP) (in areas where legal air quality limits are exceeded all development proposals must provide evidence to show that any emissions related to energy generation will be equivalent or lower than those of an ultra-low NOx gas boiler)
    f. use ultra-low NOx gas boilers.
21. CHP and ultra-low NOx gas boiler communal or district heating systems should be designed to ensure that there is no significant impact on local air quality.
22. Where a heat network is planned but not yet in existence the development should be designed for connection at a later date.

Policy SI4 Managing heat risk

A. Development proposals should minimise internal heat gain and the impacts of the urban heat island through design, layout, orientation and materials.

B. Major development proposals should demonstrate through an energy strategy how they will reduce the potential for overheating and reliance on air conditioning systems in accordance with the following cooling hierarchy:

23. minimise internal heat generation through energy efficient design
24. reduce the amount of heat entering a building through orientation, shading, albedo, fenestration, insulation and the provision of green roofs and walls
25. manage the heat within the building through exposed internal thermal mass and high ceilings
26. provide passive ventilation
27. provide mechanical ventilation
28. provide active cooling systems.

GLA 2020 Energy Assessment Guidance (April 2020) - Energy assessments requirements

- Report on a site-wide regulated CO_2 emissions and reductions (broken down for domestic and non-domestic elements of the development;
- All major developments (domestic and non-domestic) much achieve zero carbon with at least 35% on-site reduction beyond Part L 2013. Proposals to make up the shortfall must be expressed where required;
- Residential developments must reduce CO_2 emissions by 10% below Part L 2013 of the Building Regulations through energy efficiency measures alone, and by 15% for non-residential applications;
- Passive design measures should demonstrate the risk of overheating has been mitigated;
- Connection to existing or planned district heating networks should be prioritised, and developments should commit to connect to existing or planned district heating networks in the area;
- The number of energy centres should be minimised in favour of a single point of connection to the District Heating Network (DHN);
- Where it is not feasible to connect to the wider network, suitable low carbon and/or renewable heating plant should be investigated for installation within the energy centre;
- Developments should investigate and maximise the installation of renewable technologies on site;
- Provide details of how the building's actual energy performance will be monitored post-construction and report the energy and carbon performance on the GLA's online platform;
- Energy assessments should align with related documents and assessments that are submitted as part of the planning application, such as Whole Life-Cycle Carbon Assessments, Air Quality Assessments, Sustainability Statements. Whole life carbon assessment to include an embodied carbon analysis and operational energy analysis.

Local planning policy.
A local policy review has been undertaken with focus on the key London Borough of Camden (LBC) planning policy documents applicable to the proposed development. The Camden Local Plan represents the key strategy Planning Policy document. Further Camden Planning Guidance (CPG) provide 'material considerations' in planning decisions, however, carry less weight than the Local Plan. The Camden 2025 Vision document and Our Camden Plan, although not policy, have been included to capture the overarching aspirations of the LBC.

The LBC declared a climate and ecological emergency in 2019.

Camden 2025 Vision
Camden 2025 sets out a vision for the future of the borough, where everyone contributes to achieving a safe, fair, creative and active community.

Call to Action One: In 2025 everyone in Camden should have a place they call home.

Call to Action Two: In 2025 Growth in Camden should be strong and inclusive – everyone should be able to access the work that is right for them.

Call to Action Three: In 2025 Camden should be safe, strong and open, and everyone should be able to contribute to their community.

Call to Action Four: In 2025 Camden should be a clean, vibrant and sustainable place.

Call to Action Five: In 2025 Everyone in Camden should be able to live a healthy, independent life.

Our Camden Plan
Our Camden Plan is the council's response to the Camden 2025 vision. This is the council's plan for how it as an organisation will play its part to achieve the ambitions set out in Camden 2025.

Homes and housing: "We will focus on building communities that are mixed, with well-designed homes and infrastructure"

- We will build as many genuinely affordable homes as we can as quickly as we can, and help others (including housing associations and developers) to do so as well. We will build more affordable homes than we have done in a generation
- We will make sure that everyone has a sustainable roof over their head or is on a pathway to achieving this, minimising homelessness and rough sleeping.
- We will strive to make homes in Camden safe, well-managed and well-maintained, and make sure that people's homes meet their needs. We will do everything we can to reduce the number of households living in unsuitable accommodation. We will play an active role in shaping a private rented sector that works.
- We will do all we can to help young people who have grown up here, or who have strong connections to the borough, to gain a foothold in Camden and build their adult lives here.
- We will support people living in our homes to live fulfilling, connected and healthy lives, tackling social isolation and unemployment head on. We will focus our offer around what tenants need and make it easier to get this support, treating everyone as an individual.
- We will focus on building communities that are mixed, with well-designed homes and infrastructure that encourage integration, cohesion and active lifestyles.

Strong growth and access to jobs: "Every child should be able to access the pathway that is right for them, whether academic or vocational. We will recognise the needs of the full range of employees and businesses"

- We will help to make Camden the best place in London to do business and to work, working with the business community to deliver genuinely inclusive growth that benefits everyone.
- We will make sure the council is joined up in a way that businesses can easily engage with us as a single organisation.
- We will help to prepare young people to be successful in their working lives. Every child should be able to access the pathway that is right for them, whether academic or vocational, and every part of the education system should work together on this.
- We will drive forward the recommendations of the STEAM (Science, Technology, Engineering, Arts and Maths) Commission and support young people in Camden to gain the skills they need to access 21st century jobs. We will create the conditions for jobs to grow in the life sciences, digital, data and creative sectors, and ensure clear pathways into these jobs for local people.
- We will focus our efforts on helping those furthest from the labour market into rewarding work.
- We will increase the number of affordable workspaces in the borough, supporting small businesses to gain a foothold here and to grow. We will use all our levers as a planning authority, and through our Community Investment Programme, to deliver high-quality flexible workspaces that can respond to our growth sectors and changing patterns of employment.

Safe, strong and open communities: We will work to build a borough where different communities have opportunities to come together"

- Safeguarding children and adults will continue to be an absolute priority for us as a council
- We will ensure young people are well-prepared for adult life, investing in education and learning from the early years onwards, so that young people have the knowledge, resilience and relationships they need to succeed.
- We will work to protect Camden's family of schools and our shared vision of a collaborative local comprehensive education system.
- We will work to preserve and enhance a culture of lifelong learning.
- We will create a borough that supports people to age well and live independently for as long as possible.
- We will deliver the highest level of safety in our housing stock. Our focus on safety improvement will be taken forward together with tenants and leaseholders.
- We will do everything we can to reduce crime and keep our citizens safe, focusing on crimes that cause the most harm, such as serious youth violence.
- A cohesive and integrated borough is central to the values of Camden as a place. We will work to build a borough where different communities have opportunities to come together and celebrate diversity and shared values.
- We want everyone to have access to Camden's cultural and heritage assets, and to have the opportunity to contribute to and enrich the borough's cultural life.

Clean, vibrant and sustainable places: "We will make sure that public spaces are clean, attractive and safe"

- We will use all the resources at our disposal to play our part in improving air quality, one of London's biggest challenges.
- We will do what we can to reduce carbon emissions in the borough, lowering emissions from our own estate and operations, and working with others to make a powerful alliance for carbon reduction.
- We will decrease the amount of waste produced in the borough by providing the infrastructure, information and incentives for people and businesses to reduce their waste, and recycle as much as possible of the waste they do produce.
- We will make sure that green spaces, streets, housing estates and other public spaces are clean, attractive and safe, and that residents, visitors and businesses are actively involved in contributing to this.
- We will make it easier for people to travel more by foot or by bike.

Healthy, independent lives: "We will focus on intervening early and doing what we can to prevent long-term conditions arising that impact on people's quality of life later on"

- We will put health and wellbeing at the forefront of all that we do. We will promote good health and make it part of how we deliver services. We will create environments across the borough that make it easier to make healthy choices and take part in physical activity, such as walking and cycling.
- We will focus on intervening early and doing what we can to prevent long-term conditions arising that impact on people's quality of life later on. Our focus is on quality of life as well as how long people might live. In this, we will continue to recognise that the early years of life are a critical point where attitudes and behaviours are formed.

LBC Local Plan (2017).

This section includes a review of the LBC Local plan (2017) and LBC Planning Guidance (CPG) – Energy efficiency and adaptation, March 2019.

LBC C2: Community facilities
In summary, Camden's policy and guidance require the following:

The Council will work with its partners to ensure that community facilities and services are developed and modernised to meet the changing needs of our community and reflect new approaches to the delivery of services.

The Council will:

- seek planning obligations to secure new and improved community facilities and services to mitigate the impact of developments
- expect a developer proposing additional floorspace in community use, or a new community facility, to reach agreement with the Council on its continuing maintenance and other future funding requirements
- ensure that facilities provide access to a service on foot and by sustainable modes of travel
- facilitate multi-purpose community facilities and the secure sharing or extended use of facilities that can be accessed by the wider community
- seek the inclusion of measures which address the needs of community groups and foster community integration

LBC C5: Safety and security
The Council will:

- require developments to demonstrate that they have incorporated design principles which contribute to community safety and security, particularly in wards with relatively high levels of crime, such as Holborn and Covent Garden, Camden Town with Primrose Hill and Bloomsbury
- require appropriate security and community safety measures in buildings, spaces and the transport system
- promote safer streets and public areas
- promote the development of pedestrian friendly spaces

LBC C6: Access for all
The Council will:

- expect all buildings and places to meet the highest practicable standards of accessible and inclusive design so they can be used safely, easily and with dignity by all
- expect facilities to be located in the most accessible parts of the borough
- expect spaces, routes and facilities between buildings to be designed to be fully accessible
- encourage accessible public transport
- secure car parking for disabled people.

LBC A3: Biodiversity
The Council will:

- grant permission for development unless it would directly or indirectly result in the loss or harm to a designated nature conservation site or adversely affect the status or population of priority habitats and species
- seek the protection of other features with nature conservation value, including gardens, wherever possible
- assess developments against their ability to realise benefits for biodiversity through the layout, design and materials used in the built structure and landscaping elements of a proposed development, proportionate to the scale of development proposed

LBC D1: Design
The Council will require that development:

- respects local context and character
- preserves or enhances the historic environment and heritage assets in accordance with Policy D2 Heritage
- is sustainable in design and construction, incorporating best practice in resource management and climate change mitigation and adaptation
- is of sustainable and durable construction and adaptable to different activities and land uses.

LBC CC1 and CPG: Site-wide total carbon emission reductions and renewable energy technologies
In summary, Camden's policy and guidance require the following:

1. Follow the Energy Hierarchy (Be Lean – Be Clean – Be Green) and be as energy efficient as is feasible and viable.

2. New residential development to demonstrate a 19% CO2 reduction below Part L 2013 Building Regulations (in addition to requirements for renewable energy).

LBC CC1 and CPG: Passive design & energy efficiency
In summary, Camden's policies and guidance require:

1. Meet or, where possible, exceed Part L 2013 Building Regulations requirements through design and energy efficiency alone.

2. Take into account:

- Passive measures
- Making the most of sunlight
- Making the most of daylight
- Preventing overheating
- Natural system principles
- Thermal performance
- Energy efficient services
- Efficient heating, ventilation and cooling, and other technology

3. The Council expects Energy Statements to include details of enhanced U-value numbers (W/m^2K) for building fabric elements as well as the development's approach to thermal bridging.

4. To ensure that the Council can monitor the effectiveness of renewable and low carbon technologies, major developments will be required to install appropriate monitoring equipment.

LBC CC1 and CPG Energy efficiency and adaptation: Decentralised energy generation
In summary, the policies and guidance require:

1. Assess feasibility of connecting to an existing decentralised energy network, and where not possible, establish a new network. The following hierarchy is to be followed for establishing an energy source:

- Connect immediately to an existing network;
- Connect in immediate future (agreed timescale);
- Site-wide low carbon energy source such as CHP or other low carbon technology. Explore expanding to neighbouring sites.

2. Provide future point of connection to decentralised energy networks.

LBC CC1 and CPG: Low or Zero Carbon technologies
In summary, the policies and guidance require:

1. Developments > 5 dwellings and/ or > 500 sqm to achieve a 20% reduction in CO2 emissions from on-site renewable energy generation after all proposed energy efficiency measures and non-renewable decentralised energy CO2 reduction is applied.

2. In areas of poor air quality, zero emission renewable technologies should be prioritised.

LBC CC1 and CPG: Resource efficiency

1. Optimise resource efficiency by:

- Reducing waste;
- Reducing energy and water use during construction.

2. All proposals for substantial demolition and reconstruction should be fully justified in terms of the optimisation of resources and energy use, in comparison with the existing building.

3. Where demolition cannot be avoided, divert 85% of waste from landfill and comply with the Institute for Civil Engineer's Demolition Protocol and either reuse materials on-site or salvage appropriate materials to enable reuse off-site.

4. Consider specification of materials and construction processes with low embodied carbon content.

LBC CC1 and CPG: Embodied carbon

1. Consider the service life of buildings and their possible future uses to optimise resource efficiency.

2. Match durability and lifespan of the buildings' components to likely service life, and where appropriate the building should be designed to be flexible in terms of adaptation to future alternative uses in order to avoid the need for future demolition.

3. All developments with > five dwellings and/or > 500 sqm gross internal floor space are encouraged to assess embodied carbon emissions. Log results onto the WRAP embodied carbon database to contribute to the embodied carbon knowledge base.

LBC CC2 and CPG: Preventing overheating and designing out cooling

In summary, Camden's policies and guidance require:

1. Incorporate appropriate measures to enable occupants to adapt and cope with climatic changes. Measures include:

- Development is expected to reduce overheating risk through following the steps in the cooling hierarchy. All new development should submit a statement demonstrating how the cooling hierarchy has been followed (Local Plan policy CC2).
- Active cooling (air conditioning) will only be permitted where its need is demonstrated and the steps in the cooling hierarchy are followed (Local Plan policy CC2).
- All developments should seek opportunities to make a positive contribution to green space provision or greening.

LBC CC2 and CC3: Water

In summary, Camden's policies and guidance require developments to:

- incorporate water efficiency measures
- avoid harm to the water environment and improve water quality
- meet BREEAM criteria (see BREEAM section below)

LBC CC2 and CPG: Surface water flooding

In summary, Camden's policies and guidance require:

1. Incorporate appropriate measures to enable occupants to adapt and cope with climatic changes. Measures include:

- consider the impact of development in areas at risk of flooding (including drainage)
- incorporate flood resilient measures in areas prone to flooding
- utilise Sustainable Drainage Systems (SuDS) in line with the drainage hierarchy to achieve a greenfield run-off rate where feasible
- not locate vulnerable development in flood-prone areas

LBC CC4: Air quality

1. The Council will ensure that the impact of development on air quality is mitigated and ensure that exposure to poor air quality is reduced in the borough.

2. The Council will take into account the impact of air quality when assessing development proposals, through the consideration of both the exposure of occupants to air pollution and the effect of the development on air quality. Consideration must be taken to the actions identified in the Council's Air Quality Action Plan.

3. The Council will require air quality assessments where development could potentially cause significant harm to air quality. Mitigation measures will be expected in developments that are located in areas of poor air quality.

4. Development that involves significant demolition, construction or earthworks will also be required to assess the risk of dust and emissions impacts in an AQA and include appropriate mitigation measures to be secured in a Construction Management Plan.

5. Implement Camden's Air Quality Action Plan

LBC CC5: Waste and materials

In summary, Camden's policies and guidance require:

1. Include facilities for the storage and collection of waste and recycling

LBC A4: Noise and vibration

In summary, the policies and guidance require:

1. Planning permission will not be granted for:

- development likely to generate noise pollution
- development sensitive to noise in locations with noise pollution, unless appropriate attenuation measures are provided.
- development that exceeds Camden's Noise and Vibration Thresholds

2. The Council will only grant permission for plant or machinery if it can be operated without cause harm to amenity and does not exceed noise thresholds.

3. The Council will seek to minimise the impact on local amenity from the demolition and construction phases of development. Where these phases are likely to cause harm, conditions and planning obligations may be used to minimise the impact.

LBC D1 and CPG: Green & brown roofs and green walls, and protecting and enhancing biodiversity

In summary, Camden's policies and guidance require:

1. Developers should justify why the provision of a green or brown roof or green wall is not possible or suitable where they are not proposed.

LBC CC2 and CPG: Environmental assessment methods

In summary, Camden's policies and guidance require:

BREEAM:

1. Any area of more than 500 sqm to achieve BREEAM 'Excellent'

2. Achieve a percentage of un-weighted credits in the following categories:

- 60% of Energy credits
- 60% of Water credits
- 40% of Materials credits

3. Home Quality Mark and Passivhaus design standards are strongly encouraged for new build residential developments.

LBC T1: Prioritising walking, cycling and public transport

In order to promote walking in the borough and improve the pedestrian environment, the Council will seek to ensure that developments:

- improve the pedestrian environment by supporting high quality public realm improvement works

- make improvements to the pedestrian environment including the provision of high quality safe road crossings where needed, seating, signage and landscaping
- are easy and safe to walk through ('permeable')
- are adequately lit
- provide high quality footpaths and pavements that are wide enough for the number of people expected to use them. Features should also be included to assist vulnerable road users where appropriate

In order to promote cycling in the borough and ensure a safe and accessible environment for cyclists, the Council will seek to ensure that development:

- provides for and makes contributions towards connected, high quality, convenient and safe cycle routes, in line or exceeding London Cycle Design Standards
- provides for accessible, secure cycle parking facilities exceeding minimum standards outlined within the London Plan
- makes provision for high quality facilities that promote cycle usage including changing rooms, showers, dryers and lockers
- is easy and safe to cycle through ('permeable')

LBC T2: Parking and car-free development

The Council will limit the availability of parking and require all new developments in the borough to be car-free.

The Council will:

- not issue on-street or on-site parking permits in connection with new developments and use legal agreements to ensure that future occupants are aware that they are not entitled to on-street parking permits
- limit on-site parking to:
    i. spaces designated for disabled people where necessary, and/or
    ii. essential operational or servicing needs
- support the redevelopment of existing car parks for alternative uses
- resist the development of boundary treatments and gardens to provide vehicle crossovers and on-site parking

All new residential developments in the borough should be car-free. Parking will only be considered for new non-residential developments where it can be demonstrated that the parking provided is essential to the use or operation of the development. Staff parking is not considered essential and will not be permitted.

Appendix B: Grid decarbonisation.

Historic progress

The carbon factor of the National Grid – the amount of carbon dioxide released per kilowatt hour of electricity produced and distributed – is recognised in current Building Regulations as being 0.519 kgCO2/kWh. However, the national mix of electricity generation methods is progressing towards greener solutions with renewable sources accounting for 29.4% of the electricity generated in the UK in 2017; up from 24.5% in 2016 [3].

As a consequence, the Building Regulations Part L 2013 value of the National Grid carbon factor has been shown to be substantially higher than how the grid is performing in reality. This severely impacts the calculated emissions produced by all heat raising plant which use electricity directly or generate it to offset other emissions. The figure below shows how the mix of generation techniques serving the National Grid, as well as the associated carbon factor, has varied over the past six years – encouragingly, the carbon intensity of the grid has reduced to less than half its value in 2012 [HM Government, "Green Book supplementary guidance: valuation of energy use and greenhouse gas emissions for appraisal", 02 January 2018].

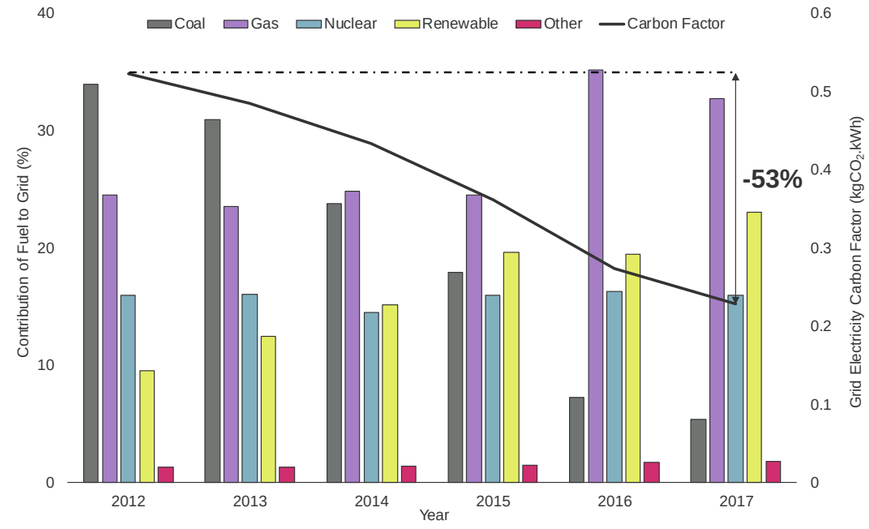


Figure 19: Historic mix of generation methods and associated carbon factor for the National Grid. 8% transmission and distribution losses are included. Sources: *electricityinfo.org* (generation mix); *BEIS Green Book* (historic carbon factors).

Future projections

The Future Energy Scenarios (FES) document, produced by the National Grid, discusses how the UK's energy landscape is changing. In this year's report, FES 2018, the carbon factor of the National Grid is projected to be less than 0.170 $kgCO_2/kWh$ by the end of this year, meaning the actual carbon emissions associated with electricity consumption are much lower than reported in Building Regulations. This means that, under the Part L 2013 methodology the CO_2 emissions associated with electrically-driven plant are being overestimated by over 200%. FES 2018 makes projections of how the mix of generation in the grid is likely to change between now and 2050 – the year by which the Climate Change Act 2008 set the target of reducing the UK's CO_2 emissions by 80% from 1990 levels.

FES discusses these projections in one of four scenarios with the best and worst-case scenarios (from an emissions perspective) being Two Degrees and Steady State respectively. Two Degrees describes a situation where a combination of drastic policy intervention and innovation pushes an ambitious agenda with a focus on long-term environmental goals – it is described as the 'cost optimal pathway to meet the UK's 2050 carbon emissions reduction target'. In contrast, Steady State is a 'business as usual' situation, where society is focussed on the short term and ensuring the security of the UK's energy supply.

The figure below combines these future trajectories with the actual carbon intensity of the National Grid over the past seven years. The reported emissions associated with electricity generation have fallen steeply since 2012 and in all cases, the FES 2018 scenarios see the carbon factor of electricity fall below $100gCO_2/kWh$ by 2035.

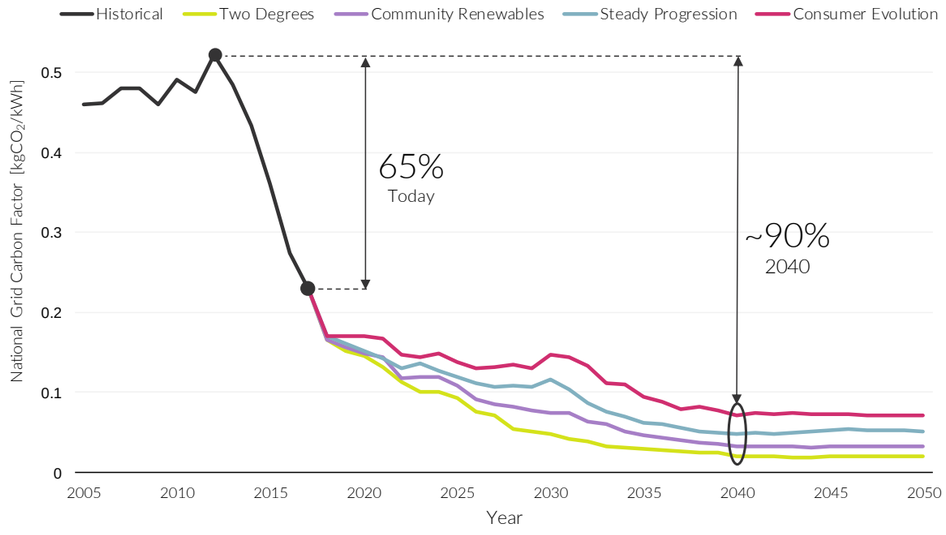


Figure 20: Historic and future projected carbon factor for the National Grid. 8% transmission and distribution losses are included. Sources: BEIS Green Book (historic carbon factors); National Grid Future Energy Scenarios (FES) 2018 (future projected carbon factors).

Consequences for servicing

The carbon emissions associated with the combustion of natural gas are unlikely to change significantly in the coming years, whereas the carbon factor of grid electricity, and consequently the emissions from operating electrical plant, is projected to decrease in all scenarios in the long-term.

As noted however, misrepresentative building regulations mean that even today, electrical plant performs far better from an emissions perspective than calculated using the Part L 2013 methodology. The following graph shows the net annual emissions of four different servicing strategies for a recent large scale, mixed use development. Whilst different in scope and scale to the Proposed development, the impact incorrect carbon factor has on the calculated emissions is obvious. For these reasons, an electrical servicing strategy is beneficial both today, and in the future.

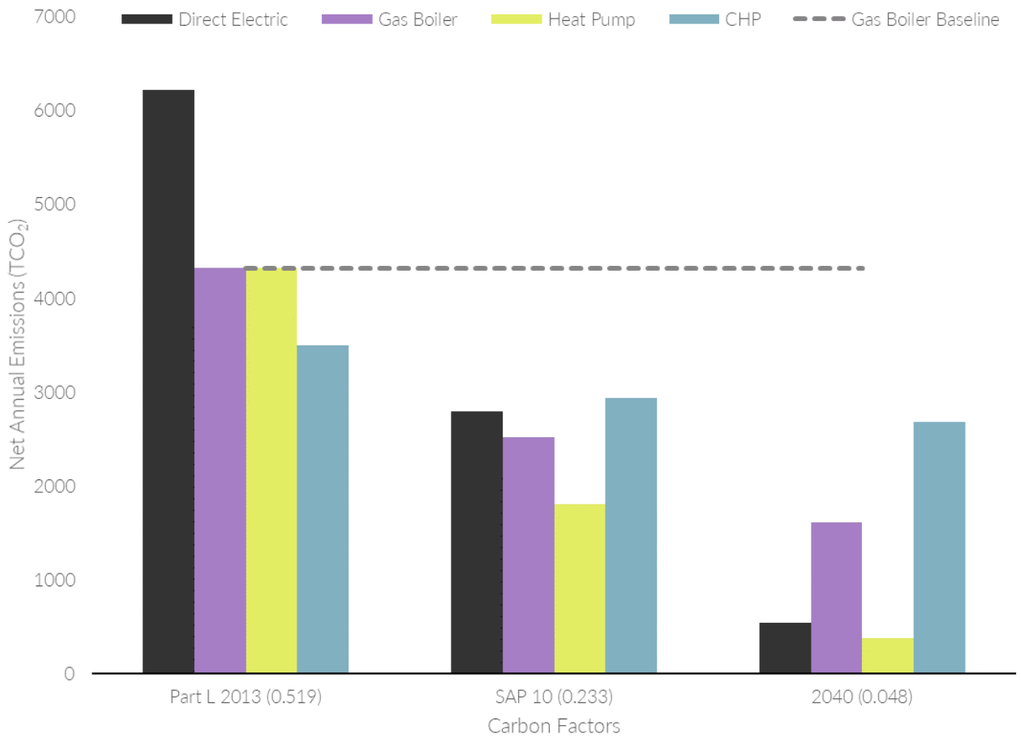


Figure 21: Net annual emissions for a large scale mixed use development for four different heating strategies using both the current Building Regulations Part L 2013 grid carbon factor and the reported performance of the grid in 2016. Source: Future Energy Scenarios 2017.

Shifting focus

As the carbon emissions associated with the generation of electricity continue to reduce, the proportion of the UK's overall greenhouse gas emissions for which the electricity sector is responsible will fall.

The carbon factor of natural gas is likely to remain relatively static. With 85% of homes in the UK relying on gas to supply their heating and hot water, as well as a significant proportion of commercial buildings, heating buildings and industry represents an ever-greater proportion of UK emissions – 32% in 2015 [HM Government, "Clean Growth Strategy," October 2017].

In order for the UK to maintain a trajectory sufficient to meet the 2050 Paris Agreement decarbonisation target of an 80% reduction in annual greenhouse gas emissions over 1990 levels, focus must necessarily shift to other contributors. The BEIS Clean Growth Strategy provides an indication of the direction the UK's energy policy is likely to take and "…sets out [the government's] proposals for decarbonising all sectors of the UK economy through the 2020s." This includes investing in infrastructure and mechanisms to facilitate a transition to low emission vehicles and strengthening the energy performance requirements of new and existing buildings.

Updates to the Standard Assessment Procedure (SAP10)

In July of 2018, the BRE released an update to the Standard Assessment Procedure (SAP) – used to assess dwellings' compliance with Building Regulations – for consultation. The following represents a brief summary of the changes to carbon factors over the current methodology, SAP2012.

Carbon factors

Many of the fuel types recognised in SAP have had their fuel types, carbon factors and primary energy factors amended following the decarbonisation of the grid and other national infrastructure changes. The table below shows the changes in carbon factor from SAP 2012 to SAP 10. It is worth noting the significant improvement for the electricity carbon factor (almost half of that used in 2012).

It is likely that that the next update to Building Regulations Part L will specify the SAP 10 carbon factors associated with natural gas and electricity.

Table 32: Current (SAP2012) and proposed (SAP10) carbon factors for natural gas and grid-supplied electricity.

Fuel	SAP 2012 Carbon Factor ($kgCO_2/kWh$)	SAP 10 Carbon Factor ($kgCO_2/kWh$)
Main Gas	0.216	0.210
Electricity	0.519	0.233

Appendix C: Technical parameters.

Compliance software and procedure
The Proposed Development has been assessed using the National Calculation Methodology for demonstrating compliance with Approved Document Part L.

A dynamic simulation model was created to assess the design for the Proposed Development's non-residential areas. Integrated Environmental Solutions Virtual Environment (IESve) is a Dynamic Simulations Modelling (DSM) software package which has the capabilities of enabling the user to create a virtual representation of a building. the results presented in this report were calculated using the approved compliance software IESve 2019 (v2019.2.0.0).

All modelling used geometry received from Hawkins\Brown (architect) on 5th October 2020.

Calculation parameters

Fabric parameters
Table 33: Target building fabric performance parameters.

Exposed Floor U-value (W/m^2K)	Ground: 0.15 Basement: 0.15
Basement Wall U-value (W/m^2K)	0.12 (Ground contact walls)
External Wall U-value (W/m^2K)	0.18
Roof U-value (W/m^2K)	Upper floors: 0.18 Plant: 0.18 Basement: 0.15
Glazing U-value (W/m^2K)	Windows: 1.30 (g value: 0.36) Curtain Walling: 1.10 (g value: 0.36)
Opaque curtain walling U-value (Inc. frame) (W/m^2K)	0.80
Air Permeability ($m^3/h.m^2$) @ 50Pa	3.00

Glazing to wall ratio
The glazing ratio has been optimised to balance levels of solar gain and daylight levels.

Table 34: Glazing to wall ratio details; per orientation.

Façade	Glazing Percentage
E01	41.1%
E02	67.1%
E03	16.3%
N01	10.9%
N02	31.7%
S01	24.0%
S02	4.7%

Façade	Glazing Percentage
Undercroft North	24.0%
Undercroft South	30.3%
W01	31.1%
W02	20.5%

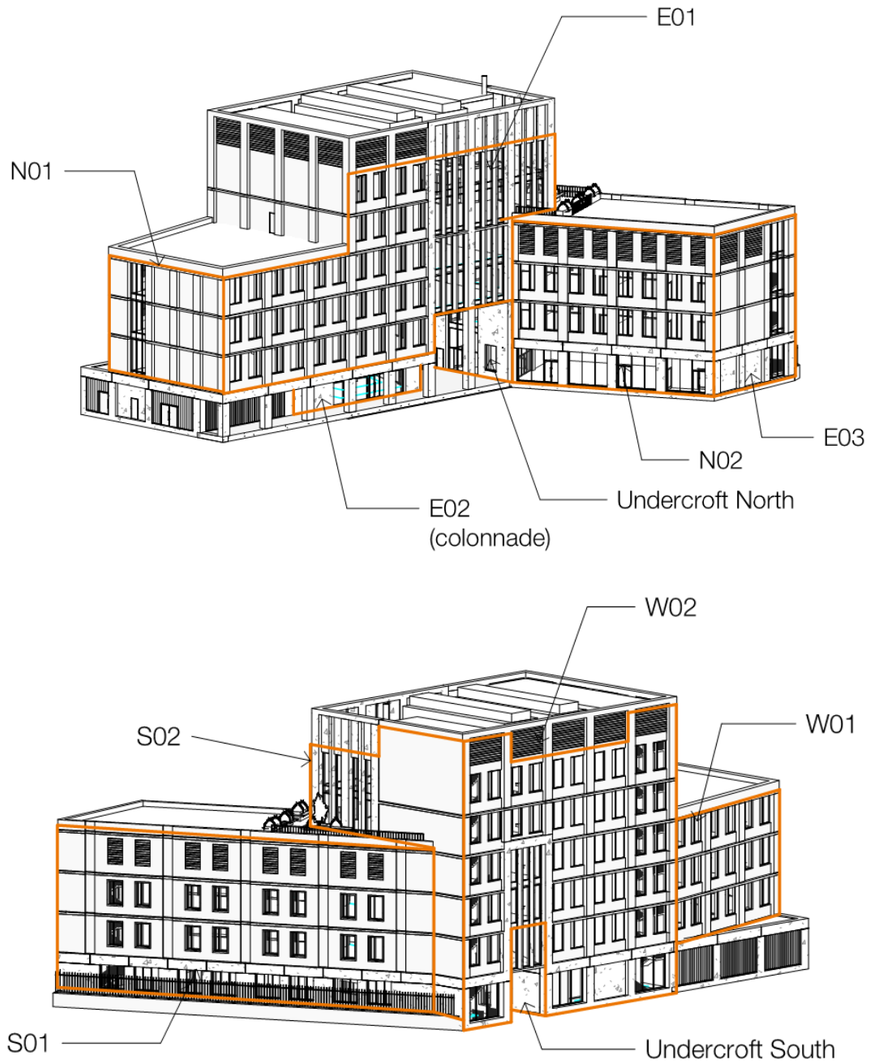


Figure 22: Glazing ratios.

System parameters
Table 35: System parameters per space type.

Heating, cooling and ventilation plant	
Heating plant	Condensing Gas Boiler SCOP: 0.956
Cooling plant	Air-cooled chillers SEER: 5.79
Ventilation	**AHU 01:** SFP 2.0 W/(l/s); HR eff 75% **AHU 02:** SFP 1.8 W/(l/s); HR eff 80% **MVHR 01:** SFP 1.4 W/(l/s); HR eff 80% **MVHR 02:** SFP 1.6 W/(l/s); HR eff 80%
System zones	
Office, Collaborative Spaces & Reception	FCUs (SFP 0.3W/(l/s)) + Mechanical ventilation (AHU 01)
Lecture Theatre	Displaced Ventilation (SFP 0.3W/(l/s)) + Mechanical ventilation (AHU 02) + Demand-controlled ventilation linked to CO_2 sensors
GF - L4 WCs & Kitchenette	LTHW rads + MVHR 01
B1-2 WCs & Showers	LTHW rads + MVHR 02
Circulation	LTHW rads only

Table 36: DHW system parameters.

Domestic Hot Water (DHW) system	
Generator	Condensing Gas Boiler (from main system) SCOP: 0.956 Kitchenettes served by electric POU
Storage	Plate heat exchanger (66% efficient with no storage) Secondary loop length: 664 700 m Secondary circulation losses: 8 W/m Time switch in secondary circulation

Table 37: Lighting input parameters.

Lighting Efficiency	
Luminaire Efficacy	Office: 120 lm/W) Collaborative Space: 110 lm/W Reception: 110 lm/W Lecture Theatre: 110 lm/W WCs: 90 lm/W Showers: 90 lm/W Kitchenette: 100 lm/W Circulation: 100 lm/W Store: 100 lm/W Plant: 90 lm/W

Lighting Efficiency	
Display Lamp efficacy	60 lm/W
Lighting Controls	
Manual on/ Auto off	Office, Collaborative Space & Meeting Room
Auto on/off	Kitchenette, Circulation, WCs & Showers
Manual on/off	Reception, Lecture Theatre, Plant & Stores.
Daylight dimming	All perimeter areas

Appendix D: Indicative roof layout for PV.

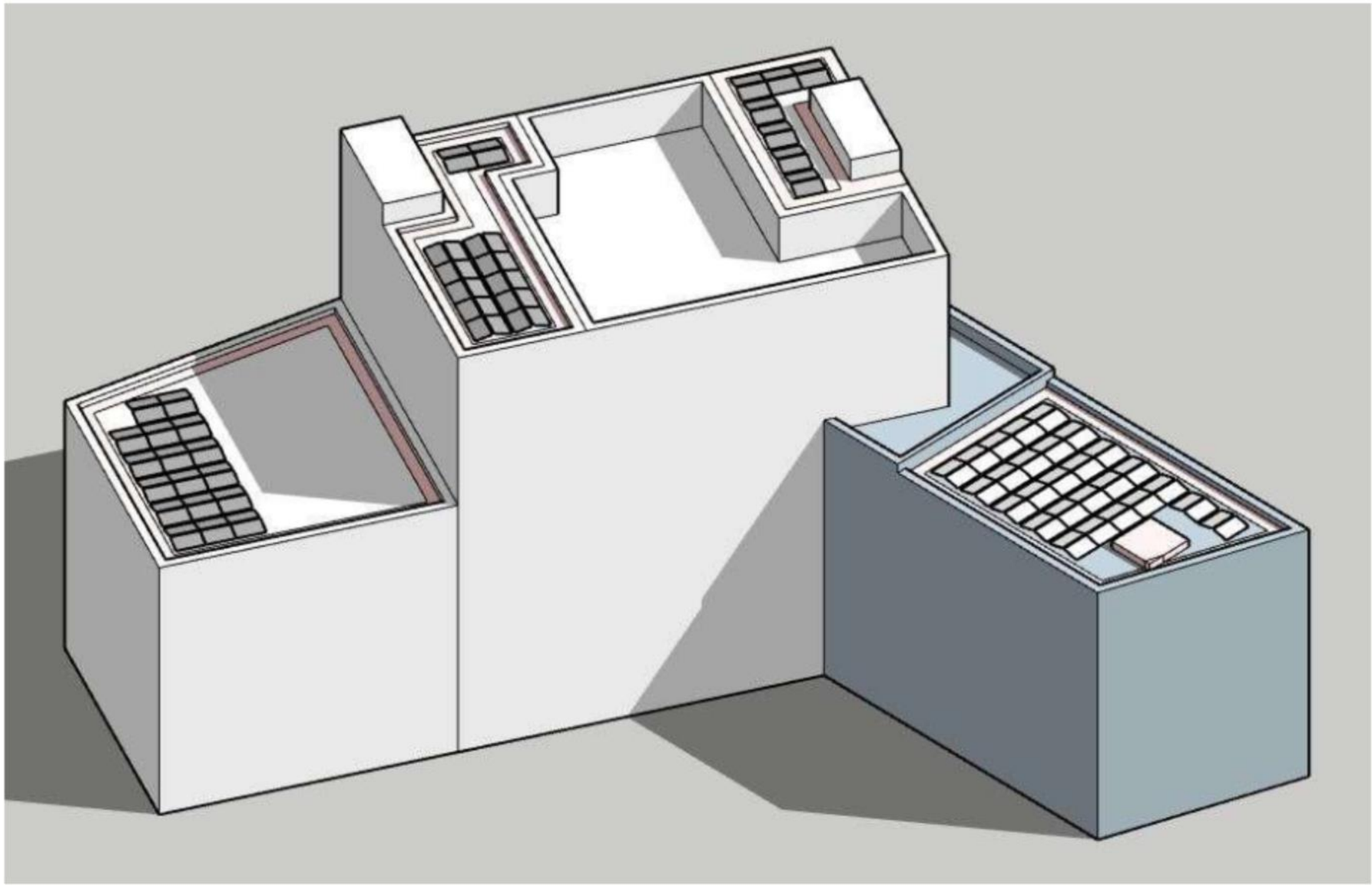


Figure 23: Indicative locations for roof-mounted solar PV panels.

Appendix E: BRUKLs.

A sample of BRUKL: Output Document sheets are provided below. The full set of BRUKL documents are available digitally.

Be Lean BRUKL

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2013

Project name

Plot 3 Be Lean Rev02 — As designed

Date: Mon Nov 02 14:35:53 2020

Administrative information

Building Details
Address: 256 Grays Inn Rd, Great Clarendon St., London, WC1X 8LD

Certification tool
Calculation engine: Apache
Calculation engine version: 7.0.12
Interface to calculation engine: IES Virtual Environment
Interface to calculation engine version: 7.0.12
BRUKL compliance check version: v5.6.a.1

Owner Details
Name: Name
Telephone number: Phone
Address: Street Address, City, Postcode

Certifier details
Name: Name
Telephone number: Phone
Address: Street Address, City, Postcode

Criterion 1: The calculated CO_2 emission rate for the building must not exceed the target

CO_2 emission rate from the notional building, $kgCO_2/m^2.annum$	18.1
Target CO_2 emission rate (TER), $kgCO_2/m^2.annum$	18.1
Building CO_2 emission rate (BER), $kgCO_2/m^2.annum$	14.9
Are emissions from the building less than or equal to the target?	BER =< TER
Are as built details the same as used in the BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and fixed building services should achieve reasonable overall standards of energy efficiency

Values which do not achieve the standards in the Non-Domestic Building Services Compliance Guide and Part L are displayed in red.

Building fabric

Element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Calc}$	Surface where the maximum value occurs*
Wall**	0.35	0.18	0.18	00000001:Surf[0]
Floor	0.25	0.15	0.15	00000007:Surf[0]
Roof	0.25	0.17	0.18	02000010:Surf[0]
Windows***, roof windows, and rooflights	2.2	1.19	1.3	00000005:Surf[0]
Personnel doors	2.2	1.43	1.8	0000000E:Surf[3]
Vehicle access & similar large doors	1.5	-	-	No Vehicle access doors in building
High usage entrance doors	3.5	-	-	No High usage entrance doors in building

$U_{a\text{-}Limit}$ = Limiting area-weighted average U-values [$W/(m^2K)$]
$U_{a\text{-}Calc}$ = Calculated area-weighted average U-values [$W/(m^2K)$]
$U_{i\text{-}Calc}$ = Calculated maximum individual element U-values [$W/(m^2K)$]

* There might be more than one surface where the maximum U-value occurs.
** Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.
*** Display windows and similar glazing are excluded from the U-value check.
N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

Air Permeability	Worst acceptable standard	This building
$m^3/(h.m^2)$ at 50 Pa	10	3

Page 1 of 14

Be Green BRUKL

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2013

Project name

Plot 3 Be Green Rev02 — As designed

Date: Mon Nov 02 15:00:51 2020

Administrative information

Building Details
Address: 256 Grays Inn Rd, Great Clarendon St., London, WC1X 8LD

Certification tool
Calculation engine: Apache
Calculation engine version: 7.0.12
Interface to calculation engine: IES Virtual Environment
Interface to calculation engine version: 7.0.12
BRUKL compliance check version: v5.6.a.1

Owner Details
Name: Name
Telephone number: Phone
Address: Street Address, City, Postcode

Certifier details
Name: Name
Telephone number: Phone
Address: Street Address, City, Postcode

Criterion 1: The calculated CO_2 emission rate for the building must not exceed the target

CO_2 emission rate from the notional building, $kgCO_2/m^2.annum$	18.1
Target CO_2 emission rate (TER), $kgCO_2/m^2.annum$	18.1
Building CO_2 emission rate (BER), $kgCO_2/m^2.annum$	12
Are emissions from the building less than or equal to the target?	BER =< TER
Are as built details the same as used in the BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and fixed building services should achieve reasonable overall standards of energy efficiency

Values which do not achieve the standards in the Non-Domestic Building Services Compliance Guide and Part L are displayed in red.

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Windows***, roof windows, and rooflights	2.2	1.19	1.3	00000005:Surf[0]
Personnel doors	2.2	1.43	1.8	0000000E:Surf[3]
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Air Permeability	Worst acceptable standard	This building
$m^3/(h.m^2)$ at 50 Pa	10	3

Page 1 of 14

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