CCCG Tottenham

ENERGY ASSESSMENT REPORT

February 2024

North Elevation

South Elevation

East Elevation

West Elevation

Introba

10379-IRB-01-XX-T-OS-5101

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1 Executive Summary

1.1 Introduction

This document has been prepared by Introba on behalf of Capital City College Group ('the Applicant') in support of an application for full planning permission for the development of the Tottenham Campus ('the Site') within London Borough of Haringey.

This report sets out how the proposed development will meet the energy aspirations, through energy efficient measures and the integration of renewable energy technology.

1.2 Proposed Energy Strategy

The energy strategy has been developed in line with the London Borough of Haringey Local Plan adopted in January 2017, the London Plan 2021 (March 2021) and associated Energy Assessment Guidance (June 2022).

The proposed development is to be an all-electric non-combustion development, with onsite heat generation and to future proof the development. A series of energy-based targets have been used to drive the design:

- A fabric first approach
- Energy efficient delivery of heating and cooling
- The use of SAP 10.2 carbon emission factors
- Aiming to meet the GLA Be Lean requirements.

Passive design principles, efficient systems, and services have been promoted in the building.

The energy strategy for the proposed development is:

1. A fabric performance improvement over Building Regulations.
2. An Air Source Heat Pump (ASHP) for the building to provide heating and cooling.
3. An Air Source Heat Pump (ASHP) serving the Domestic Hot Water (DHW) for the building.
4. Renewable energy generation from roof mounted photovoltaics.

The calculations for this energy strategy have been carried out using the SAP 10.2 CO_2 emission factors. The site wide results indicate a regulated carbon saving of 4.5 tCO_2/year, which is 36% of the site's regulated carbon emissions of 12.6 tCO_2/year.

1.3 Passive Design Measures

To ensure that the development is inherently low energy use, passive design measures were the initial point of focus. The measures implemented include:

- Efficient fabric to reduce heating demand,
- Enhanced fabric airtightness to reduce infiltration heat losses.
- Appropriate glazing ratios to limit the excess of solar gains.

1.4 Carbon Emissions and Savings

The calculated carbon emissions and regulated savings at each stage for the proposed development (referred to as 'site-wide' in this report) are outlined in the table and figure below:

Table 1.1: Carbon Emissions after each stage of the energy hierarchy for the site.

	Total Regulated emissions (tCO_2/year)	CO_2 savings (tCO_2/year)	Percentage Savings (%) under Part L 2021
Baseline	12.6	-	-
Be Lean	12.2	0.4	3 %
Be Clean	12.2	0.0	0 %
Be Green	8.1	4.1	33 %
Total	-	**4.5**	**36%**

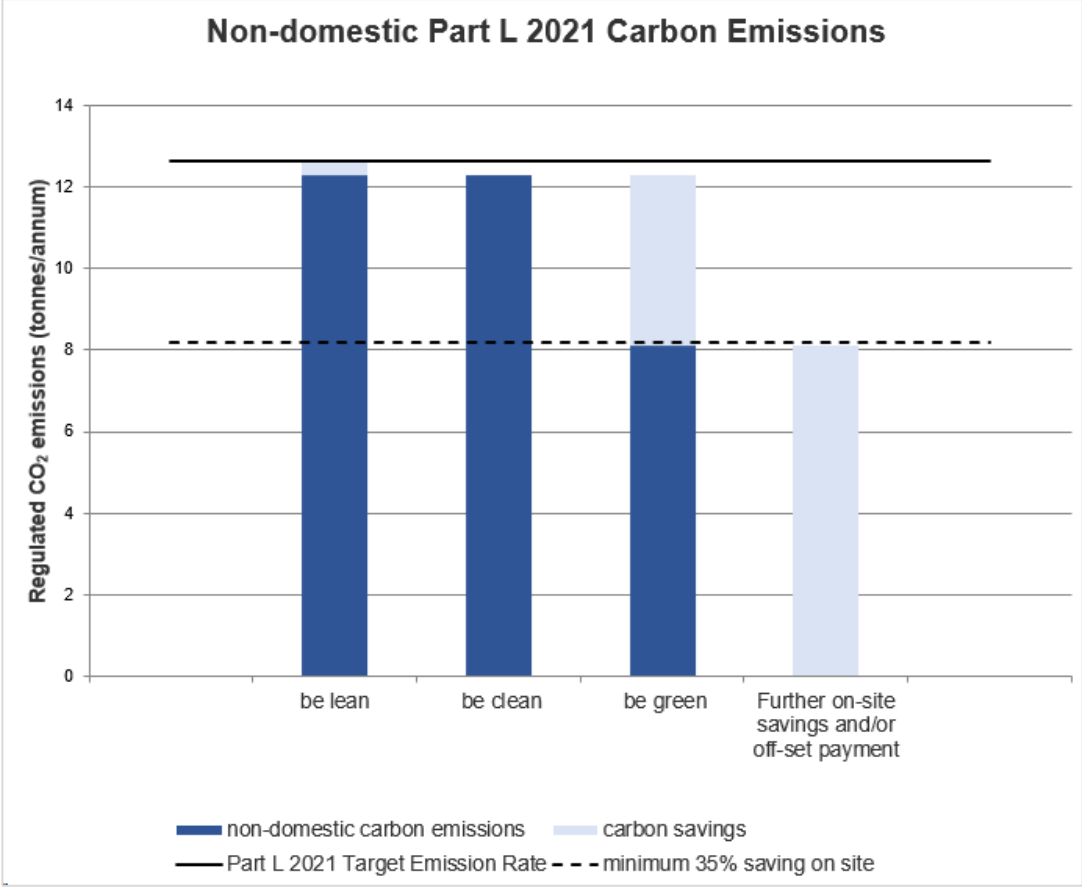


Figure 1.1: Non-Domestic Part L 2021 Carbon Emissions

To truly achieve net zero-carbon buildings and bridge the gap between design theory and measured reality, the New London Plan (policy SI2) has proposed an additional stage of the energy hierarchy: 'Be Seen'. This stage will require the calculation of the actual operational energy performance of major development during planning stage, as-built stage, and in-use stage. The operational energy will be monitored and verified and reported via the Mayor's 'be seen' monitoring portal for at least five years.

1.5 Cash-in-lieu

London Borough of Haringey has declared a Climate Emergency with the ambition to reach carbon neutrality by 2030 and will review their plan to meet this target. Therefore, they require all developments to be net zero carbon, through a combination of on-site measures and cash-in-lieu payments.

In order to achieve 100% carbon emissions reduction an overall cash-in-lieu contribution should be paid to the council based on a cost of £95 per tCO_2 for 30 years.

The following table presents the cash-in-lieu contributions related to the annual shortfall (TonnesCO_2) of the site.

Table 1.2: Cash-in-lieu contributions for the site as calculated in the GLA spreadsheet.

The Site	Non-domestic areas
Total Carbon Dioxide Emissions for the Site - Baseline (Tonnes CO_2 per annum)	12.6
Total Cumulative Savings – Be Lean and Be Green (Tonnes CO_2 per annum)	4.5
Annual CO_2 for Off-set payment (Tonnes CO_2 per annum)	8.1
Total Cumulative Savings for off-set payment (Tonnes CO_2)	244
Cash in-lieu contribution (£)	**23,146**

**Assuming £95 per tonnes CO_2 in line with the 'Carbon Offset Funds' (2018), p.6*

1.6 Primary Energy Rate

Primary energy is defined by the BRE as "*energy renewable and non-renewable sources which has not undergone any conversion of transformation process*". The Target Primary Energy Rate (**TPER**) is reported in $kWh_{PE}/m^2/yr$ and is the maximum allowable primary energy usage by development. Compliance is achieved by showing that the Building Primary Energy Rate (**BPER**) is equal to or lower than the Target Primary Energy Rate (TPER). The following table shows the TPER and BPER results of the buildings in the proposed development.

Table 1.3: Target and Building Primary Energy Rates of the different buildings in the proposed development.

Spaces	Target Primary Energy rate (TPER) ($kWh/m^2/yr$)	Building Primary Energy rate (BPER) ($kWh/m^2/yr$)	BPER ≤ TPER?
CCCG Tottenham	58.67	37.06	YES

1.7 BREEAM

The proposed site is assessed under BREEAM New Construction (NC) version 6 2022. The following credits have been tested and the analysis and results can be review in the report with the file name '10379-IRB-01-XX-T-OS-5103'.

1. **BREEAM NC ENE01**
    a. CCCG Tottenham: **8 credits** awarded.
2. **BREEAM NC ENE04**
    a. CCCG Tottenham: **2 credits** awarded.
3. **BREEAM NC HEA01**
    a. CCCG Tottenham: **0 credits** awarded.
4. **BREEAM NC HEA04**
    a. CCCG Tottenham: **2 credits** awarded.

*****Disclaimer**: The results are based on simulations of energy consumption and do not determine the measured consumption, emissions, or costs of the proposed design after construction. Measured results will differ from these calculations due to variations such as occupancy, building operation and maintenance, weather, unregulated energy, changes in carbon intensity of the electricity grid and precision of the calculation tool.*

2 Introduction

The document has been prepared by Introba on behalf of Capital City College Group (the Applicant) in support of an application for full planning permission for the development of Tottenham Campus (the Site) within London Borough of Haringey.

2.1 Site Description

The proposed site is a new Construction and Engineering Centre within the existing Tottenham Campus located in the London Borough of Haringey.

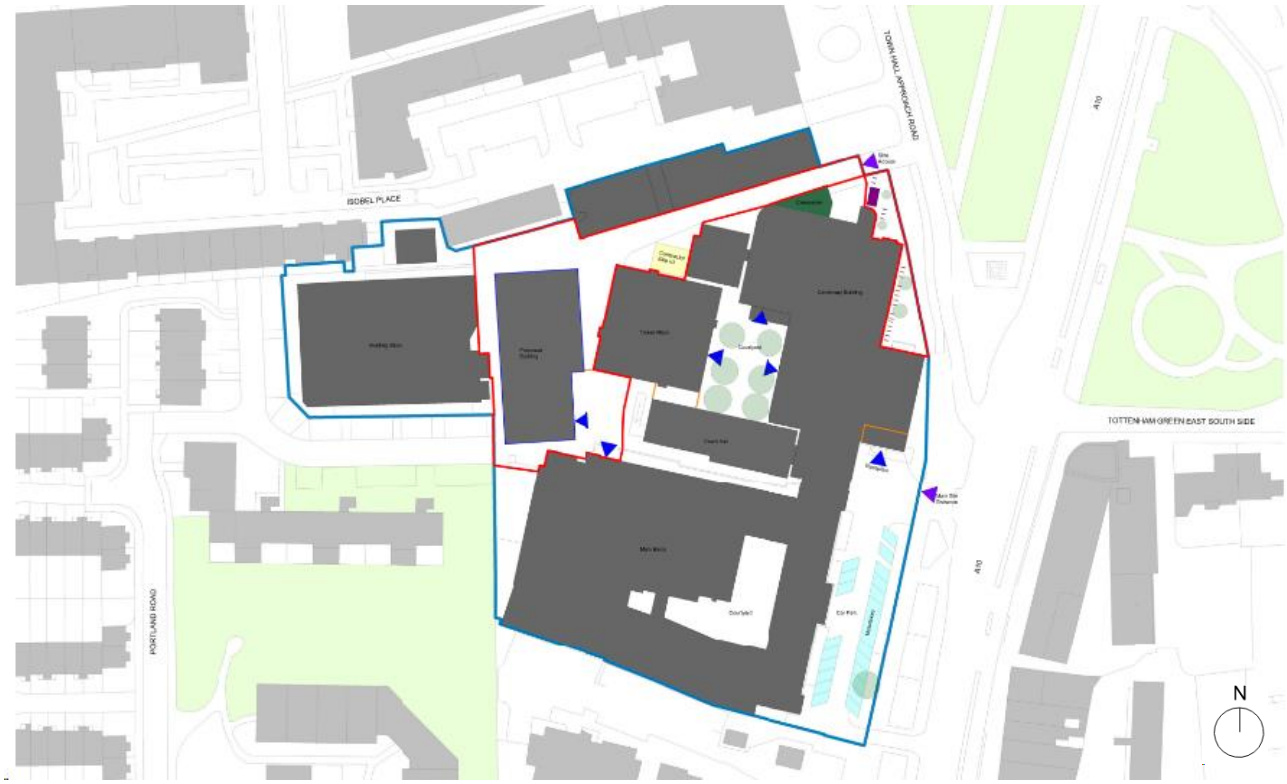


Figure 2.1: Campus Masterplan View taken by QRP Presentation 01.02.24.

The plan is the "demolition of existing gym/lecture theatre block and erection of a new Construction and Engineering Centre extending to 2,625 m2 over five storeys including plant". The project advocates for an all-electric energy strategy, and it is intended to meet the local policy requirement of at least BREEAM 'very good,' with an aspiration to attain BREEAM 'excellent' if feasible.

2.2 Legislative and Policy Requirements

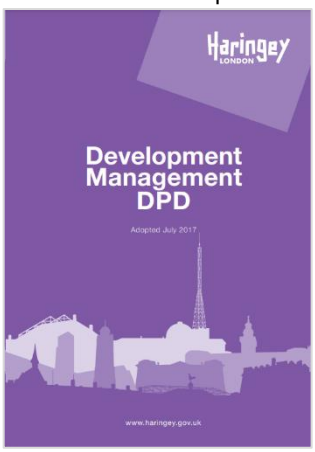
The proposed development was assessed in accordance with the following legislations and policies during RIBA Stage 2, the key aspects of which are then described further below:

1. The Local Plan – Development Management DPD (July 2017)
2. The London Plan (March 2021)
3. Mayor of London's Energy Assessment Guidance (June 2022)
4. Climate Change Act 2008 (2008)
5. National Planning Policy Framework (2023)
6. Building Regulations

2.2.1 Local Policy Drivers

2.2.1.1Local Plan – Development Management DPD, July 2017

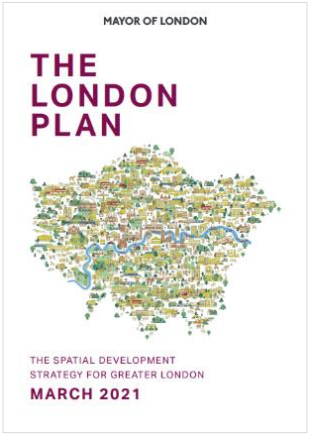
All new development, including building and landscape works, will be expected to consider and implement sustainable design, layout, and construction techniques. Proposals should:



a) Apply the energy hierarchy to minimise energy use in order to meet, and if possible exceed, minimum carbon dioxide reduction requirements;
b) Apply cooling hierarchy to reduce the potential for overheating and limit reliance on mechanical air conditioning systems.
c) Maximise opportunities to enhance biodiversity on-site, including through appropriate landscaping, Sustainable Drainage Systems, living roofs and green walls.
d) Wherever possible, use building materials with high environmental performance ratings; and
e) Seek opportunities for locally sourced labour.

2.2.2 Regional Policy Drivers

2.2.2.1The London Plan (2021)



<u>Policy GG6: Increasing efficiency and resilience</u>

To help London become a more efficient and resilient city, those involved in planning and development must:

A. Seek to improve energy efficiency and support the move towards a low carbon circular economy, contributing towards London becoming a zero-carbon city by 2050.

<u>Policy SI1: Improving air quality.</u>

A. Development plans should seek opportunities to identify and deliver further improvements to air quality and should not reduce air quality benefits that result from the Mayor's or boroughs' activities to improve air quality.
B. Describes what development proposals should not do, in order to 'tackle poor air quality, protect health and meet legal obligations….'
C. 'Masterplans and development briefs for large-scale development proposals subject to an Environmental Impact Assessment should consider how local air quality can be improved…'
D. In order to reduce the impact on air quality during construction and demolition phase development proposals must demonstrate how they plan to comply with the non-road mobile machinery low emission zone to reduce emissions from the demolition and construction of buildings following best practice guidance.
E. 'Development proposals should ensure that where emissions need to be reduced to meet the requirements of Air Quality Neutral or to make the impact of development on local air quality acceptable, this is done on site.' It also describes when off-site measures may be appropriate.

<u>Policy SI2: Minimising greenhouse gas emissions</u>

A. Major developments should be net zero-carbon. This means reducing greenhouse emissions in operation and minimising both annual and peak energy demand in accordance with the following energy hierarchy:

1. **Be Lean**: use less energy and manage demand during operation.
2. **Be Clean**: exploit local energy resources and supply energy efficiently and cleanly.
3. **Be Green**: maximise opportunities for renewable energy by producing, storing, and using renewable energy on-site.
4. Be Seen: monitor, verify and report on energy performance.

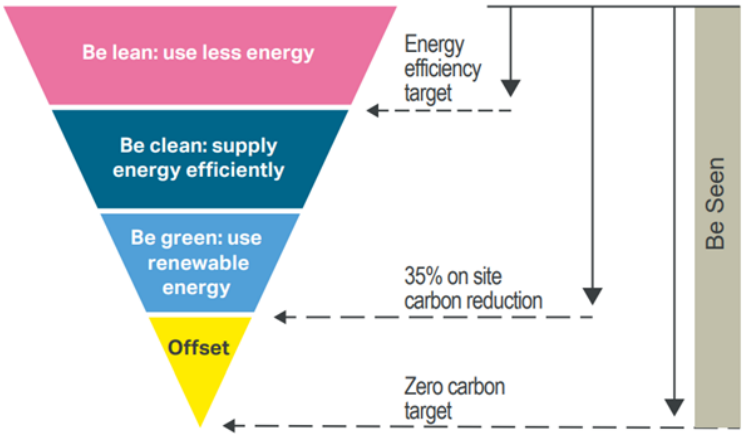


Figure 2.2: The Energy Hierarchy and associated targets (The London Plan 2021)

B. Major development proposals should include a detailed energy strategy to demonstrate how the zero-carbon target will be met within the framework of the energy hierarchy.
C. A minimum on-site reduction of at least 35 per cent beyond Building Regulations is required for major developments. Residential development should achieve 10 per cent, and non-residential development should 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.
D. Boroughs must establish and administer a carbon offset fund.
E. Major development proposals should calculate and minimise carbon emissions from any other part of the development, including plant or equipment that are not covered by Building Regulations, i.e. unregulated emissions.
F. Development proposals referable to the Mayor should calculate whole life-carbon emissions through a nationally recognised Whole Life-Cycle Carbon Assessment and demonstrate actions taken to reduce life-cycle carbon emissions.

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 and infrastructure requirements arising from large-scale development proposals such as Opportunity Areas, Town Centres, other growth areas or clusters of significant new developments.
B. Energy masterplans should be developed for large-scale development locations which establish the most effective energy supply options. The requirements for such masterplans are set out.
C. Development plans should:
    1. Identify the need for any energy infrastructure requirements including energy centres, energy storage and upgrades to existing infrastructure.
    2. Identify existing heating and cooling networks, identify proposed locations for future heating and cooling networks and identifying opportunities for expanding and inter-connecting existing networks as well as establishing new networks.
D. Major developments proposals within Heat Network Priority Areas should have a communal low-temperature heating system:
    1. The heat source for the communal heating system should be selected in accordance with the following heating hierarchy:
        i. Connect to local existing or planned heat networks
        ii. Use zero-emission or local secondary heat sources (in conjunction with heat pumps, if required)
        iii. Use low-emission combined heat and power (CHP) (only where there is a case for CHP to enable the delivery of an area-wide heat network, meet the development's electricity demand and provide demand response to the local electricity network)
        iv. Use ultra-low NOx gas boiler

2. CHP and ultra-low NOx gas boiler communal or district heating systems should be designed to ensure that they meet the requirements in Part B of 'Policy SI 1 Improving air quality'.
3. Where a heat network is planned but not yet in existence the development should be designed to allow for the cost-effective connection at a later date.

E. Heat networks should achieve good practice design and specification standards for primary, secondary and tertiary systems comparable to those set out in the CIBSE/ADE Code of Practice CP1 or equivalent.

Policy SI4: Managing heat risk

A. Development proposals should minimise adverse impacts on the urban heat island through design, layout, orientation, materials, and the incorporation of green infrastructure.
B. Major development proposals should demonstrate through an energy strategy how they will reduce the potential for internal overheating and reliance on air conditioning systems in accordance with the following cooling hierarchy:
    a. Reduce the amount of heat entering a building through orientation, shading, high albedo materials, fenestration, insulation, and the provision of green infrastructure.
    b. Minimise internal heat generation through energy efficient design
    c. Manage the heat within the building through exposed internal thermal mass and high ceilings
    d. Provide passive ventilation
    e. Provide mechanical ventilation
    f. Provide active cooling systems

2.2.2.2The Mayor of London's Energy Assessment Guidance (June 2022)

This document sets out the purpose, structure and content of energy assessments. This must include those matters set out in para 1.7 of the guidance. Major developments are required to achieve net zero-carbon by following the energy hierarchy (The London Plan, Policy SI 2). This means that regulated carbon emissions should be reduced so they are as close as possible to zero. Once on-site reductions have been maximised, the residual emissions should be offset via a payment into the relevant borough's carbon offset fund.

Major developments are required to achieve a minimum 35 per cent on-site carbon reduction over Part L 2021. Residential developments are expected to be able to exceed this, and so an additional benchmark has been set that residential developments should be aiming to achieve over 50 per cent.

2.2.3 National Legislative and Policy Drivers

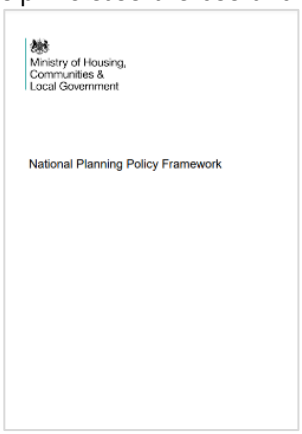
2.2.3.1 Climate Change Act 2008

The Climate Change Act (2008) (as amended) sets a legally binding target to reduce UK carbon emissions by 100% by 2050, against a 1990 baseline. The Committee on Climate Change advises the Government on the setting of binding 5-year carbon budgets on a pathway to achieving the 2050 target. The first six carbon budgets covering the period up to 2037 have been set in law. The current budget requires a 29% emissions reduction by 2017, while future budgets require reductions of 35% by 2020 and 50% by 2025.

The Act is the driver behind a framework of national strategy and policy documents such as the UK Low Carbon Transition Plan (2009) and previously anticipated zero carbon homes policy. These in turn have informed the development of local planning policy and updates to the Building Regulations.

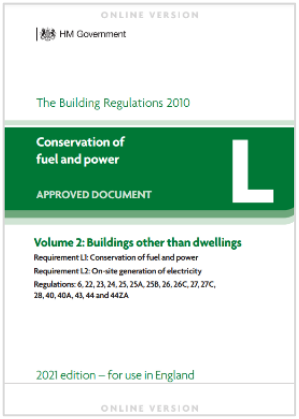
2.2.3.2National Planning Policy Framework (NPPF), 2023

The NPPF requires that plans take a proactive approach to mitigating and adapting to climate change considering, among others, the risk of overheating from rising temperatures. To help increase the use and supply of renewable and low carbon energy and heat, plans should:



a) Provide a positive strategy for energy from these sources, that maximises the potential for suitable development, while ensuring that adverse impacts are addressed satisfactorily (including cumulative landscape and visual impacts);
b) Consider identifying suitable areas for renewable and low carbon energy sources, and supporting infrastructure, where this would help secure their development; and
c) Identify opportunities for the development to draw its energy supply from decentralised, renewable or low carbon energy supply systems and for co-locating potential heat customers and suppliers.

2.3 Building Regulations Part L 2021 and SAP10.2



Part L of the Building Regulations in England sets standards for the energy performance of new and existing buildings; the current version is Part L 2021.

As of June 2022, the latest Part L Building Regulations was published which includes two main criteria, carbon emission and primary energy. The carbon emission criteria are in line with SAP10.2 as published by the BRE. The key changes are the further adjustment of the carbon factors of electricity and (to a lesser extent) natural gas, as shown in the table below, along with the newly introduced primary energy factors.

Table 2.1: Part L 2021 carbon emission and primary energy factors

	Emission Factor $kgCO_2$ /kWh	**Primary Energy Factor kWh_{PE}/kWh**
Grid Electricity ($kgCO_2$/kWh)	0.136	1.501
Natural Gas ($kgCO_2$/kWh)	0.210	1.126

3 Baseline

This section lists the inputs and assumptions made in order to create the baseline energy model, against which the Site will be assessed in order to calculate the CO_2 savings.

3.1 Methodology

The proposed development consists of 4 storeys building comprising workshops, classrooms, and laboratories. The baseline for the new buildings was calculated from the notional results of the compliance assessment, the Target Emission Rate (TER).

A carbon emission reporting spreadsheet, introduced by the GLA and revised in January 2023, was used to calculate the building carbon emissions utilizing SAP 10.2 carbon factors.

The VE compliance module of IES Virtual Environment version 2023 was used to model the entire building. Unregulated emissions from electricity use were estimated from the BRUKL output sheet, using the equipment load prediction.

3.2 Inputs and assumptions

The table below highlights the Part L for non-domestic notional values, used for the baseline.

Table 3.1: Building Fabric inputs for the non-domestic baseline models (notional values).

Elements		Non-domestic areas Notional Part L
Opaque Elements	External Wall U-Value (W/m^2.K)	0.26
	Ground Floor (W/m^2.K)	0.18
	Internal Walls U-Value (W/m^2.K)	1.80
	Internal Walls U-Value – Chilled Storage (W/m^2.K)	1.80
	Internal Ceiling/Floor (W/m^2.K)	1.0
	Internal Ceiling/Floor – Chilled Storage (W/m^2.K)	1.0
	Flat Roof U-Value (W/m^2.K)	0.18
	External Door U-Value (W/m^2.K)	1.90
Glazing Elements	Frame factor	10%
	Window / Glazed Door U-Value (W/m^2.K)	1.40
	Glazing G-Value	0.29
	Rooflight U-Value (W/m^2.K)	2.1
	Rooflight G-Value	0.40
	Glazing light transmittance	60%
Air-Leakage	Air-Permeability (m^3/hr.m^2)	3

The building services assumed for the baseline model are listed in the table below.

Table 3.2: Building systems for the non-domestic baseline model (notional values).

		Non-domestic areas (Notional)
Ventilation	Ventilation	AHU with Heat Recovery (MVHR) unit
	Specific Fan Power (SFP)	1.8 W/l/s
	Terminal FCU SFP	0.30 W/l/s
	Heat Recovery	76%
Heating	Heating System	ASHP
	Emitter	Fan-coil
	Seasonal Efficiency	264%
	Delivery Efficiency	10% included in efficiency
Cooling	Cooling System	ASHP
	Cooling Efficiency (EER)	4.5
	Delivery Efficiency	included in efficiency
DHW	DHW type	ASHP
	DHW Efficiency	286%
	Distribution Efficiency for DHW system	10% included in efficiency
	Description	n/a
Lighting	Lighting efficacy	115 lm/cw
	Daylight areas - Dimming	Photo-electric dimming
	Daylight areas - Sensor controls	No back sensors
	Occupancy sensing	Manual on – Auto off

3.3 Carbon Emissions

The regulated and unregulated carbon emissions for the baseline of the proposed development were calculated using SAP 10.2 carbon factors, as shown in the table below.

Table 3.3: Baseline Carbon emissions using SAP10.2 carbon factors.

Carbon dioxide emissions (tonnes CO_2 per annum)	**Regulated**	**Unregulated**
Baseline *– CCCG Tottenham*	**12.6**	**11.3**

4 Be Lean

The first stage in reducing CO_2 emissions is to decrease the energy required to service the building, through the implementation of passive design and energy efficient measures. This can be achieved in different ways, such as improving the thermal performance of the building fabric, providing energy efficient plant, providing adequate control of building services systems and lighting systems, and through providing training to building users to enable them to utilise the buildings efficiently.

4.1 Passive Measures

To ensure that the development is inherently low in energy use, passive design measures were the initial point of focus. Efficient fabric and envelope, enhanced fabric airtightness to reduce heating demand and infiltration heat losses, with appropriate glazing ratios to any new elements were implemented as part of the passive design strategy.

4.2 U-value inputs

The full fabric specification used when modelling the savings from energy efficiency, under the 'Be Lean' stage, is listed in the table below.

Table 4.1: U-Value specification of proposed building under the Be Lean stage.

	Elements	Non-Domestic Spaces
Opaque Elements	External Wall U-Value (W/m^2.K)	0.15
	Ground Floor (W/m^2.K)	0.12
	Internal Walls U-Value (W/m^2.K)	1.80
	Internal Ceiling/Floor (W/m^2.K)	0.12
	Flat Roof U-Value (W/m^2.K)	0.12
	External Door U-Value (W/m^2.K)	1.0
Glazing Elements	Window / Glazed Door U-Value (W/m^2.K)	1.0
	Frame factor	15%
	Glazing G-Value	0.40
	Glazing light transmittance	70%
Air-Leakage	Air-Permeability (m^3/hr.m^2)@50Pa	1

4.3 Building services systems

The full building systems specification of each room of the building used when modelling the savings from energy efficiency under the 'Be Lean' stage is listed in the table below.

Table 4.2: Building services systems for the Be Lean stage.

		Student Social Building
Ventilation	Ventilation	Air Handling Unit + VAV System
	Specific Fan Power (SFP)	1.2

	Heat Recovery	80%	
Heating	Heating System	ASHP	
	Emitter	Duct Reheat Coils (Workshops and classrooms)	Fan Coils (ICTs)
	Seasonal Efficiency	264%	264%
	Delivery Efficiency	included in efficiency	
Cooling	Cooling System	ASHP	
	Cooling Efficiency (EER)	4.5	
	Delivery Efficiency	included in efficiency	
DHW	DHW type	ASHP	
	DHW Efficiency	286%	
	Distribution Efficiency for DHW system	included in efficiency	
Lighting	Lighting efficacy	115 lm/cw	
	Daylight areas - Dimming	None	
	Daylight areas - Sensor controls	No back sensors	
	Occupancy Sensing	Circulation, Changing, Toilet – Auto ON OFF Office, Plant Rooms – Man ON Auto OFF	

*Non-Domestic EPC Convention 6.13[1] states that where a room (zone) is without any form of fixed conditioning equipment, but at least 50% of the surrounding envelope area including party walls, party floors and party ceilings is adjacent to directly conditioned space, (or for party envelopes is assumed to be adjacent to conditioned space), then it will be assumed to be indirectly conditioned. The zone will be assigned the same HVAC as the adjacent spaces, or the larger proportion of adjacent spaces unless there is significant air transfer with a specific adjacent zone, for example through a frequently used doorway.

4.4 Carbon emissions

The regulated and unregulated carbon emissions for the 'Be Lean' stage of the proposed development, including energy efficient measures described above, are listed in the tables below.

The site wide regulated carbon emissions for the 'Be Lean' stage is calculated to be 12.2 tCO_2/year, which represents a saving of 0.4 tCO_2/year, or 3%, as shown in the tables below.

Table 4.3: Carbon emissions after demand reduction for the proposed development (site-wide) under the Be Lean stage.

Carbon dioxide emissions (tonnes CO_2 per annum)	**Regulated**	**Unregulated**
Baseline	12.6	11.3
After energy demand reduciton	12.2	11.3

Table 4.4: Regulated CO_2 savings from energy efficiency for the proposed development (site-wide) under the Be Lean stage.

Regulated carbon dioxide savings	**(Tonnes CO_2 per annum)**	**(%)**
Savings from energy demand reduction	0.4	3 %

[1] Non Domestic EPC Conventions for England & Wales Issue 8

5 Overheating

This section highlights the risk of overheating for the Site, in accordance with the cooling hierarchy and guidance in preparing energy assessments.

5.1 Risk of overheating

The development has mixed mode ventilation for most of the rooms for which a CIBSE TM52 overheating analysis has been carried out as part of the BREEAM HEA04 Thermal Comfort credit. The analysis can be found in the BREEAM credits report under the file name 10379-IRB-01-XX-T-OS-5103.

The following paragraph indicates how the GLA's cooling hierarchy has been followed.

5.2 Cooling demand for non-domestic spaces

In order to minimise cooling loads and reduce solar gains (to meet Criterion 3 of Part L2A of the Building Regulations), the Cooling Hierarchy including passive measures has been considered including the following measures:

- efficient lighting and dimming where possible to reduce internal gains.
- high solar control glazing with a solar transmittance of 0.40 to reduce solar gains.
- low glazing ratio
- shading from existing buildings on site
- mechanical ventilation to reduce the cooling demand.

Once cooling loads have been minimised through the cooling hierarchy, it was apparent that certain areas required cooling. These areas included the ICT rooms and the two Laboratories that have an active cooling strategy provided by Air Source Heat Pump (ASHP) and have been added to the building to satisfy the internal comfort requirements. The following table shows the cooling demand calculation between the actual and notional building as required in section 8.22 (*Table 7*) of the GLA Energy Assessment Guidance (June 2022):

Table 5.1: Notional and Actual average building cooling demand.

	Building cooling demand (area weighted) (MJ/m²)		**Building cooling demand (area weighted) (MJ/Year)**	
	Actual	**Notional**	**Actual**	**Notional**
VAV System	60.2	28.3	65,309.6	30,702.0
Fan Coil System	105.4	78.9	39,321.0	29,434.8
Split or multi-split (server rooms)	1073.8	804	31,169.1	23,337.7
Total	**1239.4**	**911.2**	**135,799.7**	**83,474.5**

6 Be Clean

The London Plan and the Local Plan expect proposed developments to investigate any possible carbon savings achieved through decentralised energy networks. This section investigates any possibilities and options.

6.1 Decentralised heat networks

Local Plan and the London Plan expect developers to consider carbon savings achievable through decentralised energy networks, and include the following options:

1. Connection to existing heating and cooling networks
2. Site-wide CHP networks
3. Communal heating and cooling

Policy SI3 of the London Plan (2021) confirms that major development proposals within Heat Network Priority Areas should have a communal heating system. 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 zero-emission or local secondary heat sources (in conjunction with heat pump, if required)
c. Use low emission combined heat and power (CHP) (only where there is a case for CHP to enable the delivery of an area-wide heat network, meet the development's electricity demand and provide demand response to the local electricity network)
d. Use ultra-low NOx gas boilers.

Various options are being considered for the Site in the context of these policies. The new London Plan moves away from CHP as a preferred option, as decarbonisation of grid electricity makes heat pumps and other electric based technologies more favourable.

6.2 Existing and Proposed Heat Networks

The London Borough of Haringey has ambitious plans to deliver district energy networks across the borough supplying low carbon heat. The network is being developed as a single scheme connected to the new (currently under construction) publicly owned Energy Recovery Facility (ERF) in Edmonton. The figure below shows the map with the scope of the network which has been designed to supply a mix of new and existing developments especially dense clusters of heat loads in:

- *North Tottenham*
- *Tottenham Hale*
- *Broadwater Farm*
- *Wood Green*

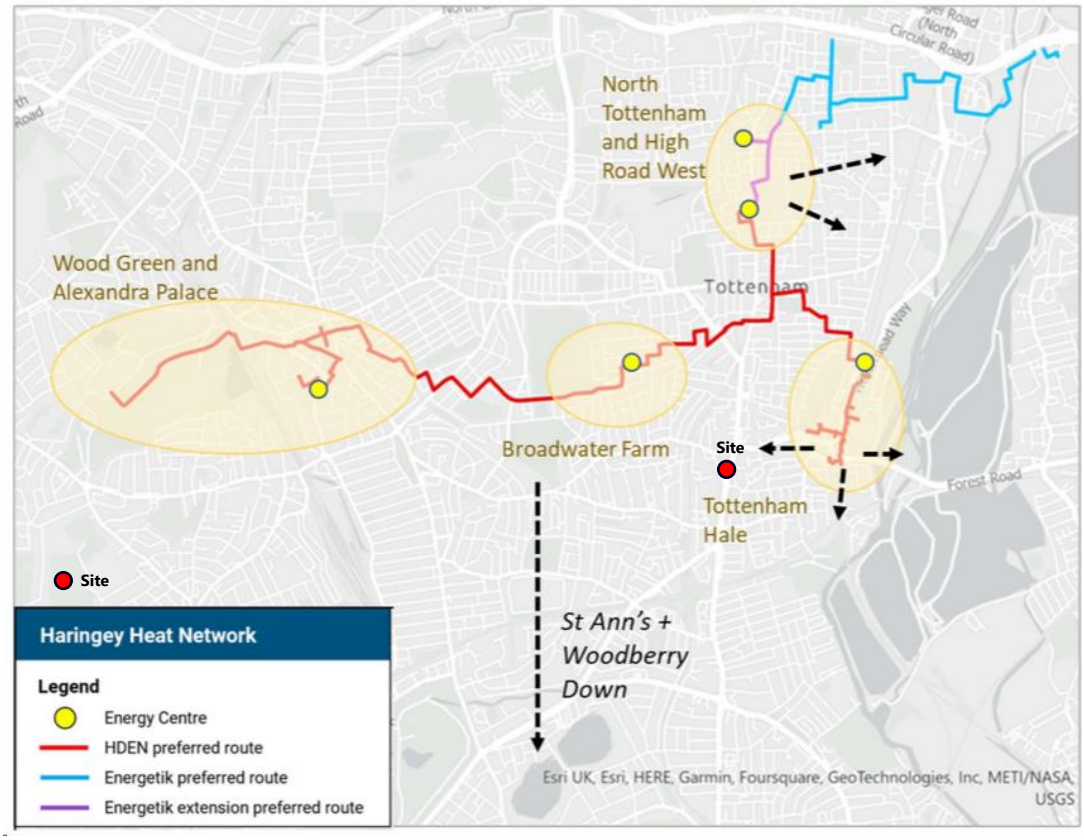


Figure 6.1: Map showing the main heat network clusters taken by the "Low Carbon Heat Supplies" September 2023

A network of highly insulated pipes will carry the heat from the ERF, via the energy centres to each building being supplied by HESCo. The route has been developed to connect the areas with high density of heat demand first, and it is perfectly feasible to connect buildings anywhere along or near to these routes.

The closest network to the proposed site is the "Tottenham Hale" network, and the figure below shows the site and the routes:

Note: the building site is outside the boundaries of the following map.

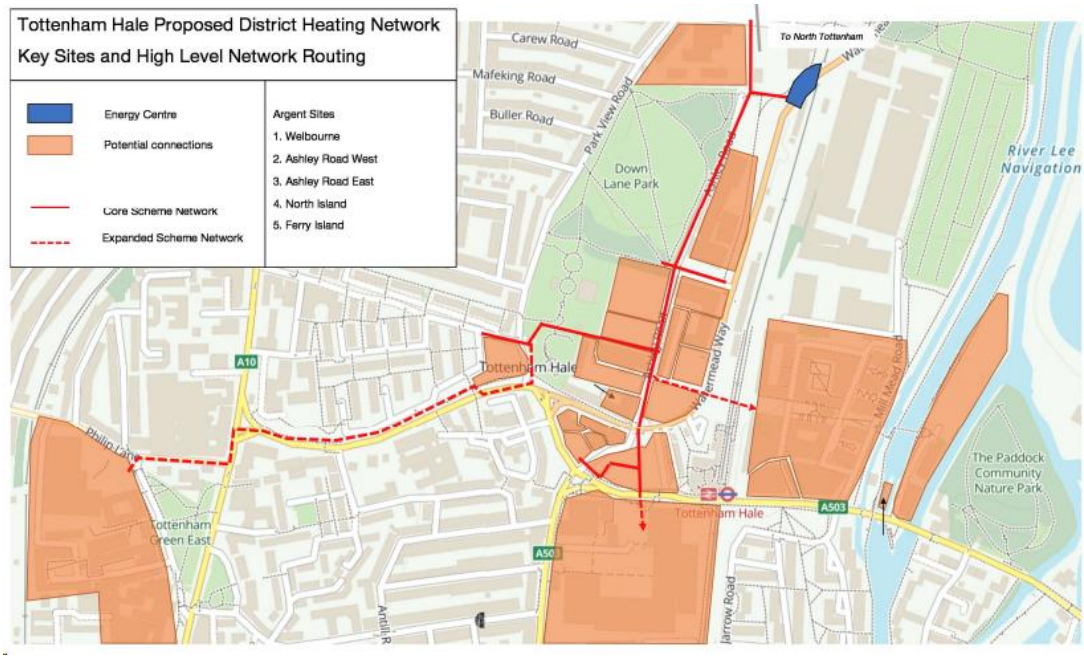


Figure 6.2: Proposed Scheme in the Tottenham Hale area

The London Heat Map[2] has been consulted as well to determine the distance between the site and the Tottenham Hale centre, as shown in the following figures:

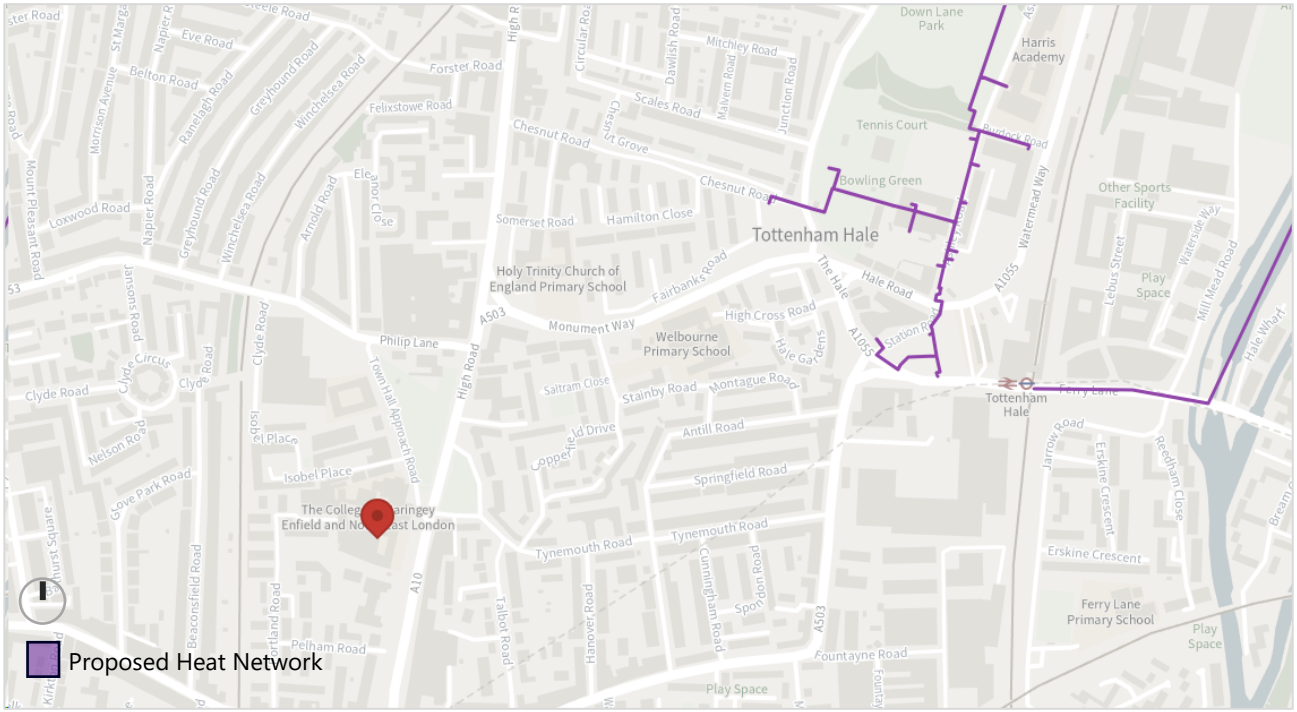


Figure 6.3: Proposed Heat Networks

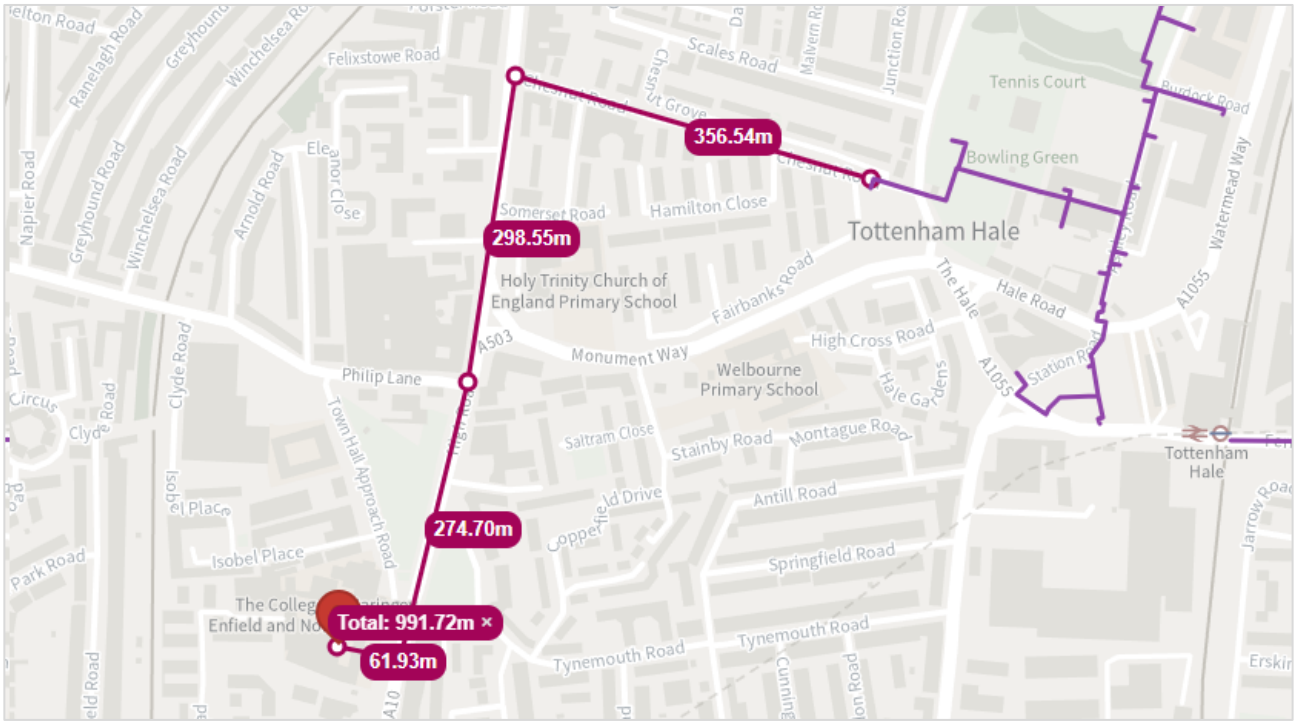


Figure 6.4: Distance between Proposed Heat Network and the Site

[2] London Heat Map

A connection of 990 meters would be required to link the site to the heat network, and, although this would not be a feasible solution, there is a plan to extend the network to improve it around the key clusters by 2030. In fact, the proposed building has been designed allowing for a future connection to the district network whenever the expansion plan will be completed.

6.3 Carbon Emissions

There are no feasible connections to any existing district heating networks, nor are any installation of on-site CHP systems proposed for this site. However, connections to future district heating networks will be allowed for. Therefore, the carbon savings for this stage of the energy hierarchy remain the same as after the 'Be Lean' stage.

The site wide regulated carbon emissions for the 'Be Clean' stage is calculated to be 0 tCO_2/year, as shown in the tables below.

Table 6.1: Carbon emissions after decentralised demand reduction for the proposed development (site-wide), under the Be Clean stage.

Carbon dioxide emissions (tonnes CO_2 per annum)	Regulated	Unregulated
Baseline	12.6	11.3
After energy demand reduciton	12.2	11.3
After heat network connection	12.2	11.3

Table 6.2: Regulated CO_2 savings from decentralised energy for the proposed development (site-wide), under the Be Clean stage.

Regulated Carbon Dioxide Savings	(Tonnes CO_2 per annum)	(%)
Savings from energy demand reduction	0.4	3%
Savings from heat network	0.0	0%

7 Be Green

This section includes the energy reduction through the use of low and zero carbon technologies incorporated into the proposed development.

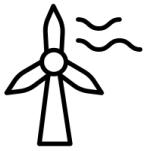
7.1 LZC Technology Options

Low and Zero Carbon (LZC) technologies that could be used for this development were evaluated and the results of the analysis showed that Air Source Heat Pumps (ASHPs) are the most appropriate technology for space heating, cooling, and Domestic Hot Water (DHW) for the building, along with PV panels.

The table below lists all the technologies reviewed:

Table 7.1: LZC technology feasibility for the Site.

LZC technology	Technically feasible	Recommended	Comments
ASHP 	Yes	Yes	Technically feasible on the site and highly efficient system – it will be used for heating, cooling and DHW for the whole building.
WSHP 	Yes	No	There is no sizeable water body in close proximityto the site.
Biomass 	No	No	Biomass heating will negatively impact air quality and the site doesn't have any capacity to store the fuel.
CHP 	Yes	No	No carbon savings due to decarbonisation of UK electricity grid.
GSHP 	No	No	This option is not feasible for the site.
Hydrogen Technology 	No	No	Technology not yet economically viable.
PV 	Yes	Yes	The PV area has been maximized on the building's rooftops. PV panels will be installed on the top floor roofs. The following section shows the PV assessment in more detail.

Solar thermal 	Yes	No	The use of this technology can be further investigated during detailed design stages to assess any possibility of installation.
Tri-Generation 	No	No	Structural limitations, height issues.
Wind Power 	No	No	Not viable due to the urban nature of the development and the historic setting surrounding the Site.

7.2 Air Source Heat Pump

Air Source Heat Pumps (ASHPs) will be used to provide space heating and Domestic Hot Water (DHW) for the entire building. ASHPs have the advantage that they do not require the digging of boreholes. The new SAP 10.2 carbon factors tend to favour heat pumps over CHP or other fossil fuel burning systems in terms of carbon performance.

Manufacturers were contacted to obtain estimates of the SCOP and SEER figures for suitable plant for each use. The SEER and SCOP values used in the modelling of the heat pump system are shown in the table below.

Table 7.2: ASHP efficiencies

ASHP Input values for the Site (Be Green)	CCCG Tottenham
Heating SCOP	3.30
DHW SCOP	3.40
Cooling SEER	4.50

******Disclaimer**: The performance of microgeneration heat pump systems is impossible to predict with certainty due to the variability of the climate and its subsequent effect on both heat supply and demand. This estimate is given as guidance only and should not be considered as a guarantee.*

7.3 Photovoltaics

Photovoltaic (PV) Panels are considered on the roof area of the proposed development. Avoiding overshadowing of a PV array is critical to its energy output, carbon savings, and cost-effectiveness, so the first step in assessing PV options for a site is to identify suitable unshaded locations to mount PV panels.

The roof area was selected to allocate and maximise the PV panels for the proposed building:

- **54 m²** of panels with 30 degrees of inclination have been allocated on the South-East side of the roof.
- **122.4 m²** are horizontally placed (0-degree angle) above the green roof area (60% of the whole area).
- **40 m²** are horizontally placed (0-degree angle) mounted on frames above the MEP systems (22% of the whole area).

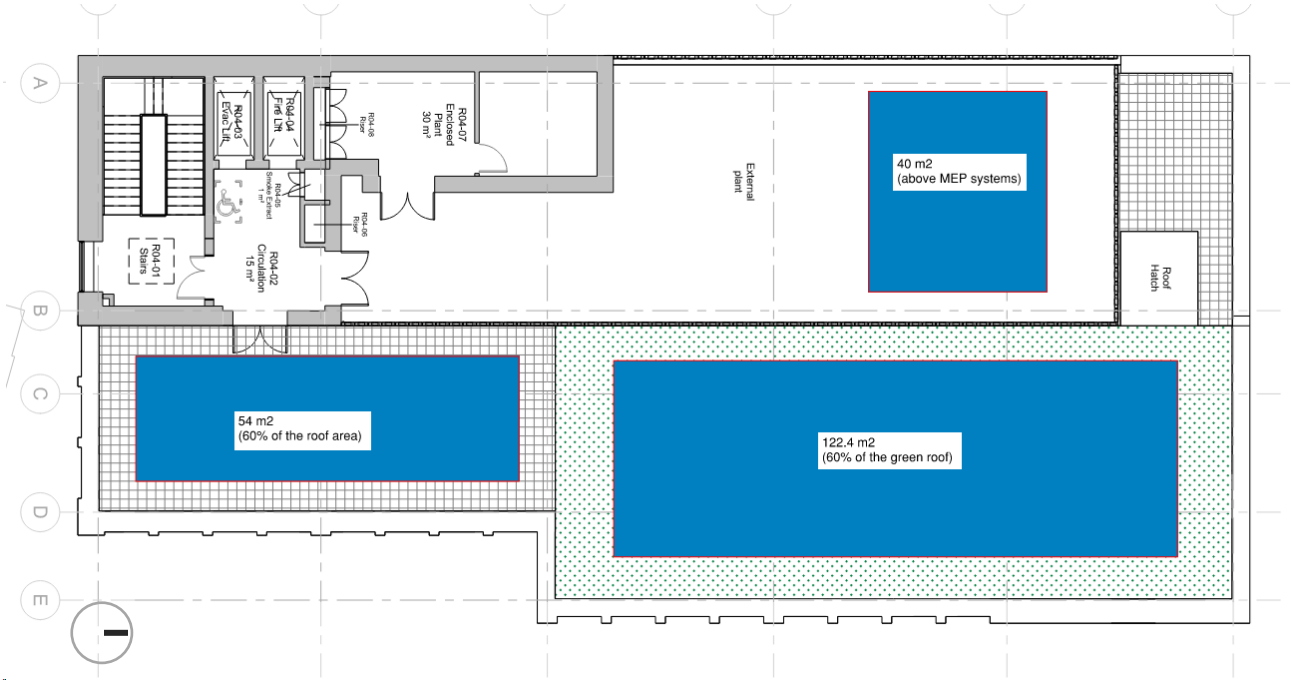


Figure 7.1: Roof Level with proposed PV panels

The assumptions made for the PV panels are listed in the table below.

Table 7.3: Photovoltaics Summary

PV Parameters	Roof PV Panels
PV module efficiency	21%
Panel area (m^2)	216.4 m^2
Azimuth (° clockwise from north)	180°
Inclination (° from horizontal)	**54 m^2** (SE) 30° **162,4 m^2** (NE and NW) 0°
Total Electricity generation per year	**27,063.4 kWh**
Total Power of the system	**45.4 kWp**

The table below shows the tonnes of CO_2 saved by the PV panels application in the "Be Green" model:

Table 7.4: Tonnes of CO_2 saved by PV panels.

Space	Energy Produced by PV Panels	Gride Electricity	CO_2 Saving
	[kWh/m^2]	[$KgCO_{2e}$]	[tCO_2]
CCCG Tottenham	11.73	0.136	3.68

7.4 Carbon emissions

The regulated emissions for the proposed development, including the low zero carbon technology of the ASHP, and the PV panels as listed above, for the 'Be Green' stage of the energy hierarchy are calculated to be a total of 8.1 tCO_2/year using SAP10.2 carbon factors, as shown in the tables below for the site.

Table 7.5: Carbon emissions after renewable energy for the proposed development (site-wide), under the Be Green stage.

Carbon dioxide emissions (tonnes CO_2 per annum)	Regulated	Unregulated
Baseline	12.6	11.3
After energy demand reduciton	12.2	11.3
After heat network connection	12.2	11.3
After renewable energy	8.1	11.3

This represents a saving of 4.1 tCO_2/year or 33% of baseline regulated emissions achieved by improving on Building Regulations emissions rate target through low zero carbon technology, as shown in the tables below:

Table 7.6: Regulated CO_2 savings from renewable energy for the proposed development (site-wide), under the Be Green stage.

Regulated carbon dioxide savings	(Tonnes CO_2 per annum)	(%)
Savings from energy demand reduction	0.4	3%
Savings from heat network	0.0	0%
Savings from renewable energy	4.1	33%
Total Savings	4.5	36%

7.5 Be Seen (Monitor, Verify, Report)

A fourth stage has been added to the Energy Hierarchy; Be Seen: monitor, verify and report on energy performance, Policy SI 2 of the London Plan 2021, requires that the energy performance of the building is monitored and reported for a period of at least five years post-occupancy. This is described as the Be Seen element of the new Energy Hierarchy, and steps to implement this are intended to commence from the Be Lean stage, through to commissioning and monitoring. It is expected that these measures would readily allow the building user to monitor, report and address the findings.

In line with the London Plan, major developments are expected to achieve net zero-carbon by following the Be Seen stage through the Mayor's post construction monitoring platform.

Although Part L calculations and Energy Performance Certificates (EPCs) give an indication of the theoretical performance of buildings, it is well established that there is a "performance gap" between design theory and measured reality. The Be Seen methodology requires monitoring and reporting of the actual operational energy performance of major developments for at least five years via the Be Seen GLA reporting spreadsheet and the Mayor's Be Seen monitoring portal Be Seen Planning Stage webform.

Applicants are required to provide accurate and verified estimates of each of the performance indicators of each reporting stage through the appropriate Be Seen reporting template. For the first stage of reporting, i.e. the planning submission stage (RIBA Stage 2/3), the planning stage Be Seen webform should be used. The second stage of reporting is at the as-built stage (RIBA Stage 4/5), and the as-built Be Seen stage webform should be used. Before uploading information to the webform, applicants can view the required information in the Be Seen spreadsheet. A separate webform for the in-use reporting stage will be made available soon. Applicants can view the reporting requirements for this stage in the Be Seen spreadsheet too. A link to the Be Seen monitoring portal which will display energy performance data publicly will be made available shortly (www.london.gov.uk).

Further details of the Be Seen spreadsheet for the Planning Stage providing accurate and verified estimates for Stage 3 performance indicators can be found in the Appendix D.

8 Additional GLA Requirements

8.1 EUI and Space Heating Demand

The EUI (regulated and unregulated energy) and space heating demand presented below has been calculated using the BRs Part L modelling methodology. DSM IES software was used for the site, and these values are also listed in the GLA spreadsheet.

Table 8.1: EUI and Space Heating Demand results

Building Type	Energy Use Intensity (kWh/m^2/year)	Space Heating Demand (kWh/m^2/year)
CCCG Tottenham	72.68	12.56

The NCM methodology used to estimate the unregulated energy consumption of the building overestimates the internal heat gains produced by lighting, occupancy, and equipment. For more detailed results, it is recommended to conduct a different assessment using the CIBSE TM54 Methodology.

8.2 Cost to Occupants

The estimated cost to occupants has been calculated in the following table considering multiple parameters:

- Energy demand reduction and energy efficient measures are the primary factors considered before proceeding with the systems selection in order to be in line with the Energy Hierarchy requirements.
- As part of the Be Seen process, the post-construction requirement is a critical factor of the Energy Hierarchy that will play an important role in keeping low running costs.

The cost calculations are based on an average electricity price (for non-domestic developments) of **0.188£/kWh** according to the Department for Energy Security & Net Zero statistical data[3]. The predicted fuel used is based on the Part L 2021 modelling calculations.

Table 8.2: Estimated Costs to Occupants

Cost Breakdown	Estimated Cost (£/year)
Fuel used[4]	£31,525[5]
Maintenance	£39,222[6]
Total Cost	**£70,747**

[3] Quarterly Energy Prices December 2023 (publishing.service.gov.uk)
[4] Excluding taxes, Climate Change Levy (CCL) etc.
[5] Based in the Part L energy calculations (total energy consumption).
[6] Annual maintenance cost of £17/m^2 (Source: BSRIA Rules of Thumb Guidelines for building services - Table 35).

9 Part L Compliance

9.1 Non – Domestic

Part L 2021 of the Building Regulations has two compliance metrics for new non-domestic buildings:

1. Carbon Emission Rate
2. Primary Energy Rate

9.1.1 Carbon Emission Rate

In line with the Part L2A 2021 of the Building Regulations, the calculated CO_2 emission rate for the building (BER) must not be greater than the Target CO_2 emission rate (TER). The results in the table below indicate that the proposed development is compliant with Criterion 1 of Part L2 2021 of the Building Regulations.

Table 9.1: Part L2A 2021 of the Carbon Emission compliance for the proposed development

Spaces	Target Emission Rate (TER) ($kgCO_2/m^2$)	Building Emission Rate (BER) ($kgCO_2/m^2$)	Carbon Emission Reduction	BER ≤ TER?
CCCG Tottenham	5.47	3.52	36%	Yes

9.1.2 Primary Energy Rate

Primary energy is defined by the BRE as "*energy renewable and non-renewable sources which has not undergone any conversion of transformation process*". The Target Primary Energy Rate (**TPER**) is reported in $kWh_{PE}/m^2/yr$ and is the maximum allowable primary energy usage by development. Compliance is achieved by showing that the Building Primary Energy Rate (**BPER**) is equal to or lower than the Target Primary Energy Rate (TPER). The following table shows the TPER and BPER results of the buildings in the proposed development.

Table 9.2: Part L2A 2021 of the Primary Energy Rate compliance for the proposed development

Spaces	Target Primary Energy rate (TPER) ($kWh/m^2/yr$)	Building Primary Energy rate (BPER) ($kWh/m^2/yr$)	Primary Energy Reduction	BPER ≤ TPER?
CCCG Tottenham	58.67	37.06	37%	Yes

10 Conclusions

The proposed development was assessed in accordance with the following legislation and policies:

1. The Local Plan – Development Management DPD (July 2017)
2. The London Plan (March 2021)
3. Mayor of London's Energy Assessment Guidance (June 2022)
4. Climate Change Act 2008 (2008)
5. National Planning Policy Framework (2023)
6. Building Regulations

10.1 The Energy Hierarchy

The energy strategy has been developed in line with the London Borough of Haringey Local Plan adopted in January 2017, the London Plan 2021 (March 2021) and associated Energy Assessment Guidance (June 2022). The proposed development is to be an all-electric non-combustion development, with onsite heat generation and to future proof the development. A series of energy-based targets have been used to drive the design:

- A fabric first approach
- Energy efficient delivery of heating and cooling
- The use of SAP 10.2 carbon emission factors
- Aiming to meet the GLA Be Lean requirements.

Passive design principles, efficient systems, and services have been promoted in the building.

The energy strategy for the proposed development is:

5. A fabric performance improvement over Building Regulations.
6. An Air Source Heat Pump (ASHP) for the building to provide heating and cooling.
7. An Air Source Heat Pump (ASHP) serving the Domestic Hot Water (DHW) for the building.
8. Renewable energy generation from roof mounted photovoltaics.

The calculations for this energy strategy have been carried out using the SAP 10.2 CO_2 emission factors. The site wide results indicate a regulated carbon saving of 4.5 tCO_2/year, which is 36% of the site's regulated carbon emissions of 12.6 tCO_2/year.

10.2 Carbon Emissions and Savings

The calculated carbon emissions and regulated savings at each stage for the proposed development (referred to as 'site-wide' in this report) are outlined in the table and figure below:

Table 10.1: Carbon Emissions after each stage of the energy hierarchy for the site.

	Total Regulated emissions (tCO_2/year)	**CO_2 savings (tCO_2/year)**	**Percentage Savings (%) under Part L 2021**
Baseline	12.6	-	-
Be Lean	12.2	0.4	3 %
Be Clean	12.2	0.0	0 %
Be Green	8.1	4.1	33 %
Total	-	**4.5**	**36%**

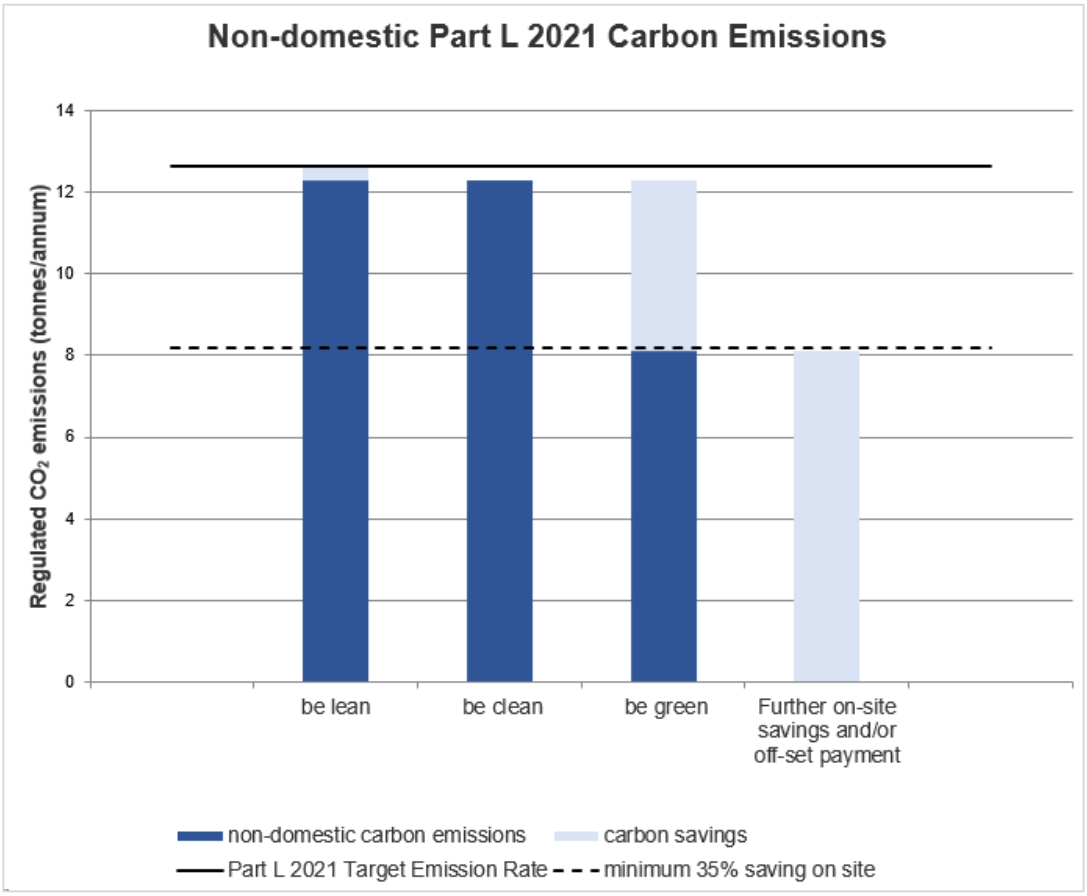


Figure 10.1: Non-Domestic Part L 2021 Carbon Emissions

To truly achieve net zero-carbon buildings and bridge the gap between design theory and measured reality, the New London Plan (policy SI2) has proposed an additional stage of the energy hierarchy: 'Be Seen'. This stage will require the calculation of the actual operational energy performance of major development during planning stage, as-built stage, and in-use stage. The operational energy will be monitored and verified and reported via the Mayor's 'be seen' monitoring portal for at least five years.

10.3 Cash-in-lieu

London Borough of Haringey has declared a Climate Emergency with the ambition to reach carbon neutrality by 2030 and will review their plan to meet this target. Therefore, they require all developments to be net zero carbon, through a combination of on-site measures and cash-in-lieu payments.

In order to achieve 100% carbon emissions reduction an overall cash-in-lieu contribution should be paid to the council based on a cost of £95 per tCO_2 for 30 years.

The following table presents the cash-in-lieu contributions related to the annual shortfall ($TonnesCO_2$) of the site.

Table 10.2: Cash-in-lieu contributions for the site as calculated in the GLA spreadsheet.

The Site	Non-domestic areas
Total Carbon Dioxide Emissions for the Site - Baseline (Tonnes CO_2 per annum)	12.6
Total Cumulative Savings – Be Lean and Be Green (Tonnes CO_2 per annum)	4.5
Annual CO_2 for Off-set payment (Tonnes CO_2 per annum)	8.1
Total Cumulative Savings for off-set payment (Tonnes CO_2)	244
Cash in-lieu contribution (£)	**23,146**

**Assuming £95 per tonnes CO_2 in line with the 'Carbon Offset Funds' (2018), p.6*

10.4 Primary Energy Rate

Primary energy is defined by the BRE as "*energy renewable and non-renewable sources which has not undergone any conversion of transformation process*". The Target Primary Energy Rate (**TPER**) is reported in $kWh_{PE}/m^2/yr$ and is the maximum allowable primary energy usage by development. Compliance is achieved by showing that the Building Primary Energy Rate (**BPER**) is equal to or lower than the Target Primary Energy Rate (TPER). The following table shows the TPER and BPER results of the buildings in the proposed development.

Table 10.3: Target and Building Primary Energy Rates of the different buildings in the proposed development.

Spaces	Target Primary Energy rate (TPER) ($kWh/m^2/yr$)	Building Primary Energy rate (BPER) ($kWh/m^2/yr$)	BPER ≤ TPER?
CCCG Tottenham	58.67	37.06	YES

10.5 BREEAM

The proposed site is assessed under BREEAM New Construction (NC) version 6 2022. The following credits have been tested and the analysis and results can be review in the report with the file name '10379-IRB-01-XX-T-OS-5103'.

1. **BREEAM NC ENE01**
    a. CCCG Tottenham: **8 credits** awarded.
2. **BREEAM NC ENE04**
    a. CCCG Tottenham: **2 credits** awarded.
3. **BREEAM NC HEA01**
    a. CCCG Tottenham: **0 credits** awarded.
4. **BREEAM NC HEA04**
    a. CCCG Tottenham: **2 credits** awarded.

11 Appendix

11.1 Appendix A: BRUKLs

11.2 Appendix B: GLA's Carbon Reporting Spreadsheet

11.3 Appendix C: Heat Network Reference

11.4 Appendix D: Be Seen Spreadsheet

Introba