

Highgate School MSC 4 Phases

Energy Assessment



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Executive Summary

This energy assessment aims to demonstrate that the proposed climate change mitigation measures comply with the current London Plan 2021 and the relevant London Borough of Haringey energy policies, including the energy hierarchy. It also ensures that energy remains integral to the Development's design and evolution. Carbon emissions savings of 77% across whole site (existing and new areas) is achieved following the energy hierarchy.

This energy statement is submitted in support of the planning application by Highgate School for the redevelopment of the Mallinson Sports Centre Complex located on Bishopswood Road. The phased redevelopment of the Mallinson Sports Centre. Extensive refurbishment of existing buildings and extensions to create new indoor sports, drama and assembly space (dry sports hall 2).

Type of Development

The Phase 1 swimming pool and changing room works have been completed (2021) and are in use. The swimming pool and changing room facilities will remain open during phases 2 and 3. Areas refurbished during Phase 1 have been excluded in this energy statement.

The proposed works will modernise this important indoor sports facility with alterations and extensions and significantly extend the life of the retained elements of the existing building, additionally providing significant improvements for accessibility, energy efficiency and reduction of the carbon footprint of the whole Development.

In line with the GLA Energy Assessment Guidance (June 2022), carbon emission reductions for new and existing parts of the development have been presented separately within this report.

GLA Energy Hierarchy						
	Existing Areas (Refurbished)		New Extensions		Site Wide	
	Tonnes CO ₂	Improvement	Tonnes CO ₂	Improvement	Tonnes CO ₂	Improvement
Base	11.4		8.9		20.3	
Be Lean	10.2	10%	7.2	19%	17.4	14%
Be Clean	10.2	0%	7.2	0%	17.4	0%
Be Green	1.2	79%	3.4	42%	4.6	63%

Table 1 SBEM 6.1e Carbon Dioxide Emissions after each stage of the Energy Hierarchy for non-domestic buildings

GLA Reporting Spread Sheet

Carbon Dioxide Emissions for non-residential buildings (Tonnes CO ₂ per annum)						
	Existing Areas (Refurbished)		New Extensions		Site Wide	
	Regulated	Unregulated	Regulated	Unregulated	Regulated	Unregulated
Baseline: Part L 2021 of the Building Regulations Compliant Development	11.4	22.1	8.9	44.7	20.3	66.8
After energy demand reduction (be lean)	10.2	22.1	7.2	44.7	17.4	66.8
After heat network connection (be clean)	10.2	22.1	7.2	44.7	17.4	66.8
After renewable energy (be Green)	1.2	22.1	3.4	44.7	4.6	66.8

Table 2 GLA Carbon Dioxide Emissions, after each stage of the Energy Hierarchy for non-residential buildings.

Regulated non-residential carbon dioxide savings						
	Existing Areas (Refurbished)		New Extensions		Site Wide	
	(Tonnes CO ₂ per annum)	(%)	(Tonnes CO ₂ per annum)	(%)	(Tonnes CO ₂ per annum)	(%)
Be lean: savings from energy demand reduction	1.2	10	1.7	19	2.9	14
Be clean: savings from a heat network	0	0	0	0	0	
Be green: savings from renewable energy	9.1	79	3.7	42	12.8	63
Total Cumulative Savings	10.2	90	5.4	61	15.7	77
Annual savings from offset payment	1.2	-	3.4	-	4.6	
	Tonnes CO ₂					
Cumulative savings for offset payment	35	-	103	-	138	-
Cash in-lieu contribution (£)	3,369		9,766		13,135	

Table 3 GLA Regulated Carbon Dioxide savings from each stage of the Energy Hierarchy for non-residential buildings.

The carbon price is the GLA's recommended price of £95 per tonne of carbon dioxide.

Be Lean

The improved standards of current building regulations make it extremely difficult to better the thermal efficiency of the base building. The designers have selected the lowest practicable and achievable thermal fabric U values using readily available building materials (brick, block and mineral Wool insulation). On completion of the proposed development, energy use is predicted to be lower than the original pre-developed building in existing areas as well as low energy use in new extensions. The predicted emission savings reduce energy consumption from the new and existing sports hall by installing high efficiency building services systems and enhanced control systems to optimise the HVAC operation.

The predicted energy consumption by end use categories in existing buildings is higher than the notional building. This is due to existing building fabric not achieving same performance as the notional building even with the proposed upgrades. For new extensions energy consumption by end use categories for lighting and auxiliary is predicted to be slightly higher than notional building. This results from the algorithms used in the energy compliance model, which does not make allowance for increased lighting required for the sports halls and underestimation of power used by fans required for sports hall ventilation.

Be Clean

Highgate is a residential area with no significant developments and is unlikely to be prioritised for the initial Development of the district heating scheme. There are no plans to develop a district heating or ambient loop network in the locality.

A communal heating system with Combined Heat and Power (CHP) is not proposed as CHP machines cannot meet the new building regulation emissions reduction and local air quality requirements.

Air source heat pumps with refrigerant coils in ventilation units as well as Air source heat pumps with low temperature heat emitters will be used to provide space heating and ventilation. Fitness studios will be provided with local heat recovery mechanical ventilation units and heating /cooling via multi-split air source heat pumps.

Be Green

On site energy generation from a large Photo Voltaic (PV) on the roof of existing buildings and new extensions will reduce carbon dioxide emission by 79% in existing areas and 42% in new extensions in comparison to building regulations compliant development. The main advantage of using PV is that Electricity is generated during daylight hours when the school uses the indoor sports facilities and the pool plant is at peak operation. The School building along Bishopswood Road take their power from a recently installed transformer. The electrical arrangement allows the surplus power generated at the MSC Sports centre to be used in other school buildings. The interlinking of the school is the first step towards a zero-carbon status.

On-site renewable energy generation

The Photovoltaic array is predicted to generate over 60% of the overall energy used in the proposed development.

Carbon Offset

The Mayor of London has declared a climate emergency and has set an ambition for London to be net zero-carbon. The London Plan requires major developments to comply with the net zero-carbon target in Policy SI 2 by following the energy hierarchy and maximising on-site carbon reductions. Overall reduction in carbon emissions achieved in

existing and new areas is 90% (Existing) & 61% (New). This requires a cash-in-lieu contribution of £13,135 (3,369+9,766) to the relevant London Borough of Haringey carbon offset fund to achieve net zero carbon.

The Carbon offset payment is calculated using the GLA energy reporting spreadsheet at £95 per tonne of CO₂ spread over 30 years. See table 2a above.

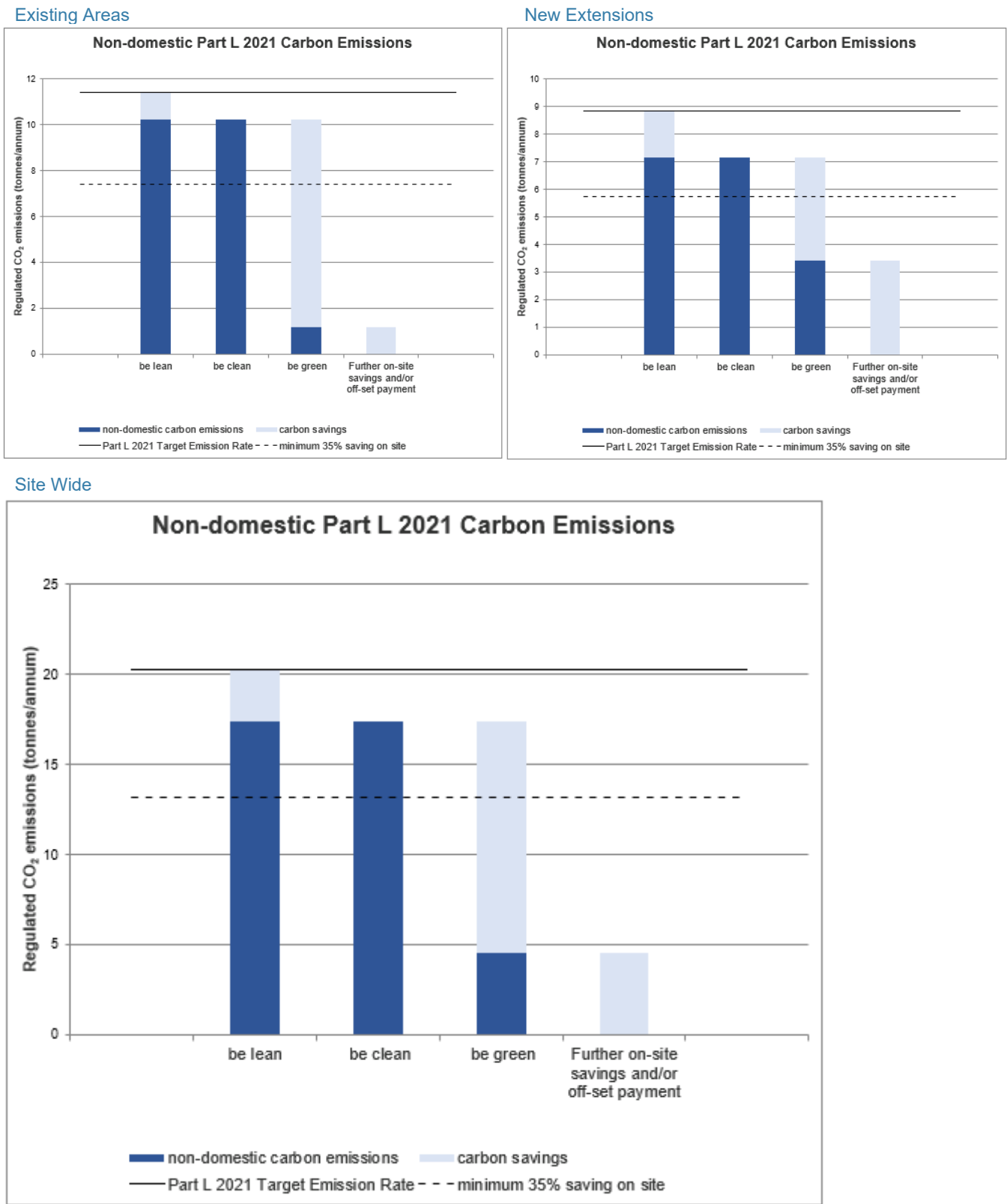


Figure 1 Carbon dioxide emission using GLA reporting tool.

1

Introduction

- 1.1
- An energy assessment aims to demonstrate that the proposed climate change mitigation measures comply with the London Plan 2021 and the relevant London Borough of Haringey energy policies, including the energy hierarchy. It also ensures that energy remains integral to the Development's design and evolution.

Site

- 1.2
- The Mallinson Sports Centre (MSC), part of the Bishopswood Road campus of the school estate, is close to other principal school buildings such as the Mills Centre, the Dining Hall, the Pre-Prep School, and the Junior School.

Site address

Mallinson Sports Centre

Bishopswood Road,

London.

N6 4PH

- 1.3
- The main building comprises the Pool Hall and associated changing rooms, which was the first building on the site in 1969, followed by the main sports hall with associated ancillary accommodation, gym, entrance hall, central offices and other sports spaces completed in 1989.
- 1.4
- The overriding aim of the design seeks to transform this building and create enhanced building aesthetics within the Conservation Area while providing all the sports and ancillary-related facilities that the school will need shortly.
- 1.5
- The intention is to retain the essential elements of the existing building that have significant long-term value and condition, provide spaces of the required technical standard, and integrate them with alterations and extensions into a unified whole, a single sports centre.
- 1.6
- The new sports hall is the principal component of the proposed Development of the school's indoor sports facilities. As part of the work, the school intends to demolish the existing Fives and Squash court buildings to open a large area within the site that can be more efficiently and architecturally developed. Integrated with these works are to build a new sports centre building comprising an indoor sports hall, teaching classrooms and staff offices.
- 1.7
- The design of the hall is to accommodate a National standard netball court within the dry sports hall 2, one that will allow Premier League games to be played. There is an aspiration nationally for netball courts of this standard, for a sport that is increasing in popularity. Many other sports courts will fit within this same interior footprint.

The Vision

- 1.8
- The proposed Development is auxiliary to several other applications in various parts of the school. The vision behind all the proposed developments at the school is set out in the planning statement accompanying the applications, an extract of which is reproduced as follows:

"Being both a Charity and a School, sustaining and further improving what Highgate does for the benefit of its pupils and pupils of partner schools elsewhere within the borough is never finished business."

"The school has, over the last 15 years or so, been undertaking an extensive programme of modernising and renewing its extensive and mixed stock of buildings and facilities to meet the educational and other demands of

a 21st Century establishment. Significant funds have been invested over that period, and the programme will continue over the next decade."

"This programme combines the continuing need to maintain, both in terms of safety and appearance, the buildings on several sites and in varying degrees of condition, with the need to provide essential, flexible, good quality and long-lasting educational facilities for its varied educational and charitable objectives, as well as catering for its diverse pupil-body, which meets the different educational and supporting requirements for each of the three Schools to satisfy Department of Education (DfE) and other statutory requirements."



Figure 2 Aerial View of the site in Red



Figure 3 Site Location in Context (Open Street Map)

The Proposed Works

- 1.9
- The new extensions will create a larger building with various sports facilities, including a second sports hall, which will also be used for other School events, parent evenings, examinations, and assemblies.

- 1.10 The principle of a single secure point of access at the south end is to be maintained, with a larger and more open entrance and foyer fronting the all-weather pitches. Once inside the foyer via a draught lobby, the main Sports Centre reception desk immediately controls the area, which will always be staffed during regular operational hours. The desk will be open within the space to create a friendly and welcoming impression for pupils and visitors and improve visibility. It is anticipated that turnstiles will be used to control and monitor access into the sports centre – Turnstiles are provided at the west entrance next to the second hall. Turnstiles and entry doors would all be linked to the building fire alarm and detection system and default to open in the event of a fire for emergency egress.
- 1.11 As a result of the proposed extensions, new lifts will allow complete accessibility for disabled users to all areas of the building which is not currently wheelchair accessible.
- 1.12 Generally, during the school Day, the main doors will be openable, the entry doors being on automatic electric opening systems for disabled and Part M access. After School hours, it is anticipated that the main doors at both entrances will have access security control, operated by coded entry devices with magnetic closing locks. An option being investigated is to have the entry systems operated by pupil and staff cards, which will also serve several other functions in the school.
- 1.13 The proposed works in this submission include:
- The Fives Court and Squash Courts building is being demolition at the site's north end. The removal of the outer games court area and high chain-link fencing.
 - i. New north-west extension for a second indoor sports hall with associated:
 - ii. new circulation corridor,
 - iii. viewing gallery,
 - iv. access stairs and lift,
 - v. ancillary spaces for storage and plant, and
 - vi. A teaching block extension for 'Combined Cadet Force' and 'Outdoor Education' classrooms, offices, and associated storage.
 - A new south extension to the existing sports hall for eight (8) no. New external covered Fives Courts with run-off area.
 - New southwest extension and alterations to the existing building to create an enhanced entrance with a foyer, reception, and café. Including a bespoke staircase down to the current changing rooms.
 - New roof to sports hall 1 with new roof lights adding natural daylight to the and improved thermal comfort.
 - The courtyard between the pool hall and sports hall 1 will be covered to provide additional space. The space provides new dance studio and weights gym spaces and forms connections back to the changing rooms, with ancillary external storage for sports.
 - The external surrounding is improved with new hard and soft landscaping around the site's perimeter, including removing three trees. The trees will be replaced with new semi-mature trees and form an entrance courtyard area at the new south main entrance.
- 1.14 The recently completed swimming pool project is the first phase of these works and provides the changing room facilities for the following sports hall phases.

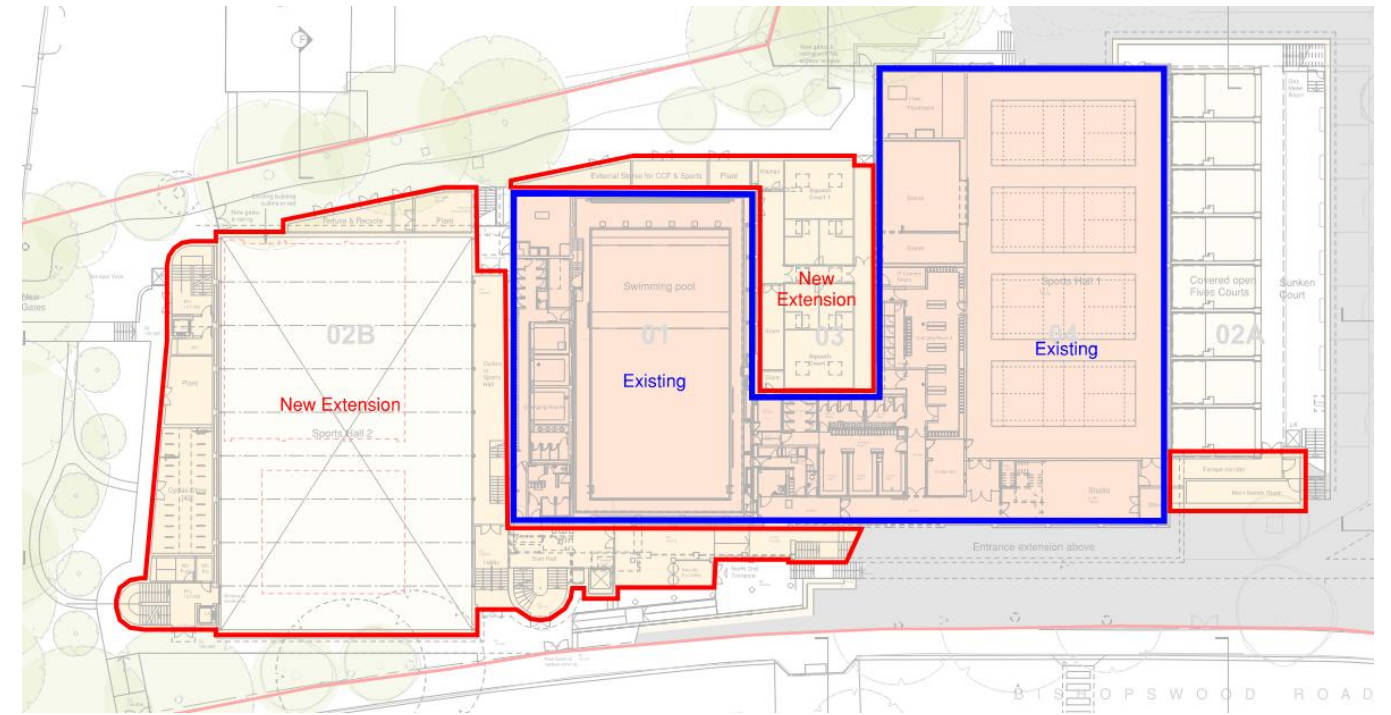


Figure 4 Existing Buildings and New Extensions

Natural Ventilation

- Maintain natural air temperature and balanced humidity when the space is not in use.
- Remove summer heat trapped in the sports hall
- Provide natural night-time purge ventilation to cool the building structure

Demand controlled mechanical ventilation system with heating and heat recovery is required to:

- Quickly heat the sports halls
- Remove moisture and maintain space humidity when fully occupied or during high-activity sports.
- Recover heat energy from the sports hall
- Aid heat removal from the space in the summer months

Strategy for mitigating overheating risk / TM59/TM52 overheating analysis

- 1.15 In line with the requirements of London Plan Policy SI4, an overheating assessment has been carried out for the proposed development and results are presented in a overheating assessment report.

Heating/cooling system description

- Fast Acting air distribution heating in the sports halls. To avoid heating the space when not in use.
- Multi-split air source heat pumps to provide heating and cooling in the fitness, dance studio, and cardio room.
- Heating from low surface temperature radiators in the Classroom and circulation spaces. Heating is provided by air to water, air source heat pumps.
- Domestic hot water in refurbished and new areas will be provided via point of use instantaneous electric water heaters.

Location of mechanical ventilation fans/heat recovery units/heat pumps.

- No plant is visible from Bishopwood and Broadlands Roads.

- The air handling plant for sports hall (2) is located on the flat roof of the corridor between the sports hall and the swimming pool viewing gallery.
- The proposal is to relocate the air handling unit supplying the second swimming pool changing room.
- The Plan is to replace Sport hall (1) heating and ventilation equipment with a new energy-efficient unit with variable speed fans, heat recovery and ductwork.
- The designer will select the external heat pump condenser unit for low noise operation and, where required, fit the additional acoustic attenuation.

2 Planning Policies

National Planning Policy

- 2.1 The National Planning Policy Framework ('NPPF') was published in July 2021 and superseded the previous versions. Paragraphs 2, 5 and 12 within the Framework confirm that the NPPF must be considered as a material planning consideration in planning decisions.
- 2.2 To ensure that sustainable Development is pursued positively, a presumption favouring sustainable Development is at the heart of the NPPF. Sustainable Development is explained in more detail in NPPF paragraph 11, which requires Local Planning Authorities to:
- 2.3 Approve development proposals that accord with an up-to-date development plan without delay; or
- 2.4 Where there are no relevant development plan policies or the policies which are most important for determining the application are out-of-date, granting permission unless:
- i) The application of policies in the framework that protect areas or assets of particular importance provides an apparent reason for refusing the Development proposed; or
 - ii) Any adverse impacts of doing so would significantly and demonstrably outweigh the benefits when assessed against the policies in this framework when taken as a whole
- 2.5 The NPPF includes a 'presumption in favour of sustainable Development. It states that for plan-making, the presumption means that local authorities should positively seek opportunities to meet the development needs of their area and that plans should meet objectively assessed needs. Plans should also be based on the Local Plan.

London Plan

- 2.6 The London Plan is the Mayor's planning strategy for Greater London. It sets borough-level housing targets and identifies locations for future growth of London-wide importance.
- 2.7 The London Plan is the overall strategic Plan for London, setting out an integrated economic, environmental, transport and social Framework for the Development of London over the next 20 to 25 years.
- 2.8 The London Plan is part of the Development Plan. The policies have been drafted to allow London to implement this ambitious London Plan as soon as possible. There is no requirement for the policies to be repeated locally. However, some instances require a local approach within the overall policy context. The London Plan sets out where this is the case.
- 2.9 The London Plan provides the strategic framework for making all these decisions. It guides boroughs' Development Plans to ensure they work toward a shared vision for London. It establishes policies that allow everyone involved in new developments to know what is expected.

Policy SI 2 Minimising greenhouse gas emissions

- A) Major Development should be net zero-carbon. This means reducing greenhouse gas emissions in operation and minimising both annual and peak energy demand under the following energy hierarchy:
- 1) be lean: use less energy and manage demand during operation
 - 2) be clean: exploit local energy resources (such as secondary heat) 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.
- 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 Development. Residential Development should achieve 10 per cent, and non-residential Development should achieve 15 per cent through energy efficiency measures. Where it is demonstrated that the zero-carbon target cannot be fully achieved on-site, any shortfall should be provided, in agreement with the Borough, either:
- 1) Through cash in lieu contribution to the Borough's carbon offset fund, or
 - 2) 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 carbon reductions. The operation of offset funds should be monitored and reported annually
- 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 to the Mayor should calculate whole lifecycle carbon emissions through a nationally recognised Whole Lifecycle Carbon Assessment and demonstrate actions to reduce lifecycle carbon emissions.

Table 4 GLA Policy SI 2 Minimising greenhouse gas emissions

- 2.10 The Mayor is committed to London becoming a zero-carbon city. Becoming zero-carbon will require reducing all greenhouse gases, of which carbon dioxide is the most prominent. London homes and workplaces are responsible for producing approximately 78 per cent of its greenhouse gas emissions. New Development must meet the framework's requirements if London aims to become a zero-carbon city by 2050. Development involving major refurbishment should also strive to meet this framework.
- 2.11 The energy hierarchy should inform new buildings' design, construction, and operation. The priority is to minimise energy demand and address how energy will be supplied and renewable technologies incorporated. An essential aspect of managing demand will be to reduce peak energy loadings.
- 2.12 Boroughs should ensure that all developments maximise on-site Electricity and heat production opportunities from solar technologies (photovoltaic and thermal) and use innovative building materials and smart technologies. This approach will reduce carbon emissions, reduce energy costs to occupants, improve London's energy resilience and support the growth of green jobs.
- 2.13 A zero-carbon target for significant residential developments has been in place for London since October 2016 and applies to significant non-residential developments on the final publication of this Plan.
- 2.14 Meeting the zero-carbon target - an on-site reduction of at least 35 per cent beyond the baseline of Part L of the current Building Regulations is required.
- 2.15 The minimum improvement over the Target Emission Rate (TER) will increase over time to achieve the net zero-carbon London ambition and reflect the costs of more efficient construction methods. The net-zero target costs will be reflected in future updates to the London Plan.
- 2.16 The Mayor recognises that Building Regulations use outdated carbon emission factors and that this will continue to cause uncertainty until Government updates them. Interim guidance has been published in the Mayor's Energy Planning Guidance on using appropriate emissions factors. The GLA guidance will be updated once Building Regulations are updated to help developers determine how these policies are implemented.
- 2.17 Developments are expected to achieve carbon reductions beyond Part L from energy efficiency measures alone to reduce energy demand as far as possible. Residential Development should achieve 10 per cent, and non-residential Development should achieve 15 per cent over Part L.

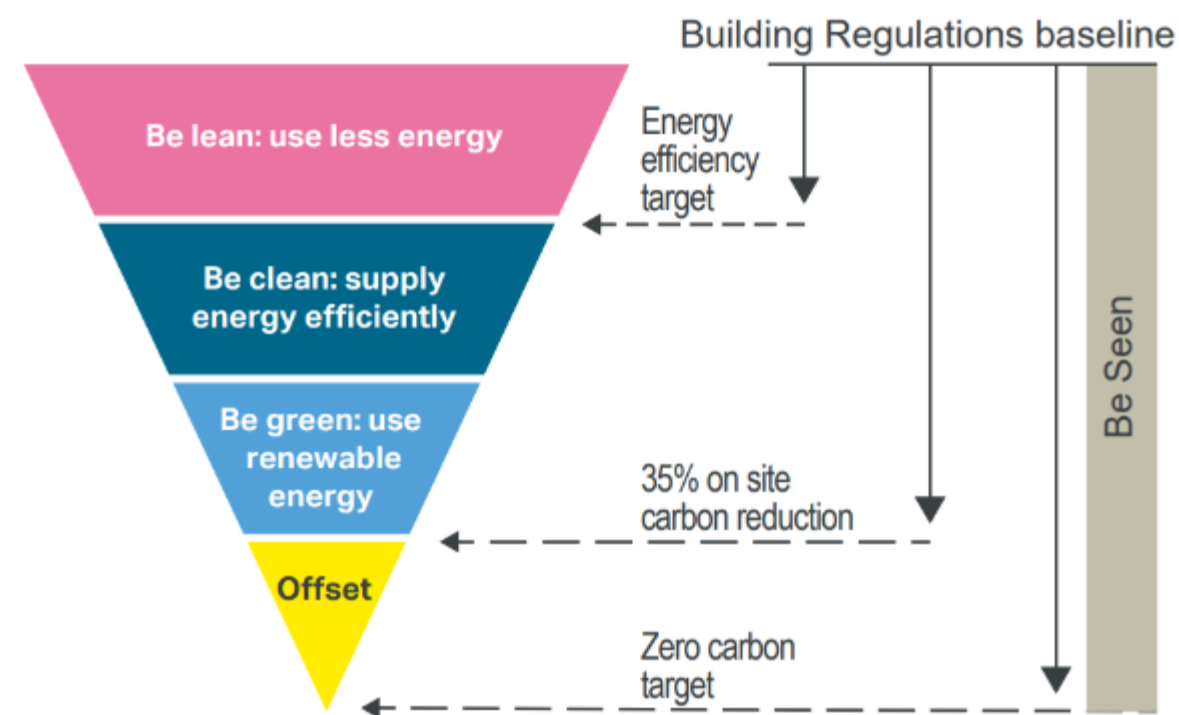


Figure 5 London plan Energy Hierarchy.

- 2.18 The price for offsetting carbon is regularly reviewed. Changes to the GLA's suggested carbon offset price will be updated in future guidance. The new Development is expected to get as close as possible to zero-carbon on-site, rather than relying on offset payments to make up for any shortfall in emissions. However, offset funds can unlock carbon savings from the existing building stock through energy efficiency programmes and by installing renewable technologies – typically more expensive to deliver in London due to the building's age, type, and tenure.
- 2.19 The Mayor will work with boroughs, energy companies, and major developers to promote London's energy system's timely and effective Development (energy production, distribution, storage, supply, and consumption).
- 2.20 London is part of a national energy system and currently sources approximately 95 per cent of its energy from outside the GLA boundary. Meeting the Mayor's zero-carbon target by 2050 requires changes to how we use and supply energy to generate power and heat for our buildings and transport from clean, low-carbon, and renewable sources. London will need to shift from relying on natural gas as its primary energy source to a diverse range of low and zero-carbon sources, including renewable energy and secondary heat sources. Decentralised energy and local secondary heat sources will become an increasingly important element of London's energy supply. They will help London become more self-sufficient and resilient concerning its energy needs.

Policy SI 3 Energy Infrastructure

- A) Boroughs and developers should engage with relevant energy companies and bodies early 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 Development.
- B) Energy masterplans should be developed for large-scale development locations (such as those outlined in Part A and other opportunities), establishing the most effective energy supply options. Energy masterplans should identify:
- 1) significant heat loads (including anchor heat loads concerning sites such as universities, hospitals, and social housing)
 - 2) heat loads from existing buildings that can be connected to future phases of a heat network
 - 3) major heat supply plant, including opportunities to utilise heat from energy from waste plants
 - 4) secondary heat sources, including both environmental and waste heat
 - 5) opportunities for low and ambient temperature heat networks
 - 6) possible land for energy centres and/or energy storage
 - 7) possible heating and cooling network routes
 - 8) opportunities for futureproofing utility infrastructure networks to minimise the impact of road works
 - 9) infrastructure and land requirements for electricity and gas supplies
 - 10) implementation options for delivering feasible projects, considering issues of procurement, funding and risk, and the role of the public sector
 - 11) opportunities to maximise renewable Electricity generation and incorporate demand-side response measures.
- C) Development Plans should:
- 1) Identify the need for, and suitable sites for, any necessary 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 identify opportunities for expanding and interconnecting existing networks and establishing new networks.
- D) Major development 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 Electricity following 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 ultra-low NOx gas boilers
 - 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 a cost-effective connection later.
- E) Heat networks should achieve good practice design and specification standards for primary, secondary, and tertiary systems comparable to those in the CIBSE/ADE Code of Practice CP1 or equivalent.

Table 5 GLA Policy SI 3 Energy Infrastructure

- 2.21 The heating system should be designed to facilitate cost-effective future connections where developments are proposed within Heat Network Priority Areas but are beyond existing heat networks. Future connections may include, for example, allocating space in plant rooms for heat exchangers and thermal stores, safeguarding suitable routes for pipework from the site boundary and making provision for connections to the future network at the site boundary. The Mayor is taking a more direct role in delivering district-level heat networks. Newer communally-heated developments will connect to them and develop a comprehensive decentralised energy support package. Further details are available in the London Environment Strategy.
- 2.22 Electricity is essential for the functioning of any modern city. Demand is expected to rise in London in response to a long-term growing population and economy, the increased take-up of electric vehicles, and the switch to electric heating systems (such as through heat pumps). The Electricity network and substations are at or near capacity in several areas, especially in central London. The Mayor will work with the Electricity and heat industry, boroughs, and developers to ensure that appropriate infrastructure is integrated within a more comprehensive smart energy system designed to meet London's needs.

Policy SI 4 Managing Heat Risk.

A) Development proposals should minimise adverse impacts on the urban heat island through design, layout, orientation, materials, and 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 following the following cooling hierarchy:

1) reduce the amount of heat entering a building through orientation, shading, high albedo materials, fenestration, insulation, and the provision of green infrastructure

2) minimise internal heat generation through energy-efficient design

3) manage the heat within the building through exposed internal thermal mass and high ceilings

4) provide passive ventilation

5) provide mechanical ventilation

6) provide active cooling systems.

Table 6 GLA Policy SI 4 Managing Heat Risk

- 2.23 Climate change means London is already experiencing higher than historical average temperatures and more severe hot weather events. Higher temperatures combined with a growing population, urbanisation, and the urban heat island effect, means London must manage heat risk in new developments, using the cooling hierarchy above. The cooling hierarchy applies to major developments, and the principles can also be applied to minor Development.
- 2.24 In managing heat risk, new developments in London face two challenges – the need to ensure London does not overheat (the urban heat island effect) and that individual buildings do not overheat. The urban heat island effect is caused by extensive built-up areas absorbing and retaining heat day and night, leading to parts of London being several degrees warmer than the surrounding area. The extra-urban heat can become problematic on the hottest days of the year as daytime temperatures can reach well over 30°C and not drop below 18°C at night. These circumstances can lead many people to feel too hot or not sleep, but for specific health conditions and 'at risk' groups, such as some young or elderly Londoners, the effects can be severe and worsen health conditions. Green infrastructure can mitigate this effect by shading roof surfaces and through evapotranspiration. Development proposals should incorporate green infrastructure in line with Policy G1 Green Infrastructure and Policy G5 Urban Greening.

- London Borough of Haringey Policies
- 2.25 Haringey's Local Plan is made up of several individual planning policy documents. These are Haringey's Local Plan Strategic Policies 2013 – 2026 (formerly the Core Strategy) March 2013. Consolidated with alterations since 2017 – sets out the Council's spatial strategy and critical policies for the future Development of the Borough through to 2026;

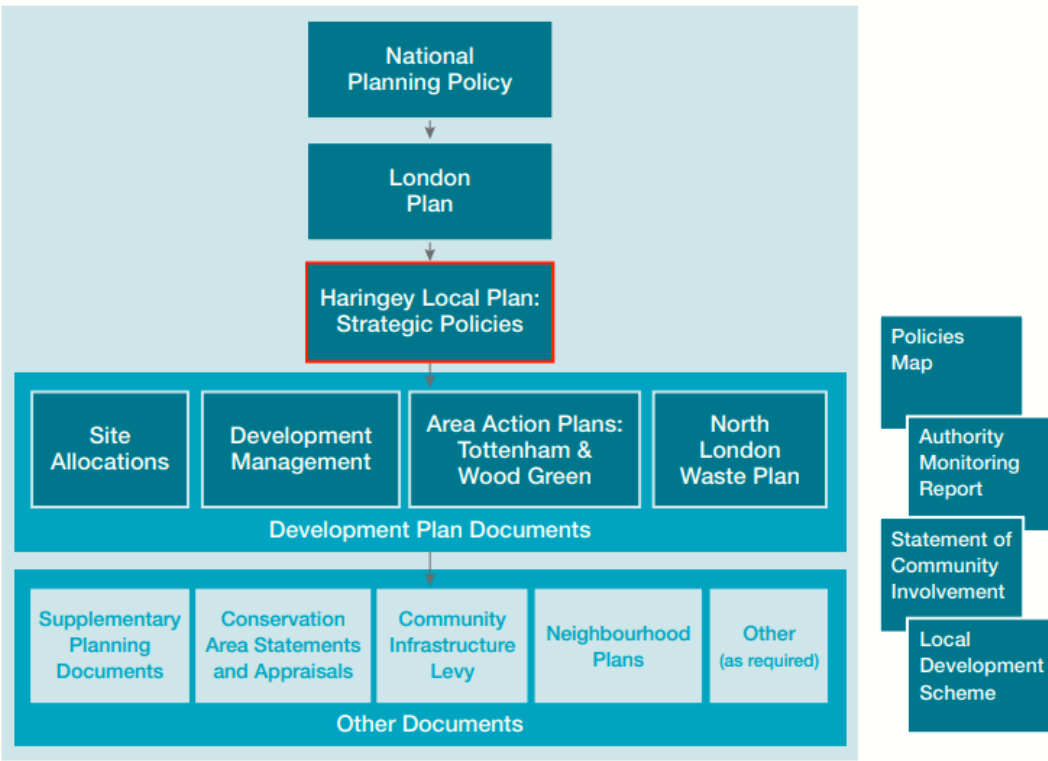


Figure 6 Haringey Local Plan

- 2.26 SP4 Working towards a Low Carbon Haringey - The Local Plan has an essential role in reducing Haringey's environmental impact and achieving sustainable Development – meeting Haringey's social, environmental, and economic needs in ways that protect the environment and do not harm our ability to meet our needs in the future. An environmentally sustainable future is one of the priorities of Haringey's Sustainable Community Strategy.

SP 4 Working towards a Low Carbon Haringey

Over the local Plan's life, reducing energy use in buildings and working towards a low-carbon borough will be one of Haringey's key challenges. The Council will promote the measures outlined below to reduce carbon emissions from new and existing buildings.

1) 1. In line with the London Plan policy, the Council will promote and require all new developments to take measures to reduce energy use and carbon emissions during design, construction, and occupation by incorporating the following measures:

a) From 2011 onwards, all new residential Development will achieve a minimum 25% reduction in total (regulated) CO2 emissions in line with Code for Sustainable Homes Level 4 energy standards and should aim to achieve Level 6. All new residential Development shall be zero carbon from 2016 onwards; and

b) From 2011 onwards, all new non-residential Development shall be built to at least BREEAM "very good" standard and aim to achieve BREEAM "excellent" or the current nationally agreed standard. All new non-residential Development shall be zero carbon from 2019.

2) 2. The Council will promote low- and zero-carbon energy generation through the following measures:

a) Requiring all developments to assess, identify and implement, where viable, site-wide, and area-wide decentralised energy facilities, including the potential to link into a wider network;

b) Establishing local networks of decentralised heat and energy facilities by requiring developers to prioritise connection to existing or planned networks where feasible;

c) Working with neighbouring boroughs and other partners to explore ways of implementing sub-regional decentralised energy networks, including the potential in the Upper Lee Valley Opportunity Area; and

d) Where viable, all new developments are required to reduce predicted carbon dioxide emissions by 20% from on-site renewable energy regeneration, including connections to local sources of decentralised renewable energy.

Development Management DPD (Adopted July 2017)

- 2.27 The Development Management Plan sets out Haringey's spatial strategy for managing Development and growth in the Borough up to 2026. The Local Plan provides a positive framework for ensuring that housing, employment, infrastructure, and other needs are met to contribute to sustainable Development in both the

Borough and Greater London. Several key objectives, which are set across five overarching themes, as follows, guide the Local Plan:

- People at the heart of change;
- An environmentally sustainable future;
- All share economic vitality and prosperity;
- Safer for all; and
- Healthier people with a better quality of life.

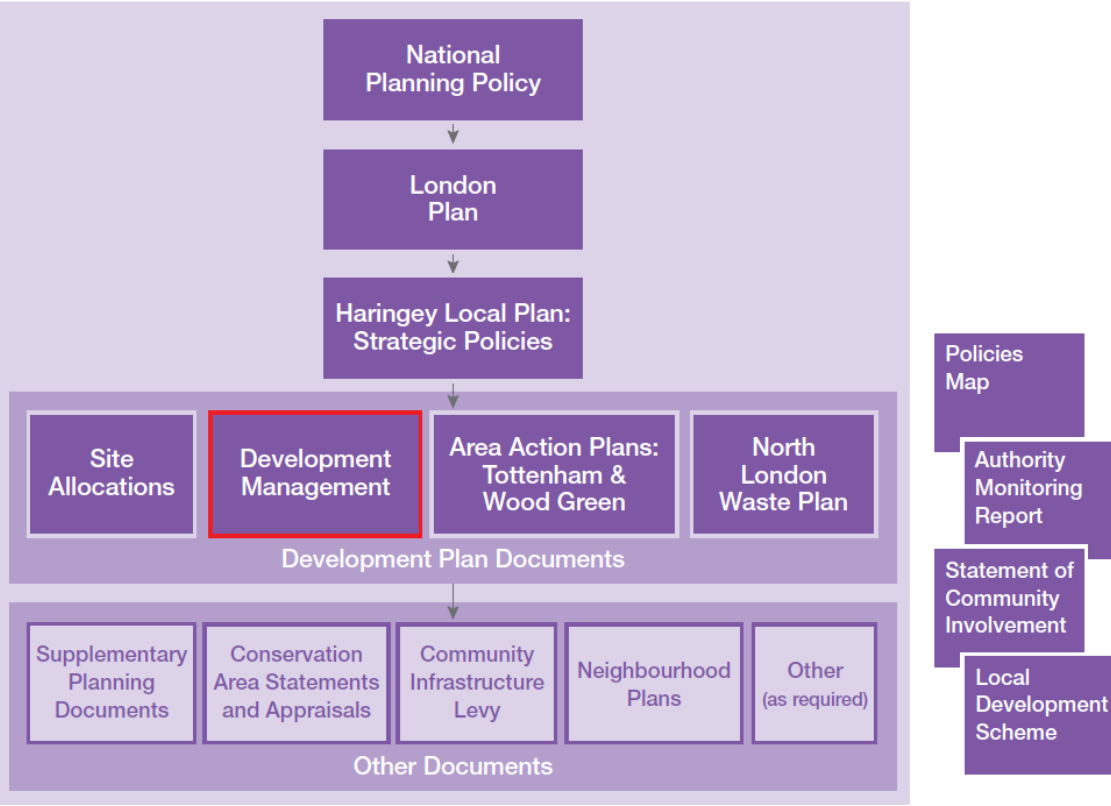


Figure 7 London Borough of Haringey Policy Hierarchy

Policy DM21: Sustainable Design,

2.28 The principles of sustainable design, layout and construction are set out in London Plan (2021). The principles cut across a few policies in this Local Plan, and all proposals should positively respond to them by engaging with the Haringey Development Charter (see Policy DM1). Applying sustainable design principles can help improve the environmental performance of buildings, making them more resilient to climate change and mitigating their effect on it. Sustainable design and construction, therefore, provide clear environmental advantages. It also offers social and economic benefits. Sustainable design results in more efficient buildings with cheaper operating costs, which benefits future owners or occupiers, particularly those at risk of fuel poverty.

Policy DM21: Sustainable Design, Layout and Construction

- A) All new Development, including building and landscape works, will be expected to consider and implement a sustainable design, layout, and construction techniques. Proposals should:
- a) Apply the energy hierarchy to minimise energy use to meet and, if possible, exceed minimum carbon dioxide reduction requirements;
 - b) Apply the 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.
- B) The Council will support appropriate measures to retrofit existing homes and non-residential buildings sustainably.
- C) Proposals that fail to demonstrate adequate consideration for sustainable design, layout and construction techniques will be resisted.
- D) Consideration will be given to using carbon offset payments, to be secured by planning obligations, where it can be demonstrated that proposals cannot meet carbon dioxide emission reduction targets on-site.

Energy Efficiency

2.29 London Plan Policy SI 2 states that all new development proposals should make significant contributions to minimising greenhouse gas emissions following the energy hierarchy, as follows:

- Be lean: use less energy
- Be clean: supply energy efficiently
- Be green: use renewable energy

2.30 The first step in the hierarchy should be met by adopting sustainable design principles and reducing energy demand. The second step should be met by fulfilling energy requirement of the development efficiently by prioritising decentralised energy, for which local requirements are set below (see Haringey DPD Policy DM22). The third step is to use renewable energy.

Layout and Construction

Policy DM22: Decentralised Energy

- A) Subject to other policy requirements, proposals contributing to the provision and use of Decentralised Energy network infrastructure will be supported.
- Communal energy systems**
- B) All Development that incorporates site-wide communal energy systems should examine opportunities for extending such systems, irrespective of whether it is connected to a DE Network.
- C) All Development incorporating site-wide communal energy systems should optimise opportunities for extending such systems beyond the site boundary to supply energy to neighbouring existing and planned future developments.
- Existing and planned future DE networks**
- D) All development proposals should prioritise connection to existing or planned future DE networks.
- E) All major Development located within 500 metres of an existing DE Network, and minor new-build Development located within 25 metres, will be expected to secure connection to that network subject to demonstration of technical feasibility and financial viability.
- F) All major Development located within 500 metres of a planned future DE Network, considered by the Council likely to be operational within 3 years of a grant of planning permission, will be expected to secure connection to that network subject to demonstration of technical feasibility and financial viability.
- DE network' connection zones.'**
- G) All major Development located within 500 metres of a DE network' connection zone' should be designed for connection to a DE network.
- H) All minor new-build Development located within 25 metres of a DE network' connection zone' should be designed for connection to a DE network.
- Customer charters**
- I) Where site-wide communal and district heating systems are operational, the Council strongly encourages heat and energy service providers to enter customer charters with domestic and micro-business customers.

- 2.31 Decentralised energy is supported by national and regional policy as a means of meeting the requirements of the Climate Change Act on carbon emission reduction. The London Plan aims to shift from the use of natural gas to a more diverse range of low carbon and renewable sources. Decentralised energy and secondary heat sources will become and increasingly important element of London's energy supply in the future. Decentralised energy will help London become more self-sufficient and resilient in relations to its energy needs.
- 2.32 Policy SP4 broadly supports DE networks as part of a package of measures to assist in delivering more energy efficient Development and working towards a low-carbon Borough. In line with the London Plan, all development proposals will be expected to select energy systems following the Mayor's energy hierarchy. This policy sets further detailed requirements to assist with implementing these strategic objectives.
- 2.33 All major Development should incorporate site-wide communal energy systems that serve all energy demands within the Development from a standard system, irrespective of whether it is connected to a DE network. Proposals should consider systems connecting different uses and building groups within and extending beyond the development site.

Overheating and cooling

- 2.34 Development proposals should seek to integrate the cooling hierarchy following sustainable design, layout, and construction principles. Helping to ensure that buildings are better equipped to manage their cooling needs in Energy efficient ways over their lifetime. This policy applies the cooling hierarchy set out in the London Plan:
1. Minimise internal heat generation through Energy efficient design
 2. Reduce the amount of heat entering a building in summer through orientation, shading, albedo, fenestration, insulation and green roofs and walls
 3. Manage the heat within the building through exposed internal thermal mass and high ceilings
 4. Passive ventilation
 5. Mechanical ventilation
 6. Active cooling systems (ensuring they are the lowest carbon options)
 7. Sustainable retrofitting
- 2.35 Existing building stock in Haringey factors significantly in local carbon emissions. The Borough's interactive heat loss map 12 indicates that many properties in the area are energy inefficient. Sustainable retrofitting offers an opportunity to improve existing buildings' environmental performance, particularly where conversions, refurbishments, changes of use and extensions are proposed.

Enhancing biodiversity

- 2.36 Urban greening can contribute to biodiversity, amenity, and climate change adaptation. Living roofs (Green and brown roofs) and green walls offer many environmental benefits, such as improving the thermal performance of buildings, reducing on-site energy demands, and limiting the 'urban heat island effect'. They also contribute to sustainable drainage by absorbing rainfall, reducing run-off and improving water quality.

Materials and locally sourced labour

- 2.37 The type and source of materials used for the construction of buildings have a major impact on sustainability. It is common for building materials and their components to be assessed regarding their environmental impact across their entire life cycle, including through energy ratings. The Council encourages applicants to use materials with high environmental performance ratings wherever possible.

Carbon Offsetting

- 2.38 The London Plan provides that boroughs may establish carbon offsetting arrangements to maximise carbon emission reductions. Carbon costing will be established using a recognised carbon price in line with London Plan supplementary planning guidance or further local guidance as appropriate. Subject to Government and regional policy, the Council will consider using carbon offsetting payments where it can be suitably demonstrated that proposals cannot meet carbon emissions reduction targets on-site. Further details in this regard are set out in the Council's Planning Obligations SPD.

3 Energy analysis

GLA Energy Assessment Guidance updates - Part L 2021 of building regulations.

- 3.1 The Mayor has declared a climate emergency and has set a target for London to be net-zero by 2030. The climate emergency puts London at the forefront of global cities and UK action on climate change. The Mayor's London Plan ensures that the planning system plays its part in achieving the net-zero target.
- 3.2 On 15th June 2022, national building regulations were updated to enhance energy performance standards for new buildings through Part L 2021. A new part L (2021) has introduced new requirements to tackle overheating.
- 3.3 The Mayor's Energy Assessment Guidance has been updated in 2022 to explain how the London Plan policy should be applied now that these regulations have taken effect. An updated spreadsheet to report carbon emissions has also been published, which planning applicants should submit as part of the energy strategy.

The Mayor's net-zero carbon target for major developments

- 3.4 As of 15th June 2022, all major developments in London must meet the London Plan net zero carbon target by following the energy hierarchy (Policy SI 2), the heating hierarchy (Policy SI 3) and by maximising on-site carbon reductions. Planning applicants are expected to demonstrate that at each stage of the energy hierarchy, they have maximised opportunities for carbon reduction to achieve as close to zero as possible. An on-site carbon reduction of at least 35 per cent beyond Part L 2021 of building regulations should be achieved. Once it is demonstrated that carbon reductions are maximised, any remaining emissions to zero should be offset by contributing to the relevant Borough's carbon offset fund. Applicants should also continue to meet the energy efficiency targets (Policy SI 2) and undertake dynamic modelling as part of their energy strategy to reduce the risk of overheating (Policy SI 4).

National Calculation Method (SBEM 6.1e June 2022)

- 3.5 The National Calculation Methods, Simplified Building Energy Model (SBEM) energy model estimates the energy consumption for the non-domestic and communal areas. The SBEM energy modelling software was developed to demonstrate the energy and emission savings for compliance with the Building Regulations. The resulting output data is accepted as suitable for early design energy comparison. The SBEM energy model also predicts unregulated energy usage using nationally agreed energy benchmarks for the proposed uses of the building.
- 3.6 As part of the recent revision to the compliance requirements for building services in England, as published by DLUHC to the Approved Document Part L2-2021 document, which is due to come into force on 15th June 2022. The main changes in the technical requirements of software since the issue of the previous NCM Modelling Guide are as follows:
 - i. The 2021 compliance target is for both CO₂ emissions and primary energy.
 - ii. New specifications of the Notional building for the 2021 edition, used to determine the CO₂ emissions and primary energy targets, have been defined to deliver a 27% reduction in CO₂ emissions on average across the new non-domestic building mix relative to Part L 2013.
 - iii. The new classification of high and low hot water demand activities determines the specifications for the Notional building's water heating system.
 - iv. On-site electricity generation by PV in the Notional building.

- v. A new set of fuel emission and primary energy factors for buildings other than dwellings is provided in Table 7 of this document, including monthly factors for Electricity. Also offered is a set of fuel factors specifically for district heating networks.
- vi. Revised approach for determining the illuminance level for a zone in the Notional building using minimum and maximum lighting levels for the activity type in the NCM Activity Database.
- vii. Revised approach for accounting for primary energy due to Electricity generated on-site by renewables.
- viii. Upgrade to the 2016 CIBSE TRY weather data sets.
- ix. Updated options for HVAC systems in the Actual building and calculation of the corresponding fan energy.
- x. Revised approach for calculating the fan energy associated with demand control of ventilation.

- 3.7 The new ISBEM of iSBEM v6.1.e to model the final proposal to confirm compliance with the building regulations.

The calculation method for estimating the building energy use and associated emissions.

- 3.8 The following approach is followed to calculate the building CO₂ emission rate.
 - A. Calculate the monthly electrical energy used by the Notional building irrespective of the source of supply. Multiply that energy use by the monthly CO₂ emission factors for grid-supplied Electricity and sum the monthly values to produce the annual figure.
 - B. Calculate the annual energy associated with any other fuels used in the Notional building and multiply the energy use by the respective CO₂ emission factors for the fuels.
 - C. Calculate the monthly Electricity generated by the on-site PV system; if applicable, multiply that by the monthly CO₂ emission factors for grid-displaced Electricity by PV generated on-site. The sum of monthly values to produce the annual figure.
 - D. The net figure of 'A plus B minus C' above is the annual CO₂ emissions used to establish the TER. If 'A plus B minus C' is a negative value, then the TER is set to 0.
- 3.9 The net primary energy of the Notional building and the TPER are calculated using the same approach.

Notional Building Photovoltaics.

- 3.10 The Notional building will have a roof-mounted PV array whose peak power (kWp) is the product of 0.2 kWp/m² and an array area (m²) calculated using the following equation:

$$APV = (A_{foundation} \times 20\% \times A_{side-lit\&unlit} / A_{total}) + (A_{foundation} \times 40\% \times A_{top-lit} / A_{total})$$

Where:

APV = area of PV array, **A_{foundation}** = area of building's foundation (as input by the user), **A_{side-lit&unlit}** = total area of side-lit and unlit zones, **A_{top-lit}** = total area of top-lit zones, and **A_{total}** = total area of all zones in the building.

The area of the building's foundation is calculated using the following equation:

$$A_{foundation} = A_{conditioned} \times N_{storeys}$$

Where:

A_{conditioned} = the total floor area of all the spaces in the modelled building which are conditioned or intended to be conditioned, e.g., after fit-out, by a space heating or space cooling system (i.e., areas of permanently unconditioned spaces are excluded), and **N_{storeys}** = the total number of stores in the entire structure that encases the modelled building, including partial storeys and storeys containing dwellings and buildings other than dwellings (whether or not they are part of the building being assessed, i.e., represented in the software model).

- 3.11 Suppose any HVAC system in the Actual building provides space heating using a heat pump. In that case, the area of the PV array in the Notional building is reduced pro-rata by the proportion of the building's space heating demand which is met by a heat pump in relation to the building's total space heating demand.
- 3.12 For example, if a heat pump meets 30% of the space heating demand in the Actual building, then the area of the PV array in the Notional building will be reduced by 30% from the value.
- 3.13 Therefore, if a heat pump meets 100% of the space heating demand in the Actual building, then the Notional building will have no PV system.

Carbon Emissions Electricity Factors

	2012 (SBEM 5.6b)		2025 (SBEM 6.1e)	
	Energy Emission	Primary Energy	Energy Emission	Primary Energy
Fuel type	kgCO ₂ /kWh		kgCO ₂ /kWh	kWhPE/kWh
Natural gas	0.216	1.22	0.21	1.126
Grid supplied Electricity	0.519	3.07	Variable Month	Variable Month
Grid displaced Electricity	0.519	3.07	PV; Variable Month	PV; Variable Month

Table 7 Energy emission factor changes between 2012 & 2022.

- 3.14 The new non-domestic building regulation grid and displace electricity Carbon Dioxide factor are calculated monthly to consider that at different seasons more Electricity is generated from sun or wind than at other times. The Carbon emission factors vary with seasons.
- 3.15 The GLA reporting tool calculates the carbon offset payment and compliance with the GLA energy hierarchy. The reporting tool uses domestic SAP 10 carbon emission factors, resulting in higher carbon dioxide emissions than the non-domestic building regulation method.

- 3.16 The GLA method increases the cost of Carbon Offset payment compared with the building regulation carbon dioxide factors.

	Grid Supplied Electricity		Grid Displaced Electricity	
	Energy Emission	Primary Energy	Energy Emission	Primary Energy
Month	kgCO ₂ /kWh	kWhPE/kWh	kgCO ₂ /kWh	kWhPE/kWh
Jan	0.163	1.602	0.196	1.715
Feb	0.16	1.593	0.19	1.697
Mar	0.153	1.568	0.175	1.645
Apr	0.143	1.53	0.153	1.567
May	0.132	1.487	0.129	1.478
Jun	0.12	1.441	0.106	1.389
Jul	0.111	1.41	0.092	1.33
Aug	0.112	1.413	0.093	1.336
Sep	0.122	1.449	0.11	1.405
Oct	0.136	1.504	0.138	1.513
Nov	0.151	1.558	0.169	1.623
Dec	0.163	1.604	0.197	1.718

Table 8 2021 new month carbon emission factor (June 2022).

Zero Carbon Building

- 3.17 National building regulations are changing on 15th June 2022. As of this date, the Mayor's net-zero carbon target set out in London Plan Policy SI 2 will continue to apply to all major developments. Applicants will be expected to continue to follow the energy hierarchy, with a minimum 35% improvement over Part L 2021 from on-site carbon savings. Once on-site carbon savings have been maximised, any remaining emissions should continue to be offset via a cash-in-lieu contribution to the relevant Borough's carbon offset fund. Further details will be provided in an update to the Energy Assessment Guidance once national regulations have taken effect. If you have any questions, please contact

Energy Modelling Results

- 3.18 The site energy usage and carbon emissions reduce at each stage of the energy hierarchy. Energy usage of some end use categories such as lighting and Auxiliary is identified as increasing due to the following reasons.
- The energy consumption of the lighting increase because the energy calculation for the base building is an area-related formula which cannot take into account the use of the zone. The proposed building is based on current luminaire efficiencies and light requirements for each zone. For example, the sports hall requires high-quality light levels. In contrast, the base building sports hall assumes a general lighting level.
 - The auxiliary energy for fans and pumps increases as the assumed equipment efficiency within the base building is not reflected by the currently available equipment manufacturers.

3.19 In conclusion, the building will consume less energy than the base building and emissions are offset by renewable energy.

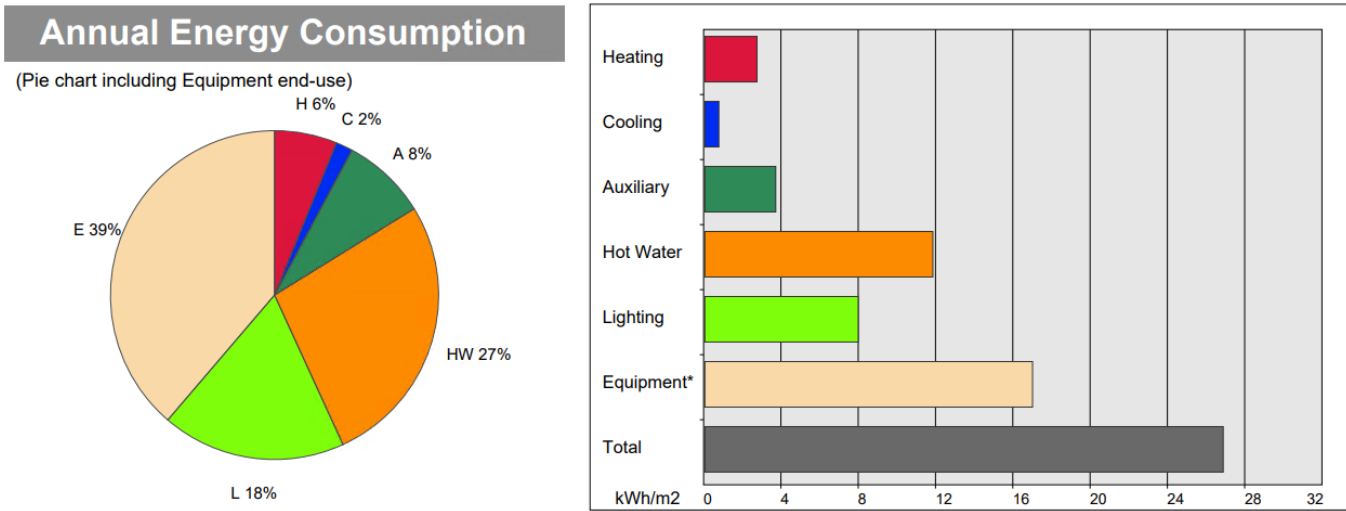


Figure 8 MSC Energy Use (New areas)

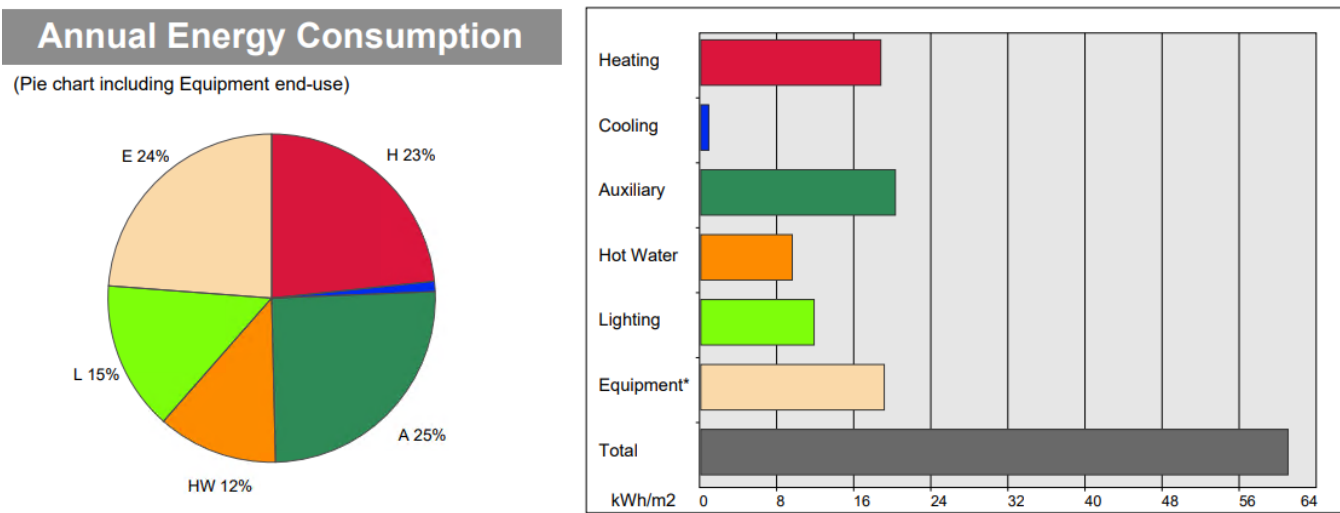


Figure 9 MSC Energy Use (Existing areas)

Building Energy Comparison with GLA Benchmarks

3.20 Energy Use Intensity (EUI) is a measure of the total energy consumed in a building annually. It includes both regulated (fixed systems for lighting, heating, hot water, air conditioning and mechanical ventilation) and unregulated (cooking and all electrical appliances, and other small power) energy. It does not include energy use from electric vehicle charging or any reduction in EUI due to renewable energy generation on-site.

3.21 In line with GLA requirements of comparing EUI and Space Heating Demand (SHD) of the development with GLA benchmarks, the table below shows proposed development performance against benchmark values.

	GLA Benchmark	Existing Areas	New Extensions
EUI	65	123.0	46.7
SHD	15	18.7	2.7

Table 9 Building energy comparison against GLA Benchmark calculated using Part L2 – approved DSM software

3.22 New extensions are predicted to perform better than the GLA benchmarks, but existing refurbished areas struggle to comply with GLA benchmarks due to existing building fabric. Although the existing areas are predicted to use more energy than GLA benchmark, the reduction/savings of embodied carbon achieved due to retaining majority of the existing building fabric in existing areas exceeds the emissions associated with the higher energy usage.

3.23 The calculated regulated space heating demand of 2.70 kWh/m²/year for the new extensions is taken from BRUKL report, calculated in accordance with the UK National Calculation Methodology (NCM) for SBEM. While this figure is lower than standard GLA benchmark (15kWh/m²/year), this variance is expected as a result of standard methodologies of building regulations compliance modelling that applies high internal heat gains generated by occupants’ metabolic activity in sports halls, gyms, exercise studios and offsets internal gains against heat losses to calculate space heating demand.

2022 Building Regulations Terminology

Regulated Energy use

3.24 Regulated energy is used for the SBEM calculation to demonstrate building control compliance.

- Heating
- Hot Water
- Fans and Pumps
- Lighting
- Unregulated Energy

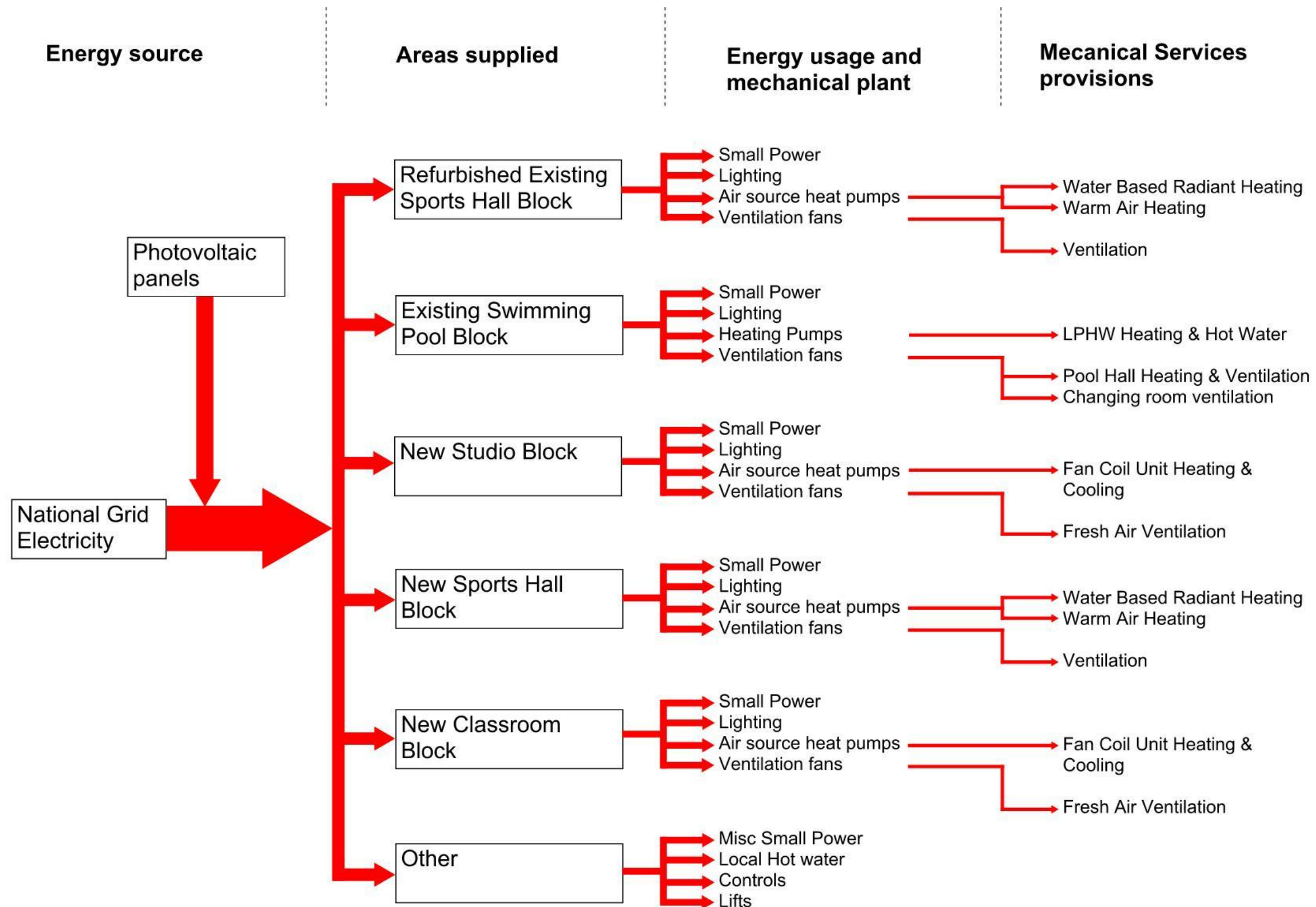
3.25 Unregulated energy is the energy the occupants use for cooking appliances and entertainment. This energy is not regulated (included/calculated for the BER), as it depends on the occupants and their lifestyles.

Base Building or Target Emission Rate (TER)

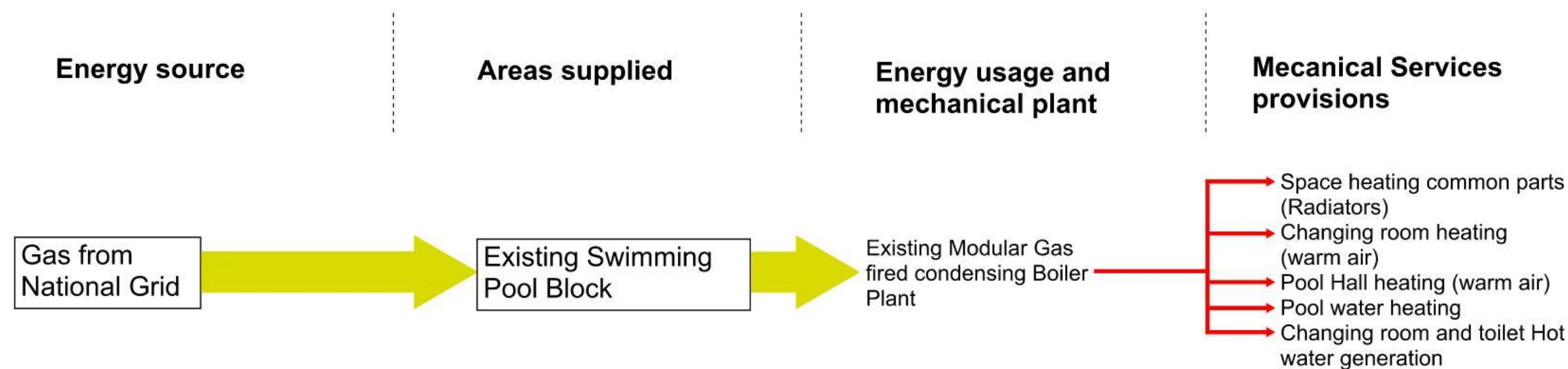
3.26 The building has been designed to comply with the standards of the 2022 Building Regulations and meet the GLA target of 15% (Be Lean) emission reduction from improvement in the building fabric and 20% from energy-efficient (Be Clean) and renewable energy generation (Be Green).

Proposed Building Emission Rate (BER).

3.27 The Building Emission rate is the regulated energy-related Carbon Dioxide emission rate from the building services design of the proposed building.



Electricity Usage Diagram



Gas Usage Diagram

4 Energy Hierarchy

Baseline

- 4.1 In line with GLA Energy Assessment Guidance (June 2022), the baseline emissions for new extensions are taken as the TER of final proposed building and baseline for existing buildings have been established by modelling existing building with notional building specifications as indicated in for building fabric and building services systems efficiencies as per minimum efficiencies listed in Approved document L.
- 4.2 Existing building fabric consists of double brick (no cavity or insulated), single glazing, uninsulated roof and uninsulated ground floor which is significantly poor performing than notional building specifications therefore baseline emissions established in accordance with GLA guidance are not realistic and better performing than the actual existing building.
- 4.3 Upgrading existing building fabric to notional building specifications will be an improvement in real life but is not demonstrated in GLA carbon emission reporting spreadsheet which make it very difficult to achieve the 15% reduction in carbon emissions at Be lean stage of the energy hierarchy for the existing building.

Building Element / System	Notional Building Specification
Roof (Flat / Pitched)	0.18 / 0.16 W/m²K
External Walls (cavity insulation)	0.55 W/m²K
External Walls (internal/external insulation)	0.30 W/m²K
Ground Floor	0.25 W/m²K
Windows & Glazing	1.40 W/m²K • Total solar transmittance (<i>g</i> -value): 0.40
Air Permeability	25 m³/(h·m²) at 50 Pa Based on existing buildings built pre 1995
HVAC System & Fuel Type	As per Be Green proposals

Table 10 Notional building specifications used to establish baseline emissions for existing buildings

Be Lean

Thermal Elements

- 4.4 Wall construction of existing buildings is generally in solid masonry cavity wall construction, with external clay-facing bricks or Portland stone facings. It is proposed to insulate existing solid walls to improve fabric performance in existing areas. New external walls will be constructed to be better than limiting standards listed in Approved document L.
- 4.5 Windows are to be aluminium or aluminium/timber composite windows or curtain walling systems, with double-glazed glass units. The glazing will include security glazing tape, dedicated security sealant or gasket and a secure mechanical fixing system – in general, all glass units will consist of safety glass, laminated, and toughened in compliance with Part N and beyond – this will apply to glass at all levels, as the sports activities will also require safety glass.
- 4.6 Roofs are constructed with a base which might be CLT panels or profiled metal sheeting, fixed to the main structural frame, and finished with rigid insulation and bituminous flat roof weatherproofing systems. In many cases, this will be combined with green roof systems, including extensive roof build-ups and drainage layers.

- 4.7 The table below shows that the proposed U-values for the new build extensions as well as the proposed upgrades to existing building fabric in comparison to limiting standards listed in Part L. The proposed fabric performance can be achieved using standard building materials for construction.

Element	Limiting Standards (Part L)	New Extension	Existing Elements Upgraded
Wall	0.26 W/m²K	0.15 W/m²K	0.30 W/m²K
Windows	1.60 W/m²K	1.40 W/m²K	1.40 W/m²K
Glass G factor	-	0.4	0.4
Roof	0.18 W/m²K	0.12 W/m²K	0.12 W/m²K
Floor	0.18 W/m²K	0.14 W/m²K	0.25 W/m²K
Air permeability Rates	8.0 m³/m².h @50Pa	3.0 m³/m².h @50Pa	8.0 m³/m².h @50Pa

Table 11 U Values for Thermal Elements

- 4.8 The proposed U-values combined with the high-efficiency building services systems reduce carbon emissions and energy consumption over Baseline scenarios for both existing areas and new extensions.

Airtightness

- 4.9 Building air tightness is a major saving of heating energy, which now has higher importance than external wall U values. Modern construction methods allow new buildings to be constructed to achieve permeability rates is as low as 3m³/ (h.m²) @50Pa.
- 4.10 New extensions will be designed to achieve air permeability of 3m³/m²h@50Pa, which is a challenging but achievable target as the design team will be specifying sealing and jointing fabric openings at external element junctions. Leakage is usually caused either by a lack of awareness of the importance of airtightness or by a lack of contractual responsibility for this requirement.
- 4.11 Proposed upgrades to existing fabric elements will also allow air permeability of existing areas to be improved and the targeted air permeability for existing areas is 8m³/m²h@50Pa.
- 4.12 Airtightness must be prioritised throughout the construction process – before, during and after. The contractor must apply suitable construction quality assurance methods, and it is recommended to undertake early air tests to identify air leakage paths.

Thermal Mass

- 4.13 Thermal mass is the ability of a material to absorb and store heat energy. Significant heat energy is required to change the temperature of high-density materials like concrete, bricks, and tiles. They are therefore said to have a high thermal mass. Lightweight materials such as timber have a low thermal mass. Appropriate use of thermal mass throughout the building can significantly affect thermal comfort.
- 4.14 Thermal mass can store solar energy during the day and radiate it at night and, when correctly used, contributes towards moderating internal temperatures by averaging out diurnal (day–night) extremes. The thermal mass contributes toward thermal comfort and reduces energy costs.
- 4.15 The new construction is a medium thermal mass design. This will allow the building to respond to heating and cooling control changes in a reasonable amount of time. External summer heat is kept out of the building through the thick internal insulation layer and a large cavity between the outer brick skin and the inner insulation layer. On average, the window wall area ratio is 25% of the external wall area. The proposal is to use solar glass, having the ability to reduce the heat gain without significant loss of light or discolouration of the glass.

- 4.16 The sports halls require a light thermal mass structure with a fast-response heating system. The highly insulated walls and the roof protects the internal space from outside weather conditions. When the sports hall heats up quickly, the wall temperatures respond to reduce the risks of condensation. The occupants have a better thermal comfort experience as they do not feel the extreme radiant effects of the building structure.
- 4.17 Highly insulated low thermal mass structures allow rapid heating with a more extended cool-down period. The ability to retain heat is required to enable reduced ventilation for sports where internal air movement should be kept low.

Thermal Bridging

- 4.18 A thermal bridge occurs when a material with high thermal conductivity (like steel, aluminium, or concrete) creates a path for heat to flow more easily than through surrounding insulated areas. Thermal bridges in building construction can lead to areas of high heat loss and condensation/mould developing risks.
- 4.19 Linear thermal bridges occur at junctions such as wall corners, wall to floor junctions, wall to roof junctions, openings, etc. The design team will develop robust construction details that will minimise thermal bridges and achieve the following psi values or better.

Thermal Bridges Psi Values (W/mK)		
Junction Type	Metal Clad	Not Metal Clad
Roof-Wall	0.28	0.12
Wall-Ground floor	1	0.16
Wall-Wall	0.2	0.09
Wall-Not Ground Floor	0	0.07
Lintel	1	0.3
Sill	0.95	0.04
Jamb	0.95	0.05

Table 12 Proposed Psi Values

Low Energy Lighting

- 4.20 All lighting will be low-energy integrated LED light fittings and controls
- 4.21 LED lighting technology with the Development of multichip LED Lamps means it is now possible to install high-quality, low-energy lights with short warm-up periods and low fading loss over the life of the lamps. The lighting industry is continually developing new stylish compact LED luminaires that can replace all the less efficient incandescent and fluorescent lights.
- 4.22 The external lighting designer will include input from a metropolitan police officer to ensure the exterior lighting design provides good quality, safe lighting, which can help prevent crime and will not cause a nuisance to the neighbours.
- 4.23 The selected luminaires will include the following integrated controls to avoid wasting energy
- Automatic presence detection to turn light fitting on and off.
 - BMS-compatible time clock controls
 - Daylight Sensing dimming control,
 - Automated self-test to give warning of when luminaire requires replacing.
 - Automated and self-testing emergency lighting and record-keeping tracked through the BMS.

- The strength of external lighting was reduced after midnight and before six am.

- 4.24 The lighting energy required in most areas of the building is generally less than the base building; however, the lighting requirements for some areas, such as the sports hall, will be greater than the base building because of the lighting levels required for the sports hall.

Overheating

Elevation	Wall Area	Windows Area	Wall Window ratio
North	344.5 m²	82.7 m²	24%
East	860.7 m²	74.0 m²	9%
South (Five Courts)	415.0 m²	44.0 m²	11%
West (Bishopwood Road)	815.3 m²	260.2 m²	32%

- 4.25 Sports centres, like any other building, are at risk of overheating during prolonged heatwave conditions. The design team have reduced the risk through the following measures.

- Green Roof. Living roofs effectively reduce heat transfer in a large industrial shed-type building. The new sports hall living roof is designed to retain rainwater for plant irrigation. The combination of plants' soil and stored water slows the heat transfer and the heat gain into the sports hall.
- Openable roof lights, lower air vents, and windows allow hot air to escape the sports halls.
- Solar shading motorised blinds enable the occupants to reduce solar through the windows.
- Mechanical ventilation and use purge the sport so heat using the overnight cooling
- The windows are mainly located along access corridors and high with the sports hall.

Be Clean

District Energy Networks

- 4.26 The London Borough of Haringey Energy Master Plan (2016)

"It appears unlikely that a network in Highgate or Hornsey will be viable based on the existing loads/development plans. Hence, these areas should be reviewed only when significant additional Development emerges."

The school is in Highgate Conservation Area. It is unlikely that the school could get planning consent for a large boiler house and combined heat/power unit, as this would be potentially unsightly in the heritage context and have implications on the local air quality. Combined Heat and Power units emit high quantities of NO_x, a gas, that are monitored as part of the London air quality target gasses. The recent guidance for flue gas emission from CHP has exceeded the capabilities of the smaller market CHP machines.

- 4.27 The design team have reviewed the London Heat map, and the site is in a location with no potential for the future Development of a district heating network.

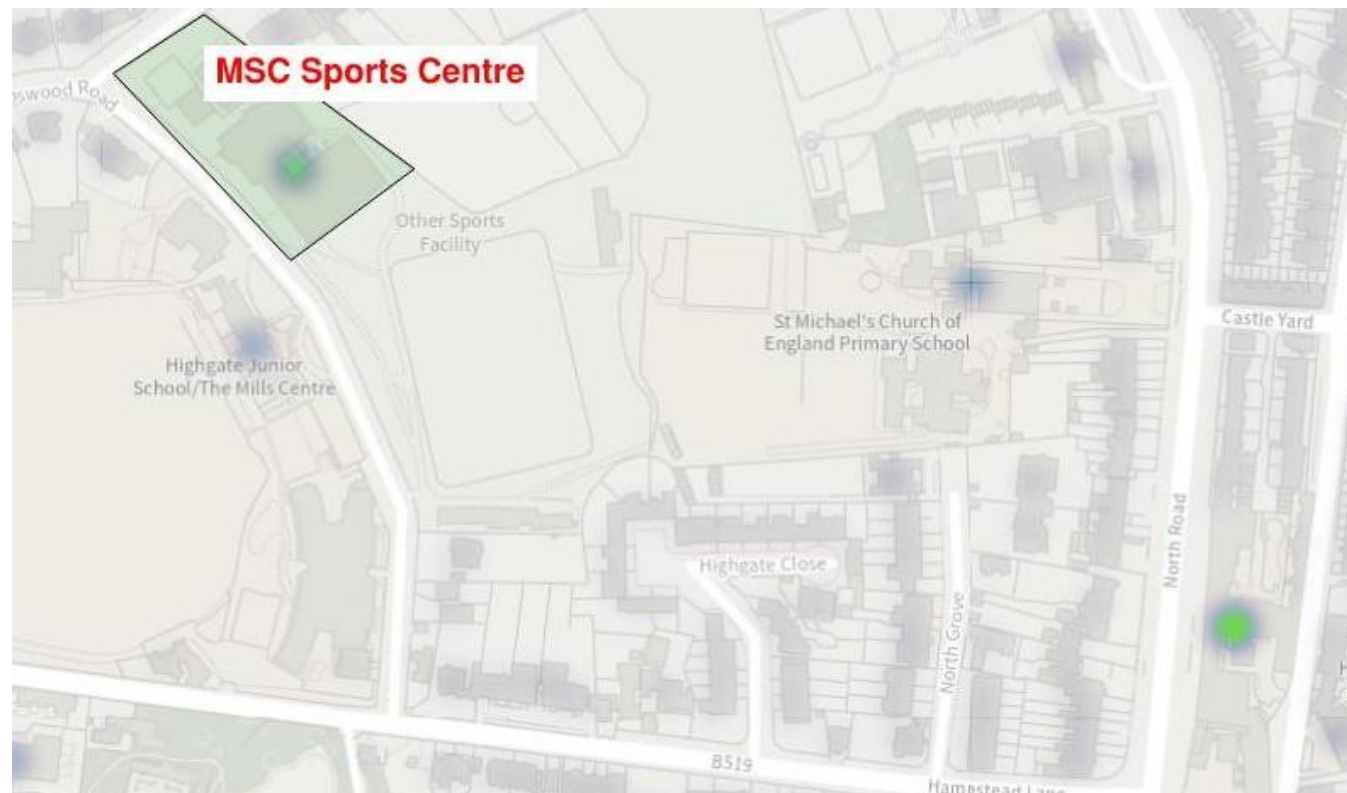


Figure 10 Mayor of London Heat Map

- 4.28 Highgate School, as part of the environmental strategy plan (2019), the school has set a challenge to become a net-zero emissions emitter. For the school to become net-zero will require a complete change in how it provides heat and power. An energy review of the various school buildings is to be undertaken, and where possible, the heating system is converted to electric heating. One of the low carbon heating solutions is a low-temperature ambient loop that interlinks buildings with low-temperature (heat pump) heating systems.

Communal Energy Network

- 4.29 The Highgate School estate has low building density with a wide variety of building types and uses. The buildings are in a continual process of change of use, refurbishment, and remodelling in response to the ever-changing requirements of the modern school estate. All the buildings have separate heating systems and power supplies that enable the facility to operate independently.
- 4.30 There is no energy advantage in connecting the heating system to a single energy centre on-site, as the system heat loss would far exceed the benefits of a communal heating system. The distance between buildings and the energy centre creates heating system losses. There is no advantage in using Combined Heat and Power as heat demand occurs between 06:00 and 09:00 in the morning while peak electrical demand occurs around the middle of the day, limiting the opportunity to supply heat and power simultaneously. It is not environmentally beneficial to operate a Combine heat power where 30% of the produce is heating the ground between the building, and the Electricity is not used on sit.
- 4.31 The improving London air quality targets now require ultra-Low NO_x flue gas emissions from boilers and combined heat power machines. The new requirements of less NO_x than 30mg/kWh of dry emission are below many gasses engines' ability to combine heat and power.

- 4.32 The school's recent investment in a new transformer connecting multiple buildings' power supplies to a single incoming supply. The transformer allows the surplus power from CHP tracking heating to supply multiple buildings with electrical power.
- 4.33 The whole site is to be developed in different phases. Separate heating plants and power supplies are required to serve each construction phase.
- 4.34 In conclusion, an estate energy centre would increase the energy required to heat all estate buildings resulting in higher CO₂ and NO_x emissions. Therefore, the communal heating system is not proposed.

Proposed Energy System

- 4.35 The proposal is to utilise a combination of air to water and air to refrigerant heat pumps to provide heating and cooling to various areas of the development. It is not intended to use natural gas for space heating or domestic hot water production in any of the areas being refurbished or in the new extensions.
- 4.36 The existing swimming pool hall and associated adjacent changing rooms have been refurbished recently (2021) with new boilers installed during the refurbishment works. It is proposed that these boilers will be retained to service the spaces until the end of their economic life to lower embodied carbon emissions and replaced with ASHP at the end of the boiler life.
- 4.37 As indicated in Figure 12, approximately 20% of Mallinson Sports Centre will be heated using retained gas boilers and 80% of the spaces will be heated using Air Source Heat Pumps.
- 4.38 Natural ventilation is required to reduce air velocities in sports halls for competition badminton use. Additional air shafts are included in the north wall. A very similar system is proposed for the dry sports hall with supplementary radiant heating for when the sports hall is used for examination.
- 4.39 Air source heat pumps will be utilised to provide space heating to classrooms, circulation spaces and store rooms.

Be Green

- 4.40 **GLA Policy 5.7 Renewable Energy** - There is a presumption by the GLA that all major development proposals will seek to reduce carbon dioxide emissions by at least 35% by using on-site renewable energy generation wherever feasible. Development proposals should seek to utilise renewable energy technologies such as biomass heating, cooling, and Electricity; renewable energy from waste; photovoltaics; solar water heating; wind and heat pumps. The mayor encourages the usage of a full range of renewable energy technologies, which should be incorporated wherever site conditions make them feasible and where they contribute to the highest overall and most cost-effective carbon dioxide emissions savings for a development proposal.

Photovoltaics

- 4.41 The proposal is to utilise majority of the roofs over existing and new extensions for installation of Photovoltaic (PV) array. PV is the most suitable and reliable renewable energy option that will achieve emissions reduction for this project.
- 4.42 PV is the most practical renewable energy technology that results in the best financial return as well as good carbon savings. 1kWp of PV generally generates around 700kWh of energy in an average year. The variation from the norm is generally around 100kWh/annum, making PV a predictable renewable energy source.

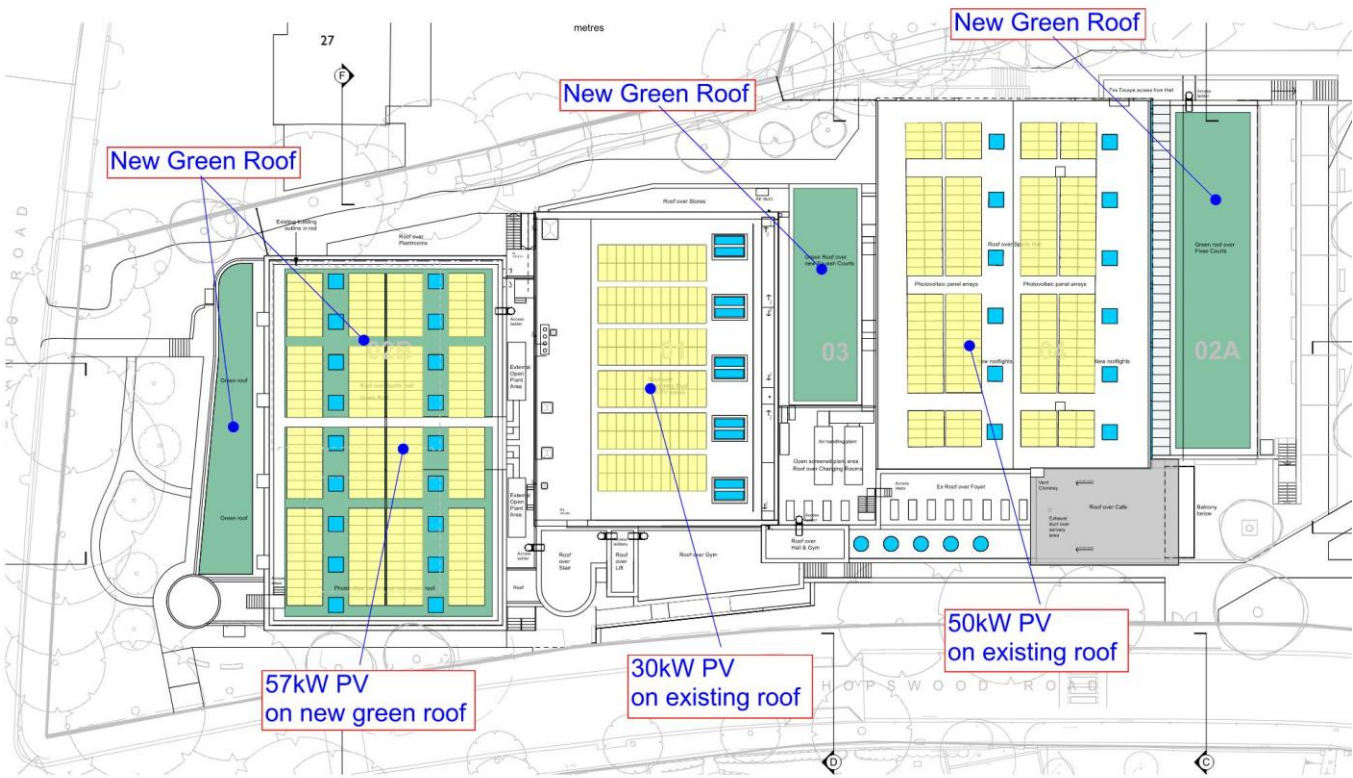


Figure 11 Proposed Location for Renewables

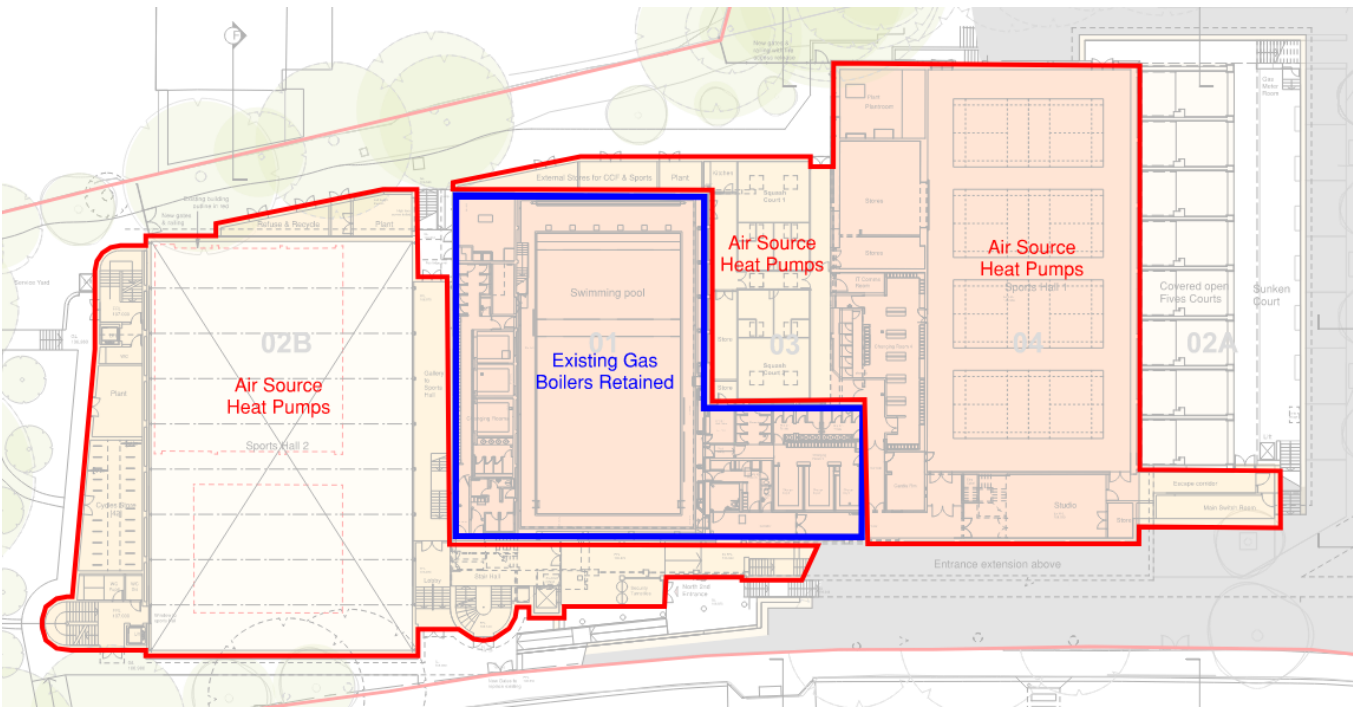


Figure 12 Proposed Heating Systems

Alternative renewable energy options

4.43 The following alternative renewable options that have been considered but found not to be appropriate are:

- **Biomass** – Not suitable for the urban location as installation will reduce local air quality through smoke emission and increase vehicle movement from the transportation of biomass fuel.
- **Air Source Heat pumps** - Is recommended as the primary heating system for sry sports halls, Classrooms and ventilation space. The heat pumps are designed as integral within the air handling units or air to water units connected to the low surface temperature radiators.
- **Solar Thermal** – There is only a tiny hot water requirement for the sports hall as the changing rooms are in the swimming pool complex have a recently installed plant. Solar thermal offset domestic hot water use in the summer months when school is fully operational. There is a more significant energy saving by utilising the available roof space for Photovoltaics generating Electricity. There is always an electricity demand for the operation of pumps, fans, and lighting.
- **Wind Turbines** – unsuitable in an urban location with turbulent airflow around buildings, generating a reasonable amount of electricity requires a substantial unit with a blade diameter over 6m.

5 Appendices

Appendix A	BRUKL Reports.....	24
Appendix B	Building Services Plant Layouts.....	32

Appendix A BRUKL Reports

BRUKL Output Document

 HM Government
Compliance with England Building Regulations Part L 2021

Project name

MSC Existing Areas (Baseline) As designed

Date: Mon Apr 28 15:26:59 2025

Administrative information

Building Details

Address: LONDON, N6 4AY

Certification tool

Calculation engine: SBEM

Calculation engine version: v6.1.e.2

Interface to calculation engine: DesignBuilder SBEM

Interface to calculation engine version: v7.3.1

BRUKL compliance module version: v6.1.e.1

Certifier details

Name:

Telephone number:

Address: , ,

Foundation area [m²]: 579.4The CO₂ emission and primary energy rates of the building must not exceed the targets

The building does not comply with England Building Regulations Part L 2021

Target CO ₂ emission rate (TER), kgCO ₂ /m ² annum	1.38
Building CO ₂ emission rate (BER), kgCO ₂ /m ² annum	9.85
Target primary energy rate (TPER), kWh _e /m ² annum	11.71
Building primary energy rate (BPER), kWh _e /m ² annum	104.69
Do the building's emission and primary energy rates exceed the targets?	BER > TER BPER > TPER

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

Fabric element	U _{Limit}	U _{Calc}	U _{Calc}	First surface with maximum value
Walls*	0.26	0.35	1.5	2. FF CORR S - STAFF WELFARE (CHANGI)
Floors	0.18	0.13	0.25	1. GF REST - CARDIO RM_S_3
Pitched roofs	0.16	-	-	No heat loss pitched roofs
Flat roofs	0.18	0.18	0.18	1. GF REST - IT COMMS RM_R_5
Windows** and roof windows	1.6	1.4	1.4	2. FF CORR S - CIRR_G_17
Rooflights***	2.2	1.7	1.7	1. GF SP HALL 1 - SP HALL 1_G_13
Personnel doors^	1.6	-	-	No external personnel doors
Vehicle access & similar large doors	1.3	-	-	No external vehicle access doors
High usage entrance doors	3	-	-	No external high usage entrance doors

U_{Limit} = Limiting area-weighted average U-values [W/(m²K)]U_{Calc} = Calculated maximum individual element U-values [W/(m²K)]U_{Calc} = Calculated area-weighted average U-values [W/(m²K)]

* 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. *** Values for rooflights refer to the horizontal position.

^ For fire doors, limiting U-value is 1.8 W/m²K

NB: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

Air permeability	Limiting standard	This building
m ³ /(h.m ²) at 50 Pa	8	25

BRUKL Output Document

 HM Government
Compliance with England Building Regulations Part L 2021

Project name

MSC Existing Areas (Be Lean) As designed

Date: Mon Apr 28 15:24:46 2025

Administrative information

Building Details

Address: LONDON, N6 4AY

Certification tool

Calculation engine: SBEM

Calculation engine version: v6.1.e.2

Interface to calculation engine: DesignBuilder SBEM

Interface to calculation engine version: v7.3.1

BRUKL compliance module version: v6.1.e.1

Certifier details

Name:

Telephone number:

Address: , ,

Foundation area [m²]: 579.4The CO₂ emission and primary energy rates of the building must not exceed the targets

The building does not comply with England Building Regulations Part L 2021

Target CO ₂ emission rate (TER), kgCO ₂ /m ² annum	1.26
Building CO ₂ emission rate (BER), kgCO ₂ /m ² annum	8.84
Target primary energy rate (TPER), kWh _e /m ² annum	10.26
Building primary energy rate (BPER), kWh _e /m ² annum	93.64
Do the building's emission and primary energy rates exceed the targets?	BER > TER BPER > TPER

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

Fabric element	U _{Limit}	U _{Calc}	U _{Calc}	First surface with maximum value
Walls*	0.26	0.3	0.3	1. GF REST - IT COMMS RM_P_7
Floors	0.18	0.13	0.25	1. GF REST - CARDIO RM_S_3
Pitched roofs	0.16	-	-	No heat loss pitched roofs
Flat roofs	0.18	0.12	0.12	1. GF REST - IT COMMS RM_R_5
Windows** and roof windows	1.6	1.4	1.4	2. FF CORR S - CIRR_G_17
Rooflights***	2.2	1.7	1.7	1. GF SP HALL 1 - SP HALL 1_G_13
Personnel doors^	1.6	-	-	No external personnel doors
Vehicle access & similar large doors	1.3	-	-	No external vehicle access doors
High usage entrance doors	3	-	-	No external high usage entrance doors

U_{Limit} = Limiting area-weighted average U-values [W/(m²K)]U_{Calc} = Calculated maximum individual element U-values [W/(m²K)]U_{Calc} = Calculated area-weighted average U-values [W/(m²K)]

* 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. *** Values for rooflights refer to the horizontal position.

^ For fire doors, limiting U-value is 1.8 W/m²K

NB: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

Air permeability	Limiting standard	This building
m ³ /(h.m ²) at 50 Pa	8	25

BRUKL Output Document

Compliance with England Building Regulations Part L 2021



Project name

MSC Existing Areas (Be Green) As designe

Date: Mon Apr 28 14:19:54 2025

Administrative information

Building Details

Address: LONDON, N6 4AY

Certifier details

Name:

Telephone number:

Address: , ,

Certification tool

Calculation engine: SBEM

Calculation engine version: v6.1.e.2

Interface to calculation engine: DesignBuilder SBEM

Interface to calculation engine version: v7.3.1

BRUKL compliance module version: v6.1.e.1

Foundation area [m²]: 579.4

The CO₂ emission and primary energy rates of the building must not exceed the targets

Target CO ₂ emission rate (TER), kgCO ₂ /m ² annum	1.26
Building CO ₂ emission rate (BER), kgCO ₂ /m ² annum	1.02
Target primary energy rate (TPER), kWh _e /m ² annum	10.26
Building primary energy rate (BPER), kWh _e /m ² annum	2.82
Do the building's emission and primary energy rates exceed the targets?	BER =< TER BPER =< TPER

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

Fabric element	U _{Limit}	U _{Calc}	U _{Calc}	First surface with maximum value
Walls*	0.26	0.3	0.3	1. GF REST - IT COMMS RM_P_7
Floors	0.18	0.13	0.25	1. GF REST - CARDIO RM_S_3
Pitched roofs	0.16	-	-	No heat loss pitched roofs
Flat roofs	0.18	0.12	0.12	1. GF REST - IT COMMS RM_R_5
Windows** and roof windows	1.6	1.4	1.4	2. FF CORR S - CIRR_G_17
Rooflights***	2.2	1.7	1.7	1. GF SP HALL 1 - SP HALL 1_G_13
Personnel doors^	1.6	-	-	No external personnel doors
Vehicle access & similar large doors	1.3	-	-	No external vehicle access doors
High usage entrance doors	3	-	-	No external high usage entrance doors

U_{Limit} = Limiting area-weighted average U-values [W/(m²K)]
 U_{Calc} = Calculated maximum individual element U-values [W/(m²K)]
 U_{Calc} = Calculated area-weighted average U-values [W/(m²K)]
 * 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. *** Values for rooflights refer to the horizontal position.
 ^ For fire doors, limiting U-value is 1.8 W/m²K
 NB: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

Air permeability	Limiting standard	This building
m ³ /(h.m ²) at 50 Pa	8	25

Building services

For details on the standard values listed below, system-specific guidance, and additional regulatory requirements, refer to the Approved Documents.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	YES
Whole building electric power factor achieved by power factor correction	<0.9

1- Multi split baseline 5.0

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	2.5	5	-	-	-
Standard value	2.5*	5	N/A	N/A	N/A

Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system NO

* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps.

2- Local Electric Heating

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	1	-	0.4	-	-
Standard value	N/A	N/A	N/A	N/A	N/A

Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system NO

3- Dry Sport Hall Warm air heating

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	2.5	-	-	2.2	0.7
Standard value	N/A	N/A	N/A	1.9^	N/A

Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system NO

^ Limiting SFP may be increased by the amounts specified in the Approved Documents if the installation includes particular components.

1- DHW from Electric

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	1	-
Standard value	1	N/A

Zone-level mechanical ventilation, exhaust, and terminal units

ID	System type in the Approved Documents
A	Local supply or extract ventilation units
B	Zonal supply system where the fan is remote from the zone
C	Zonal extract system where the fan is remote from the zone
D	Zonal balanced supply and extract ventilation system
E	Local balanced supply and extract ventilation units
F	Other local ventilation units
G	Fan assisted terminal variable air volume units
H	Fan coil units
I	Kitchen extract with the fan remote from the zone and a grease filter

NB: Limiting SFP may be increased by the amounts specified in the Approved Documents if the installation includes particular components.

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I	Zone	Standard
Standard value	0.3	1.1	0.5	2.3	2	0.5	0.5	0.4	1		
1. GF REST - CHANGING RM 3	-	-	-	-	1.9	-	-	-	-	0.8	N/A
1. GF REST - CARDIO RM	-	-	-	-	1.9	-	-	-	-	0.8	N/A

Zone name	SFP [W/(l/s)]										HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I			
Standard value	0.3	1.1	0.5	2.3	2	0.5	0.5	0.4	1	Zone	Standard	
2. FF CORR S - RECEPTION	-	-	-	-	1.9	-	-	-	-	0.7	N/A	
2. FF CORR S - STAFF WELFARE (CHANGING RM)	-	-	-	-	1.9	-	-	-	-	0.8	N/A	
2. FF CORR S - OFFICE	-	-	-	-	1.9	-	-	-	-	0.8	N/A	
2. FF CORR S - STAFF WC 2	-	-	0.5	-	-	-	-	-	-	-	N/A	
2. FF CORR S - STAFF WC 1	-	-	0.5	-	-	-	-	-	-	-	N/A	

General lighting and display lighting		General luminaire		Display light source	
Zone name		Efficacy [lm/W]		Efficacy [lm/W]	Power density [W/m²]
Standard value		95		80	0.3
1. GF REST - STORES 2		95		-	-
1. GF REST - PLANT RM SPH 1		95		-	-
2. FF CORR S - STORE		95		-	-
1. GF REST - IT COMMS RM		95		-	-
1. GF REST - CHANGING RM 3		95		-	-
1. GF REST - CARDIO RM		95		-	-
2. FF CORR S - RECEPTION		95		50	2.7
2. FF CORR S - STAFF WELFARE (CHANGING RM)		95		-	-
2. FF CORR S - OFFICE		95		-	-
2. FF CORR S - CENTRAL OFFICE		95		-	-
2. FF CORR S - CIRR		95		-	-
2. FF CORR S - LOBBY & STAIR		95		-	-
2. FF CORR S - STAFF WC 2		95		-	-
2. FF CORR S - STAFF WC 1		95		-	-
1. GF SP HALL 1 - SP HALL 1		95		-	-

The spaces in the building should have appropriate passive control measures to limit solar gains in summer

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
1. GF REST - IT COMMS RM	N/A	N/A
1. GF REST - CHANGING RM 3	N/A	N/A
1. GF REST - CARDIO RM	N/A	N/A
2. FF CORR S - RECEPTION	N/A	N/A
2. FF CORR S - STAFF WELFARE (CHANGING RM)	N/A	N/A
2. FF CORR S - OFFICE	N/A	N/A
2. FF CORR S - CENTRAL OFFICE	N/A	N/A
1. GF SP HALL 1 - SP HALL 1	NO (-55%)	NO

Regulation 25A: Consideration of high efficiency alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	NO
Is evidence of such assessment available as a separate submission?	NO
Are any such measures included in the proposed design?	NO

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters			Building Use	
	Actual	Notional	% Area	Building Type
Floor area [m²]	1158.8	1158.8		Retail/Financial and Professional Services
External area [m²]	3109.2	3109.2		Restaurants and Cafes/Drinking Establishments/Takeaways
Weather	LON	LON		Offices and Workshop Businesses
Infiltration [m³/hm²@ 50Pa]	25	4		General Industrial and Special Industrial Groups
Average conductance [W/K]	689.44	896.41		Storage or Distribution
Average U-value [W/m²K]	0.22	0.29		Hotels
Alpha value* [%]	11.42	20.99		Residential Institutions: Hospitals and Care Homes
* Percentage of the building's average heat transfer coefficient which is due to thermal bridging				
				Residential Institutions: Residential Schools
				Residential Institutions: Universities and Colleges
				Secure Residential Institutions
				Residential Spaces
				Non-residential Institutions: Community/Day Centre
				Non-residential Institutions: Libraries, Museums, and Galleries
			100	Non-residential Institutions: Education
				Non-residential Institutions: Primary Health Care Building
				Non-residential Institutions: Crown and County Courts
				General Assembly and Leisure, Night Clubs, and Theatres
				Others: Passenger Terminals
				Others: Emergency Services
				Others: Miscellaneous 24hr Activities
				Others: Car Parks 24 hrs
				Others: Stand Alone Utility Block

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	18.68	11.23
Cooling	0.81	0.48
Auxiliary	20.19	3.62
Lighting	11.76	5.55
Hot water	9.49	9.49
Equipment*	19.04	19.04
TOTAL**	60.94	30.37

* Energy used by equipment does not count towards the total for consumption or calculating emissions.
** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m²]

	Actual	Notional
Photovoltaic systems	62.1	24.1
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0
Displaced electricity	62.1	24.1

Energy & CO₂ Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m²]	183.53	146.9
Primary energy [kWh _{PE} /m²]	2.82	10.26
Total emissions [kg/m²]	1.02	1.26

HVAC Systems Performance										
System Type	Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER	
[ST] No Heating or Cooling										
Actual	102.8	304.2	0	0	0	0	0	0	0	
Notional	68.2	291.8	0	0	0	0	0	---	---	
[ST] Split or multi-split system, [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
Actual	60.7	57.9	7.2	4.5	7.6	2.33	3.55	2.5	5	
Notional	17.7	42.3	1.9	2.7	2.3	2.64	4.4	---	---	
[ST] Unflued radiant heater, [HS] Unflued radiant heater, [HFT] Electricity, [CFT] Natural Gas										
Actual	240.2	44.4	71.5	0	0.4	0.93	0	1	0	
Notional	97	91.4	20.1	0	0.4	1.34	0	---	---	
[ST] Central heating using air distribution, [HS] Direct or storage electric heater, [HFT] Electricity, [CFT] Electricity										
Actual	119.4	13.6	13.6	0	33.2	2.44	0	2.5	0	
Notional	69.6	50.1	14.4	0	5.6	1.34	0	---	---	

Key to terms	
Heat dem [MJ/m2]	= Heating energy demand
Cool dem [MJ/m2]	= Cooling energy demand
Heat con [kWh/m2]	= Heating energy consumption
Cool con [kWh/m2]	= Cooling energy consumption
Aux con [kWh/m2]	= Auxiliary energy consumption
Heat SSEFF	= Heating system seasonal efficiency (for notional building, value depends on activity glazing class)
Cool SSEER	= Cooling system seasonal energy efficiency ratio
Heat gen SSEFF	= Heating generator seasonal efficiency
Cool gen SSEER	= Cooling generator seasonal energy efficiency ratio
ST	= System type
HS	= Heat source
HFT	= Heating fuel type
CFT	= Cooling fuel type

BRUKL Output Document



HM Government

Compliance with England Building Regulations Part L 2021

Project name

MSC New Extensions (Be Lean)

As designed

Date: Mon Apr 28 16:10:26 2025

Administrative information

Building Details

Address: LONDON, N6 4AY

Certifier details

Name:

Telephone number:

Address: , ,

Certification tool

Calculation engine: SBEM

Calculation engine version: v6.1.e.2

Interface to calculation engine: DesignBuilder SBEM

Interface to calculation engine version: v7.3.1

BRUKL compliance module version: v6.1.e.1

Foundation area [m²]: 658.98

The CO₂ emission and primary energy rates of the building must not exceed the targets

Target CO ₂ emission rate (TER), kgCO ₂ /m ² annum	3,36
Building CO ₂ emission rate (BER), kgCO ₂ /m ² annum	3,27
Target primary energy rate (TPER), kWh _e /m ² annum	35,13
Building primary energy rate (BPER), kWh _e /m ² annum	34,65
Do the building's emission and primary energy rates exceed the targets?	BER =< TER BPER =< TPER

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

Fabric element	U _{Limit}	U _{Calc}	U _{Calc}	First surface with maximum value
Walls*	0.26	0.15	0.3	3. SF MZ CAFE - MAZ CAFE_W_7
Floors	0.18	0.11	0.14	1. GF CORR N - STAIR 2_F_3
Pitched roofs	0.16	-	-	No heat loss pitched roofs
Flat roofs	0.18	0.12	0.12	0. LGF SP HALL 2 - SPORTS HALL 2_R_4
Windows** and roof windows	1.6	1.4	1.4	2. FF CORR W - FF CORR M_G_10
Rooflights***	2.2	1.7	1.7	0. LGF SP HALL 2 - SPORTS HALL 2_G_5
Personnel doors^	1.6	1.5	1.5	1. GF CORR N - STAIR 2_D_31
Vehicle access & similar large doors	1.3	-	-	No external vehicle access doors
High usage entrance doors	3	-	-	No external high usage entrance doors
U _{Limit} = Limiting area-weighted average U-values [W/(m²K)] U _{Calc} = Calculated area-weighted average U-values [W/(m²K)] * 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. *** Values for rooflights refer to the horizontal position. ^ For fire doors, limiting U-value is 1,8 W/m²K NB: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.				

Air permeability	Limiting standard	This building
m³/(h.m²) at 50 Pa	8	3

BRUKL Output Document



HM Government

Compliance with England Building Regulations Part L 2021

Project name

MSC New Extensions (Be Green)

As designed

Date: Mon Apr 28 16:14:14 2025

Administrative information

Building Details

Address: LONDON, N6 4AY

Certifier details

Name:

Telephone number:

Address: , ,

Certification tool

Calculation engine: SBEM

Calculation engine version: v6.1.e.2

Interface to calculation engine: DesignBuilder SBEM

Interface to calculation engine version: v7.3.1

BRUKL compliance module version: v6.1.e.1

Foundation area [m²]: 658.98

The CO₂ emission and primary energy rates of the building must not exceed the targets

Target CO ₂ emission rate (TER), kgCO ₂ /m ² annum	3,36
Building CO ₂ emission rate (BER), kgCO ₂ /m ² annum	1,3
Target primary energy rate (TPER), kWh _e /m ² annum	35,13
Building primary energy rate (BPER), kWh _e /m ² annum	11,77
Do the building's emission and primary energy rates exceed the targets?	BER =< TER BPER =< TPER

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

Fabric element	U _{Limit}	U _{Calc}	U _{Calc}	First surface with maximum value
Walls*	0.26	0.15	0.3	3. SF MZ CAFE - MAZ CAFE_W_7
Floors	0.18	0.11	0.14	1. GF CORR N - STAIR 2_F_3
Pitched roofs	0.16	-	-	No heat loss pitched roofs
Flat roofs	0.18	0.12	0.12	0. LGF SP HALL 2 - SPORTS HALL 2_R_4
Windows** and roof windows	1.6	1.4	1.4	2. FF CORR W - FF CORR M_G_10
Rooflights***	2.2	1.7	1.7	0. LGF SP HALL 2 - SPORTS HALL 2_G_5
Personnel doors^	1.6	1.5	1.5	1. GF CORR N - STAIR 2_D_31
Vehicle access & similar large doors	1.3	-	-	No external vehicle access doors
High usage entrance doors	3	-	-	No external high usage entrance doors
U _{Limit} = Limiting area-weighted average U-values [W/(m²K)] U _{Calc} = Calculated area-weighted average U-values [W/(m²K)] * 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. *** Values for rooflights refer to the horizontal position. ^ For fire doors, limiting U-value is 1,8 W/m²K NB: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.				

Air permeability	Limiting standard	This building
m³/(h.m²) at 50 Pa	8	3

Building services

For details on the standard values listed below, system-specific guidance, and additional regulatory requirements, refer to the Approved Documents.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	YES
Whole building electric power factor achieved by power factor correction	<0.9

1- Dry Sport Hall Warm air heating

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	3.5	-	-	1.4	0.85
Standard value	2.5*	N/A	N/A	1.9^	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps.					
^ Limiting SFP may be increased by the amounts specified in the Approved Documents if the installation includes particular components.					

2- Heat Pump with UFH

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	3.8	-	-	-	-
Standard value	2.5*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps.					

3- VRF with Fan coil

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	4.5	6.5	-	-	-
Standard value	2.5*	5	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps.					

1- DHW from Electric

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	1	-
Standard value	1	N/A

Zone-level mechanical ventilation, exhaust, and terminal units

ID	System type in the Approved Documents
A	Local supply or extract ventilation units
B	Zonal supply system where the fan is remote from the zone
C	Zonal extract system where the fan is remote from the zone
D	Zonal balanced supply and extract ventilation system
E	Local balanced supply and extract ventilation units
F	Other local ventilation units
G	Fan assisted terminal variable air volume units
H	Fan coil units
I	Kitchen extract with the fan remote from the zone and a grease filter
NB: Limiting SFP may be increased by the amounts specified in the Approved Documents if the installation includes particular components.	

Zone name	SFP [W/(l/s)]										HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		Zone	Standard
Standard value	0.3	1.1	0.5	2.3	2	0.5	0.5	0.4	1			
0. LGF CORR N - CLNR STORE	-	-	-	-	1	-	-	-	-	-	-	N/A

Zone name	SFP [W/(l/s)]										HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		Zone	Standard
Standard value	0.3	1.1	0.5	2.3	2	0.5	0.5	0.4	1			
1. GF CORR N - WC	-	-	0.3	-	-	-	-	-	-	-	-	N/A
1. GF REST - KITCHEN	-	-	-	-	1	-	-	-	-	-	0.8	N/A
2. FF CORR S - VISITOR WC 1	-	-	0.3	-	-	-	-	-	-	-	-	N/A
2. FF CORR S - VISITOR WC 2	-	-	0.3	-	-	-	-	-	-	-	-	N/A
2. FF CORR N - CLASSROOM	-	-	-	-	1	-	-	-	-	-	0.8	N/A
2. FF CORR N - IT FACILITY	-	-	-	-	1	-	-	-	-	-	0.8	N/A
2. FF CORR S - MAIN FOYER	-	-	-	-	1	-	-	-	-	-	0.8	N/A
2. FF CORR S - RECEPTION	-	-	-	-	1	-	-	-	-	-	0.8	N/A
2. FF CORR S - OFFICE	-	-	-	-	1	-	-	-	-	-	0.8	N/A
2. FF CORR S - CENTRAL OFFICE	-	-	-	-	1	-	-	-	-	-	0.8	N/A
2. FF GYM M - FF GYM M	-	-	-	-	1	-	-	-	-	-	0.8	N/A
3. SF MZ CAFE - MAZ CAFE	-	-	-	-	1	-	-	-	-	-	0.8	N/A

General lighting and display lighting		General luminaire	Display light source	
Zone name		Efficacy [lm/W]	Efficacy [lm/W]	Power density [W/m²]
Standard value	95	80	0.3	
1. GF CCF SPORTS - CCF STORES	95	-	-	
1. GF CCF SPORTS - PLANT	95	-	-	
1. GF RR STR - REFUSE & RECYCLE	95	-	-	
1. GF RR STR - PLANT	95	-	-	
0. LGF CORR N - CLNR STORE	95	-	-	
0. LGF CORR N - SPORTS STORES	95	-	-	
0. LGF CORR S - UNUSED ROOMS	95	-	-	
0. LGF CORR S - STORES	95	-	-	
1. GF CORR N - PLANT	95	-	-	
1. GF CORR N - CYCLES STORE	95	-	-	
1. GF REST - STORES 1	95	-	-	
0. LGF SP HALL 2 - SPORTS HALL 2	109	-	-	
1. GF REST - SQUASH COURT 2	95	-	-	
1. GF REST - SQUASH COURT 1	95	-	-	
2. FF CORR W - FF CORR M	95	-	-	
0. LGF CORR N - STAIR 2	95	-	-	
0. LGF CORR N - STAIR 1	95	-	-	
0. LGF CORR S - LOBBY & STAIRS	95	-	-	
0. LGF CORR S - STAIR 1	95	-	-	
1. GF CORR N - STAIR 2	95	-	-	
1. GF CORR N - WC	95	-	-	
1. GF CORR N - STAIR 1	95	-	-	
2. FF CORR N - STAIR 2	95	-	-	
2. FF CORR N - STAIR 1	95	-	-	
1. GF REST - CORR 1	95	-	-	
1. GF REST - KITCHEN	95	-	-	
2. FF CORR S - CIRR	95	-	-	

General lighting and display lighting	General luminaire	Display light source	
Zone name	Efficacy [lm/W]	Efficacy [lm/W]	Power density [W/m²]
Standard value	95	80	0.3
2. FF CORR S - LOBBY & STAIR	95	-	-
2. FF CORR S - VISITOR WC 1	95	-	-
2. FF CORR S - VISITOR WC 2	95	-	-
3. SF CORR N - STAIR	95	-	-
3. SF MZ CAFE - STAIR	95	-	-
3. SF CORR W - MEZZANINE STUDIO	95	-	-
2. FF CORR N - CLASSROOM	95	-	-
2. FF CORR N - IT FACILITY	95	-	-
2. FF CORR S - MAIN FOYER	95	-	-
2. FF CORR S - RECEPTION	95	-	-
2. FF CORR S - OFFICE	95	-	-
2. FF CORR S - CENTRAL OFFICE	95	-	-
2. FF GYM M - FF GYM M	95	-	-
3. SF MZ CAFE - MAZ CAFE	95	-	-

The spaces in the building should have appropriate passive control measures to limit solar gains in summer

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
0. LGF SP HALL 2 - SPORTS HALL 2	NO (-97.5%)	YES
1. GF REST - SQUASH COURT 2	N/A	N/A
1. GF REST - SQUASH COURT 1	N/A	N/A
3. SF CORR N - STAIR	N/A	N/A
3. SF CORR W - MEZZANINE STUDIO	NO (-78%)	NO
2. FF CORR N - CLASSROOM	NO (-38.7%)	NO
2. FF CORR N - IT FACILITY	NO (-26.4%)	NO
2. FF CORR S - MAIN FOYER	N/A	N/A
2. FF CORR S - RECEPTION	N/A	N/A
2. FF CORR S - OFFICE	N/A	N/A
2. FF CORR S - CENTRAL OFFICE	N/A	N/A
2. FF GYM M - FF GYM M	NO (-17.6%)	NO
3. SF MZ CAFE - MAZ CAFE	NO (-86.8%)	NO

Regulation 25A: Consideration of high efficiency alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	NO
Is evidence of such assessment available as a separate submission?	NO
Are any such measures included in the proposed design?	NO

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Floor area [m²]	2635.9	2635.9
External area [m²]	7276.5	7276.5
Weather	LON	LON
Infiltration [m³/hm²@ 50Pa]	3	4
Average conductance [W/K]	1236.27	2205.73
Average U-value [W/m²K]	0.17	0.3
Alpha value* [%]	15.63	26.05

* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Building Use

% Area	Building Type
	Retail/Financial and Professional Services
	Restaurants and Cafes/Drinking Establishments/Takeaways
	Offices and Workshop Businesses
	General Industrial and Special Industrial Groups
	Storage or Distribution
	Hotels
	Residential Institutions: Hospitals and Care Homes
	Residential Institutions: Residential Schools
	Residential Institutions: Universities and Colleges
	Secure Residential Institutions
	Residential Spaces
	Non-residential Institutions: Community/Day Centre
	Non-residential Institutions: Libraries, Museums, and Galleries
100	Non-residential Institutions: Education
	Non-residential Institutions: Primary Health Care Building
	Non-residential Institutions: Crown and County Courts
	General Assembly and Leisure, Night Clubs, and Theatres
	Others: Passenger Terminals
	Others: Emergency Services
	Others: Miscellaneous 24hr Activities
	Others: Car Parks 24 hrs
	Others: Stand Alone Utility Block

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	2.7	7.03
Cooling	0.73	0.75
Auxiliary	3.67	2.94
Lighting	7.94	5.15
Hot water	11.8	11.8
Equipment*	16.96	16.96
TOTAL**	26.83	27.67

* Energy used by equipment does not count towards the total for consumption or calculating emissions.
** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m²]

	Actual	Notional
Photovoltaic systems	19.94	4.28
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0
Displaced electricity	19.94	4.28

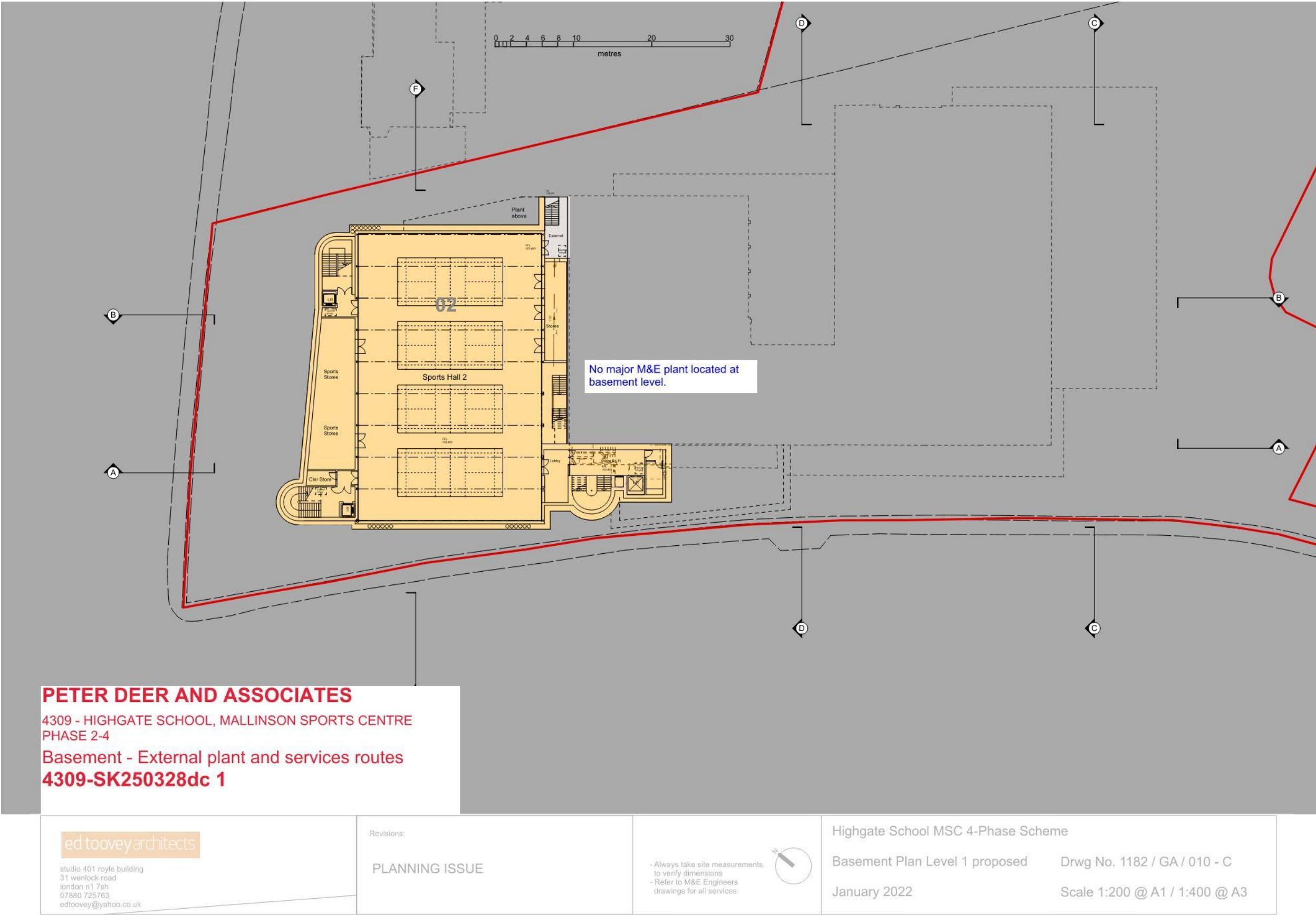
Energy & CO₂ Emissions Summary

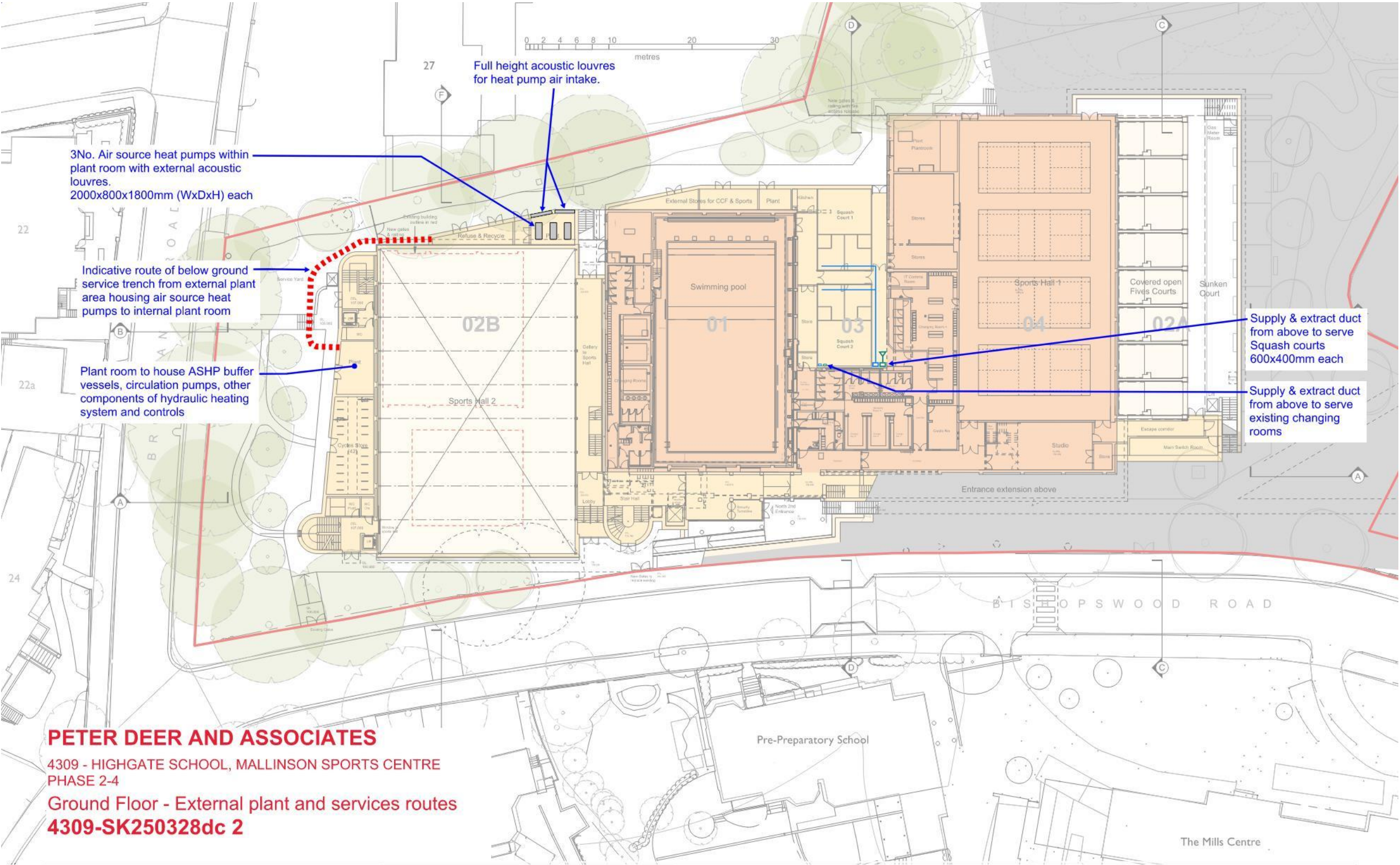
	Actual	Notional
Heating + cooling demand [MJ/m²]	102.79	156.03
Primary energy [kWh _{PE} /m²]	11.77	35.13
Total emissions [kg/m²]	1.3	3.36

HVAC Systems Performance									
System Type	Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEFF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] No Heating or Cooling									
Actual	143.8	149.5	0	0	0.1	0	0	0	0
Notional	151.7	150.6	0	0	0.1	0	0	---	---
[ST] Central heating using air distribution, [HS] ASHP, [HFT] Electricity, [CFT] Natural Gas									
Actual	24.3	9	1.8	0	6.6	3.85	0	3.5	0
Notional	73.1	47.3	7.7	0	5.6	2.64	0	---	---
[ST] Central heating using water: floor heating, [HS] ASHP, [HFT] Electricity, [CFT] Natural Gas									
Actual	71.5	32.2	5.6	0	1.5	3.57	0	3.8	0
Notional	86.8	57.2	9.1	0	1.7	2.64	0	---	---
[ST] Split or multi-split system, [HS] ASHP, [HFT] Electricity, [CFT] Electricity									
Actual	34.9	62.3	2.3	3.7	3.8	4.19	4.62	4.5	6.5
Notional	74.2	61.6	7.8	3.9	1.7	2.64	4.4	---	---

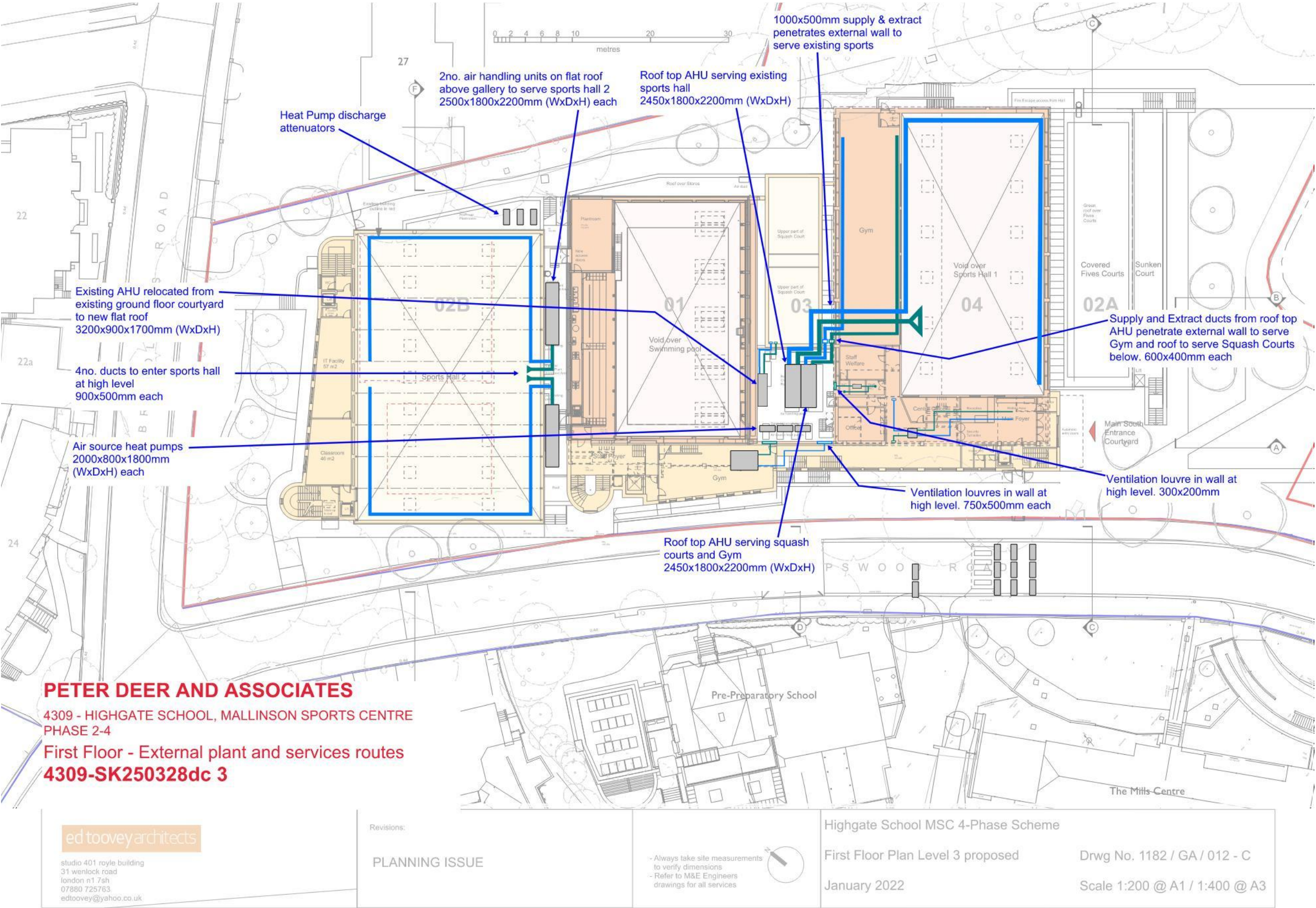
Key to terms	
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Heat con [kWh/m2]	= Heating energy consumption
Cool con [kWh/m2]	= Cooling energy consumption
Aux con [kWh/m2]	= Auxiliary energy consumption
Heat SSEFF	= Heating system seasonal efficiency (for notional building, value depends on activity glazing class)
Cool SSEER	= Cooling system seasonal energy efficiency ratio
Heat gen SSEFF	= Heating generator seasonal efficiency
Cool gen SSEER	= Cooling generator seasonal energy efficiency ratio
ST	= System type
HS	= Heat source
HFT	= Heating fuel type
CFT	= Cooling fuel type

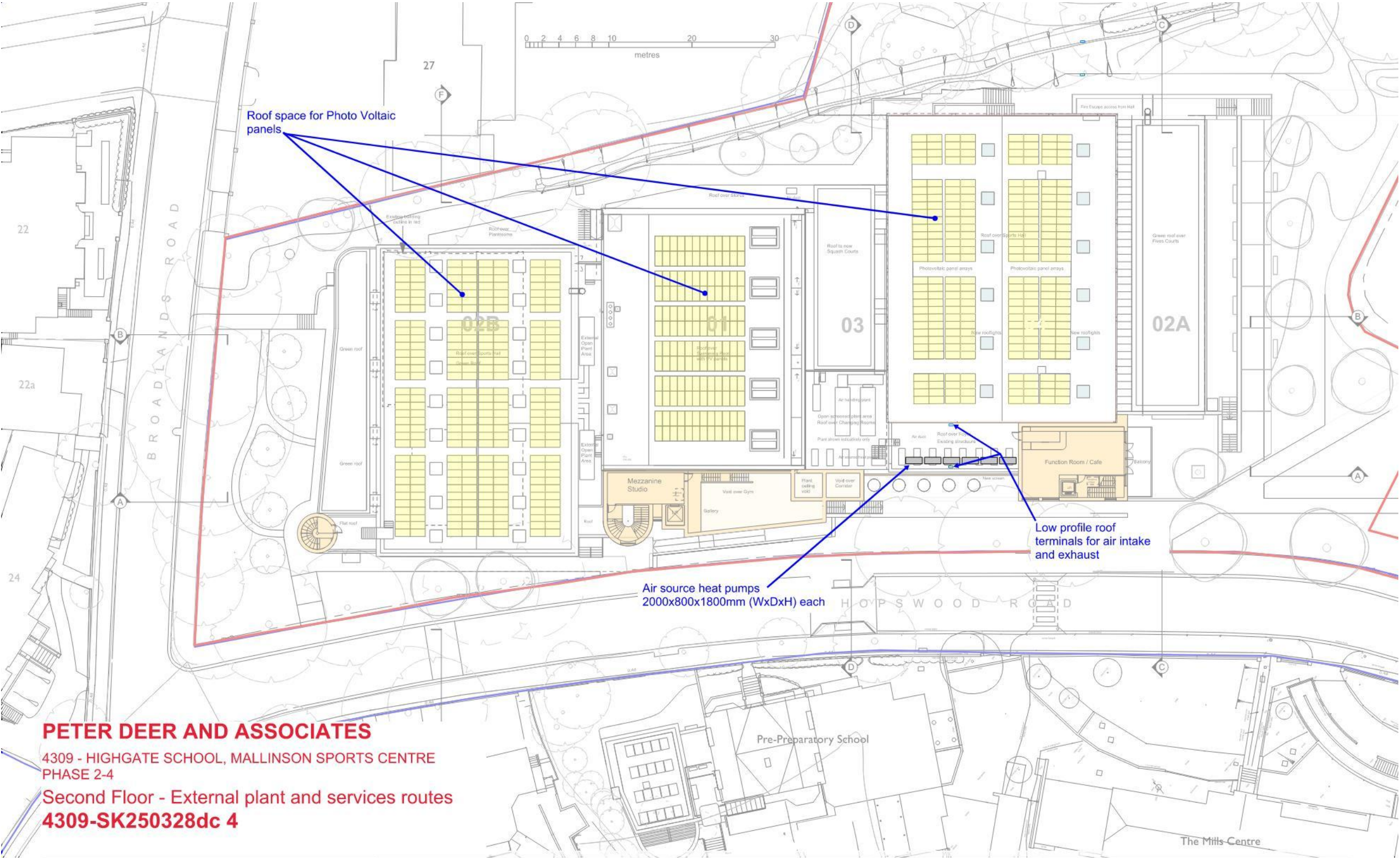
Appendix B Building Services Plant Layouts.





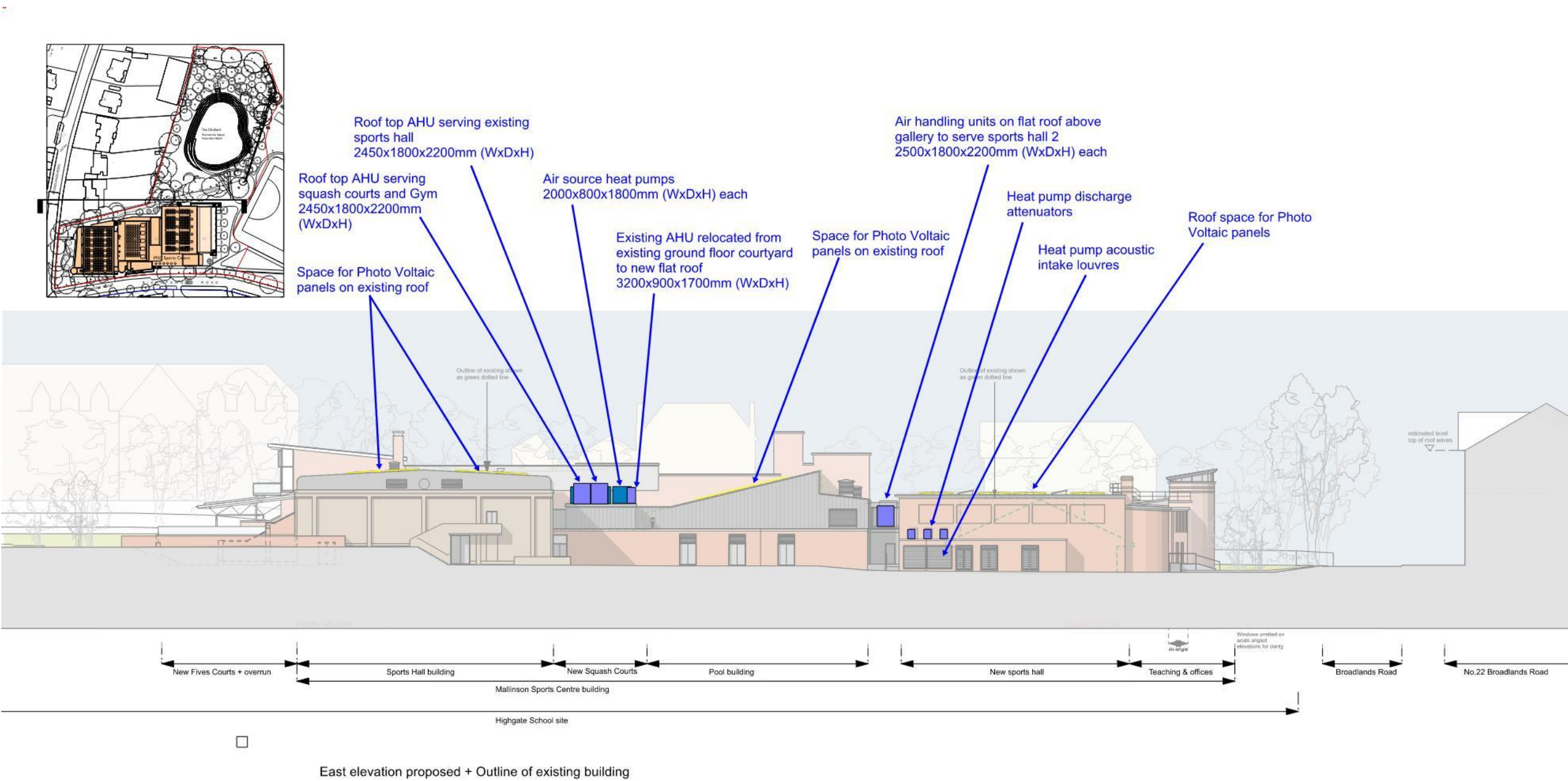
ed tooveyarchitects studio 401 royle building 31 wenlock road london n1 7sh 07880 725763 edtoovey@yahoo.co.uk	Revisions: PLANNING ISSUE	- Always take site measurements to verify dimensions - Refer to M&E Engineers drawings for all services	Highgate School MSC 4-Phase Scheme Ground Floor Plan Level 2 proposed January 2022	Drwg No. 1182 / GA / 011 - C Scale 1:200 @ A1 / 1:400 @ A3
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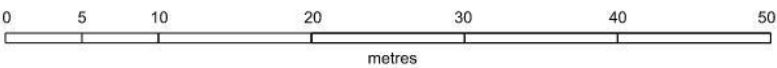


PETER DEER AND ASSOCIATES
4309 - HIGHGATE SCHOOL, MALLINSON SPORTS CENTRE
PHASE 2-4
Second Floor - External plant and services routes
4309-SK250328dc 4

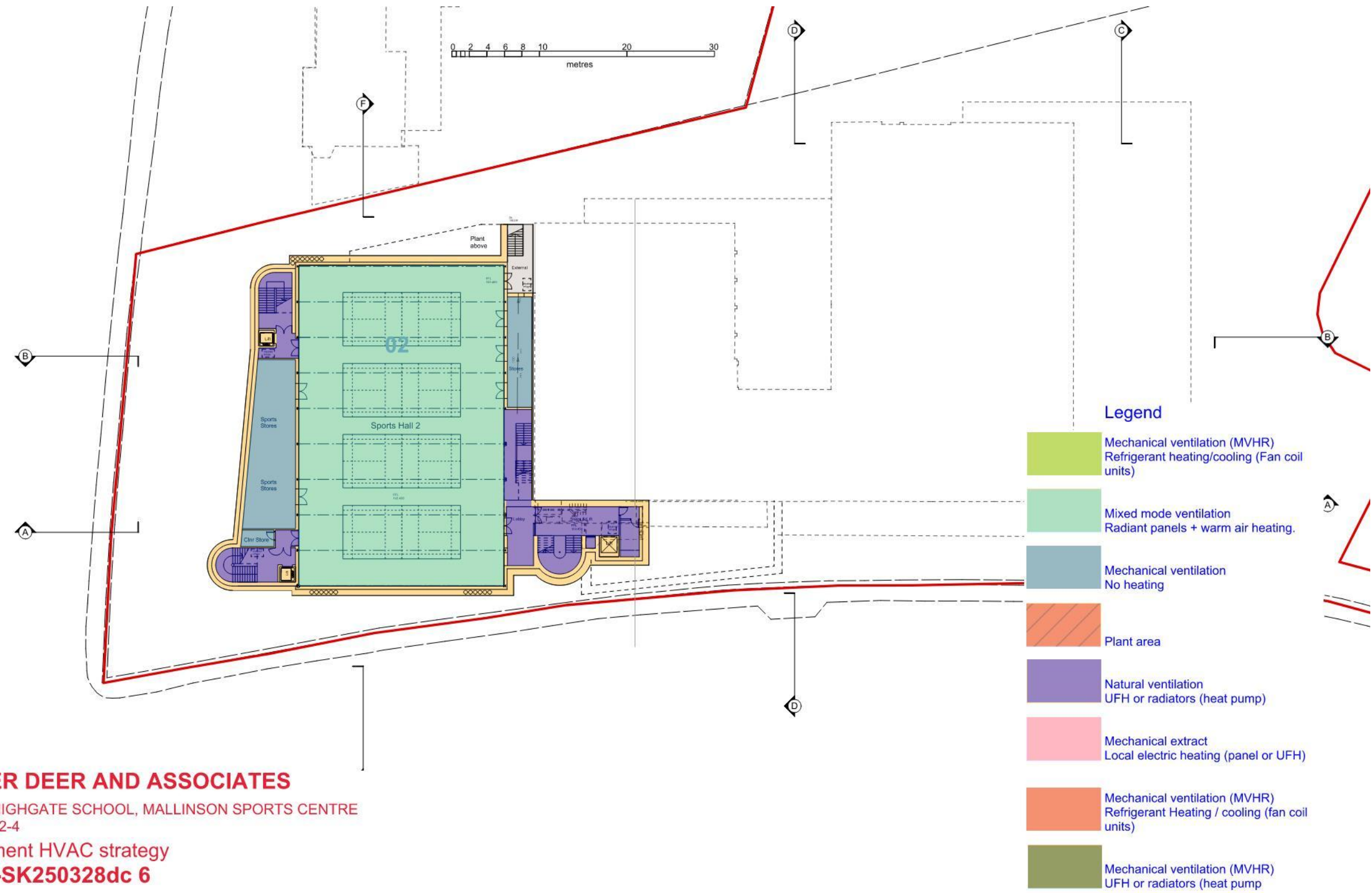
ed toovey architects studio 401 royle building 31 wenlock road london n1 7sh 07880 725763 edtoovey@yahoo.co.uk	Revisions: PLANNING ISSUE	- Always take site measurements to verify dimensions. - Refer to M&E Engineers' drawings for all services	Highgate School MSC 4-Phase Scheme Second Floor Plan Level 4 proposed January 2025 Drwg No. 1182 / GA / 013- C Scale 1:200 @ A1 / 1:400 @ A3
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4309 - HIGHGATE SCHOOL, MALLINSON SPORTS CENTRE
PHASE 2-4
East Elevation - External plant and services routes
4309-SK250328dc 5



ed toovey architects studio 401 royle building 31 wenlock road london n1 7sh 07880 725763 edtoovey@yahoo.co.uk	Revisions: PLANNING ISSUE Revision A: July 2023 - Roof ridges at back of elevational view identified, key added	- Always take site measurements to verify dimensions - Refer to M&E Engineers drawings for all services	Highgate School MSC 4-Phase Future Development Elevation East proposed January 2022 Drwg No. 1182 / GE / 014-A Scale 1:400 @ A3 ; 1:200 @ A1
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PETER DEER AND ASSOCIATES
4309 - HIGHGATE SCHOOL, MALLINSON SPORTS CENTRE
PHASE 2-4
Basement HVAC strategy
4309-SK250328dc 6

ed tooveyarchitects studio 401 royle building 31 wenlock road london n1 7sh 07880 725763 edtoovey@yahoo.co.uk	Revisions: PLANNING ISSUE	- Always take site measurements to verify dimensions - Refer to M&E Engineers drawings for all services.	Highgate School MSC 4-Phase Scheme Basement Plan Level 1 proposed Drwg No. 1182 / GA / 010 - C January 2022 Scale 1:200 @ A1 / 1:400 @ A3
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