

# HIGHGATE SCHOOL – TEMPORARY ACCOMMODATION ON SYNTHETIC SPORTS PITCH (BISHOPSWOOD ROAD CAMPUS)

## Energy and Sustainability Statement

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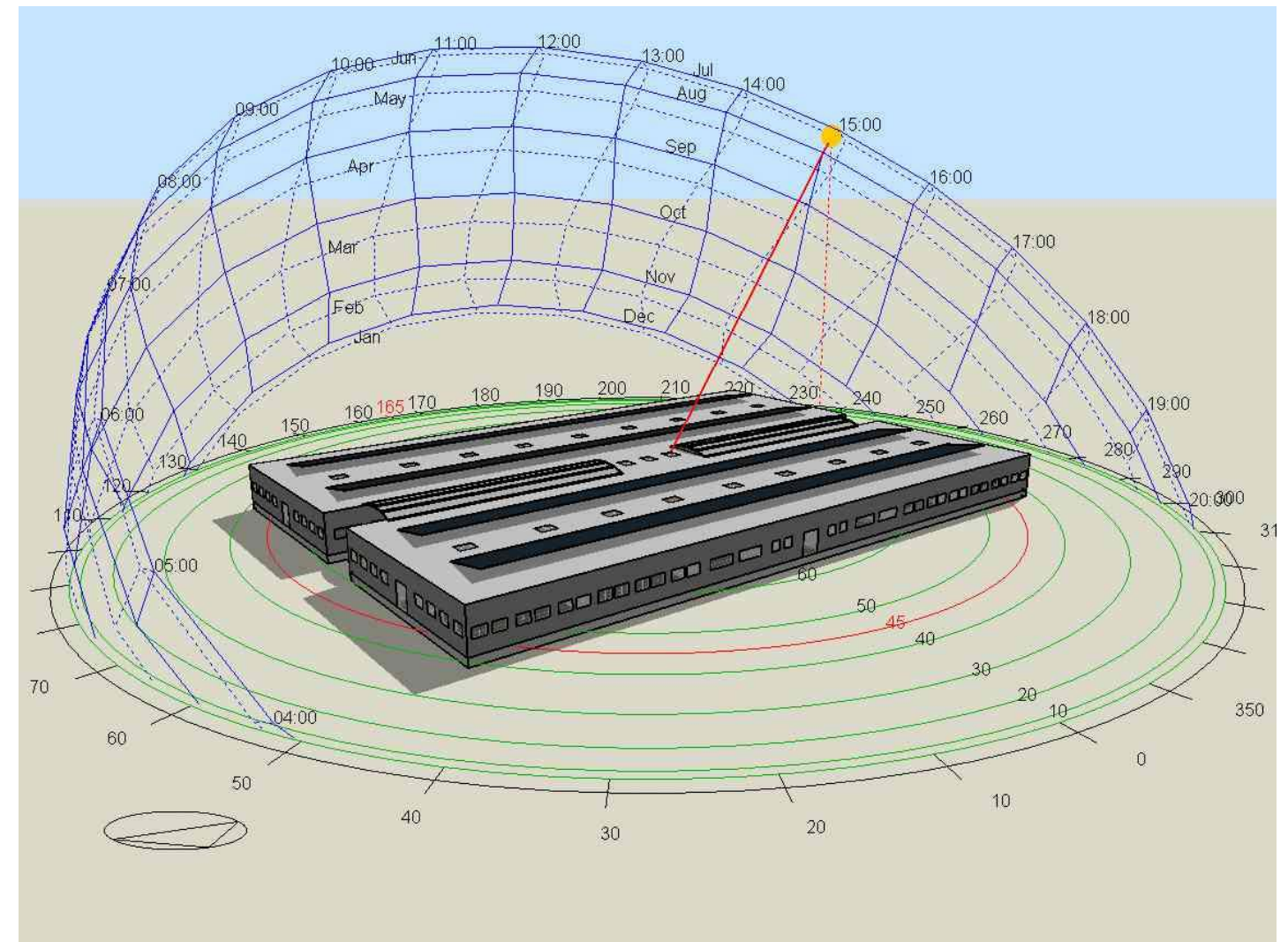
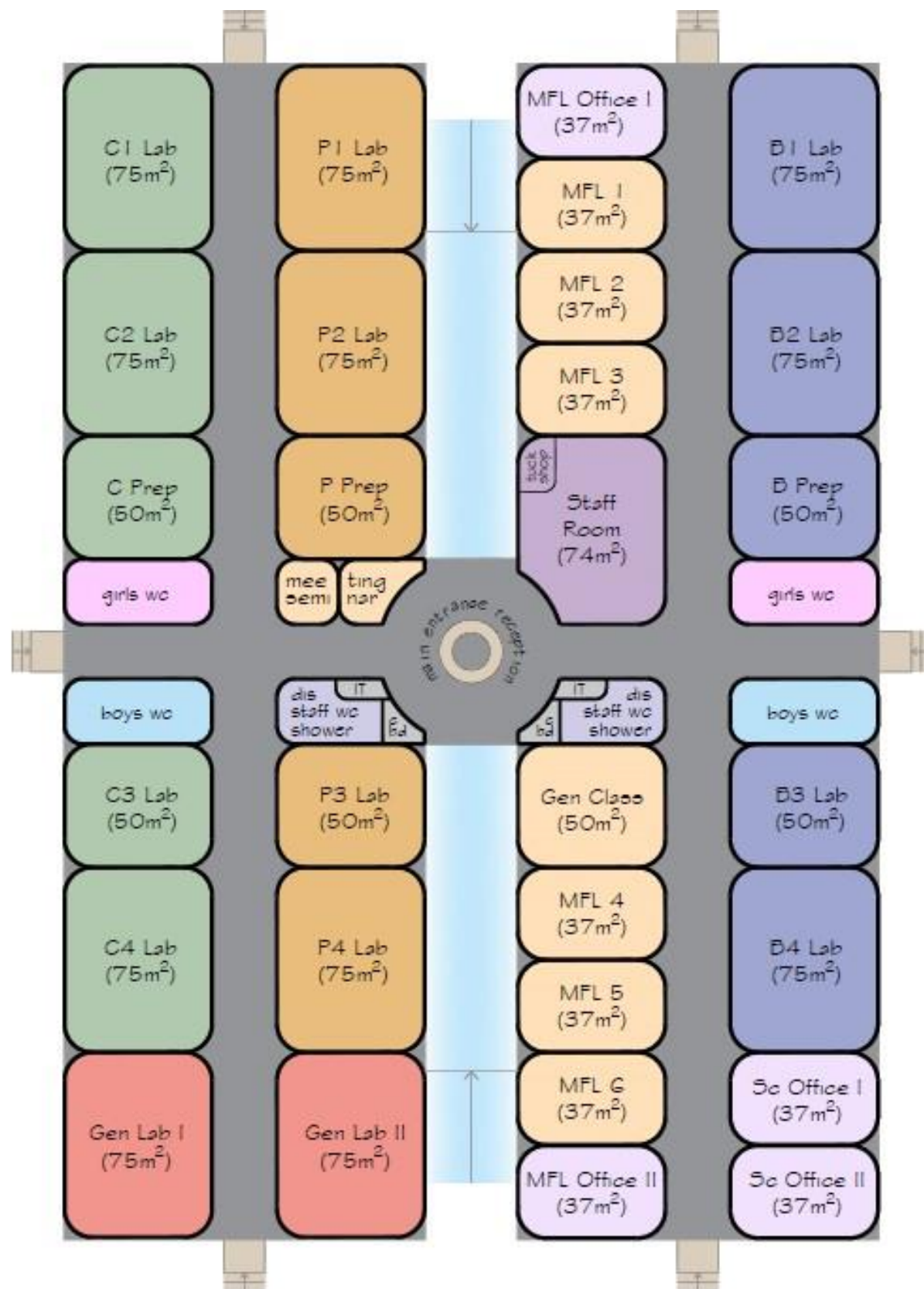


TABLE OF CONTENTS

1. EXECUTIVE SUMMARY ..... 6

*Be Lean* ..... 7

*Be Clean* ..... 7

*Be Green* ..... 7

*Summary* ..... 8

2. INTRODUCTION ..... 9

*Highgate School* ..... 9

*The Vision* ..... 9

*Proposed Works* ..... 9

*Planning Context and Background* ..... 10

*Operational Need* ..... 10

*Site* ..... 10

3. PLANNING POLICIES ..... 12

*National Planning Policy* ..... 12

*London Plan* ..... 12

*London Borough of Haringey Policies* ..... 14

        Development Management DPD (Adopted July 2017) ..... 15

        DM21: Sustainable Design, ..... 16

        Energy Efficiency ..... 16

        Overheating and Cooling ..... 17

        Enhancing biodiversity ..... 17

        Materials and locally sourced labour ..... 17

        Carbon Offsetting ..... 17

4 ENERGY ANALYSIS ..... 18

*Proposed Building Energy Systems* ..... 18

5 ENERGY HIERARCHY ..... 20

Be Lean ..... 20

Building Fabric ..... 20

Thermal Fabric Performance and Embodied Carbon..... 20

Typical Manufactures Construction Details ..... 21

Walls..... 21

Thermal insulation ..... 21

Floor ..... 21

Roof..... 21

Doors and windows ..... 21

Structural integrity..... 21

Minimum building design standards..... 21

Security ..... 21

Lighting ..... 21

Domestic hot water ..... 22

Fire performance..... 22

Climate control..... 22

Be Clean ..... 22

District Energy Networks..... 22

Communal Energy Network..... 22

Proposed Energy System..... 23

Be Green ..... 23

Photovoltaics..... 23

Summary ..... 25

Alternative renewable energy options..... 25

6 SUSTAINABLE DESIGN ..... 26

Non-Renewable Material ..... 26

Logistics ..... 26

Service Delivery..... 26

Reuse 26

Recycling Options..... 26

Supply Chain Influence ..... 26

7 CONSTRUCTION PHASE..... 27

Working with the Local Community..... 27

Construction & Transport Management Plan. .... 28

Site Access..... 28

Site Compound & Accommodation..... 28

Deliveries..... 28

Material Storage..... 28

Waste Management..... 28

On-site and off-site vehicle movements..... 28

Transport of personnel to site..... 29

Installation of New School Building ..... 29

Monitoring and management of traffic management plan..... 29

User Training..... 29

8 APPENDICES ..... 30

## 1. EXECUTIVE SUMMARY

An energy assessment aims to demonstrate that the proposed climate change mitigation measures comply with the London Plan 2021 and the London Borough of Haringey energy policies, including the energy hierarchy. It also ensures that project designers, contractors, and occupiers prioritise energy savings and emission reduction over other factors, such as construction costs, as part of the Development's design, construction, and occupation.

This Energy Statement is submitted in support of a full planning application by Highgate School to create a temporary classroom building. This planning application is linked to the primary planning applications for the Science Block, Dyne House, and Richards Music Centre redevelopments for Highgate School.

The temporary building will be located on the part of the School's synthetic playing fields accessed from Bishopswood Road to provide teaching facilities to cater for the decanting requirements of the three main schemes referred to above on a phased programme over a period of 10 years.

It is proposed that the temporary building be provided with a new water main supply extended from the water mains parallel to Bishopswood Road and foul water drainage discharge to connect to the existing sewer, which runs along the boundary edge of the playing field.

The School will proceed to tender after planning has been given for the other projects for a temporary building with several UK Manufactures. The temporary building has not been completely defined at this stage and will be procured through a design & build contract per the design principles set out within this document. The building will be constructed to meet and exceed the current building regulations (35% emissions reduction) and comply with "Standard Equipment Specification Highgate School" (Oct 2019). The structure will be constructed off-site and delivered in modules.

Modular buildings are mainly built using modules, where the components and parts are upgraded in the factory environment. Most manufactures claim to achieve low embodied carbon values as many components are reused. The Manufactures will design and construct the temporary building according to the current building regulations as the Approved Document Part L volume 2 (2021). The new guidance requires all temporary buildings to be reconstructed to meet new thermal standards and emission reduction regardless of the number of reused modules. Therefore, the building regulations consider all temporary buildings as new buildings.

To reduce manufacturing costs, modular buildings are constructed to meet the current 2021 building regulations. Greater London Authority (GLA) and the London Borough of Haringey (LBH) require higher thermal fabric standards. Reducing the temporary building carbon emission by 15% (Be Lean) will require encapsulating the modular structure with additional insulation and cladding.

The additional insulation and cladding required to reduce carbon emissions by 15% (Be Lean) will have to be specifically designed to suit the proposed configuration of modules for this site which is unlikely to suit any other sites, therefore, it is very unlikely that the cladding will be re-used on any future project. As the additional cladding and insulation will not be re-usable it is likely that the metal cladding and structure will be chipped for recycling (in another country) and the insulation burnt for energy recovery. The resulting loss of embodied carbon will probably exceed the energy saving from the improved building fabric over the predicted 10 years of use. It is recommended that the planners consider not applying the additional 15% Be Lean emission reduction from building fabric improvement to this development.

A large low-angle PV (80kW) array will be installed on the roof to ensure the building energy emissions comply with the London Borough of Haringey (LBH) and Greater London Authority (GLA) emissions reduction targets.

The school will commit that the temporary buildings, including all site work, landscaping, access alterations, boundary treatments and roads, will be returned to their original appearance and used as quickly as possible once removed.

|                                                                         | Carbon Dioxide Emissions for non-residential buildings (SBEM6.1e)<br>(Tonnes CO <sub>2</sub> per annum) |             |
|-------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------|-------------|
|                                                                         | Regulated                                                                                               | Unregulated |
| Baseline: Part L 2021 of the Building Regulations Compliant Development | 8.7                                                                                                     | 2.1         |
| After energy demand reduction (be lean)                                 | 8.0                                                                                                     | 2.1         |
| After heat network connection (be clean)                                | 8.0                                                                                                     | 2.1         |
| After renewable energy (be green)                                       | -0.3                                                                                                    | 2.1         |

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

|                                               | Regulated non-residential carbon dioxide savings (SBEM 6.1e) |      |
|-----------------------------------------------|--------------------------------------------------------------|------|
|                                               | (Tonnes CO <sub>2</sub> per annum)                           | (%)  |
| Be lean: savings from energy demand reduction | 0.70                                                         | 9%   |
|                                               | 0.00                                                         | 0%   |
| Be green: savings from renewable energy       | 8.30                                                         | 95%  |
| Total Cumulative Savings                      | 9.00                                                         | 104% |
| Annual savings from offset payment            | -10                                                          |      |

Table 2 Carbon dioxide emissions after each stage of the Energy Hierarchy for non-domestic buildings

|                   | Notional - Average Fabric U value (W/m²K) | Actual - Average Fabric U value (kWh/m²) | Improvement (%) |
|-------------------|-------------------------------------------|------------------------------------------|-----------------|
| Development total | 0.24                                      | 0.16                                     | 33%             |

Table 3 Non-Domestic Building Average U -Value.

|          | Area weighted non-domestic cooling demand (MJ/m2) | Total area weighted non-domestic cooling demand (MJ/year)2 |
|----------|---------------------------------------------------|------------------------------------------------------------|
| Actual   | 131.30 MJ/m²                                      | 303,867 MJ/year                                            |
| Notional | 96.20 MJ/m²                                       | 222,635 MJ/year                                            |

Table 4 Building cooling demand.

|                                                                                                          |                                                                                                  |
|----------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------|
| Building type                                                                                            | School                                                                                           |
| EUI (kWh/m2/year) (excluding renewable energy)                                                           | 67.20 kWh/m²                                                                                     |
| Space heating demand (kWh/m2/year) (excluding renewable energy)                                          | 4.24 kWh/m²                                                                                      |
| EUI value from Table 4 of the guidance (kWh/m2/year) (excluding renewable energy)                        | 65.00 kWh/m²                                                                                     |
| Space heating demand from Table 4 of the guidance(kWh/m2/year) (excluding renewable energy)              | 15.00 kWh/m²                                                                                     |
| Methodology used (e.g., ‘be seen’ methodology or an alternative predictive energy modelling methodology) | In concept design, the building energy is estimated for extended hours of use based on SBEM6.1e. |
| Explanatory notes (if expected performance differs from the Table 4 values in the guidance)              | Revise based on the actual design                                                                |

Table 5 EUI & space heating demand (predicted energy use).

Be Lean

Due to the improvements in Building Regulations, Part L 2021, and subsequent amendments is difficult for new non-domestic buildings to exceed the notional building energy consumption. Therefore, the temporary building will be constructed to be as energy efficient as technically possible. See Table 12 Proposed U Values.

Be Clean

It is proposed to utilise air source heat pumps to heat the new building.

Be Green

London Borough of Haringey and GLA require a 35% on-site reduction in carbon emissions beyond Part L 2021 for non-residential developments. It is proposed to reduce the carbon emissions through on-site energy generation using roof-mounted Photo Voltaic (PV) panels. All the available roof space in the new building will accommodate the PV array. In recent years, the School installed a dedicated electricity sub-station that supplies power to multiple school buildings. The sub-station enables the school to use majority of the electricity from the PV panels by allowing the energy to be used by multiple buildings being supplied from the new sub-station.

Summary

PV peak 58.9 kW

PV Generation 52,901 kWh per annum.

Area of PV array 589 m<sup>2</sup>

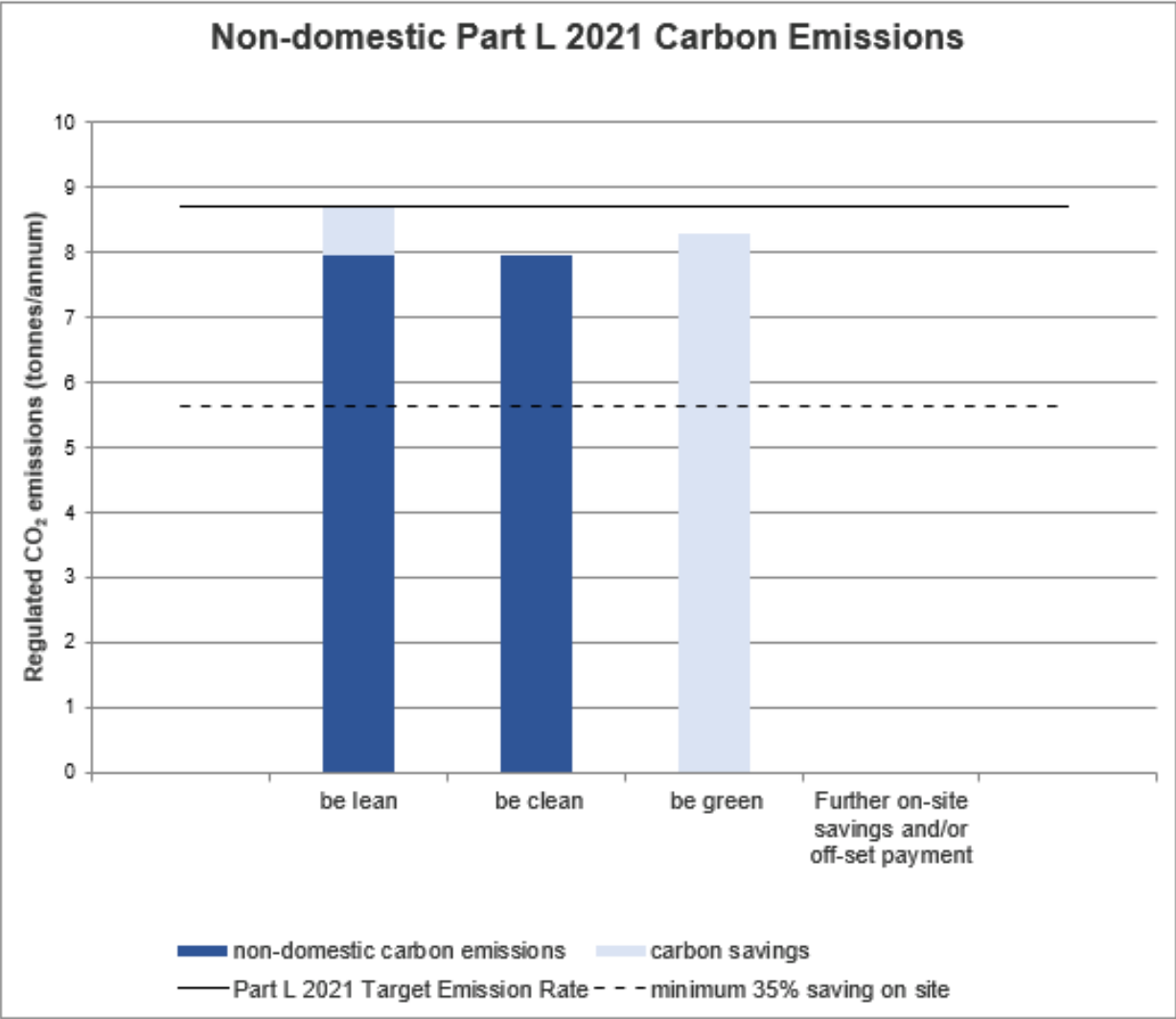


Figure 1 GLA Energy Hierarchy - SBEM 6.1e (2021) Emission Factors

## 2. INTRODUCTION

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

2.2 This energy statement is submitted in support of a full planning application by Highgate School to create temporary accommodation. This planning application is linked to the primary planning applications for the Science Block, Dyne House and Richards Music Centre redevelopments for Highgate School.

### Highgate School

2.3 Highgate School was established in 1565 by a Royal Charter of Queen Elizabeth the First. Sir Roger Cholmeley, the School's Founder, was granted a Letters Patent to found a grammar school for good education and instruction.

2.4 The external appearance of most of the Senior School buildings originates from the nineteenth century, constructed under the dynamic leadership of Head Master Rev. John Bradley Dyne (1838-1874). The works include the listed School Chapel and Big School, which dominate the western end of Highgate High Street and are considered a notable North London landmark

2.5 The Pre-Preparatory School was coeducational from 1993. The School admitted girls into the Junior and Senior schools in 2004; by 2010 each year, the group was fully coeducational.

2.6 Highgate School is a registered charity, no.312765.

### The Vision

2.7 The proposed Development is auxiliary to several other applications submitted in various school parts. 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:

2.8 "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."

2.9 "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."

2.10 "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."

### Proposed Works

2.11 The main redevelopment works will require existing buildings at the Senior School to be fully vacated. It will be, therefore, impossible to maintain the daily operation of the Senior School in the existing buildings. It is essential that the Senior School facilities, even in their temporary home, are close to the other School facilities such as the Dining, Sports, and communal Foundation facilities such as the Mills Centre for Art and Design Technology and Engineering. The temporary building is intended to provide teaching facilities to cater for the decanting requirements of three schemes on a phased programme over a period of 10 years. This energy statement has been carried out for the temporary building.

2.12 The proposed works in this submission include:

- Install a single-storey temporary modular teaching block at the south end of the synthetic playing fields on the east side of Bishopswood Road.
- Alterations to existing cricket fencing and new temporary cricket fence divider.
- Alterations and extensions to existing pathways provide access around the site's perimeter with low-level lighting for safety.
- Installation of temporary utility intake shed and connections to the existing sewer.
- Removal of the temporary buildings and reinstatement of the site.

- Replacement of the existing damaged synthetic turf with permanent new synthetic turf to meet current standards and Specs (sports and exercise) curriculum requirements.

- 2.13 Highgate School aims to maintain a high standard of the physical environment for all pupils throughout this interim period until the main redevelopment projects are completed.
- 2.14 The School will commit to returning the site as quickly and as practically possible to the original appearance and use once the proposed phased works have been completed

## Planning Context and Background

- 2.15 For a complete and detailed assessment of the planning context of this proposal, refer to the separate detailed covering letter and planning statements by Bidwell's LLP that accompanies this application.
- 2.16 The School carried out a thorough analysis of sites for the temporary accommodation.
- 2.17 The Synthetic Sports Pitch on Junior Field (Bishopswood Road Campus) was the only viable and feasible site.
- 2.18 The existing Synthetic Sports Pitch sits in the centre of the Junior Field, which lies within the Highgate Conservation Area and Metropolitan Open Land.
- 2.19 School buildings and facilities surround the Junior Field to the North (Mallinson Sports Centre), West (Mills Centre, Junior School) and South (Richards Music Centre), and St Michael's CofE Primary school playing fields to the East along a line of mature trees and the rear gardens of residential properties to the South-East.
- 2.20 The Junior Field has high fencing along its westerly boundary on Bishopswood Road, and the Synthetic Sports Pitch is fully enclosed within a high post and netting fence.
- 2.21 The School is committed to a good quality temporary building that will not be detrimental to the Conservation Area whilst expressing its temporary nature. The temporary building will be single-storey, located at a distance from boundaries, and nested within the "sunken" southern half of the Synthetic Sports Pitch. Furthermore, it will be partly screened from the road behind two intervening bands of existing fencing.
- 2.22 This location has been strategically selected to maintain the lowest profile possible and minimise its visibility from the road and neighbouring buildings further afield.

## Operational Need

- 2.23 The temporary decant facilities will reflect the operational needs of the main refurbishment and redevelopment schemes referred to in the individual applications for the Science Block, Dyne House and Richards Music Centre projects.
- 2.24 During its temporary life, the building's internal layout will be reconfigured to cater for the different functions and requirements as follows: period I - Science labs and general classrooms during the Science Block works; period II - general classrooms, Music and Drama facilities during the Dyne House works; period III - Specs (Sport and Exercise) Department facilities, Drama facilities and IT offices during the Richards Music Centre works. These internal layout changes will not affect its external appearance and elevations.
- 2.25 The temporary accommodation must provide a satisfactory standard of educational accommodation in terms of available facilities, relationships of spaces and atmosphere. The learning environment applies not only to the buildings and the learning areas but also to the external spaces.
- 2.26 It is a fundamental approach to ensure that pupils present during the rolling decanting period will enjoy the same high standard and welcoming, uplifting environment the School offers across the Foundation. Similarly, it is essential to continue with a good standard of spaces for teaching and welfare.
- 2.27 The planning of these temporary facilities has been based on providing a stimulating and friendly environment that maintains a high standard of educational performance.

## Site

- 2.28 The address is Synthetic Pitch (adjacent to Mallinson Sports Centre), Bishopswood Road, Highgate, Haringey, London N6 4NY.
- 2.29 The synthetic playing sports pitch forms part of the school estate and is near other essential School buildings such as the Mills Centre, the Dining Hall, the Pre-Prep School, and the Junior School.

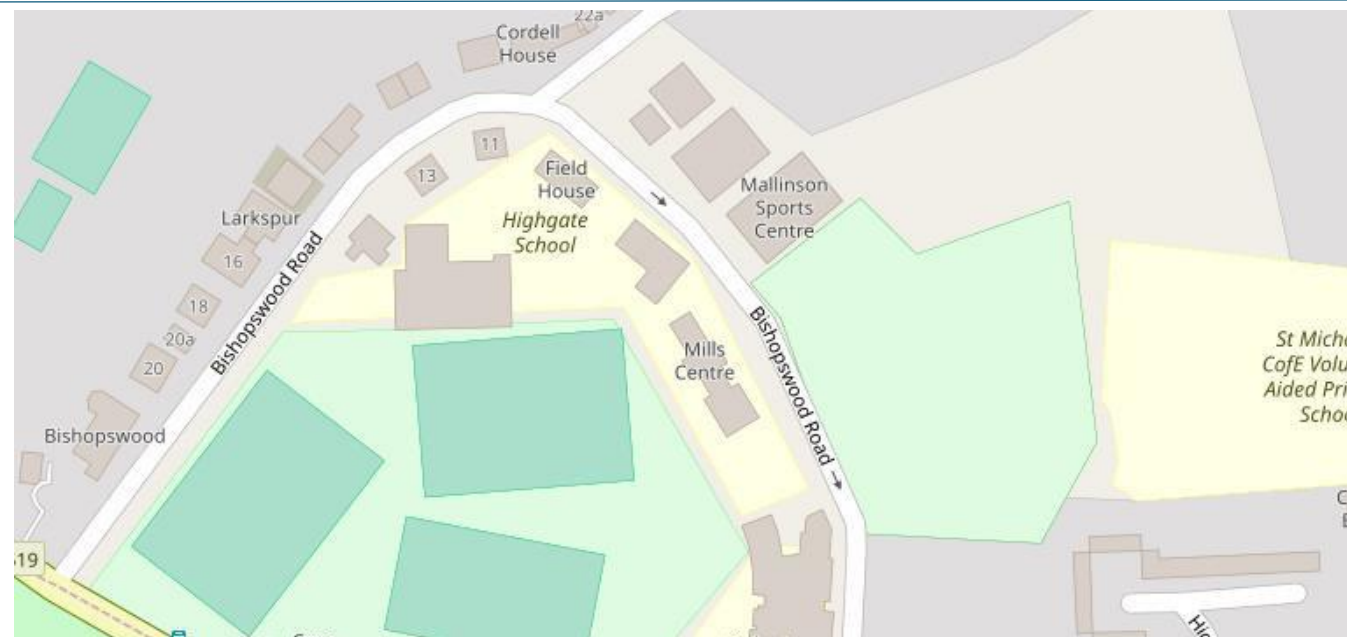


Figure 3 Site location in context (Open Street Map)



Figure 4 Aerial view of synthetic pitch area.



Figure 5 Proposed location for a temporary classroom building.

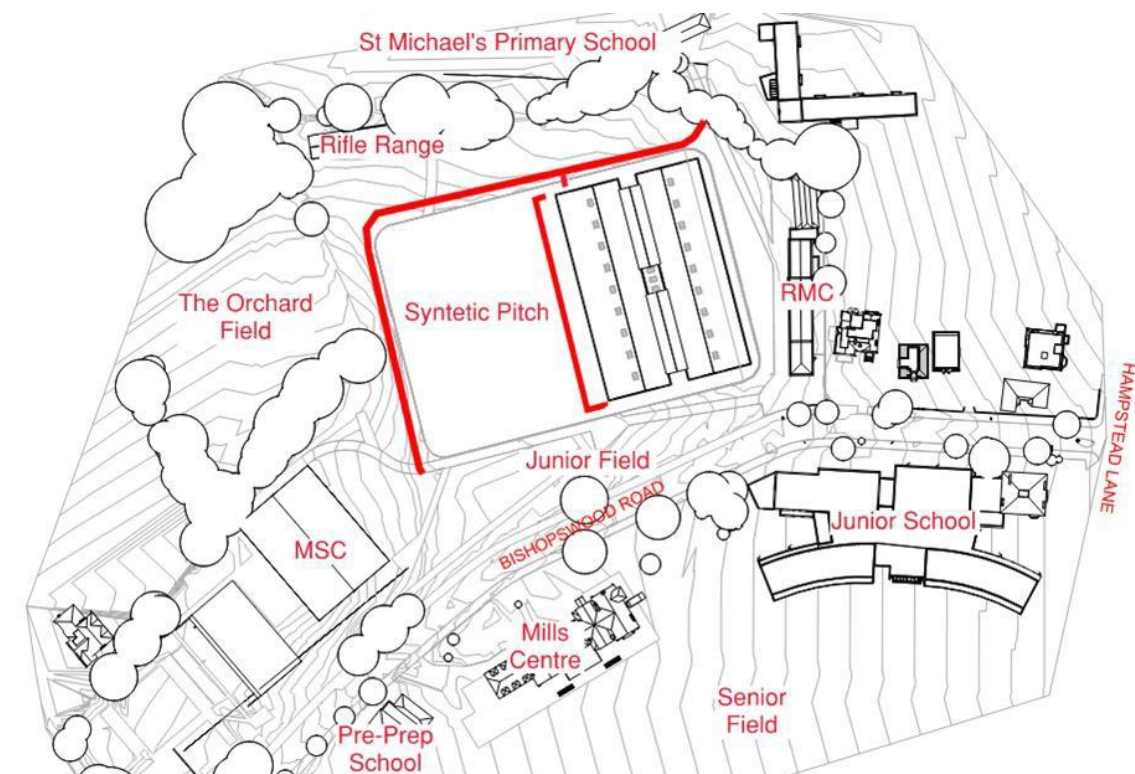


Figure 6 Named parts of the site

3. PLANNING POLICIES

- 3.1 Planning law requires that applications for planning permission be determined following the development plan unless material considerations indicate otherwise. Planning policies and decisions must also reflect relevant international obligations and statutory requirements. The National Planning Policy Framework must be considered in preparing the development plan and is a material consideration in planning decisions.
- 3.2 The purpose of the planning system is to contribute to achieving sustainable Development. At a very high level, sustainable Development's objective can be summarised as meeting the needs of the present without compromising the ability of future generations to meet their own needs.
- 3.3 The planning system should fully support the transition to a low-carbon future in a changing climate, considering flood risk and climate change. It should help to:
  - shape places in ways that contribute to radical reductions in greenhouse gas emissions
  - minimise vulnerability and improve resilience
  - encourage the reuse of existing resources
  - including the conversion of existing buildings
  - support renewable and low-carbon energy and associated infrastructure.

National Planning Policy

- 3.4 The National Planning Policy Framework (NPPF) sets out the Government's planning policies for England and how these should be applied. It provides a framework within which locally prepared housing plans and other developments can be produced.
- 3.5 The NPPF was published in February 2021 which superseded the 2012, 2018 and 2019 versions. Paragraphs 2 and 12 within the Framework confirm that the NPPF must be considered a material planning consideration in planning decisions.

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:

Approve development proposals that accord with an up-to-date development plan without delay

Or

- 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:
- The application of policies in the framework that protect areas or assets of particular importance provides an apparent reason for refusing the Development proposed;
- 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.
- 3.6 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

- 3.7 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.
- 3.8 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.
- 3.9 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.
- 3.10 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.

Or

## Policy SI 2 Minimising greenhouse gas emissions

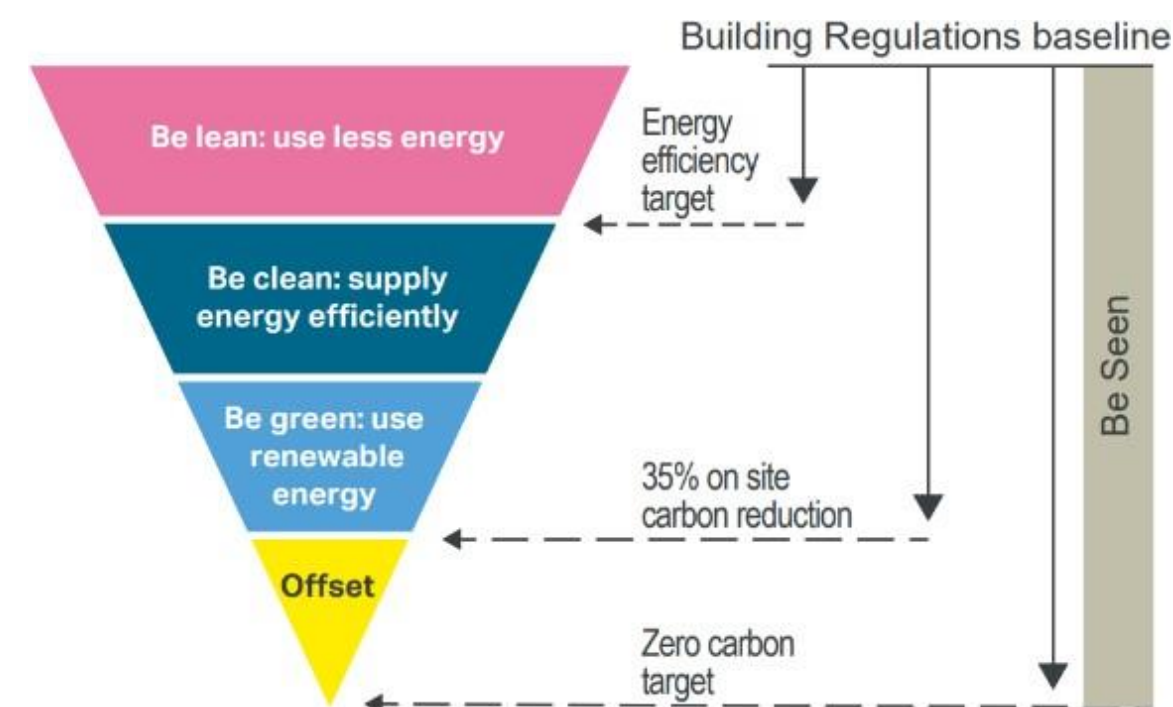
- A) Major Development should be net zero-carbon. This means reducing greenhouse gas emissions in operation and minimising both annual and peak energy demand under the following energy hierarchy:
- 1) be lean: use less energy and manage demand during operation
  - 2) be clean: exploit local energy resources (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 significant 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 6 GLA Policy SI 2 Minimising greenhouse gas emissions

- 3.11 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.
- 3.12 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.
- 3.13 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 intelligent technologies. This approach will reduce carbon emissions, reduce energy costs to occupants, improve London's energy resilience and support the growth of green jobs.
- 3.14 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.
- 3.15 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.
- 3.16 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.

3.17 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.

3.18 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 percent over Part L.



- 3.19 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.
- 3.20 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).
- 3.21 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.

|                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Policy SI 3 Energy Infrastructure</b> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| 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:<br>1) significant heat loads (including anchor heat loads concerning sites such as universities, hospitals, and social housing)<br>2) heat loads from existing buildings that can be connected to future phases of a heat network<br>3) major heat supply plant, including opportunities to utilise heat from energy from waste plants<br>4) secondary heat sources, including both environmental and waste heat<br>5) opportunities for low and ambient temperature heat networks<br>6) possible land for energy centres and/or energy storage<br>7) possible heating and cooling network routes<br>8) opportunities for futureproofing utility infrastructure networks to minimise the impact of road works<br>9) infrastructure and land requirements for electricity and gas supplies<br>10) implementation options for delivering feasible projects, considering issues of procurement, funding and risk, and the role of the public sector<br>11) opportunities to maximise renewable Electricity generation and incorporate demand-side response measures. |
| C)                                       | Development Plans should:<br>1) Identify the need for, and suitable sites for, any necessary energy infrastructure requirements, including energy centres, energy storage and upgrades to existing infrastructure<br>2) 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:<br>1) The heat source for the communal heating system should be Electricity following the following heating hierarchy:<br>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)<br>b) use low-emission combined heat and power (CHP) (only where there is a case for CHP to enable the delivery of an area- wide heat network, meet the Development's Electricity demand and provide demand response to the local Electricity network)<br>c) use ultra-low NOx gas boilers<br>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<br>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 7 GLA Policy SI 3 Energy Infrastructure

- 3.22 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.
- 3.23 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.

|                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|----------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Policy SI 4 Managing Heat Risk.</b> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| 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:<br>1) reduce the amount of heat entering a building through orientation, shading, high albedo materials, fenestration, insulation, and the provision of green infrastructure<br>2) minimise internal heat generation through energy-efficient design<br>3) manage the heat within the building through exposed internal thermal mass and high ceilings<br>4) provide passive ventilation<br>5) provide mechanical ventilation<br>6) provide active cooling systems. |

Table 8 GLA Policy SI 4 Managing Heat Risk

- 3.24 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.
- 3.25 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

- 3.26 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 key

policies for the future Development of the Borough through to 2026;

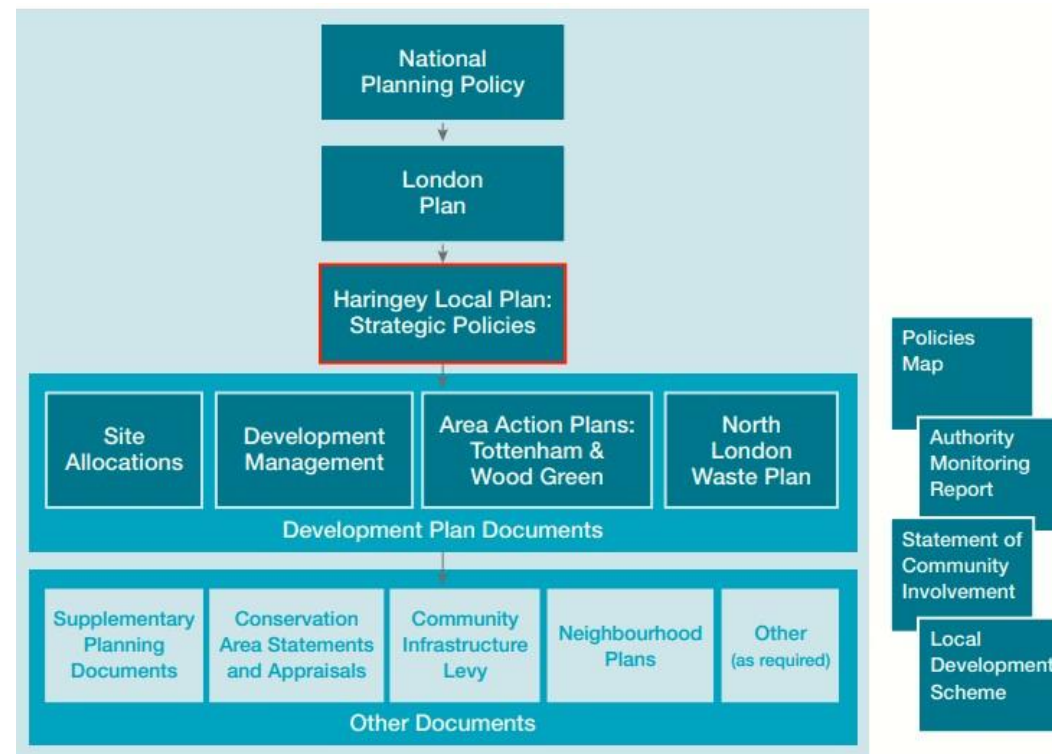


Figure 8 Haringey Local Plan

#### 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) CO<sub>2</sub> 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)

3.28 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.

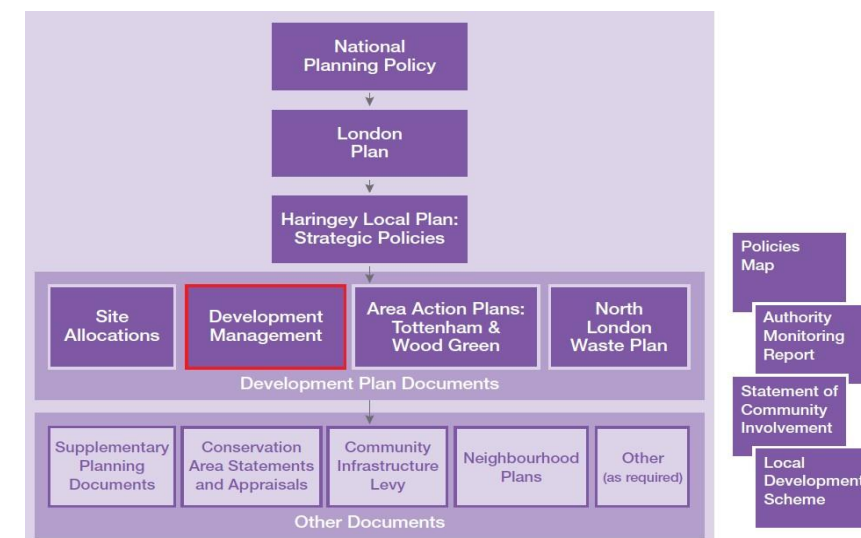


Figure 9 London Borough of Haringey Policy Hierarchy

3.27 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.

## DM21: Sustainable Design,

- 3.29 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. It also offers social and economic benefits— sustainable design results in more efficient buildings with cheaper operating costs, which benefits future owners or occupiers. Sustainable design and construction, therefore, provide clear environmental advantages.

### 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:
- Apply the energy hierarchy to minimise energy use to meet and, if possible, exceed minimum carbon dioxide reduction requirements;
  - Apply the cooling hierarchy to reduce the potential for overheating and limit reliance on mechanical air conditioning systems;
  - Maximise opportunities to enhance biodiversity on-site, including through appropriate landscaping, Sustainable Drainage Systems, living roofs and green walls
  - Wherever possible, use building materials with high environmental performance ratings; and
  - Seek opportunities for locally sourced labour.
- B) The Council will support appropriate measures to sustainably retrofit existing homes and non-residential buildings.
- 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

- 3.30 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
- 3.31 The first step in the hierarchy should be met by adopting sustainable design principles. The second step should be met by prioritising decentralised energy, for which local requirements are set below (see 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.

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 includes a target for 25% of heat and power used in London to be generated through localised DE systems by 2025.

- 3.32 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.
- 3.33 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.

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## Overheating and Cooling

- 3.34 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:
- Minimise internal heat generation through Energy efficient design
  - Reduce the amount of heat entering a building in summer through orientation, shading, albedo, fenestration, insulation and green roofs and walls
  - Manage the heat within the building through exposed internal thermal mass and high ceilings
  - Passive ventilation
  - Mechanical ventilation
  - Active cooling systems (ensuring they are the lowest carbon options)
  - Sustainable retrofitting
- 3.35 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, remarkably where conversions, refurbishments, changes of use and extensions are proposed.

## Enhancing biodiversity

- 3.36 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

- 3.37 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.

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## Carbon Offsetting

- 3.38 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.

## 4 ENERGY ANALYSIS

- 4.1 The National Calculation Methods Simplified Building Energy Model (SBEM) Version 6.1e 2021 estimates the energy consumption for the temporary building regulated and unregulated energy consumption. The SBEM energy modelling software was developed to demonstrate the energy and emission savings for compliance with the 2021 Building Regulations. The resulting output data is accepted as suitable for early design energy comparison.

### Proposed Building Energy Systems

- 4.2 The temporary building will be designed and constructed to comply with the current building regulations and relevant School building standards. The temporary modular classroom building will be constructed along sustainable design principles.
- The building fabric will match the thermal U-values of the Base (notional) building .
  - Temporary buildings will be designed, constructed, and air tested to attain lower air permeability rates than conventional buildings.
  - All lighting will be low-energy LED lighting with integrated presence detection and daylighting dimming controls.
  - The classrooms and offices will be a Monodraught HVR hybrid ventilation system with openable windows.
  - Washroom facilities will use low-flow water fittings and have automated water shut-off valves to reduce the risk of flooding over weekends and holidays.
- 4.3 The primary heating system is air source heat pumps. As the building's occupational requirements will change annually, additional heat pumps with cooling may be required for rooms requiring a higher density of installed IT equipment.
- 4.4 The temporary building will not require the removal of the existing synthetic playing field to excavate for new utility supplies, as this would damage the field. The proposal is to run services above ground to the edge of the field and then connect to the existing water and sewer network below ground.
- 4.5 There is an existing mains-fed freshwater supply from a pipe along the edge of the playing field. The proposal is to provide appropriate leak detection with automated shut-off valves and to prevent burst pipes from freezing additional insulation levels to all above-ground mains cold water pipes.

| Month     | Carbon Emission Factor for Energy |           | Carbon Emission factor for Primary Energy |           |
|-----------|-----------------------------------|-----------|-------------------------------------------|-----------|
|           | Supplied                          | Displaced | Supplied                                  | Displaced |
|           | kgCO <sub>2</sub> /kWh            | kWhPE/kWh | kgCO <sub>2</sub> /kWh                    | kWhPE/kWh |
| January   | 0.163                             | 0.196     | 1.602                                     | 1.715     |
| February  | 0.16                              | 0.19      | 1.593                                     | 1.697     |
| March     | 0.153                             | 0.175     | 1.568                                     | 1.645     |
| April     | 0.143                             | 0.153     | 1.53                                      | 1.567     |
| May       | 0.132                             | 0.129     | 1.487                                     | 1.478     |
| June      | 0.12                              | 0.106     | 1.441                                     | 1.389     |
| July      | 0.111                             | 0.092     | 1.41                                      | 1.33      |
| August    | 0.112                             | 0.093     | 1.413                                     | 1.336     |
| September | 0.122                             | 0.11      | 1.449                                     | 1.405     |
| October   | 0.136                             | 0.138     | 1.504                                     | 1.513     |
| November  | 0.151                             | 0.169     | 1.558                                     | 1.623     |
| December  | 0.163                             | 0.197     | 1.604                                     | 1.718     |

**Table 9 2021 Building Regulation Carbon Dioxide Factors for electricity.**

| Fuel            | Emission Factor              |
|-----------------|------------------------------|
| GLA Natural Gas | 0.210 kgCO <sub>2</sub> /kWh |
| GLA Electricity | 0.136 kgCO <sub>2</sub> /kWh |

**Table 10 GLA 2021 Carbon Dioxide Emission Factors.**

| Base                    | Energy                   |
|-------------------------|--------------------------|
| Heating (electric)      | 11,409 kWh               |
| Cooling                 | 0 kWh                    |
| Aux Energy              | 11,247 kWh               |
| Lighting                | 14,487 kWh               |
| Hot Water (Electricity) | 25,087 kWh               |
| Renewable               | 0 kWh                    |
| Total Regulated         | 62,230 kWh               |
| Area weighted           | 26.89 kWh/m <sup>2</sup> |
|                         |                          |
| Be Lean / Be Clean      | Energy                   |
| Heating (electric)      | 9,812 kWh                |
| Cooling                 | 0 kWh                    |
| Aux Energy              | 6,572 kWh                |
| Lighting                | 14,186 kWh               |
| Hot Water (Electricity) | 25,480 kWh               |
| Renewable               | 0 kWh                    |
| Total Regulated         | 56,050 kWh               |
| Area weighted           | 24.22 kWh/m <sup>2</sup> |
|                         |                          |
| Be Green                | Energy                   |
| Heating (electric)      | 9,812 kWh                |
| Cooling                 | 0 kWh                    |
| Aux Energy              | 6,572 kWh                |
| Lighting                | 14,186 kWh               |
| Hot Water (Electricity) | 25,573 kWh               |
| Renewable               | -65,170 kWh              |
| Total Regulated.        | -9,027 kWh               |
| Area weighted           | -3.90 kWh/m <sup>2</sup> |

Table 11 GLA Energy Hierarchy - Energy Analysis

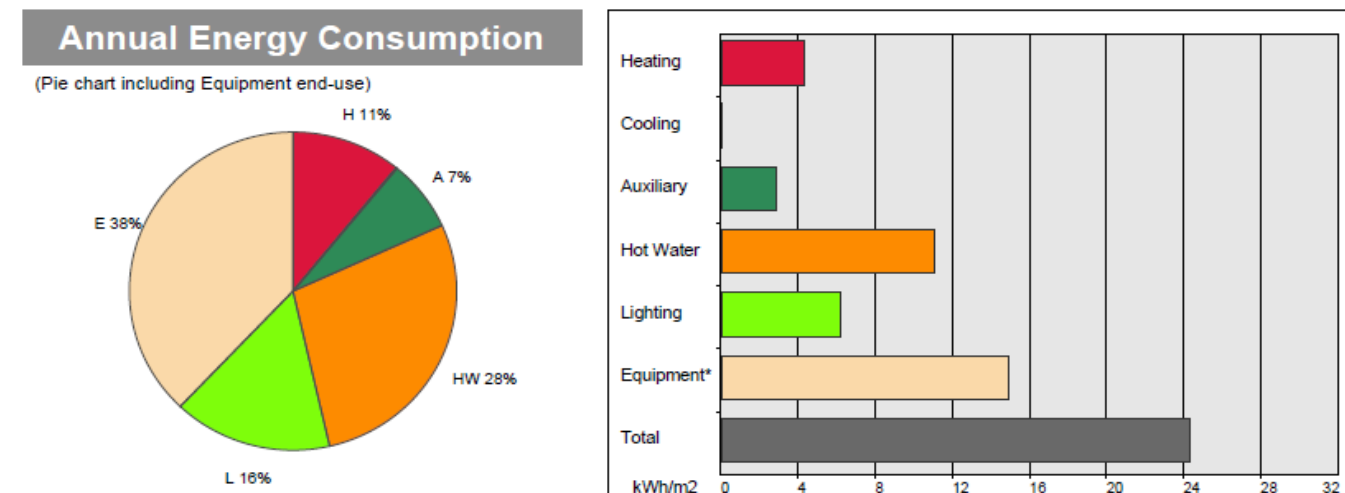


Figure 10 Annual Energy Consumption including Equipment end-use.

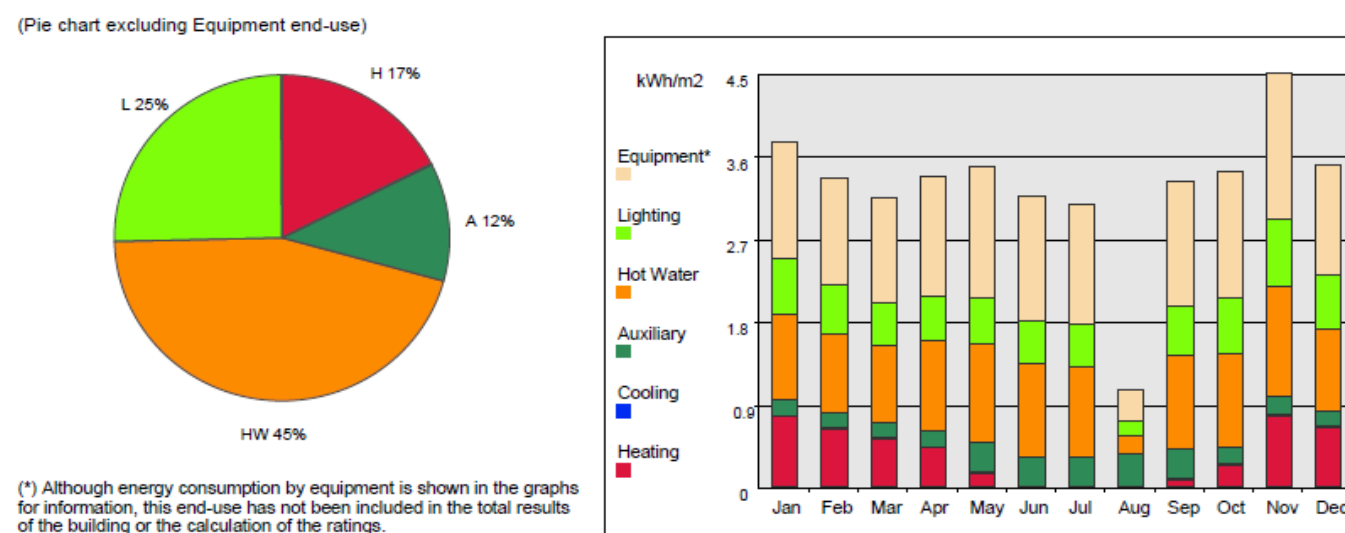


Figure 11 Annual Energy Consumption excluding Equipment end-use.

## 5 ENERGY HIERARCHY

### Be Lean

5.1 The project is currently at the design stage, and the main design parameters for the temporary building are shown in this section. The temporary building will be designed and constructed to comply with the current building regulations and relevant school building standards.

### Building Fabric

- 5.2 The modular building manufacturer is responsible for ensuring that the whole building complies with the current building regulations for whatever region the modular building is installed in “Section 2, paragraphs 2.11 – 2.19 of approved document L Volume 2, (2021) cover elements specific to modular building structures.” The building regulation considers all modular buildings that will be in place for more than two years as new buildings structures. The building regulation does not differentiate between a new modular building or one made of reused modules.
- 5.3 The School has not sourced or purchased a modular building and is still undertaking a competitive tender process. The modular structure's price and availability will determine the supplier selection. As previously stated, the building regulation considers modular buildings a new building structure and must comply with recently updated and improved thermal performance factors. Many modular building supplies and manufacturers have yet to update their technical literature with new thermal values. However, all the modular suppliers will be required to provide a modular building structure that complies with building regulations and additional planning conditions.

| Element         | Manufactures Thermal value (2010)         | Limiting Building regulation standard (2021) | Possible required                           | Comment                                            |
|-----------------|-------------------------------------------|----------------------------------------------|---------------------------------------------|----------------------------------------------------|
| Roof            | 0.25 W/m <sup>2</sup> K                   | 0.18 W/m <sup>2</sup> K                      | 0.10 W/m <sup>2</sup> K                     | Additional external cladding                       |
| Walls           | 0.34 W/m <sup>2</sup> K                   | 0.26 W/m <sup>2</sup> K                      | 0.12 W/m <sup>2</sup> K                     | Additional external cladding                       |
| Windows         | 1.6 W/m <sup>2</sup> K                    | 1.6 W/m <sup>2</sup> K                       | 1.4 W/m <sup>2</sup> K                      | Upgraded glazing windows                           |
| Roof lights     | 1.6 W/m <sup>2</sup> K                    | 1.6 W/m <sup>2</sup> K                       | 1.4 W/m <sup>2</sup> K                      | Upgraded glazing                                   |
| Floor           | 0.25 W/m <sup>2</sup> K                   | 0.22 W/m <sup>2</sup> K                      | 0.10 W/m <sup>2</sup> K                     | Additional external cladding                       |
| Pedestrian Door | 3.0 W/m <sup>2</sup> K                    | 1.6 W/m <sup>2</sup> K                       | 1.4 W/m <sup>2</sup> K                      | Upgraded doors frames and seals                    |
| air Tightness   | 5 m <sup>3</sup> /m <sup>2</sup> .h @50Pa | 8 m <sup>3</sup> /m <sup>2</sup> .h @50Pa    | 5 m <sup>3</sup> /m <sup>2</sup> .h at 50Pa | Less than 5m <sup>3</sup> /m <sup>2</sup> .h @50Pa |

Table 12 Proposed U Values.

## Thermal Fabric Performance and Embodied Carbon

- 5.4 The London Borough of Haringey and London Plan require all new non-domestic buildings to demonstrate a 15% Carbon emission through improvement to the building fabric beyond the requirements of the building regulations.
- 5.5 Modular Buildings are factory-constructed buildings, reusing material and structural components from previously used modules (see Section 6 Sustainable Design).
- 5.6 The manufacture will have developed their building modules to comply with current building regulation guidance found in approved documents Part L Volume 2 2021 section 6. Their modules will be designed to achieve the minimum standards required to comply with the limited building regulation standard (Table 12, column 3).
- 5.7 To achieve the 15% carbon emission improvement beyond the building regulations, the manufacturer adds external rigid (weather resistant) insulation and rain-screen cladding to envelope the standard building modules post-deployment. The additional elements will be unique to this building, and when the building is removed from the site, the additional element will be broken down. The metal elements will be chipped and recycled as rigid insulation, and the plastic cladding element will likely burn waste to energy plants.
- 5.8 The modular temporary building is to be procured after planning has been given for the other projects. It is yet to be determined how the building manufacturer will achieve the higher thermal fabric performance set by the new 2021 building regulations and the additional standards required by LBH and GLA.

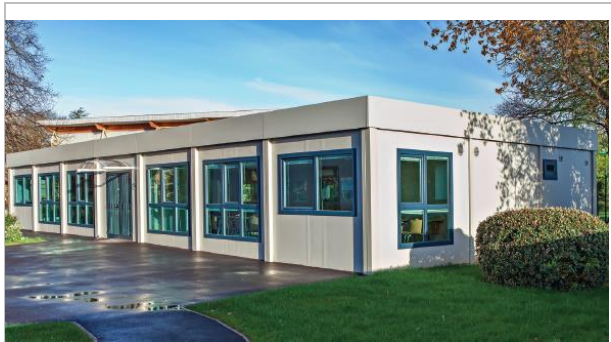


Figure 12 Typical Modular Building



Figure 13 Modular building with external insulation and cladding.

## Typical Manufactures Construction Details

### Walls

- 5.9 External walls are durable one-piece construction with high-performance, low-maintenance plastisol- coated galvanised steel to protect against fire, extreme weather, and accidental damage. Internally, the walls are made of vinyl-faced plasterboard, providing a wipe-clean finish.

### Thermal insulation

- 5.10 Walls, doors, and roofs are insulated with environmentally friendly CFC-free Antifoam, a rigid polymer insulation material that is lightweight yet enhances long-life structural strength and ensures an energy-efficient building.

### Floor

- 5.11 The floor has a rigid galvanised steel frame and underfloor thermal insulation of foil-faced rigid polymer slabs, which offers a sturdy and robust feel. The suspended floor is completely integrated into the structure of the building. Various floor coverings are available, depending on the purpose of the building, including hardwearing vinyl, carpeting, or chequer plate.

### Roof

- 5.12 The construction of the roof provides outstanding insulation. The roof deck is of one-piece construction and is impact resistant. It is covered with solar-reflective, profiled plastisol- coated galvanised steel to reduce heat gain. Internally, the polyester-coated galvanised steel ceiling is designed to prevent condensation problems and has a low-maintenance finish.

### Doors and windows

- 5.13 Steel-faced doors have an insulating core that minimises heat loss. The anodised aluminium frame also incorporates draughtproof weather seals. The windows have PVC-U frames and are double-glazed with low-energy glass for optimum thermal performance. Weather seals and the low thermal conductivity of the window frame and glazing materials help maintain a stable climate. Windows in critical locations are glazed with toughened safety glass as standard, with various other glazings available as an option.

## Structural integrity

- 5.14 The modular building will have the UK's ISO 9001 Quality Management System. The manufacturer will ensure the design complies with all elements of the current (England and Wales) building regulation (2021) and meets relevant building standards and codes of practice.

### Minimum building design standards

- Floor 3.00kN/m2 Roof 0.75kN/m2
- Wind actions following BS EN 1991-1-4,

## Security

- 5.15 The building design will include protection against theft and vandalism, with a wide range of security options.
- 5.16 Building layout Complete modules are used to construct buildings with an unlimited floor area. The installation of partition walls can achieve a variety of room layouts. Additional stories may be added at any time if the appropriate foundations have been laid.

## Lighting

- 5.17 All lighting will be via low-energy integrated LED light fittings with daylight and presence detection controls
- 5.18 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, which can now replace all the less efficient incandescent and fluorescent lights.
- 5.19 The exterior lighting design will include input from metropolitan police crime officers to ensure the exterior lighting design provides good quality, safe lighting that can help prevent crime and will not cause a nuisance to the neighbours.
- 5.20 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 ELF test to give warning of when luminaire requires replacing.
  - Automated emergency light testing and record keeping through the BMS.
  - A reduction in the output of external lighting after midnight and before six am.

- 5.21 The lighting energy in most areas of the building is generally less than in the base building; however, the lighting requirements for some areas, such as the science labs, will be greater than in the base building because of the type of room used.

## Domestic hot water

- 5.22 The only domestic hot water is for the wash hand basins. The wash basins will be fitted with low water Flow rate taps requiring a small amount of hot water. The most energy-efficient method is an under- counter electric instantaneous water heater fitted with a thermostatic mixing valve. The mixing valve is required to limit the hot water to a safe hand-washing temperature while maintaining the use of a low flow rate outlet.

## Fire performance

- 5.23 Fire-engineered construction ensures safe fire performance. Non-combustible materials are used for all external finishes and wall internal linings, minimising the potential fire load. Walls and ceilings will be constructed of Class O surfaces, FAA-rated roof deck and the underfloor thermal insulation slabs have a Class 1 surface spread of flame rating. Walls (from the inside) and combined ceiling and floor assembly (from the underside) have one-hour fire resistance.
- 5.24 FAA - this is the external Flat Roof Fire rating 60-minute fire rating (from the outside) and no fire spread during a 3-minute spread test.
- 5.25 A Class 0 fire rating is part of UK building regulations for fire safety within and around buildings, covering materials such as wood and wood-based wall coverings and internal linings. A Class 0 material must achieve a Class 1 classification for the flame spread and the BS 476 (part 6) Fire Propagation Test, which measures the amount of heat released.
- 5.26 Class 1 is the highest rating in British Standard 476 (part 7) fire resistance classifications, which measures the spread of flame along the surface of a specimen of building material (positioned vertically). A Class 1 building material/product will have achieved the lowest flame spread (classes 2 to 4 are progressively less fire-resistant).

## Climate control

- 5.27 Install Monodraught HVR ZERO XC + low energy hybrid ventilation systems that integrate heat recovery ventilation strategies. It provides natural ventilation, hybrid mixing ventilation and low energy mechanical ventilation with heat recovery in one compact unit. The system operates completely autonomously to ensure optimum indoor air quality and thermal comfort with the

lowest possible energy use. The system includes a two pipe coil complete with condensate tray and condensate pump enclosure. The system is optimised for use with the lower water flow temperatures provided through renewable heating solutions like heat pumps. The system lowers the overall power consumption of buildings by combining ventilation, heat recovery, primary heating and cooling in a highly efficient, integrated solution with a harmonious control strategy.

- 5.28 An air-source heat pump can provide efficient heating and cooling to the building. Air source heat pumps extract low-grade heat from the outside air like a fridge extracts heat from the food inside the fridge. It can get heat from the air even when it is as low as -15° C. When properly installed, an air-source heat pump can deliver one-and-a-half to three times more heat energy to a building than the electrical energy it consumes. The higher efficiency is achievable as heat pumps move heat rather than creating heat from combustion.
- 5.29 The heat pump system includes sophisticated controls for demand response, operations, and maintenance alerts.

## Be Clean

### District Energy Networks

- 5.30 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, and hence these areas should be reviewed only when significant additional Development emerges in this area.

- 5.31 The School is located within the 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 NOx gasses, which are monitored as part of the London air quality target. The recent guidance for flue gas emissions from CHP has exceeded the capabilities of the smaller CHP machines on the market.

### Communal Energy Network

- 5.32 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, refurbishment, and remodelling in response to the ever- changing requirements of the modern school estate. All the buildings are currently fitted with individual heating systems and power supplies that enable each building to operate independently.

5.33 There is no energy advantage in connecting the heating system to a single energy centre on site, as the system transmission heat losses would far exceed the advantages 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 combined heat power where 30% of the energy is heating the ground between the buildings, and the total generated electricity output is not being used on site.

5.34 The improving London air quality targets now require ultra-Low NOx flue gas emissions from boilers and combined heat/power machines. The new requirement of less than 30mg/kWh of dry NOx emission is below the ability of many gas engines used for combined heat and power.

5.27 In conclusion, an estate energy centre would increase the energy required to heat all estate buildings resulting in higher CO<sub>2</sub> and NOx emissions. Therefore, a communal heating system is not proposed.

#### Proposed Energy System

5.28 A new mains gas supply is not acceptable to avoid damaging playfield surfaces. Therefore, an electric fuelled heating system is the only workable option. The temporary classroom building type is suited to fast-acting and controllable blown air hybrid system using air source heat pumps as the primary heat generator, in rooms not suited to this system such as toilets with no external wall a wet radiator system using air source heat pumps as the primary heat generator will be adopted. The factory-constructed airtight building will retain heat overnight and only require a relatively small heat input from the fast-acting heating systems. The hybrid ventilation system will ensure internal temperatures of the classrooms can be regulated. The internal heat gains from building equipment and occupants will maintain the room temperatures.

## Be Green

5.11 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 20% 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 using 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

5.12 PV is the most practical renewable energy technology, which can be applied to almost any building; 1kWp of PV generates around 850kWh in an average year. Since the feed-in tariff incentive removal in April 2019, the financial payback for PV has lengthened to about 15 years.

Typical annual generation from 1kW of PV is 850kWh

Saving £130 at 16 pence per kWh

Typical installation cost per kW =£2,000

Typical simple payback of 15 years

5.13 The microgeneration scheme still promotes the installation of PV panels with extended warranty periods by qualified installers.

5.14 There is a predicted price increase for Electricity to above 20 pence kWh, because of the operation of Hinckley Point nuclear power station, with the decline of North Sea gas, resulting in increased importation of gas from outside Europe and increased use of renewables.

5.15 The European Union and the United Kingdom have placed an import tax on PV arrays to avoid flooding the market with cheaper imported panels destroying local European manufacturers.

5.16 The proposal is to cover the whole roof of the new temporary building with a Photovoltaic (PV) array. PV is the only reliable renewable energy option that will guarantee emissions reduction.

5.17 The proposal is to install a low-angle PV array on the roof of the building to offset 35% of the building's regulated energy carbon emission.



Figure 14 Low Angle Photovoltaic panels.

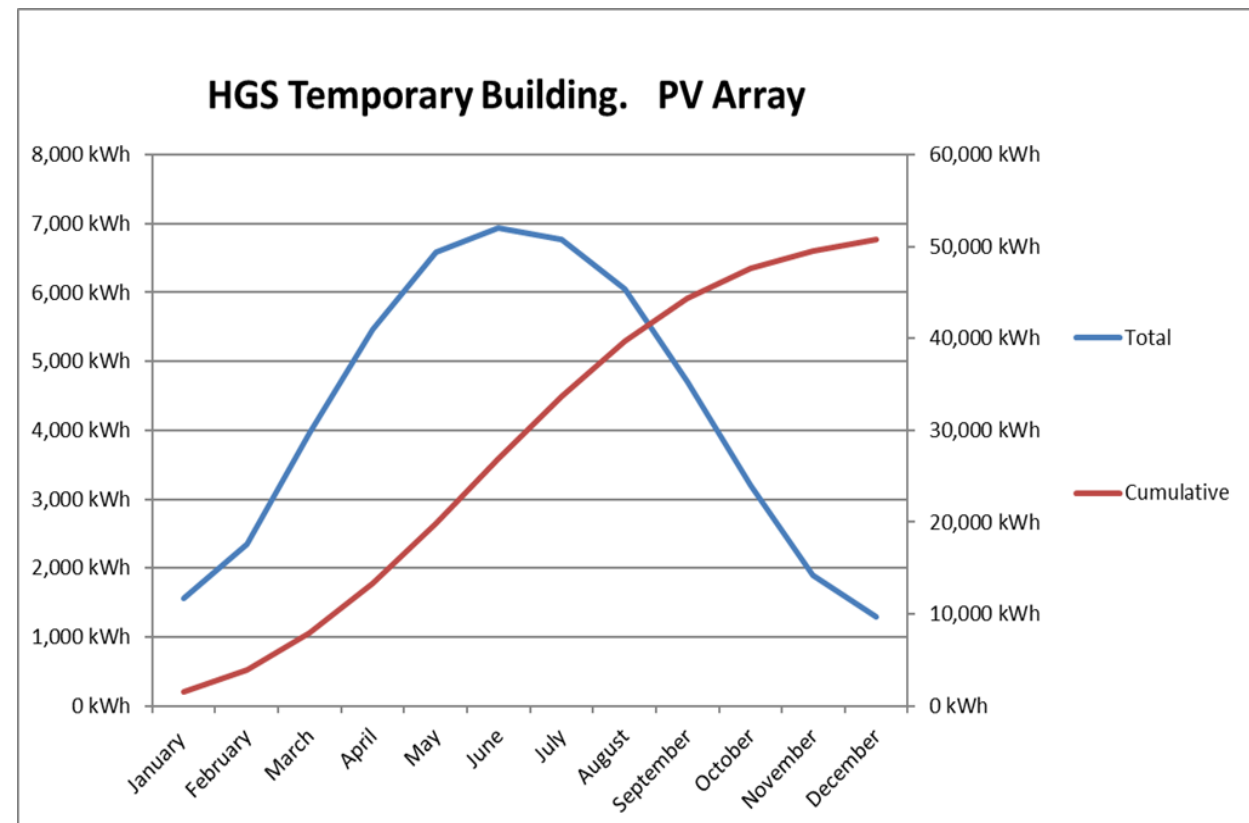
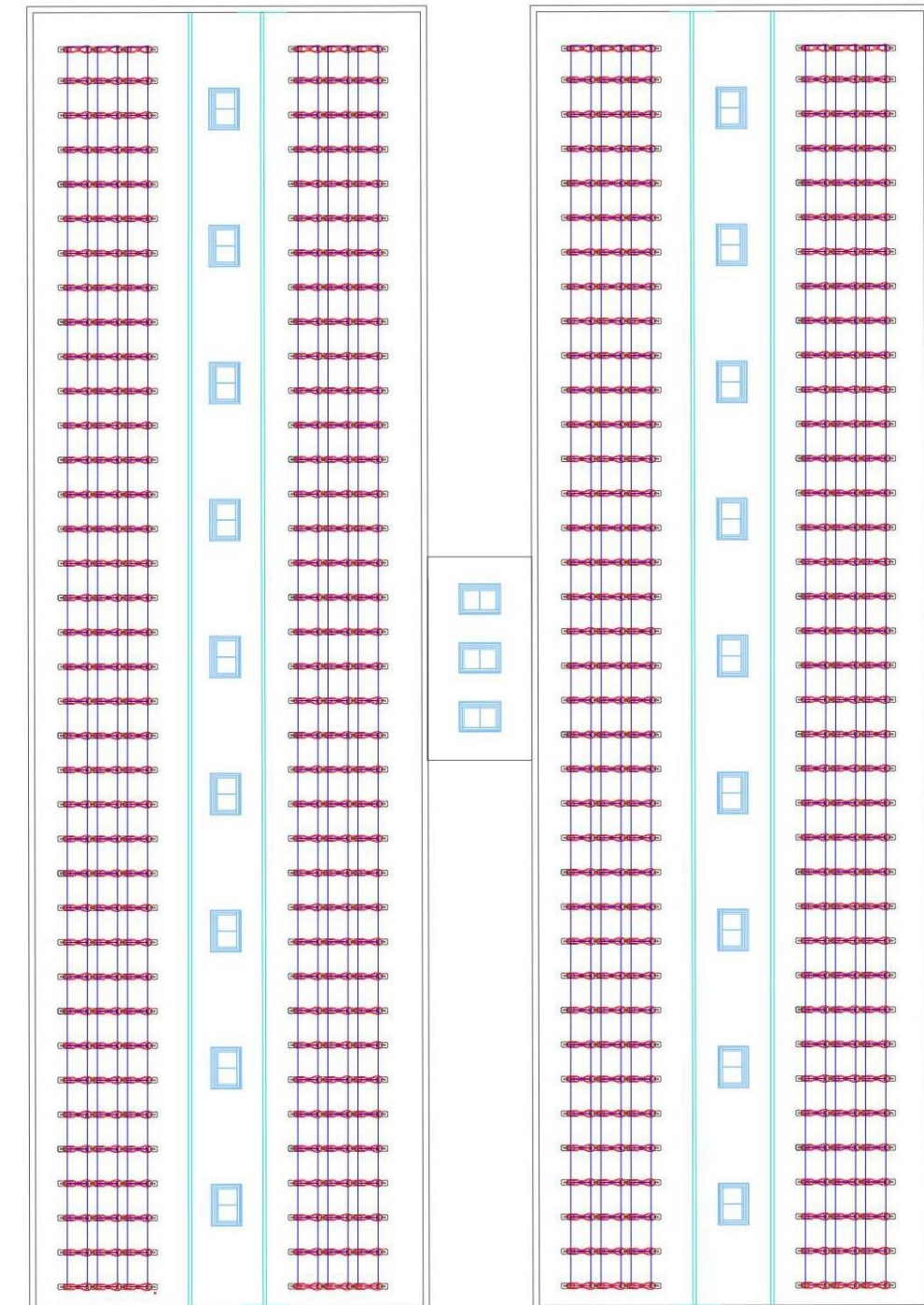


Figure 15 Predicted Renewable Electricity Generation across the year.



Low angle PV Panels (12 col by 36 row = 432 panel)  
80kW peak estimated 50,791kWh per year, South Facing  
30 degrees.

Figure 16 Proposed roof area for low-level 58.9 kW PV array (580m<sup>2</sup>)

| Financial Inputs          |             | Financial Inputs   |                     |
|---------------------------|-------------|--------------------|---------------------|
| System Size               | 69.6 kW     | Fit                | £0.00               |
| System Cost               | -£77,961.8  | Exported           | £862.18             |
| RPI                       | 3.00%       | Saving             | £4,473.33           |
| Fuel inflation            | 0.25%       | Total Income       | £5,335.51           |
| Number of years           | 20 years    | Yield              | 6.84%               |
| Feed in Tariff            | 0.00 p/kWh  | Payback (Years)    | 15 years            |
| Cost of Electricity       | 16.00 p/kWh | PV Variables       |                     |
| Export Price              | 4.85 p/kWh  | Location           | Thames              |
| Electricity Exported      | 35.00%      | Direction          | South               |
| Electricity Used In-House | 65.00%      | Panel Angle        | 30°                 |
| Generated Electricity     | 50,791 kWh  | Shading Factor     | None or very little |
| Export                    | 17,777 kWh  | Array Sizes        | 80 kW               |
| Used                      | 33,014 kWh  | Annual Electricity | 50,791 kWh          |
| Return after 20 years     | £34,152.05  | Number Of Panels   | 432                 |

**Table 13 Financial Appraisal for PV Array.**

5.18 The financial appraisal makes the following assumption

- School is closed for 38% of the year (weekends and Holidays)
- When the School is closed, Electricity is lost to the National Grid without value.
- When the School is open, the estate consumes all the Electricity generated.
- The Electricity generated is equal to the cost of the price of Electricity.
- The solar radiation on vertical or inclined surfaces at different orientations is calculated using the BRE solar algorithms.

5.19 Some of the Electricity generated during the holiday period will be consumed by the sports centre and other buildings used for out-of-school activities. Due to the feed losses in tariff and the simple assumption that School is closed during the weekends and holidays with all the PV generated to the grid, the payback period is 20 years with an estimated rate return of only 1%. The payback period reduces to 16 years if 80% of Electricity is used on-site.

## Summary

|                    |                      |
|--------------------|----------------------|
| PV peak            | 80 kW                |
| PV Generation      | 50,791 kWh per annum |
| Number of PV array | 436 panels           |

## Alternative renewable energy options

5.20 The following alternative renewable options have been considered but found not to be appropriate:

**Biomass** – Not suitable for an urban location as installation will reduce local air quality through smoke emission and increase vehicle movement from the transportation of biomass fuel.

**Solar Thermal** – There will be a minimal hot water requirement, as the temporary building will mainly be used to provide classroom-teaching facilities, with the temporary toilet facilities located on the senior school site. There will be little energy saving from domestic hot water generation using solar thermal, as the School is less busy during the long summer holidays when solar thermal energy saving is at a peak.

**Wind Turbines** – unsuitable in an urban location with turbulent airflow around the building, generating a valuable amount of Electricity requires a substantial unit with a blade diameter above 6m.

## 6 SUSTAINABLE DESIGN

- 6.1 Modular construction methods and buildings help to reduce energy and resource use, minimise waste and cut carbon emissions.

### Non-Renewable Material

- 6.2 The modular building manufacturer will have high environmental management standards and commitment to ongoing environmental responsibility international standard ISO 14001 accreditation. All material used in the construction is sourced from suppliers with a registered procurement method, such as FSC or equivalent certifications, and are signatories to the UK Timber Federation Environmental Code of Practice so that the material used does not deplete natural resources. The modular building manufacturer targets 90% use of recycled material within the building structure.
- 6.3 Insulation material used in wall and roof panels contains no HCFCs and has zero ozone depletion potential to help protect the environment.

### Logistics

- 6.4 Due to minimal site deliveries, there are up to 90% fewer vehicle movements on a modular building site than on a traditional building project, reducing on-site dust levels and congestion as well as emissions associated with vehicle use (Source: MTech)

### Service Delivery

- 6.5 To minimise the environmental impact of construction activities through environmentally responsible practices, including preventing pollution, minimising waste, and sourcing from sustainable natural resources. The Contractor will conduct their activities and operations in line with current legislation.
- 6.6 Other initiatives include all site reporting utilising the Smart Waste reporting system and delivering a target of zero reportable incidents to the Environmental Agency.

### Reuse

- 6.7 The Contractor will operate a Reuse Policy to ensure, where practical, that materials, ancillary

items, and physical assets are recovered from modular Hire buildings and returned to storage areas for reuse on future Hire projects. Damaged items are repaired and refurbished, either by modular building manufacturers or specialised contractors. Where they are beyond repair, they are kept for parts.

- 6.8 Second-hand stock levels are regularly checked, and the use of these items is prioritised. A register detailing buildings due to be returned from hire projects is circulated to all Service Centres so they can promote these buildings to new customers where they have similar requirements.
- 6.9 Waste materials from the manufacturing processes are recycled rather than disposed of at landfills. Work continues to increase this list of materials. Colour-coded waste segregation is also in operation at the factory, and production staff receive training to identify waste streams.
- 6.10 Use specially-designed reusable containers to hold and protect components such as windows for modular manufacturing. These 'stillages' are then returned to suppliers for refilling, removing the need for packaging.

### Recycling Options

- 6.11 Waste streams from the manufacturing centre include:
- Used vinyl flooring recycled for traffic cones and other plastic products
  - Take-back schemes for batteries, fluorescent bulbs, printer cartridges and new vinyl flooring offcuts
  - Waste streams for plastics increased from 3 to 5, and mastic tubes are now recycled
  - 5 metal waste streams for recycling different grades of steel, aluminium, and copper
  - Waste from solvents is reused as furnace fuel.
- 6.12 Portakabin has invested £100,000 in a new high-tech saw machine which uses advanced technology to optimise material usage, further reducing waste.
- 6.13 General waste is compacted at the manufacturing centre to put cardboard, soft plastics, plastic bottles, and plastic strapping into bails. It reduces transportation and carbon emissions by achieving higher tonnage per truck movement.

### Supply Chain Influence

- 6.14 The manufacture will be required to produce a procurement and sourcing policy covering:
- supplier selection criteria within the procurement process cover environmental,
  - sustainability and ethics, and
  - assessing suppliers against a broad range of issues, with continuous product initiatives with suppliers that focus on products and services that support sustainable practices and who

also commit Total Quality and continuous improvement."

6.15 The selection and assessment of suppliers involve the following:

- Assessing the performance of suppliers' products and services concerning
- compliance, safety, environment, innovation, and cost;
- Giving priority to those providing improvements in sustainability in addition to commercial consideration, e.g., accredited to ISO 14001;
- Negotiations with suppliers to find opportunities for tightening specifications to improve sustainability and cost performance, maximise recycled content and reduce packaging.

## 7 CONSTRUCTION PHASE

- 7.1 Meticulous planning before and during construction safeguards the school users, workforce, and community. The installation will occur during the summer holiday (July to September). The Contractor is to register with the Considerate Constructor Scheme and is required to achieve an Excellent Performance Rating (A score of 39 or higher). The Considerate Constructor Scheme requirements to are designed to engage with School and broader community stakeholders to minimise the construction site impacts on neighbours and the community.
- 7.2 During the critical pre-construction phase, the Project Manager will set out the Project Management Plan (PMP), which covers all H&S aspects of the work. The PMP includes the Construction Phase Plan, which is required under CDM 2015. The PMP for the phases of the on-site work, including the programme, will be developed in parallel with the manufacturing phase and in agreement with the School to minimise the disruption to their education delivery. The PMP will ensure that the H&S of all on-site is always maintained. The PMP will also ensure that an appropriate safe sequence of work is followed and that critical path activities are focused on to ensure a smooth workflow.
- 7.3 Regular liaison meetings with Highgate school (the Client) will be instigated to ensure that all requirements are clarified as delivery unfolds. The construction site is fully segregated from the School and permanently secured.
- 7.4 Hoarding with vision panels to allow the pupils to have a safe interest in the works will be erected around the site. A Construction Management Plan and Traffic Management Plan to detail how to access the site, considering peak times and the safe transfer of pupils and the public.
- 7.5 The construction period is planned to be on weekdays between 08:00 and 17:00. A banksman control and co-ordinated Major deliveries and wagon movements. Delivery vehicles will visit the site outside of the school start (08:00 and 10:00) and finish times (15:00 and 17:00).
- 7.6 The Contractor will engage with the School to understand their current emergency plans and ensure that the activities do not affect the safety of the teachers and pupils.
- 7.7 Construction noise is limited by using a modern, quiet low emission plant. The Contractor is deploying methods to minimise noise and dust. All Construction personnel likely to meet pupils as part of the works have enhanced DBS clearance.

### Working with the Local Community.

- 7.8 The Contractor recognises that construction operations influence the communities and environments. The School and its contractors are committed to operating socially responsibly and

engaging with the employees and the local community.

The Contractor will publish the regular new letter and engages with the community and School to create interest and knowledge of the construction process. To develop a "good neighbourhood" strategy collaboratively, the Contractor will contact the neighbours with a newsletter and pre-start meeting at the start of the project. In conjunction with a mapping exercise, the pre-start meet will be used to identify stakeholders and interested parties in the broader community to form part of the overall stakeholder engagement strategy. Ensuring all stakeholders are consulted, on the appropriate topics, in the appropriate format at the appropriate time.

- 7.9 Site notice boards will notify the contact details of the Site Manager, who will always be available to discuss any issues or concerns. Formal project meetings with key stakeholders will be set up and used to review progress and formally minute agreed actions. Communication with key neighbours will be via a regular newsletter. Engagement meetings will be set up during the project to inform of construction progress and future planned activities and as an open forum to raise any issues. The Contractor will set up a social media feed to provide progress information and updates and to allow online communications and concerns to be raised.

### Construction & Transport Management Plan.

- 7.10 This Construction & Transport Management Plan is developed to install the temporary teaching building for Highgate School. These works will begin planned during the spring, and the on-site works to be programmed to occur during the school summer break, starting at the beginning of July and completed by the start of the school year in September.

### Site Access

- 7.11 The site is at Highgate School, Bishopswood Road, Highgate, London N6 4PL.
- 7.12 The route for general site traffic will be to use A406 or A1, then take the A1 South, turn right on North Hill B519, turn right onto Hampstead Lane B519, turn right onto Bishopswood Road, and then left onto the site.
- 7.13 The building module is to be transported along the route proposed by the Highways Department route. All suppliers will be notified of the route to the site and permitted delivery times.
- 7.14 There will be a secure entrance and exit gate, which will be controlled and managed by the Site Manager. Construction site access is proposed along Bishopswood Road. Pedestrian access throughout the construction will be via the north of the site via a dedicated footpath.

Grassed areas disrupted by site works will be reinstated before completion.

### Site Compound & Accommodation

- 7.15 Staff welfare facilities and storage compounds are shown on the preliminary plans. The welfare facilities include office/meeting space, canteen, WC, drying room.

### Deliveries

- 7.16 Site deliveries will be timed to avoid school drop-off/collection times. The site opening hours will be between 07.30hrs and 18:00hrs. Vehicles will not be allowed to off-load until 08:00hrs, and no plant will be used after this time. There will be no planned deliveries at weekends or on Bank Holidays.
- 7.17 All deliveries will be made directly onto the site, and vehicles will be off-loaded on site. All vehicles will be off-loaded at the designated area on the site plan, and vehicles will be able to turn on the site once they have been off-loaded.

### Material Storage

- 7.19 Material storage will be within dedicated secure containers, split via trade. Areas within the building will also be identified for localised storage.
- 7.20 Fuels, oils, and the like will be stored in purpose-made drums in suitable zones to contain spillages. Spill kits will be available on site.
- 7.21 Gases and the like will be stored in cages. All materials will be stored in line with the COSHH requirements.

### Waste Management

- 7.22 Site waste will be removed from the building to the central waste management zone adjacent to the site. Waste will be segregated into designated skips for recycling or disposal depending on the type of waste material involved. All skips will have lockable covers.

### On-site and off-site vehicle movements

- 7.23 A banksman will be at the site entrance to assist with large vehicles on and off-site. They will ensure that all delivery vehicles entering and leaving the site will cause as little disruption as

- possible.
- 7.24 Routine noise assessments will prevent excessive construction noise risks to students, staff, contractors, visitors, and public members. Exposure to excessive noise is either eliminated at source or, where not reasonably practicable, reduced to as low as possible by introducing control measures. It should note that there is no earth movement or use of large (except self-loading vehicles) as part of the construction works.
- 7.25 Dust levels are kept to a minimum to protect the workforce and those in the vicinity of the work. Internal activities with the potential to generate dust will be controlled locally by the operative. Industrial vacuums will be used within the building instead of sweeping operations. Water suppression methods will minimise airborne dust externally, particularly in dry conditions.
- 7.26 Delivery vehicles and the site plant will be required to operate at a minimal speed limit.
- 7.27 Skip vehicles will ensure loads are appropriately sheeted when entering or vacating the site environment.

### Transport of personnel to site.

- 7.28 To reduce any inconvenience to residents, the site workers, all construction site operatives and contractors will be encouraged to share vehicles and, when possible, use public transport.
- 7.29 Some parking spaces will be provided within the school grounds. Site operatives will not be permitted to use local roads for parking their vehicles. The site induction will enforce this, and the site manager will monitor it.

### Installation of New School Building

- 7.30 The building modules will be manufactured, assembled, and arrive on site as a finished building.
- 7.31 The modules will be delivered to the site with traffic management support. These vehicles will need to reverse into the site via Bishopswood Road to be positioned for unloading to achieve the crane's lifting radius and working duties to ensure all lifting is carried out safely.
- 7.32 Pedestrian and vehicle movements on site will be segregated to provide a safe working environment for all parties. The modular building is programmed to arrive on-site over two weeks.
- 7.33 The principle of the modular building installation is as follows:
- Full height hoarding will be in place to create a segregated area between construction activities and school users.
  - Crane arrives on site.
  - Crane set up during the day.
  - 76 no modules installed.

- Crane is dismantled and leaves the site two weeks later.
- Hoarding is removed.

- 7.34 The crane position is shown on the site plan shown below.

### Monitoring and management of traffic management plan

- 7.35 The Site Manager will monitor the traffic management plan, ensure that it is adhered to, and make changes if improvements can be made. The Site Manager will review the Plan weekly and update it as required. As part of the weekly review, the site manager will monitor vehicle numbers and investigate whether it is possible to reduce these and ensure that vehicle sharing and public transport are utilised whenever possible.
- 7.36 The site manager is tasked with providing a record of all site activities, including deliveries, energy use, waste removal, staff numbers, etc.

### User Training

- 7.37 Before the handover, the Contractor will provide appropriate training for different stakeholders, ensuring that the teaching staff understand how their classrooms function.
- 7.38 On completion, the manufacturer will provide Building Information Model for services, structure, finishes and equipment.
- 7.39 The Contractor is to schedule time demonstrations with a complete training programme for the caretaking staff followed by user-friendly demonstrations for other staff. In addition to the usual H&S information and O&M manuals, provide information in alternative forms such as user guides and DVD demonstrations.

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**8      APPENDICES**

Appendix A - Temporary Accommodation Baseline (TER) and Be Lean (BER) Thermal Improvements (air source heat pumps)

Appendix B - Temporary Accommodation Be Green (BER) Renewable Energy (photovoltaic panel array)

Project name

Modular and Portable

Highgate School Decant Building No PV

As designed

Date: Fri Apr 19 11:02:46 2024

## Administrative information

## Building Details

Address: Highgate School, North Road, London, N6 4AY

## Certifier details

Name: Paul Dodds

Telephone number: 01325 310404

Address: , ,

## Certification tool

Calculation engine: SBEM

Calculation engine version: v6.1.e.0

Interface to calculation engine: DesignBuilder SBEM

Interface to calculation engine version: v7.1.4

BRUKL compliance module version: v6.1.e.0

Foundation area [m<sup>2</sup>]: 2314.27The CO<sub>2</sub> emission and primary energy rates of the building must not exceed the targets

|                                                                                        |                         |
|----------------------------------------------------------------------------------------|-------------------------|
| Target CO <sub>2</sub> emission rate (TER), kgCO <sub>2</sub> /m <sup>2</sup> .annum   | 3.76                    |
| Building CO <sub>2</sub> emission rate (BER), kgCO <sub>2</sub> /m <sup>2</sup> .annum | 3.44                    |
| Target primary energy rate (TPER), kWh <sub>PE</sub> /m <sup>2</sup> .annum            | 40.12                   |
| Building primary energy rate (BPER), kWh <sub>PE</sub> /m <sup>2</sup> .annum          | 36.96                   |
| 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 <sub>a-Limit</sub> | U <sub>a-Calc</sub> | U <sub>i-Calc</sub> | First surface with maximum value           |
|--------------------------------------|----------------------|---------------------|---------------------|--------------------------------------------|
| Walls*                               | 0.26                 | 0.12                | 0.12                | Storey 01 - Ground Floor - Circulation_W_7 |
| Floors                               | 0.18                 | 0.1                 | 0.1                 | Storey 01 - Ground Floor - Circulation_S_3 |
| Pitched roofs                        | 0.16                 | -                   | -                   | No heat loss pitched roofs                 |
| Flat roofs                           | 0.18                 | 0.1                 | 0.1                 | Storey 01 - Ground Floor - Circulation_R_4 |
| Windows** and roof windows           | 1.6                  | 1.4                 | 1.4                 | Storey 01 - Ground Floor - Circulation_G_5 |
| Rooflights***                        | 2.2                  | -                   | -                   | No external rooflights                     |
| 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<sub>a-Limit</sub> = Limiting area-weighted average U-values [W/(m<sup>2</sup>K)]U<sub>i-Calc</sub> = Calculated maximum individual element U-values [W/(m<sup>2</sup>K)]U<sub>a-Calc</sub> = Calculated area-weighted average U-values [W/(m<sup>2</sup>K)]

\* 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/m<sup>2</sup>K

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 <sup>3</sup> /(h.m <sup>2</sup> ) at 50 Pa | 8                 | 5             |

## 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 | NO   |
| Whole building electric power factor achieved by power factor correction                     | <0.9 |

### 1- Project HVAC - Samsung AE140BXYDGG/EU & Radiators

|                                                                                               | Heating efficiency | Cooling efficiency | Radiant efficiency | SFP [W/(l/s)] | HR efficiency |
|-----------------------------------------------------------------------------------------------|--------------------|--------------------|--------------------|---------------|---------------|
| This system                                                                                   | 3.75               | -                  | -                  | -             | -             |
| 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. |                    |                    |                    |               |               |

### 2- Project HVAC - Samsung AE140BXYDGG/EU & HVR Zero System

|                                                                                               | Heating efficiency | Cooling efficiency | Radiant efficiency | SFP [W/(l/s)] | HR efficiency |
|-----------------------------------------------------------------------------------------------|--------------------|--------------------|--------------------|---------------|---------------|
| This system                                                                                   | 3.75               | -                  | -                  | -             | -             |
| 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. |                    |                    |                    |               |               |

### 1- Project DHW - Aquapoint III AP3/100

|                | Water heating efficiency | Storage loss factor [kWh/litre per day] |
|----------------|--------------------------|-----------------------------------------|
| This building  | 1                        | 0                                       |
| 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 |      |               |          |
| Storey 01 - Ground Floor - Girls WC 1 | -             | -   | 0.4 | -   | -   | -   | -   | -   | - | -    | -             | N/A      |
| Storey 01 - Ground Floor - Girls WC 2 | -             | -   | 0.4 | -   | -   | -   | -   | -   | - | -    | -             | N/A      |
| Storey 01 - Ground Floor - Boys WC 1  | -             | -   | 0.4 | -   | -   | -   | -   | -   | - | -    | -             | N/A      |
| Storey 01 - Ground Floor - Staff WC 1 | -             | -   | 0.4 | -   | -   | -   | -   | -   | - | -    | -             | N/A      |
| Storey 01 - Ground Floor - Staff WC 2 | -             | -   | 0.4 | -   | -   | -   | -   | -   | - | -    | -             | N/A      |
| Storey 01 - Ground Floor - Boys WC 2  | -             | -   | 0.4 | -   | -   | -   | -   | -   | - | -    | -             | N/A      |
| Storey 01 - Ground Floor - C1 Lab     | -             | -   | -   | -   | 0.2 | -   | -   | -   | - | 0.42 | -             | 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 |
| Storey 01 - Ground Floor - P1 Lab        | -                 | -   | -   | -   | -   | 0.2 | -   | -   | -   | - | 0.42          | N/A      |
| Storey 01 - Ground Floor - MFL Office I  | -                 | -   | -   | -   | -   | 0.2 | -   | -   | -   | - | 0.42          | N/A      |
| Storey 01 - Ground Floor - B1 Lab        | -                 | -   | -   | -   | -   | 0.2 | -   | -   | -   | - | 0.42          | N/A      |
| Storey 01 - Ground Floor - C2 Lab        | -                 | -   | -   | -   | -   | 0.2 | -   | -   | -   | - | 0.42          | N/A      |
| Storey 01 - Ground Floor - P2 Lab        | -                 | -   | -   | -   | -   | 0.2 | -   | -   | -   | - | 0.42          | N/A      |
| Storey 01 - Ground Floor - MFL 2         | -                 | -   | -   | -   | -   | 0.2 | -   | -   | -   | - | 0.42          | N/A      |
| Storey 01 - Ground Floor - B2 Lab        | -                 | -   | -   | -   | -   | 0.2 | -   | -   | -   | - | 0.42          | N/A      |
| Storey 01 - Ground Floor - C Prep        | -                 | -   | -   | -   | -   | 0.2 | -   | -   | -   | - | 0.42          | N/A      |
| Storey 01 - Ground Floor - P Prep        | -                 | -   | -   | -   | -   | 0.2 | -   | -   | -   | - | 0.42          | N/A      |
| Storey 01 - Ground Floor - Staff Room    | -                 | -   | -   | -   | -   | 0.2 | -   | -   | -   | - | 0.42          | N/A      |
| Storey 01 - Ground Floor - B Prep        | -                 | -   | -   | -   | -   | 0.2 | -   | -   | -   | - | 0.42          | N/A      |
| Storey 01 - Ground Floor - C3 Lab        | -                 | -   | -   | -   | -   | 0.2 | -   | -   | -   | - | 0.42          | N/A      |
| Storey 01 - Ground Floor - P3 Lab        | -                 | -   | -   | -   | -   | 0.2 | -   | -   | -   | - | 0.42          | N/A      |
| Storey 01 - Ground Floor - Gen Class     | -                 | -   | -   | -   | -   | 0.2 | -   | -   | -   | - | 0.42          | N/A      |
| Storey 01 - Ground Floor - B3 Lab        | -                 | -   | -   | -   | -   | 0.2 | -   | -   | -   | - | 0.42          | N/A      |
| Storey 01 - Ground Floor - C4 Lab        | -                 | -   | -   | -   | -   | 0.2 | -   | -   | -   | - | 0.42          | N/A      |
| Storey 01 - Ground Floor - P4 Lab        | -                 | -   | -   | -   | -   | 0.2 | -   | -   | -   | - | 0.42          | N/A      |
| Storey 01 - Ground Floor - MFL 4         | -                 | -   | -   | -   | -   | 0.2 | -   | -   | -   | - | 0.42          | N/A      |
| Storey 01 - Ground Floor - B4 Lab        | -                 | -   | -   | -   | -   | 0.2 | -   | -   | -   | - | 0.42          | N/A      |
| Storey 01 - Ground Floor - Gen Lab I     | -                 | -   | -   | -   | -   | 0.2 | -   | -   | -   | - | 0.42          | N/A      |
| Storey 01 - Ground Floor - Gen Lab II    | -                 | -   | -   | -   | -   | 0.2 | -   | -   | -   | - | 0.42          | N/A      |
| Storey 01 - Ground Floor - MFL Office II | -                 | -   | -   | -   | -   | 0.2 | -   | -   | -   | - | 0.42          | N/A      |
| Storey 01 - Ground Floor - Sc Office II  | -                 | -   | -   | -   | -   | 0.2 | -   | -   | -   | - | 0.42          | N/A      |
| Storey 01 - Ground Floor - MFL 6         | -                 | -   | -   | -   | -   | 0.2 | -   | -   | -   | - | 0.42          | N/A      |
| Storey 01 - Ground Floor - MFL 5         | -                 | -   | -   | -   | -   | 0.2 | -   | -   | -   | - | 0.42          | N/A      |
| Storey 01 - Ground Floor - Sc Office I   | -                 | -   | -   | -   | -   | 0.2 | -   | -   | -   | - | 0.42          | N/A      |
| Storey 01 - Ground Floor - MFL 3         | -                 | -   | -   | -   | -   | 0.2 | -   | -   | -   | - | 0.42          | N/A      |
| Storey 01 - Ground Floor - MFL 1         | -                 | -   | -   | -   | -   | 0.2 | -   | -   | -   | - | 0.42          | 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                  |
| Storey 01 - Ground Floor - Circulation       |                | 135               | -                    | -                    |
| Storey 01 - Ground Floor - Girls WC 1        |                | 135               | -                    | -                    |
| Storey 01 - Ground Floor - Meeting Seminar 2 |                | 135               | -                    | -                    |
| Storey 01 - Ground Floor - Girls WC 2        |                | 135               | -                    | -                    |
| Storey 01 - Ground Floor - Boys WC 1         |                | 135               | -                    | -                    |
| Storey 01 - Ground Floor - Staff WC 1        |                | 135               | -                    | -                    |
| Storey 01 - Ground Floor - CBD               |                | 135               | -                    | -                    |
| Storey 01 - Ground Floor - CBD               |                | 135               | -                    | -                    |
| Storey 01 - Ground Floor - Staff WC 2        |                | 135               | -                    | -                    |
| Storey 01 - Ground Floor - Boys WC 2         |                | 135               | -                    | -                    |
| Storey 01 - Ground Floor - IT 1              |                | 135               | -                    | -                    |

| General lighting and display lighting        |                | General luminaire |  | Display light source |                                   |
|----------------------------------------------|----------------|-------------------|--|----------------------|-----------------------------------|
| Zone name                                    |                | Efficacy [lm/W]   |  | Efficacy [lm/W]      | Power density [W/m <sup>2</sup> ] |
|                                              | Standard value | 95                |  | 80                   | 0.3                               |
| Storey 01 - Ground Floor - IT 2              |                | 135               |  | -                    | -                                 |
| Storey 01 - Ground Floor - C1 Lab            |                | 135               |  | -                    | -                                 |
| Storey 01 - Ground Floor - P1 Lab            |                | 135               |  | -                    | -                                 |
| Storey 01 - Ground Floor - MFL Office I      |                | 135               |  | -                    | -                                 |
| Storey 01 - Ground Floor - B1 Lab            |                | 135               |  | -                    | -                                 |
| Storey 01 - Ground Floor - C2 Lab            |                | 135               |  | -                    | -                                 |
| Storey 01 - Ground Floor - P2 Lab            |                | 135               |  | -                    | -                                 |
| Storey 01 - Ground Floor - MFL 2             |                | 135               |  | -                    | -                                 |
| Storey 01 - Ground Floor - B2 Lab            |                | 135               |  | -                    | -                                 |
| Storey 01 - Ground Floor - C Prep            |                | 135               |  | -                    | -                                 |
| Storey 01 - Ground Floor - P Prep            |                | 135               |  | -                    | -                                 |
| Storey 01 - Ground Floor - Staff Room        |                | 135               |  | -                    | -                                 |
| Storey 01 - Ground Floor - B Prep            |                | 135               |  | -                    | -                                 |
| Storey 01 - Ground Floor - Meeting Seminar 1 |                | 135               |  | -                    | -                                 |
| Storey 01 - Ground Floor - C3 Lab            |                | 135               |  | -                    | -                                 |
| Storey 01 - Ground Floor - P3 Lab            |                | 135               |  | -                    | -                                 |
| Storey 01 - Ground Floor - Gen Class         |                | 135               |  | -                    | -                                 |
| Storey 01 - Ground Floor - B3 Lab            |                | 135               |  | -                    | -                                 |
| Storey 01 - Ground Floor - C4 Lab            |                | 135               |  | -                    | -                                 |
| Storey 01 - Ground Floor - P4 Lab            |                | 135               |  | -                    | -                                 |
| Storey 01 - Ground Floor - MFL 4             |                | 135               |  | -                    | -                                 |
| Storey 01 - Ground Floor - B4 Lab            |                | 135               |  | -                    | -                                 |
| Storey 01 - Ground Floor - Gen Lab I         |                | 135               |  | -                    | -                                 |
| Storey 01 - Ground Floor - Gen Lab II        |                | 135               |  | -                    | -                                 |
| Storey 01 - Ground Floor - MFL Office II     |                | 135               |  | -                    | -                                 |
| Storey 01 - Ground Floor - Sc Office II      |                | 135               |  | -                    | -                                 |
| Storey 01 - Ground Floor - MFL 6             |                | 135               |  | -                    | -                                 |
| Storey 01 - Ground Floor - MFL 5             |                | 135               |  | -                    | -                                 |
| Storey 01 - Ground Floor - Sc Office I       |                | 135               |  | -                    | -                                 |
| Storey 01 - Ground Floor - MFL 3             |                | 135               |  | -                    | -                                 |
| Storey 01 - Ground Floor - MFL 1             |                | 135               |  | -                    | -                                 |

**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? |
|----------------------------------------------|--------------------------------|-----------------------|
| Storey 01 - Ground Floor - Meeting Seminar 2 | N/A                            | N/A                   |
| Storey 01 - Ground Floor - C1 Lab            | NO (-71.3%)                    | NO                    |
| Storey 01 - Ground Floor - P1 Lab            | NO (-67.9%)                    | NO                    |
| Storey 01 - Ground Floor - MFL Office I      | NO (-70%)                      | NO                    |
| Storey 01 - Ground Floor - B1 Lab            | NO (-64.8%)                    | NO                    |
| Storey 01 - Ground Floor - C2 Lab            | NO (-72.7%)                    | NO                    |
| Storey 01 - Ground Floor - P2 Lab            | NO (-70.9%)                    | NO                    |
| Storey 01 - Ground Floor - MFL 2             | NO (-78.1%)                    | NO                    |
| Storey 01 - Ground Floor - B2 Lab            | NO (-57.7%)                    | NO                    |

| Zone                                         | Solar gain limit exceeded? (%) | Internal blinds used? |
|----------------------------------------------|--------------------------------|-----------------------|
| Storey 01 - Ground Floor - C Prep            | NO (-74.8%)                    | NO                    |
| Storey 01 - Ground Floor - P Prep            | NO (-61.5%)                    | NO                    |
| Storey 01 - Ground Floor - Staff Room        | NO (-74.8%)                    | NO                    |
| Storey 01 - Ground Floor - B Prep            | NO (-61.5%)                    | NO                    |
| Storey 01 - Ground Floor - Meeting Seminar 1 | N/A                            | N/A                   |
| Storey 01 - Ground Floor - C3 Lab            | NO (-74.4%)                    | NO                    |
| Storey 01 - Ground Floor - P3 Lab            | NO (-60.9%)                    | NO                    |
| Storey 01 - Ground Floor - Gen Class         | NO (-74.4%)                    | NO                    |
| Storey 01 - Ground Floor - B3 Lab            | NO (-60.7%)                    | NO                    |
| Storey 01 - Ground Floor - C4 Lab            | NO (-72.6%)                    | NO                    |
| Storey 01 - Ground Floor - P4 Lab            | NO (-70.8%)                    | NO                    |
| Storey 01 - Ground Floor - MFL 4             | NO (-77.7%)                    | NO                    |
| Storey 01 - Ground Floor - B4 Lab            | NO (-57.6%)                    | NO                    |
| Storey 01 - Ground Floor - Gen Lab I         | NO (-71.3%)                    | NO                    |
| Storey 01 - Ground Floor - Gen Lab II        | NO (-67.9%)                    | NO                    |
| Storey 01 - Ground Floor - MFL Office II     | NO (-69.5%)                    | NO                    |
| Storey 01 - Ground Floor - Sc Office II      | NO (-64.3%)                    | NO                    |
| Storey 01 - Ground Floor - MFL 6             | NO (-77.8%)                    | NO                    |
| Storey 01 - Ground Floor - MFL 5             | NO (-77.4%)                    | NO                    |
| Storey 01 - Ground Floor - Sc Office I       | NO (-64.9%)                    | NO                    |
| Storey 01 - Ground Floor - MFL 3             | NO (-77.1%)                    | NO                    |
| Storey 01 - Ground Floor - MFL 1             | NO (-76.9%)                    | NO                    |

### Regulation 25A: Consideration of high efficiency alternative energy systems

|                                                                                        |     |
|----------------------------------------------------------------------------------------|-----|
| Were alternative energy systems considered and analysed as part of the design process? | YES |
| Is evidence of such assessment available as a separate submission?                     | YES |
| Are any such measures included in the proposed design?                                 | YES |

# Technical Data Sheet (Actual vs. Notional Building)

## Building Global Parameters

|                                                       | Actual | Notional |
|-------------------------------------------------------|--------|----------|
| Floor area [m <sup>2</sup> ]                          | 2314.3 | 2314.3   |
| External area [m <sup>2</sup> ]                       | 6046.9 | 6046.9   |
| Weather                                               | LON    | LON      |
| Infiltration [m <sup>3</sup> /hm <sup>2</sup> @ 50Pa] | 5      | 3        |
| Average conductance [W/K]                             | 952.4  | 1481.29  |
| Average U-value [W/m <sup>2</sup> K]                  | 0.16   | 0.24     |
| Alpha value* [%]                                      | 5.68   | 14.39    |

\* 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/m<sup>2</sup>]

|                 | Actual       | Notional     |
|-----------------|--------------|--------------|
| Heating         | 4.24         | 4.93         |
| Cooling         | 0            | 0            |
| Auxiliary       | 2.84         | 4.86         |
| Lighting        | 6.13         | 6.26         |
| Hot water       | 11.01        | 10.84        |
| Equipment*      | 14.82        | 14.82        |
| <b>TOTAL **</b> | <b>24.23</b> | <b>26.89</b> |

\* 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/m<sup>2</sup>]

|                              | Actual   | Notional |
|------------------------------|----------|----------|
| Photovoltaic systems         | 0        | 0        |
| Wind turbines                | 0        | 0        |
| CHP generators               | 0        | 0        |
| Solar thermal systems        | 0        | 0        |
| <i>Displaced electricity</i> | <i>0</i> | <i>0</i> |

## Energy & CO<sub>2</sub> Emissions Summary

|                                                     | Actual | Notional |
|-----------------------------------------------------|--------|----------|
| Heating + cooling demand [MJ/m <sup>2</sup> ]       | 116.2  | 100.05   |
| Primary energy [kWh <sub>PE</sub> /m <sup>2</sup> ] | 36.96  | 40.12    |
| Total emissions [kg/m <sup>2</sup> ]                | 3.44   | 3.76     |

## HVAC Systems Performance

| System Type                                                                                  | Heat dem<br>MJ/m2 | Cool dem<br>MJ/m2 | Heat con<br>kWh/m2 | Cool con<br>kWh/m2 | Aux con<br>kWh/m2 | Heat<br>SSEEF | Cool<br>SSEER | Heat gen<br>SEFF | Cool gen<br>SEER |
|----------------------------------------------------------------------------------------------|-------------------|-------------------|--------------------|--------------------|-------------------|---------------|---------------|------------------|------------------|
| [ST] Central heating using water: radiators, [HS] ASHP, [HFT] Electricity, [CFT] Natural Gas |                   |                   |                    |                    |                   |               |               |                  |                  |
| Actual                                                                                       | 56.4              | 64.4              | 4.5                | 0                  | 4.5               | 3.52          | 0             | 3.75             | 0                |
| Notional                                                                                     | 62.2              | 34.1              | 6.5                | 0                  | 5                 | 2.64          | 0             | ----             | ----             |
| [ST] Other local room heater - fanned, [HS] ASHP, [HFT] Electricity, [CFT] Natural Gas       |                   |                   |                    |                    |                   |               |               |                  |                  |
| Actual                                                                                       | 47.1              | 66.9              | 4.1                | 0                  | 2                 | 3.16          | 0             | 3.75             | 0                |
| Notional                                                                                     | 39.7              | 62.1              | 4.2                | 0                  | 4.8               | 2.64          | 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                                                                                   |

Project name

Modular and Portable

Highgate School Decant Building + PV

As designed

Date: Fri Apr 19 11:09:47 2024

## Administrative information

## Building Details

Address: Highgate School, North Road, London, N6 4AY

## Certifier details

Name: Paul Dodds

Telephone number: 01325 310404

Address: , ,

## Certification tool

Calculation engine: SBEM

Calculation engine version: v6.1.e.0

Interface to calculation engine: DesignBuilder SBEM

Interface to calculation engine version: v7.1.4

BRUKL compliance module version: v6.1.e.0

Foundation area [m<sup>2</sup>]: 2314.27The CO<sub>2</sub> emission and primary energy rates of the building must not exceed the targets

|                                                                                        |                         |
|----------------------------------------------------------------------------------------|-------------------------|
| Target CO <sub>2</sub> emission rate (TER), kgCO <sub>2</sub> /m <sup>2</sup> .annum   | 3.76                    |
| Building CO <sub>2</sub> emission rate (BER), kgCO <sub>2</sub> /m <sup>2</sup> .annum | -0.14                   |
| Target primary energy rate (TPER), kWh <sub>PE</sub> /m <sup>2</sup> .annum            | 40.12                   |
| Building primary energy rate (BPER), kWh <sub>PE</sub> /m <sup>2</sup> .annum          | -4.35                   |
| 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 <sub>a-Limit</sub> | U <sub>a-Calc</sub> | U <sub>i-Calc</sub> | First surface with maximum value           |
|--------------------------------------|----------------------|---------------------|---------------------|--------------------------------------------|
| Walls*                               | 0.26                 | 0.12                | 0.12                | Storey 01 - Ground Floor - Circulation_W_7 |
| Floors                               | 0.18                 | 0.1                 | 0.1                 | Storey 01 - Ground Floor - Circulation_S_3 |
| Pitched roofs                        | 0.16                 | -                   | -                   | No heat loss pitched roofs                 |
| Flat roofs                           | 0.18                 | 0.1                 | 0.1                 | Storey 01 - Ground Floor - Circulation_R_4 |
| Windows** and roof windows           | 1.6                  | 1.4                 | 1.4                 | Storey 01 - Ground Floor - Circulation_G_5 |
| Rooflights***                        | 2.2                  | -                   | -                   | No external rooflights                     |
| 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<sub>a-Limit</sub> = Limiting area-weighted average U-values [W/(m<sup>2</sup>K)]U<sub>i-Calc</sub> = Calculated maximum individual element U-values [W/(m<sup>2</sup>K)]U<sub>a-Calc</sub> = Calculated area-weighted average U-values [W/(m<sup>2</sup>K)]

\* 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/m<sup>2</sup>K

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 <sup>3</sup> /(h.m <sup>2</sup> ) at 50 Pa | 8                 | 5             |

## 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 | NO   |
| Whole building electric power factor achieved by power factor correction                     | <0.9 |

### 1- Project HVAC - Samsung AE140BXYDGG/EU & Radiators

|                                                                                                      | Heating efficiency | Cooling efficiency | Radiant efficiency | SFP [W/(l/s)] | HR efficiency |
|------------------------------------------------------------------------------------------------------|--------------------|--------------------|--------------------|---------------|---------------|
| <b>This system</b>                                                                                   | 3.75               | -                  | -                  | -             | -             |
| <b>Standard value</b>                                                                                | 2.5*               | N/A                | N/A                | N/A           | N/A           |
| <b>Automatic monitoring &amp; targeting with alarms for out-of-range values for this HVAC system</b> |                    |                    |                    |               | YES           |
| * Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps.        |                    |                    |                    |               |               |

### 2- Project HVAC - Samsung AE140BXYDGG/EU & HVR Zero System

|                                                                                                      | Heating efficiency | Cooling efficiency | Radiant efficiency | SFP [W/(l/s)] | HR efficiency |
|------------------------------------------------------------------------------------------------------|--------------------|--------------------|--------------------|---------------|---------------|
| <b>This system</b>                                                                                   | 3.75               | -                  | -                  | -             | -             |
| <b>Standard value</b>                                                                                | 2.5*               | N/A                | N/A                | N/A           | N/A           |
| <b>Automatic monitoring &amp; targeting with alarms for out-of-range values for this HVAC system</b> |                    |                    |                    |               | YES           |
| * Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps.        |                    |                    |                    |               |               |

### 1- Project DHW - Aquapoint III AP3/100

|                       | Water heating efficiency | Storage loss factor [kWh/litre per day] |
|-----------------------|--------------------------|-----------------------------------------|
| <b>This building</b>  | 1                        | 0                                       |
| <b>Standard value</b> | 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 |      |               |          |
| Storey 01 - Ground Floor - Girls WC 1 | -             | -   | 0.4 | -   | -   | -   | -   | -   | - | -    | -             | N/A      |
| Storey 01 - Ground Floor - Girls WC 2 | -             | -   | 0.4 | -   | -   | -   | -   | -   | - | -    | -             | N/A      |
| Storey 01 - Ground Floor - Boys WC 1  | -             | -   | 0.4 | -   | -   | -   | -   | -   | - | -    | -             | N/A      |
| Storey 01 - Ground Floor - Staff WC 1 | -             | -   | 0.4 | -   | -   | -   | -   | -   | - | -    | -             | N/A      |
| Storey 01 - Ground Floor - Staff WC 2 | -             | -   | 0.4 | -   | -   | -   | -   | -   | - | -    | -             | N/A      |
| Storey 01 - Ground Floor - Boys WC 2  | -             | -   | 0.4 | -   | -   | -   | -   | -   | - | -    | -             | N/A      |
| Storey 01 - Ground Floor - C1 Lab     | -             | -   | -   | -   | 0.2 | -   | -   | -   | - | 0.42 | -             | 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 |
| Storey 01 - Ground Floor - P1 Lab        | -                 | -   | -   | -   | -   | 0.2 | -   | -   | -   | - | 0.42          | N/A      |
| Storey 01 - Ground Floor - MFL Office I  | -                 | -   | -   | -   | -   | 0.2 | -   | -   | -   | - | 0.42          | N/A      |
| Storey 01 - Ground Floor - B1 Lab        | -                 | -   | -   | -   | -   | 0.2 | -   | -   | -   | - | 0.42          | N/A      |
| Storey 01 - Ground Floor - C2 Lab        | -                 | -   | -   | -   | -   | 0.2 | -   | -   | -   | - | 0.42          | N/A      |
| Storey 01 - Ground Floor - P2 Lab        | -                 | -   | -   | -   | -   | 0.2 | -   | -   | -   | - | 0.42          | N/A      |
| Storey 01 - Ground Floor - MFL 2         | -                 | -   | -   | -   | -   | 0.2 | -   | -   | -   | - | 0.42          | N/A      |
| Storey 01 - Ground Floor - B2 Lab        | -                 | -   | -   | -   | -   | 0.2 | -   | -   | -   | - | 0.42          | N/A      |
| Storey 01 - Ground Floor - C Prep        | -                 | -   | -   | -   | -   | 0.2 | -   | -   | -   | - | 0.42          | N/A      |
| Storey 01 - Ground Floor - P Prep        | -                 | -   | -   | -   | -   | 0.2 | -   | -   | -   | - | 0.42          | N/A      |
| Storey 01 - Ground Floor - Staff Room    | -                 | -   | -   | -   | -   | 0.2 | -   | -   | -   | - | 0.42          | N/A      |
| Storey 01 - Ground Floor - B Prep        | -                 | -   | -   | -   | -   | 0.2 | -   | -   | -   | - | 0.42          | N/A      |
| Storey 01 - Ground Floor - C3 Lab        | -                 | -   | -   | -   | -   | 0.2 | -   | -   | -   | - | 0.42          | N/A      |
| Storey 01 - Ground Floor - P3 Lab        | -                 | -   | -   | -   | -   | 0.2 | -   | -   | -   | - | 0.42          | N/A      |
| Storey 01 - Ground Floor - Gen Class     | -                 | -   | -   | -   | -   | 0.2 | -   | -   | -   | - | 0.42          | N/A      |
| Storey 01 - Ground Floor - B3 Lab        | -                 | -   | -   | -   | -   | 0.2 | -   | -   | -   | - | 0.42          | N/A      |
| Storey 01 - Ground Floor - C4 Lab        | -                 | -   | -   | -   | -   | 0.2 | -   | -   | -   | - | 0.42          | N/A      |
| Storey 01 - Ground Floor - P4 Lab        | -                 | -   | -   | -   | -   | 0.2 | -   | -   | -   | - | 0.42          | N/A      |
| Storey 01 - Ground Floor - MFL 4         | -                 | -   | -   | -   | -   | 0.2 | -   | -   | -   | - | 0.42          | N/A      |
| Storey 01 - Ground Floor - B4 Lab        | -                 | -   | -   | -   | -   | 0.2 | -   | -   | -   | - | 0.42          | N/A      |
| Storey 01 - Ground Floor - Gen Lab I     | -                 | -   | -   | -   | -   | 0.2 | -   | -   | -   | - | 0.42          | N/A      |
| Storey 01 - Ground Floor - Gen Lab II    | -                 | -   | -   | -   | -   | 0.2 | -   | -   | -   | - | 0.42          | N/A      |
| Storey 01 - Ground Floor - MFL Office II | -                 | -   | -   | -   | -   | 0.2 | -   | -   | -   | - | 0.42          | N/A      |
| Storey 01 - Ground Floor - Sc Office II  | -                 | -   | -   | -   | -   | 0.2 | -   | -   | -   | - | 0.42          | N/A      |
| Storey 01 - Ground Floor - MFL 6         | -                 | -   | -   | -   | -   | 0.2 | -   | -   | -   | - | 0.42          | N/A      |
| Storey 01 - Ground Floor - MFL 5         | -                 | -   | -   | -   | -   | 0.2 | -   | -   | -   | - | 0.42          | N/A      |
| Storey 01 - Ground Floor - Sc Office I   | -                 | -   | -   | -   | -   | 0.2 | -   | -   | -   | - | 0.42          | N/A      |
| Storey 01 - Ground Floor - MFL 3         | -                 | -   | -   | -   | -   | 0.2 | -   | -   | -   | - | 0.42          | N/A      |
| Storey 01 - Ground Floor - MFL 1         | -                 | -   | -   | -   | -   | 0.2 | -   | -   | -   | - | 0.42          | 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                  |
| Storey 01 - Ground Floor - Circulation       |                | 135               | -                    | -                    |
| Storey 01 - Ground Floor - Girls WC 1        |                | 135               | -                    | -                    |
| Storey 01 - Ground Floor - Meeting Seminar 2 |                | 135               | -                    | -                    |
| Storey 01 - Ground Floor - Girls WC 2        |                | 135               | -                    | -                    |
| Storey 01 - Ground Floor - Boys WC 1         |                | 135               | -                    | -                    |
| Storey 01 - Ground Floor - Staff WC 1        |                | 135               | -                    | -                    |
| Storey 01 - Ground Floor - CBD               |                | 135               | -                    | -                    |
| Storey 01 - Ground Floor - CBD               |                | 135               | -                    | -                    |
| Storey 01 - Ground Floor - Staff WC 2        |                | 135               | -                    | -                    |
| Storey 01 - Ground Floor - Boys WC 2         |                | 135               | -                    | -                    |
| Storey 01 - Ground Floor - IT 1              |                | 135               | -                    | -                    |

| 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                  |
| Storey 01 - Ground Floor - IT 2              |                | 135               |  | -                    | -                    |
| Storey 01 - Ground Floor - C1 Lab            |                | 135               |  | -                    | -                    |
| Storey 01 - Ground Floor - P1 Lab            |                | 135               |  | -                    | -                    |
| Storey 01 - Ground Floor - MFL Office I      |                | 135               |  | -                    | -                    |
| Storey 01 - Ground Floor - B1 Lab            |                | 135               |  | -                    | -                    |
| Storey 01 - Ground Floor - C2 Lab            |                | 135               |  | -                    | -                    |
| Storey 01 - Ground Floor - P2 Lab            |                | 135               |  | -                    | -                    |
| Storey 01 - Ground Floor - MFL 2             |                | 135               |  | -                    | -                    |
| Storey 01 - Ground Floor - B2 Lab            |                | 135               |  | -                    | -                    |
| Storey 01 - Ground Floor - C Prep            |                | 135               |  | -                    | -                    |
| Storey 01 - Ground Floor - P Prep            |                | 135               |  | -                    | -                    |
| Storey 01 - Ground Floor - Staff Room        |                | 135               |  | -                    | -                    |
| Storey 01 - Ground Floor - B Prep            |                | 135               |  | -                    | -                    |
| Storey 01 - Ground Floor - Meeting Seminar 1 |                | 135               |  | -                    | -                    |
| Storey 01 - Ground Floor - C3 Lab            |                | 135               |  | -                    | -                    |
| Storey 01 - Ground Floor - P3 Lab            |                | 135               |  | -                    | -                    |
| Storey 01 - Ground Floor - Gen Class         |                | 135               |  | -                    | -                    |
| Storey 01 - Ground Floor - B3 Lab            |                | 135               |  | -                    | -                    |
| Storey 01 - Ground Floor - C4 Lab            |                | 135               |  | -                    | -                    |
| Storey 01 - Ground Floor - P4 Lab            |                | 135               |  | -                    | -                    |
| Storey 01 - Ground Floor - MFL 4             |                | 135               |  | -                    | -                    |
| Storey 01 - Ground Floor - B4 Lab            |                | 135               |  | -                    | -                    |
| Storey 01 - Ground Floor - Gen Lab I         |                | 135               |  | -                    | -                    |
| Storey 01 - Ground Floor - Gen Lab II        |                | 135               |  | -                    | -                    |
| Storey 01 - Ground Floor - MFL Office II     |                | 135               |  | -                    | -                    |
| Storey 01 - Ground Floor - Sc Office II      |                | 135               |  | -                    | -                    |
| Storey 01 - Ground Floor - MFL 6             |                | 135               |  | -                    | -                    |
| Storey 01 - Ground Floor - MFL 5             |                | 135               |  | -                    | -                    |
| Storey 01 - Ground Floor - Sc Office I       |                | 135               |  | -                    | -                    |
| Storey 01 - Ground Floor - MFL 3             |                | 135               |  | -                    | -                    |
| Storey 01 - Ground Floor - MFL 1             |                | 135               |  | -                    | -                    |

**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? |
|----------------------------------------------|--------------------------------|-----------------------|
| Storey 01 - Ground Floor - Meeting Seminar 2 | N/A                            | N/A                   |
| Storey 01 - Ground Floor - C1 Lab            | NO (-71.3%)                    | NO                    |
| Storey 01 - Ground Floor - P1 Lab            | NO (-67.9%)                    | NO                    |
| Storey 01 - Ground Floor - MFL Office I      | NO (-70%)                      | NO                    |
| Storey 01 - Ground Floor - B1 Lab            | NO (-64.8%)                    | NO                    |
| Storey 01 - Ground Floor - C2 Lab            | NO (-72.7%)                    | NO                    |
| Storey 01 - Ground Floor - P2 Lab            | NO (-70.9%)                    | NO                    |
| Storey 01 - Ground Floor - MFL 2             | NO (-78.1%)                    | NO                    |
| Storey 01 - Ground Floor - B2 Lab            | NO (-57.7%)                    | NO                    |

| Zone                                         | Solar gain limit exceeded? (%) | Internal blinds used? |
|----------------------------------------------|--------------------------------|-----------------------|
| Storey 01 - Ground Floor - C Prep            | NO (-74.8%)                    | NO                    |
| Storey 01 - Ground Floor - P Prep            | NO (-61.5%)                    | NO                    |
| Storey 01 - Ground Floor - Staff Room        | NO (-74.8%)                    | NO                    |
| Storey 01 - Ground Floor - B Prep            | NO (-61.5%)                    | NO                    |
| Storey 01 - Ground Floor - Meeting Seminar 1 | N/A                            | N/A                   |
| Storey 01 - Ground Floor - C3 Lab            | NO (-74.4%)                    | NO                    |
| Storey 01 - Ground Floor - P3 Lab            | NO (-60.9%)                    | NO                    |
| Storey 01 - Ground Floor - Gen Class         | NO (-74.4%)                    | NO                    |
| Storey 01 - Ground Floor - B3 Lab            | NO (-60.7%)                    | NO                    |
| Storey 01 - Ground Floor - C4 Lab            | NO (-72.6%)                    | NO                    |
| Storey 01 - Ground Floor - P4 Lab            | NO (-70.8%)                    | NO                    |
| Storey 01 - Ground Floor - MFL 4             | NO (-77.7%)                    | NO                    |
| Storey 01 - Ground Floor - B4 Lab            | NO (-57.6%)                    | NO                    |
| Storey 01 - Ground Floor - Gen Lab I         | NO (-71.3%)                    | NO                    |
| Storey 01 - Ground Floor - Gen Lab II        | NO (-67.9%)                    | NO                    |
| Storey 01 - Ground Floor - MFL Office II     | NO (-69.5%)                    | NO                    |
| Storey 01 - Ground Floor - Sc Office II      | NO (-64.3%)                    | NO                    |
| Storey 01 - Ground Floor - MFL 6             | NO (-77.8%)                    | NO                    |
| Storey 01 - Ground Floor - MFL 5             | NO (-77.4%)                    | NO                    |
| Storey 01 - Ground Floor - Sc Office I       | NO (-64.9%)                    | NO                    |
| Storey 01 - Ground Floor - MFL 3             | NO (-77.1%)                    | NO                    |
| Storey 01 - Ground Floor - MFL 1             | NO (-76.9%)                    | NO                    |

### Regulation 25A: Consideration of high efficiency alternative energy systems

|                                                                                        |     |
|----------------------------------------------------------------------------------------|-----|
| Were alternative energy systems considered and analysed as part of the design process? | YES |
| Is evidence of such assessment available as a separate submission?                     | YES |
| Are any such measures included in the proposed design?                                 | YES |

# Technical Data Sheet (Actual vs. Notional Building)

## Building Global Parameters

|                                                       | Actual | Notional |
|-------------------------------------------------------|--------|----------|
| Floor area [m <sup>2</sup> ]                          | 2314.3 | 2314.3   |
| External area [m <sup>2</sup> ]                       | 6046.9 | 6046.9   |
| Weather                                               | LON    | LON      |
| Infiltration [m <sup>3</sup> /hm <sup>2</sup> @ 50Pa] | 5      | 3        |
| Average conductance [W/K]                             | 952.4  | 1481.29  |
| Average U-value [W/m <sup>2</sup> K]                  | 0.16   | 0.24     |
| Alpha value* [%]                                      | 5.68   | 14.39    |

\* 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/m<sup>2</sup>]

|                 | Actual       | Notional     |
|-----------------|--------------|--------------|
| Heating         | 4.24         | 4.93         |
| Cooling         | 0            | 0            |
| Auxiliary       | 2.84         | 4.86         |
| Lighting        | 6.13         | 6.26         |
| Hot water       | 11.01        | 10.84        |
| Equipment*      | 14.82        | 14.82        |
| <b>TOTAL **</b> | <b>24.23</b> | <b>26.89</b> |

\* 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/m<sup>2</sup>]

|                              | Actual       | Notional |
|------------------------------|--------------|----------|
| Photovoltaic systems         | 28.16        | 0        |
| Wind turbines                | 0            | 0        |
| CHP generators               | 0            | 0        |
| Solar thermal systems        | 0            | 0        |
| <i>Displaced electricity</i> | <i>28.16</i> | <i>0</i> |

## Energy & CO<sub>2</sub> Emissions Summary

|                                                     | Actual | Notional |
|-----------------------------------------------------|--------|----------|
| Heating + cooling demand [MJ/m <sup>2</sup> ]       | 116.2  | 100.05   |
| Primary energy [kWh <sub>PE</sub> /m <sup>2</sup> ] | -4.35  | 40.12    |
| Total emissions [kg/m <sup>2</sup> ]                | -0.14  | 3.76     |

## HVAC Systems Performance

| System Type                                                                                  | Heat dem<br>MJ/m2 | Cool dem<br>MJ/m2 | Heat con<br>kWh/m2 | Cool con<br>kWh/m2 | Aux con<br>kWh/m2 | Heat<br>SSEEF | Cool<br>SSEER | Heat gen<br>SEFF | Cool gen<br>SEER |
|----------------------------------------------------------------------------------------------|-------------------|-------------------|--------------------|--------------------|-------------------|---------------|---------------|------------------|------------------|
| [ST] Central heating using water: radiators, [HS] ASHP, [HFT] Electricity, [CFT] Natural Gas |                   |                   |                    |                    |                   |               |               |                  |                  |
| Actual                                                                                       | 56.4              | 64.4              | 4.5                | 0                  | 4.5               | 3.52          | 0             | 3.75             | 0                |
| Notional                                                                                     | 62.2              | 34.1              | 6.5                | 0                  | 5                 | 2.64          | 0             | ----             | ----             |
| [ST] Other local room heater - fanned, [HS] ASHP, [HFT] Electricity, [CFT] Natural Gas       |                   |                   |                    |                    |                   |               |               |                  |                  |
| Actual                                                                                       | 47.1              | 66.9              | 4.1                | 0                  | 2                 | 3.16          | 0             | 3.75             | 0                |
| Notional                                                                                     | 39.7              | 62.1              | 4.2                | 0                  | 4.8               | 2.64          | 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                                                                                   |