

Richards Music Centre

Energy Strategy

Highgate School

60580302-RMC-MEP-VAR-RPT-X-003

November 2022

Quality information

Prepared by	Checked by	Verified by	Approved by
RB Principal Consultant	AD Associate Director	GA Associate Director	JE Associate Director

Revision History

Revision	Revision date	Details	Authorized	Position
V1	05/10/2022	Draft for client team comment	JE	Associate Director
V2	08/11/2022	Final version	JE	Associate Director

Prepared for:
Highgate School

AECOM Limited
Aldgate Tower
2 Leman Street
London E1 8FA
United Kingdom
aecom.com

© 2022 AECOM Limited. All Rights Reserved.

This document has been prepared by AECOM Limited ("AECOM") for sole use of our client (the "Client") in accordance with generally accepted consultancy principles, the budget for fees and the terms of reference agreed between AECOM and the Client. Any information provided by third parties and referred to herein has not been checked or verified by AECOM, unless otherwise expressly stated in the document. No third party may rely upon this document without the prior and express written agreement of AECOM.

Table of Contents

Executive Summary.....	6
Introduction.....	6
Development description	6
Policy review	6
Proposed energy strategy.....	6
1. Introduction and background.....	10
1.1 Development Description	10
1.2 Policy Review	10
2. Baseline CO ₂ emissions and annual energy demand	15
2.1 Building energy modelling	15
3. 'Be Lean' – Energy demand reduction.....	16
3.1 General approach	16
3.2 Carbon emissions – 'Be Lean'	16
3.3 Energy use intensity and space heating demand.....	18
4. Overheating risk analysis.....	19
4.1 Overheating modelling	19
4.2 Overheating summary.....	20
5. 'Be Clean' – Decentralised energy	21
5.1 Decentralised heat networks	21
5.2 Air Quality.....	23
5.3 'Be Clean' results summary.....	23
6. 'Be Green' – Renewable Energy	24
6.1 Technology options appraisal	24
6.2 Carbon emissions – 'Be Green'	28
6.3 Energy monitoring – 'Be Seen'	28
7. Flexibility and peak energy demand	29
8. Conclusion.....	31
8.1 Baseline.....	31
8.2 'Be Lean' – Energy demand reduction	31
8.3 'Be Clean' – District heating	31
8.4 'Be Green' - Renewable energy generation	31
8.5 Energy monitoring – 'Be Seen'	32
8.6 Carbon offsetting	32
8.7 Proposed energy strategy	32
Appendix A GLA Carbon Reporting Spreadsheets.....	36
Appendix B BRUKL output documents.....	37
Appendix C Part L2A report	38
Appendix D Correspondence with heat pump manufacturer	39
Appendix E Overheating Risk Analysis	40
Appendix F – Planning Policy Review	41
Policy Review	41

Figures

Figure 1 Extract from London Heat Map (the site is shown with a red star).....	22
Figure 2 Proposed PV location (red outline).	24
Figure 3 Proposed borehole location under the building (shown in red shading).....	26
Figure 4 Proposed GSHP plant location (thick red outline)	26

Figure 5 Proposed energy strategy: Energy Hierarchy CO₂ baseline, emissions and savings 34

Tables

Table 1 Modelled baseline carbon emissions	15
Table 2 Baseline carbon emissions	15
Table 3 Carbon emissions after demand reduction	17
Table 4 Regulated carbon savings from energy efficiency	17
Table 5 Energy use intensity and space heating demand	18
Table 6 Carbon emissions after district heating	23
Table 7 Regulated carbon savings from district heating	23
Table 8 PV summary.....	25
Table 9 GSHP performance	27
Table 10 Heat pump carbon savings	27
Table 11 Carbon emissions after renewable energy	28
Table 12 Regulated carbon savings from renewable energy	28
Table 13 Summary of site-wide peak demand, capacity and flexibility potential	29
Table 14 Summary of peak demand flexibility interventions	30
Table 15 Carbon emissions after each stage of the energy hierarchy	32
Table 16 Regulated carbon savings from each stage of the energy hierarchy	33
Table 17 Carbon savings shortfall and offset payment.....	33

Executive Summary

Introduction

AECOM has been commissioned by Highgate School ('the Applicant') to produce an energy statement in support of a detailed planning application for the redevelopment of their Richards Music Centre (RMC) site at Bishopswood Road ('the Site') in the London Borough of Haringey.

This document summarises the options considered during design of the building redevelopment (hereafter referred to as the 'Proposed Development') for reducing carbon emissions through energy efficiency measures, low carbon energy supply from decentralised sources and the integration of renewable energy technologies.

Development description

The proposed development consists of *Redevelopment of Richards Music Centre, including complete demolition of existing structure and development of a replacement building of two and a half storeys plus basement, and associated landscaping with improved provision for emergency services, servicing and disabled parking.*

The proposed building will be used to provide changing facilities, a drama theatre and drama classrooms for Highgate School. For full details and the scope of the application, refer to the Hopkins Architects Design and Access Statement.

Policy review

The energy strategy for the proposed development responds to national, regional and local planning policies, including but not limited to:

- National Planning Policy Framework.
- UK Climate Change Act.
- Building Regulations 2021 and Future Buildings Standard.
- GLA Energy Assessment Guidance 2022.
- The London Plan 2021.
- Haringey Strategic Policies 2013 – 2016.
- Haringey Development Management DPD 2017.
- Haringey Highgate School SPD 2021.

Proposed energy strategy

The energy strategy for the proposed development is:

1. Energy efficient fabric and buildings services design;
2. A GSHP system to provide space heating and cooling to the building and hot water to changing room areas;
3. A PV array on the roof of the building.

The carbon emissions at each stage in the energy hierarchy are summarised below.

Summary Figure 1 shows the carbon baseline, and emissions and savings with the proposed energy strategy, at each step in the energy hierarchy. Calculations at this stage suggest this strategy would save 2.3 tCO₂/year, which is 43% of the baseline emissions of 5.4 tCO₂/year. This is also summarised in Summary Table 1 and Summary Table 2.

	Carbon emissions for new buildings (tCO ₂ /year)	
	Regulated	Unregulated
Baseline: Part L 2021 of the Building Regulations Compliant Development	5.4	7.9
After energy demand reduction	5.4	7.9
After heat network/CHP	5.4	7.9
After renewable energy	3.1	7.9

Summary Table 1 Carbon emissions after each stage of the energy hierarchy.

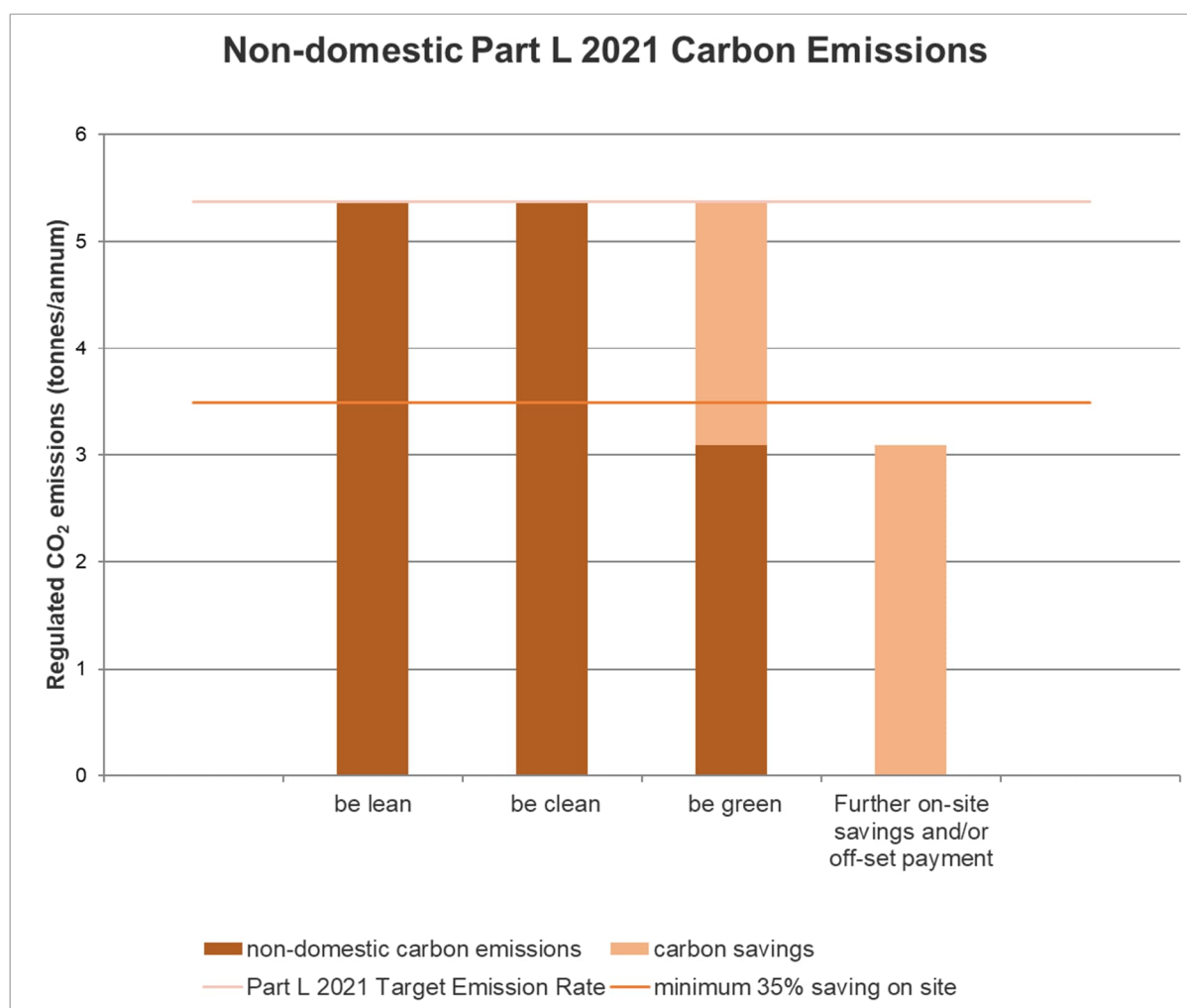
	Regulated new-building carbon savings	
	(tCO ₂ /year)	(%)
Savings from energy demand reduction	0.0	0%
Savings from heat network/CHP	0.0	0%
Savings from renewable energy	2.3	43%
Total cumulative savings	2.3	43%

Summary Table 2 Regulated carbon savings from each stage of the energy hierarchy

The shortfall in savings relative to the 'zero carbon' 100% regulated emission saving target is 3.1 tCO₂/year, which is a cumulative total over 30 years of 93 tCO₂ that is expected to be addressed through offsetting. Based on a carbon price of £95/tCO₂/year, this results in an estimated carbon offset payment of approximately £8,801, subject to agreement with LBH. This is summarised in Summary Table 3.

	Annual (tCO ₂)	Cumulative shortfall (tCO ₂)
Total Target Savings	5.4	-
Shortfall	3.1	93
Cash in-lieu contribution (£)	-	£8,801

Summary Table 3 Carbon savings shortfall and offset payment



Summary Figure 1 Proposed energy strategy: Energy Hierarchy CO₂ baseline, emissions and savings

Comparison with carbon saving targets

'Be Lean' target

GLA planning policy encourages on-site regulated carbon savings of 15% against the baseline from energy efficiency measures alone (the 'Be Lean' stage). The proposed development does not achieve carbon savings over the Part L 2021, but does match the notional building through energy efficiency alone. This is despite the proposed building having efficient building fabric and services. The main reason for this is the updates to the notional building in Part L 2021, which have been made to improve the overall performance of all buildings. In particular, the following changes to the Part L notional building have impacted the ability of the proposed building to meet Building Regulations through energy efficiency alone:

Lighting in the notional building is now LED lighting, which matches the performance of efficient lighting options available. Lighting savings compared to the notional building are now more difficult to achieve than under Part L 2013. The proposed building has efficient lighting and controls including daylight dimming and PIR controls.

General building fabric and services efficiencies are now much improved for the notional building. This makes savings from efficiency alone much harder to achieve with available products.

In addition, hot water provision for buildings which incorporate heat pumps assumes that heat pumps provide water heating in the notional building. At the be lean stage, there are no opportunities to make improvements to the hot water efficiency (as efficiency improvements are made at the be green stage in line with GLA Energy Assessment Guidance). In this building, which has proportionally large

changing room areas, hot water represents a large proportion of the energy use. This limits the potential for overall savings. Further, there is limited potential for savings from the be green stage as the notional building already includes heat pumps.

The 2021 update to Building Regulations are aimed to improve efficiency across all new buildings in England. This important improvement has lowered the scope available for buildings to achieve improvements relative to the notional building and makes it difficult to meet building regulations through energy efficiency alone, or meet the GLA 15% “be lean” savings target. The GLA *Note to accompany GLA Energy Assessment Guidance 2022* acknowledges that non-domestic developments may find meeting the be lean targets difficult, but advises that applicants should follow the energy hierarchy to ensure that carbon savings are maximised. The proposed development provides efficient building fabric, in line with the energy hierarchy, to maximise available operational carbon savings.

1. Introduction and background

AECOM has been commissioned by Highgate School ('the Applicant') to produce an energy statement in support of a detailed planning application for the redevelopment of their Richards Music Centre (RMC) site at Bishopswood Road ('the Site') in the London Borough of Haringey.

This document summarises the options considered during design of the building redevelopment (hereafter referred to as the 'Proposed Development') for reducing carbon emissions through energy efficiency measures, low carbon energy supply from decentralised sources and the integration of renewable energy technologies.

1.1 Development Description

The proposed development consists of *Redevelopment of Richards Music Centre, including complete demolition of existing structure and development of a replacement building of two and a half storeys plus basement, and associated landscaping with improved provision for emergency services, servicing and disabled parking.*

The proposed building will be used to provide changing facilities, a drama theatre and drama classrooms for Highgate School. For full details and the scope of the application, refer to the Hopkins Architects Design and Access Statement.

1.2 Policy Review

This section summarises the key national, regional and local planning policy applicable to the proposed development. A full planning policy review is included in Appendix F.

1.2.1 National Legislation and Policy Drivers

1.2.1.1 UK Climate Change Act

The Climate Change Act (2008) sets a legally binding target to reduce UK carbon emissions by 100% by 2050, against a 1990 baseline.

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

1.2.1.2 National Planning Policy Framework

The National Planning Policy Framework (NPPF) prescribes government planning policy and outlines the way in which this is to be applied. The document sets out a framework for local plan development and illustrates national-scale policy aims. The NPPF includes requirements for new development which assist in supporting the transition to a low carbon future.

1.2.1.3 Building Regulations and Future Buildings Standard

Part L of the Building Regulations in England is the key mechanism that prescribes standards for the energy performance of new and the refurbishment of existing buildings in the UK, based on metrics such as the estimated level of primary energy demand and CO₂ emissions. Approved Documents set out the measures required to comply with Building Regulations.

The final version of the new Part L 2021 Approved Documents was published in December 2021 and was adopted in June 2022.

The Approved Documents set out the performance of the notional building against which the 2021 targets are to be set. For new buildings this is estimated to deliver a 31% carbon saving on average compared to the previous 2013 standards.

Development on RMC is outside the window for transitional arrangements for Part L 2013. Therefore, the development will be required to be built in line with Part L 2021 standards and as such these

standards are an important consideration in developing the energy strategy for the proposed development.

The building is required to meet the Part L 2021 standards and has been modelled using the new Part L 2021 compliant software.

1.2.2 Regional Policy Drivers

1.2.2.1 Greater London Authority (GLA)

Local planning policy is set within the context of London-wide policy and guidance. The following are identified as potentially relevant to the application:

- The London Plan, March 2021.
- Sustainable Design and Construction Supplementary Planning Guidance, April 2014.
- GLA Energy Assessment Guidance, June 2022.

For energy purposes, the regional policy requires that developments reduce their CO₂ emissions in accordance with the Energy Hierarchy and make the fullest contribution to London's adaptation to climate change. In order to meet the 'zero-carbon target', a minimum on-site reduction in regulated CO₂ emissions of at least 35% beyond Building Regulations is required for a major development. Non-residential developments should achieve a 15% reduction through energy efficiency measures. Where the zero-carbon target cannot be met, the remaining carbon emissions should be offset to the 100% target.

The regional policy also seeks:

- Minimisation of the overheating risk and the demand for cooling;
- On-site renewable energy generation;
- Commitment to site wide networks with a single energy centre, where feasible; and
- Allowance for connection to existing or planned district heating networks identified in the area.

This energy statement aims to follow GLA guidance on preparing energy assessments, which sets out "how to prepare an energy assessment to accompany strategic planning applications... [and] demonstrate that climate change mitigation measures comply with London Plan energy policies". The 2022 guidance on preparing energy statements is focussed on responding to the updates to Building Regulations.

The following excerpts and summaries provide an outline of planning policy expectations with regard to energy and CO₂ emissions from the building development.

1.2.2.2 London Plan (2021) Policy SI 2 Minimising Greenhouse Gas Emissions

This policy outlines an energy hierarchy which developments should follow to reduce their carbon emissions and peak energy demand.

Any shortfall in on-site carbon savings relative to the 35% target should be made up through offsetting, in agreement with the borough. Arrangements for offsetting are the responsibility of the Local Planning Authority. GLA Energy Planning Guidance states that Boroughs should use a carbon offset price of £95/tonne or set their own price based on local viability evidence.

GLA Energy Assessment Guidance (June 2022) states that developments should use Part L 2021 of the Building Regulations when calculating emissions and demonstrating compliance with GLA energy planning policies.

1.2.2.3 London Plan (2021) Policy SI 3 Energy Infrastructure

Part A of Policy SI 3 states that development plans should identify any necessary energy infrastructure requirements and identify any nearby existing or proposed heating and cooling networks. It outlines a heating hierarchy prioritising communal heating over individual building scale systems

1.2.2.4 London Plan (2021) Policy SI 4 Managing Heat Risk

Part A states that: *Development proposals should minimise adverse impacts on the urban heat island through design, layout, orientation, materials and the incorporation of green infrastructure.*

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

GLA Energy Assessment Guidance (April 2020) provides further guidance regarding the cooling hierarchy in line with Policy SI 4.

1.2.2.5 Energy Assessment Guidance (June 2022)

An updated guidance document for the production of Energy Assessments was published by GLA in June 2022¹ to reflect the national policy updates and how these relate to the London Plan. The document includes updates to guidance, including:

- How London Plan policies apply now that Part L 2021 has taken effect;
- How to demonstrate carbon improvements from the 'be lean' stage of the hierarchy; and
- Requirement to report the Energy Use Intensity (EUI) and space heating demand of the development and explains how to report them;

The most significant elements of this update is the confirmation that the GLA expects developments to achieve the overall 35% onsite reduction and the 'be lean' reductions of 10% for residential and 15% for non-residential uses, against the new Part L 2021, which includes more stringent fabric standards, and as such an overall greater savings compared to previous guidance. However, a cover note² to the updated guidance confirms that it is expected this may be difficult to achieve for non-residential developments.

1.2.2.6 Whole Life-Cycle Carbon Assessments Guidance (March 2022)

The GLA requires a separate Whole Life-Cycle Carbon Assessment report to be submitted to the GLA which considers both the embodied carbon and operational carbon expected to arise as a result of the Proposed Development.

1.2.2.7 The London Plan March 2021 Improving Air Quality

The London Plan requires proposals to address air quality risks as per Policy SI 1 Improving air quality. Alternatively, where an air quality assessment has been undertaken, this can be referenced.

1.2.3 Local policy drivers

1.2.3.1 London Borough of Haringey (LBH) Strategic Policies

The Haringey Strategic Policies 2013 – 2016 document (March 2013, consolidated with alterations since 2017) policies in terms of energy largely refer to the London Plan.

Policy SP4 Working towards a low carbon Haringey requires that all new residential developments should be zero carbon from 2016 onwards and all non-residential developments should be zero carbon from 2019. It also states:

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

1. *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;*
2. *Establishing local networks of decentralised heat and energy facilities by requiring developers to prioritise connection to existing or planned networks where feasible;*

¹ GLA, June 2022; Energy Assessment Guidance. Available at: https://www.london.gov.uk/sites/default/files/gla_energy_assessment_guidance_june_2022_0.pdf

² GLA, 15th June 2022; Note to accompany GLA Energy Assessment Guidance 2022. Available at https://www.london.gov.uk/sites/default/files/energy_assessment_guidance_cover_note_june_2022_july_update.pdf

3. *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*
4. *All new developments are required, where viable, to achieve a reduction in predicted carbon dioxide emissions of 20% from on site renewable energy regeneration, which can include connections to local sources of decentralised renewable energy.*

1.2.3.2 LBH Development Management DPD

The Development Management DPD (adopted July 2017) policy DM22 covers decentralised energy. It confirms that *subject to other policy requirements, proposals that contribute to the provision and use of Decentralised Energy network infrastructure will be supported.*

In addition, policy DM21 outlines that new developments are expected to take measures to reduce carbon emissions and overheating in line with the energy and overheating hierarchies. It also confirms that where emissions targets cannot be fully met on site, offset payments may be considered.

1.2.3.3 Highgate School SPD

The Highgate School Supplementary Planning Document (March 2021) was developed “*to help give more certainty to the local community about future development in the School's estate*”.

Paragraph 4.27 acknowledges that the mechanical and electrical systems of the school are in need of modernisation to make them more sustainable and energy efficient. It states that “*Whilst it would be desirable to establish a school-wide decentralised heat and energy facility, including the potential link into a wider network should one come forward, the fragmented nature of the School's estate makes this unviable. The Council will assess the approach to energy and carbon conservation against policy on a site-by-site basis in the detailed planning application stage looking to make each building as energy efficient as possible.*”

Paragraph 5.26 confirms that the Council will support development which reduces energy demand and carbon emissions.

1.2.4 Summary of key energy targets

The key energy targets relevant to the Proposed Development are summarised as follows:

- Ensure that efficiency standards are sufficient to meet Part L 2021 Target Emission Rates prior to any allowance for low carbon or renewable energy supply options. Target 15% savings from energy efficiency;
- Achieve the 100% saving standard for non-residential buildings (including 35% on-site savings) by additional on-site savings and/or offsetting the remaining regulated CO₂ emissions through contribution to offset funds; and
- Where viable, achieve a 20% carbon saving from on-site renewable technologies.

1.2.5 London Borough of Haringey Quality Review Panel and Pre-Application Consultation

Highgate School have engaged with Haringey through a Quality Review Panel consultation. As described on Haringey's website, the QRP *"brings together a team of independent professionals from a range of backgrounds to scrutinise all major development proposals. The QRP advises applicants, council officers and the Planning Committee on their consideration of how well a development scheme is meeting the principles of the Haringey Development Charter (see Policy DM1 in Haringey's Development Management DPD)"*.

A Report of Formal Review Meeting: RMC, Highgate School dated 2nd February 2022 which included the following comments in relation to energy and low carbon design:

- *The panel feels that the approach to sustainability is positive, but it would like to see a calculation of the scheme's embodied carbon.*
- *The panel feels that the building's form factor, the proposed use of a timber structure and the use of heat pumps strengthen the building's potential environmental performance.*
- *However, the panel is concerned by the extent of glazing proposed and it recommends that this is reassessed, with excess glazing removed.*

A further pre-application sustainability meeting was held 11th February 2022 where AECOM presented the sustainability strategy for RMC. Haringey provided a Pre-Application Planning Advice Note in response and the comment included the following specific items in relation to RMC:

- *Consider the large amounts of glazing on the north elevation; this is great for daylight and views out, but it may result in higher heat losses. Triple glazing may be more appropriate for this elevation.*
- *Submit a plan to show which spaces require mechanical cooling.*
- *Submit details of the mechanical cooling energy demand (kWh/m²/year), energy use, specification of equipment and efficiency, and how the cooling demand has been reduced as far as possible in line with the Cooling Hierarchy for those spaces.*
- *Explain in the application how the two-stage heat pump will work, and for what uses.*
- *Explain in the application how the ventilation will work (including diagrams preferably). And, set out why the displacement variable volume mechanical ventilation method for the studio theatre is better than other options.*
- *Good to see the GSHP proposal, please ensure you provide the relevant spec and details for the system and hot water storage in the application. Include detail on whether it will meet 100% of the space heating/hot water demand and explain the two-stage system.*
- *Good to see PV will be included, please specify output, modelled energy generated per year, orientation, tilt, efficiency.*

2. Baseline CO₂ emissions and annual energy demand

2.1 Building energy modelling

The proposed development was modelled to establish baseline regulated carbon emissions. A copy of the GLA carbon reporting spreadsheet summary page is included in Appendix A and a full excel version has been submitted with this energy strategy.

The VE Compliance module of IES Virtual Environment version 2022.1 was used to establish the regulated Target Emission Rate (TER) of the new-build non-domestic elements of “a development that complies with Part L 2021 of the Building Regulations”, which is the baseline specified in 2022 GLA guidance on preparing energy assessments.

Unregulated emissions from electricity use were estimated using the equipment load prediction from the Building Regulations UK Part L (BRUKL) output sheet.

The treated floor area as modelled, the TER and resulting CO₂ emissions are set out in Table 1. Note that the definition of treated floor area for the purposes of Part L of the Building Regulations differs from the definitions of gross and net areas widely used for other purposes. For these reasons, the areas used for modelling will differ from the areas cited in other documents submitted as part of the planning application. The Design and Access Statement submitted with the planning application should be referred to for definitive gross and net areas for the proposed development.

Use	Total Floor Area (m ²)	TER (kgCO ₂ /m ² /year)	Carbon emissions (tCO ₂ /year)
Overall new-build	1,768.8	3.0	5.4

Table 1 Modelled baseline carbon emissions

The BRUKL output document for the building is included in Appendix B.

2.1.1 Carbon emissions baseline

The total regulated carbon emissions baseline for the proposed development was calculated to be 5.4 tCO₂/year (based on Part L 2021 carbon emissions factors). Additional unregulated emissions (e.g. from office equipment / appliances and similar plug-in loads) are calculated to be 7.9 tCO₂/year. Baseline emissions for the existing Site are summarised in Table 2.

	Site-wide carbon emissions (tCO ₂ /year)	
	Regulated	Unregulated
Baseline: Part L 2021 of the Building Regulations Compliant Development	5.4	7.9

Table 2 Baseline carbon emissions

3. 'Be Lean' – Energy demand reduction

3.1 General approach

GLA Guidance on the Preparation of Energy Strategies states that a new development should exceed Building Regulations requirements (Part L 2021) through demand reduction measures alone. Non-domestic areas should aim for a 15% improvement from energy efficiency measures, as proposed in the London Plan 2021. To this end, consideration has been given to the passive design of the proposed development in order to target these requirements.

The passive design measures included in the proposed buildings are outlined in the Design and Access Statement, and include:

- Efficient building fabric with U-values optimised to reduce heating and cooling loads.
- Solar control glazing to optimise daylighting and thermal gains whilst minimising cooling demand.
- Service routes minimised to reduce heat loss.
- Solid panels and shading included in the building façade to manage solar gains.

The modelled glazed area of the façade is 24%.

Energy efficient equipment has also been proposed where practicable, including energy efficient lighting and ventilation systems. The BRUKL input document is included in Appendix C and confirms the full specifications used when modelling the savings from energy efficiency. All proposed values meet or exceed the Part L2A minimum values. Table 3 outlines the key building fabric performance parameters included in the building energy modelling for the "be lean" stage.

Element	U-value (W/m ² K)	g-value (EN ISO 410)	Visible light transmittance
Roof	0.13	N/A	N/A
Exposed walls	0.15	N/A	N/A
Exposed floors and ground floors	0.13	N/A	N/A
Windows and glazed doors	1.20	0.29	0.60
Rooflights	1.80	0.40	0.71
Opaque vehicle access and similar large doors	1.50	N/A	N/A
Opaque pedestrian doors and high usage entrance doors	2.20	N/A	N/A

Table 3 Proposed building fabric performance

The approach taken to energy efficiency is to aim for a consistent incremental improvement across the majority of energy efficiency parameters, avoiding reliance on exceptionally demanding specifications for particular fabric or services elements, and retaining flexibility and scope for optimisation during detailed design. Consideration was also given to achieving a balance between reducing energy demands and the avoidance of overheating.

3.2 Carbon emissions – 'Be Lean'

Incorporating the energy efficiency measures summarised above, the regulated carbon emissions for the proposed development were calculated at the 'be lean' stage of the GLA energy hierarchy.

Incorporating the energy efficiency measures described above, the calculated regulated carbon emissions are 5.4 tCO₂/year, as shown in Table 4.

As summarised in Table 5 below, this represents no additional savings when compared to the baseline carbon emissions. The proposed development does however meet building regulations through energy efficiency alone. Further details and explanation of this are provided in section 3.2.1.

	Carbon emissions for new building (tCO ₂ /year)	
	Regulated	Unregulated
Baseline: Part L 2021 of the Building Regulations Compliant Development	5.4	7.9
After energy demand reduction	5.4	7.9

Table 4 Carbon emissions after demand reduction

	Regulated new-build carbon savings	
	(tCO ₂ /year)	(%)
Savings from energy demand reduction	0.0	0%

Table 5 Regulated carbon savings from energy efficiency

3.2.1 Modelling and design limitations – ‘Be Lean’

GLA planning policy encourages on-site regulated carbon savings of 15% against the baseline from energy efficiency measures alone (the ‘Be Lean’ stage). The proposed development does not achieve carbon savings over the Part L 2021, but does match the notional building through energy efficiency alone. This is despite the proposed building having efficient building fabric and services. The main reason for this is the updates to the notional building in Part L 2021, which have been made to improve the overall performance of all buildings. In particular, the following changes to the Part L notional building have impacted the ability of the proposed building to meet Building Regulations through energy efficiency alone:

Lighting in the notional building is now LED lighting, which matches the performance of efficient lighting options available. Lighting savings compared to the notional building are now more difficult to achieve than under Part L 2013. The proposed building has efficient lighting and controls including daylight dimming and PIR controls.

General building fabric and services efficiencies are now much improved for the notional building. This makes savings from efficiency alone much harder to achieve with available products.

In addition, hot water provision for buildings which incorporate heat pumps assumes that heat pumps provide water heating in the notional building. At the be lean stage, there are no opportunities to make improvements to the hot water efficiency (as efficiency improvements are made at the be green stage in line with GLA Energy Assessment Guidance). In this building, which has proportionally large changing room areas, hot water represents a large proportion of the energy use. This limits the potential for overall savings. Further, there is limited potential for savings from the be green stage as the notional building already includes heat pumps.

The 2021 update to Building Regulations are aimed to improve efficiency across all new buildings in England. This important improvement has lowered the scope available for buildings to achieve improvements relative to the notional building and makes it difficult to meet Building Regulations through energy efficiency alone, or meet the GLA 15% “be lean” savings target. The GLA *Note to accompany GLA Energy Assessment Guidance 2022* acknowledges that non-domestic developments may find meeting the be lean targets difficult, but advises that applicants should follow the energy hierarchy to ensure that carbon savings are maximised. The proposed development provides efficient building fabric, in line with the energy hierarchy, to maximise available operational carbon savings.

3.3 Energy use intensity and space heating demand

AECOM calculated the energy use intensity using the GLA “be seen” methodology. Space heating demands were also calculated using the Part L modelling software. These are reported in Table 6.

Building Type	EUI (kW h/m ² /year)	Space heating demand (kW h/m ² /year)	Methodology used	Notes
School	55.0	24.1	Be seen/TM54	In the modelling of EUI, the space heating is based on volume of the building. In some double height spaces, the volume of air is large relative to the floor area. Further, AHU equipment is sized for peak load of a full auditorium with a high occupancy density. There is a limit to the system turn down capacity, which reduces ability to reduce demands in off-peak/typical teaching times. In actual operation, air would be recirculated where necessary, which is not reflected in modelling. Demands will continue to be reduced where possible during detailed design. This leads to higher fresh air heating loads, which will be reduced in practice and in later building energy modelling.

Table 6 Energy use intensity and space heating demand

4. Overheating risk analysis

In accordance with the GLA and Haringey guidance on preparing energy assessments, the overheating risk has been considered for the proposed development.

The building is a school building and has generally been designed to use natural ventilation. However, some rooms have been designed to use mechanical ventilation where natural ventilation is not practical, including the drama studio and AV rooms. Wherever practical, passive solutions to minimise heat and solar gains to reduce overheating have been considered.

The cooling hierarchy has been considered in order to reduce the cooling loads where possible, as outlined below:

1. Minimising internal heat generation through energy efficient design:

- Where possible the heat distribution infrastructure within the proposed building has been designed to minimise pipe lengths.
- Efficient lighting has been specified which incorporates dimming in areas where there is sufficient daylight.

2. Reducing the amount of heat entering the building in summer:

- High performance solar control glazing has been specified which will reduce heat gains through windows.
- Horizontal shading fins have been included to the southern elevation to reduce solar gains to the foyer.
- Building insulation reduces conductive heat gains.

3. Use of thermal mass and high ceilings to manage the heat within the building:

- Exposed soffits are proposed where possible, which will provide some limited thermal mass benefits when used in conjunction with the proposed night-time ventilation.

4. Passive ventilation:

- Natural ventilation is included to spaces where possible as part of the baseline design. Cross-ventilation and high-level clerestory ventilation louvres are included in addition to large openable areas.

5. Mechanical ventilation:

- Ventilation can be used to provide night cooling when outside temperatures are lower than inside.

6. Active Cooling:

- Mechanical cooling is provided to rooms which would otherwise overheat even when the above hierarchy has been implemented. These are areas with particularly high internal loads such as drama studios and AV equipment rooms.

4.1 Overheating modelling

In line with GLA and Haringey policy, AECOM has undertaken thermal modelling in line with CIBSE TM52 for the proposed development.

Mitigation measures were tested and included in the proposed development to ensure that all spaces pass the CIBSE TM52 criteria for the DSY1 2020 high emissions scenario 50th percentile weather file. Iterative steps were taken in line with the cooling hierarchy above to help mitigate overheating risk whilst avoiding unnecessary use of mechanical ventilation or cooling. This demonstrates compliance with Haringey and GLA policy.

In addition, the final design was also modelled using the DSY2 and DSY3 weather files. GLA and Haringey policy requires that buildings are modelled using these weather files, although compliance

for all spaces is not required. Although some spaces continue to pass the criteria in TM52 under these weather files, some spaces fail.

As described above, measures to mitigate overheating risk have been introduced in line with the cooling hierarchy. This helps to reduce overheating risk even under the weather scenarios where some rooms will likely overheat on some days. In line with Haringey policy, the overheating report outlines some additional measures which could be retrofitted to the proposed building in future if further mitigation is required. These include:

Installation of ceiling fans.

Installation of phase-change MVHR units to provide passive temperature lopping.

Further mechanical cooling.

The measures above could be included at a later stage if required, although some (fans and mechanical cooling) would involve an increase in the energy demands of the building and are therefore not proposed at this stage.

4.2 Overheating summary

The proposed development was modelled and assessed against the CIBSE TM52 overheating criteria using the DSY1, DSY2 and DSY3 criteria. An iterative process was followed to add in passive and active mitigation measures in line with the cooling hierarchy.

The proposed building passes the TM52 overheating criteria when modelled using the DSY1 weather file. This meets GLA and Haringey planning policy. In line with policy, the building was also modelled under DSY2 and DSY3 weather files. Some rooms fail when these weather files are used. Potential future retrofit options are included in the overheating report.

More information on overheating, including a copy of the overheating modelling results is included in the overheating report in Appendix E.

5. 'Be Clean' – Decentralised energy

5.1 Decentralised heat networks

The London Plan 2021 expects developers to consider carbon savings which are achievable through decentralised energy networks. Policy SI3 confirms that major development proposals within Heat Network Priority Areas should have a communal heating system. The heat source for the communal heating system should be selected in accordance with the following heating hierarchy:

1. Connect to local existing or planned heat networks;
2. Use zero-emission or local secondary heat sources (in conjunction with heat pump, if required);
3. Use low emission CHP (only where there is a case for CHP to enable the delivery of an area-wide heat network);
4. Use ultra-low NO_x gas boilers.

Relevant options for the proposed development are considered below in the context of these policies. The London Plan 2021 moves away from CHP as a preferred option as decarbonisation of grid electricity makes heat pump and other electric based technologies more favourable.

The current GLA guidance on preparing energy statements also outlines a hierarchy for selecting energy systems which can be summarised as follows:

1. Connection to an area wide heat network
2. Communal heating systems (Site wide or building level)
3. Individual heating systems.

The GLA guidance on preparing energy assessments refers to Part L 2021 and its associated carbon factors and are used for energy strategies. This report has followed the guidance and a move away from CHP technology has been reflected in this energy strategy.

5.1.1 Connection to existing or planned heat networks

The London Heat Map³ has been consulted in order to determine whether there are any existing or planned heat networks within the vicinity of the development. In the map extract in Figure 1 below, the site location is marked with a red star. The map shows that there are no existing heat networks in the vicinity of the proposed development (which would be shown in red if these were present). There are also no proposed networks (which would be shown in orange). The site is not located in a heat network priority area.

³ <https://maps.london.gov.uk/heatmap>

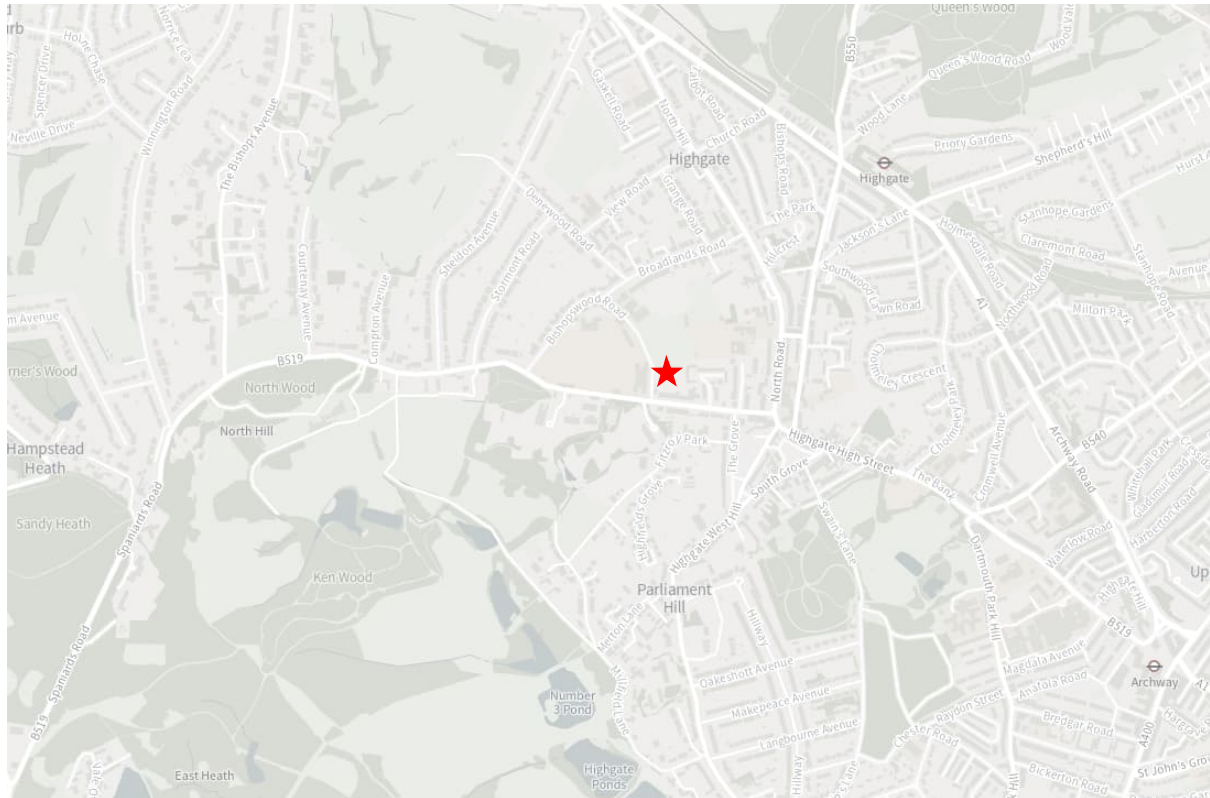


Figure 1 Extract from London Heat Map (the site is shown with a red star)

Connection to the wider school site was also considered for the proposed building. Connecting the wider school estate could provide opportunities to utilise waste heat from other buildings if this were available.

The closest other school building to the site is the Highgate Junior School building on the opposite side of Bishopswood Road. However, no modifications are proposed to this building. Other school buildings are a significant distance from the proposed development, and there are no plans for heat networks to these buildings. In addition, the RMC development is relatively small and is unlikely to be able to accommodate significant plant to provide heating for export.

In addition, the addition of pipes to connect the proposed development to other school buildings would introduce distribution losses between the buildings which could be avoided by building-scale heating systems. Separate systems also simplify control of the system, which would otherwise be required to select between multiple heat sources.

The LBH Highgate School SPD acknowledges that connection of the school buildings together in a heat network is unviable. It states that *"Whilst it would be desirable to establish a school-wide decentralised heat and energy facility, including the potential link into a wider network should one come forward, the fragmented nature of the School's estate makes this unviable. The Council will assess the approach to energy and carbon conservation against policy on a site-by-site basis in the detailed planning application stage looking to make each building as energy efficient as possible."*

For the reasons outlined above, connection of the site to the wider school estate is not proposed. As described in 5.1.2, the proposed development is designed to have a building-scale heating system with ground source heat pumps providing low carbon heating and cooling to the proposed development.

5.1.2 Site-wide heat network

It is proposed that a building scale network is provided for the proposed development. A single heat network will serve the building.

It is proposed that the building is future-proofed to allow for connection to a district heat network if a low carbon network is developed in future. The proposed plant room for the GSHP plant is adjacent to the building external wall, allowing for easy access for potential future pipework.

In any case, as outlined in section 6, ground source heat pumps are proposed for the site, which are a low-carbon form of heating which will have reducing operational carbon emissions as the electricity grid decarbonises in future. Any potential heat network is unlikely to provide lower operational carbon emissions and the proposed development will not have significant amounts of heating available for export, weakening any case for connection to a wider network.

5.2 Air Quality

The impacts of the development on local air quality have been considered during design. The Site falls within Haringey Air Quality Management Area (AQMA). An Air Quality Assessment has been prepared for the proposed development and is submitted with the planning application and should be consulted for more detailed information on air quality.

No combustion on Site is proposed for the normal operation of the proposed development and this is expected to help to limit the negative impacts from the operation of the building on local air quality.

The Air Quality Assessment concludes that the Proposed Development is considered to be Air Quality Neutral for Transport and Building Related Emissions as the development is defined as 'car-free' and has a zero-emission heat source as defined by the Air Quality Neutral London Plan Guidance.

5.3 'Be Clean' results summary

Connection to district heating networks or installation of on-site CHP systems is not proposed for this Site. Therefore, the carbon savings for this stage of the energy hierarchy remain the same as after the 'Be Lean' stage. For completeness, the carbon emissions and savings for this stage of the energy hierarchy are shown in the following section.

5.3.1 Site carbon emissions – 'Be Clean'

After decentralised energy, the calculated regulated carbon emissions are 5.4 tCO₂/year, as shown in Table 7.

As summarised in Table 8, the proposed development achieved no carbon savings from CHP or district heat networks.

	Carbon emissions (tCO ₂ /year)	
	Regulated	Unregulated
Baseline: Part L 2013 of the Building Regulations Compliant Development	5.4	7.9
After energy demand reduction ('Be Lean')	5.4	7.9
After heat network/CHP ('Be Clean')	5.4	7.9

Table 7 Carbon emissions after district heating

	Regulated carbon savings	
	(tCO ₂ /year)	(%)
Savings from energy demand reduction	0.0	0%
Savings from heat network/CHP	0.0	0%

Table 8 Regulated carbon savings from district heating

6. 'Be Green' – Renewable Energy

This section provides a summary of the feasibility assessment carried out into the options for incorporating low and zero carbon energy technologies into the proposed development and details the system which will be adopted.

6.1 Technology options appraisal

6.1.1 Scope

The London Plan states that within the framework of the energy hierarchy (Policy SI 2), major development proposals should provide a reduction in expected carbon emissions through the use of on-site renewable energy generation, where feasible. This section summarises the appraisal of renewable options that has been undertaken for the proposed development. The following technologies were considered:

- Photovoltaics (PV);
- Solar thermal water heating;
- Ground source heat pumps (GSHP);
- Air source heat pumps (ASHP);
- Biomass heating; and
- Wind turbines.

6.1.2 Feasibility Assessment

Photovoltaics

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

The proposed building has a zinc clad roof, with raised standing seams. In order to maintain the desired aesthetics of the proposed development, it is proposed that this film PV is laid in the flat areas of the roof between the raised seams. AECOM estimated the area of thin film PV cells which could be included on the roof of the proposed building, allowing for the avoidance of shading.

Figure 2 shows the proposed location of the thin film PV cells on the roof of the building.

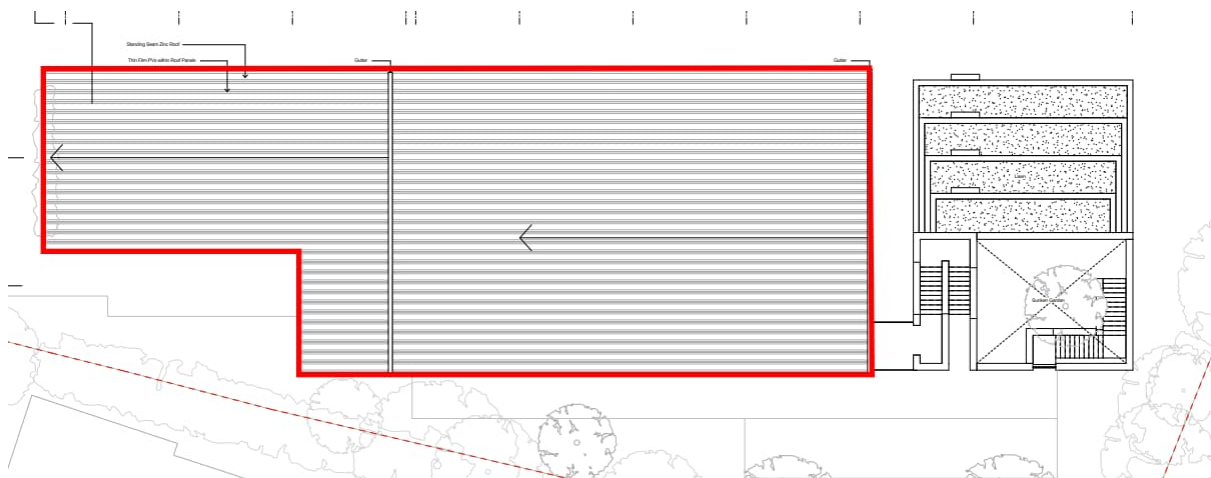


Figure 2 Proposed PV location (red outline).

It is estimated that the available roof areas identified could accommodate approximately 136 m² of PV cells, at an orientation of 66° from north.

AECOM obtained a datasheet from a manufacturer of thin film PV cells. This has been used to estimate the electricity generation of the proposed PV array was modelled using the Part L compliance software. The performance and assumptions of the proposed system are summarised in Table 9.

Item	Value
PV module nominal efficiency (%)	15
Nominal cell temperature (NOCT) (°C)	48
Reference irradiance for NOCT (W/m²)	800
Temperature coefficient for module efficiency (1/K)	0.003
Electrical conversion efficiency	0.97
Area of panels (m²)	136
Azimuth (° clockwise from north)	66
Inclination (° from horizontal)	5
Annual electricity generation (kW h)	16,357
Annual carbon savings (tCO₂/year)	2.0
Annual carbon savings (%)	38%

Table 9 PV summary

AECOM found that a PV array of approximately 136 m² of panel area could produce, 16,357 kW h of electricity per year, saving approximately 2.0 tCO₂/year.

Solar thermal water heating

PV has been proposed for the building and solar thermal water heating would compete with PV for the available roof space with PV. Although the building has a regular hot water demand from the changing rooms, it is proposed that this is met using air source heat pumps which can provide low carbon water heating. This has the advantage of allowing electricity generated when hot water is not needed to be used to meet other energy uses on site or exported to the grid. This allows for carbon savings even when there is no hot water demand, for example in school holidays.

Accommodating the inclusion of solar thermal collectors would also require additional infrastructure and plant space.

It is considered that no further study of solar thermal water heating is warranted at this stage as PV is preferred over solar thermal water heating.

Heat pumps

Water source heat pumps

There are no significant bodies of water nearby to the site which could be used for water source heat pumps.

Ground source heat pumps

Ground source heat pump (GSHP) technology could be used to provide heating and cooling to the proposed building. AECOM investigated the potential to incorporate GSHP technology into the proposed development.

Closed loop GSHP systems were investigated by AECOM for their potential to provide heating, cooling and some DHW to the building. Absorber loops could be installed under the building, as there will be access to the ground between demolition of the existing building and construction of the proposed new building. AECOM contacted Genius Energy Lab, a GSHP designer, to assess the amount of heating and cooling a GSHP system could provide to the proposed development. Genius Energy Lab confirmed that a system could meet the entire heating needs of the building. Figure 3 shows the proposed borehole locations for the site. Final quantity and locations of boreholes will be dependent upon ground conditions which will be determined by a borehole specialist.

Plant space in the basement has been allowed to accommodate the required GSHP equipment. Table 5 shows the proposed plant room location for the GSHP plant.

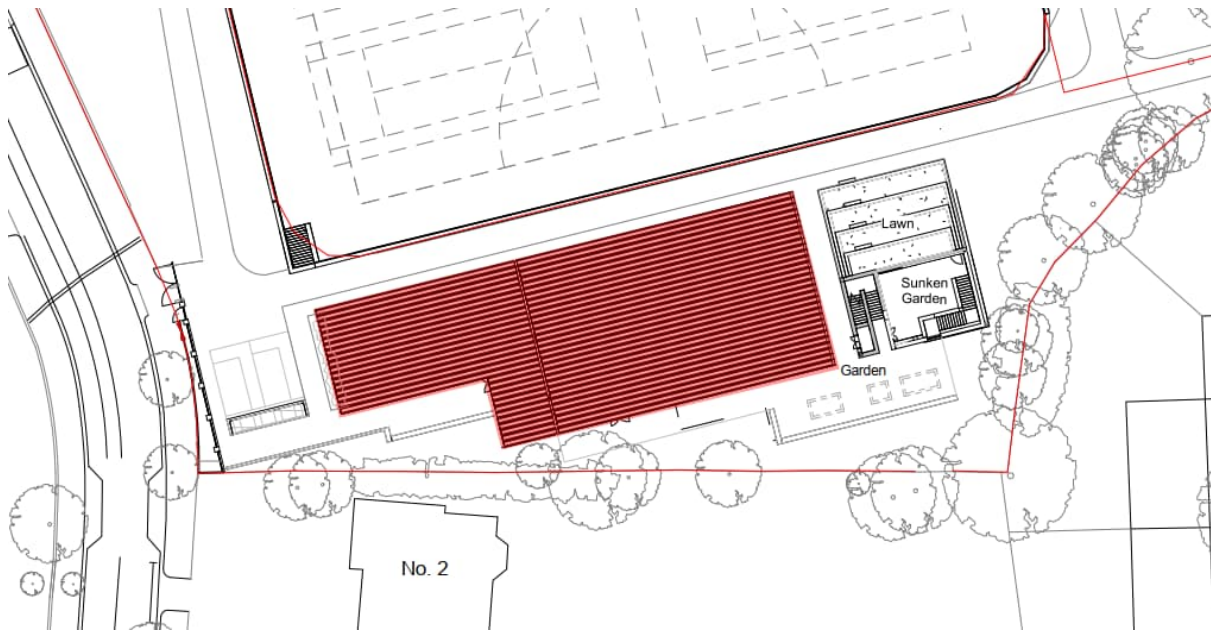


Figure 3 Proposed borehole location under the building (shown in red shading)

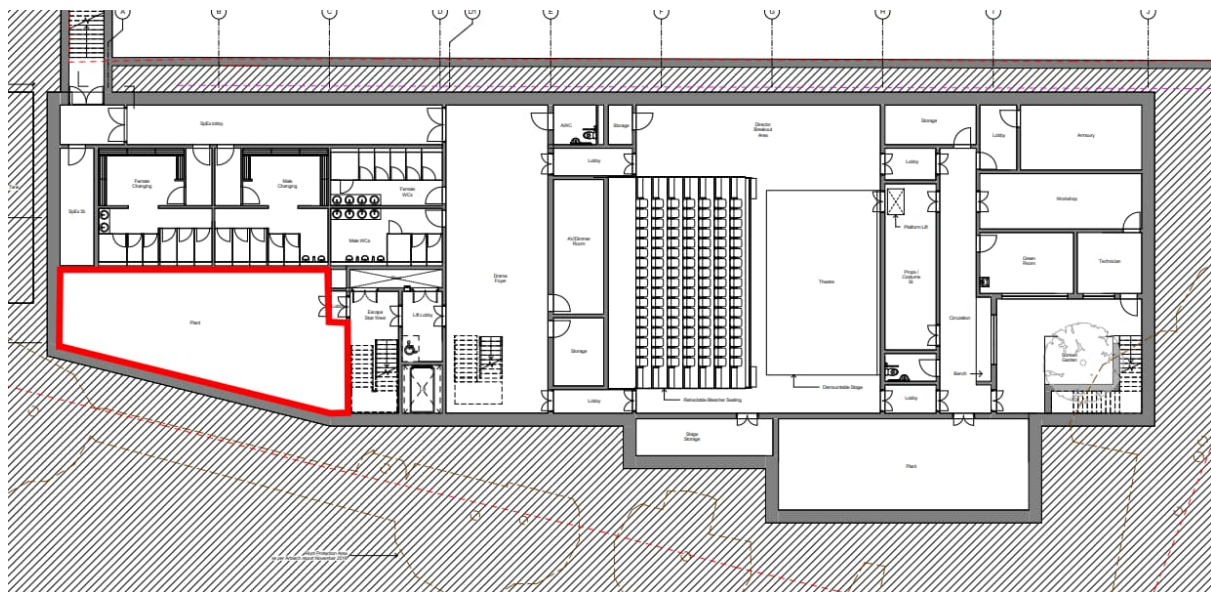


Figure 4 Proposed GSHP plant location (thick red outline)

The proposed system is to be an unbalanced system, as the building has a significantly larger heating and DHW demand than cooling demand. Unbalanced systems used primarily for heating generally cool the ground by 1-2°C before the ground temperature stabilises. The design of the proposed system will take into account building energy demands and ground conditions to ensure that the ground is not excessively cooled by the proposed system and that the proposed efficiencies are maintained. It is proposed that the AECOM MEP team undertake detailed design, incorporating the Ground Source Heat Pump Association's Vertical Borehole Standard and Good Practice Guide to ensure that the GSHP remains efficient long-term.

It is proposed that hot water to the changing rooms and showers is provided using the GSHP system to provide a low-carbon heat source for the dominant hot water demand in the building. A "cascade" heat pump arrangement will be used, where a secondary water to water heat pump will be used to raise the temperature of the delivered water to avoid contamination.

For other smaller hot water demands elsewhere in the building (such as in WCs and kitchenettes) it is proposed that direct electric water heaters are used. This helps to avoid excessive storage and distribution losses from what is expected to be small and intermittent water demand.

Detailed source and sink temperatures are not available at this stage of design. AECOM proposed SCoP and SEER values to Genius Energy Lab who confirmed that these are realistic estimates at this stage and that it is expected that these values can be improved upon during detailed design. Proposed GSHP efficiencies are shown in Table 10.

Parameter	Value
GSHP CoP (heating)	3.5
GSHP SEER (cooling)	5.0
GSHP CoP (DHW)	2.86

Table 10 GSHP performance

Thermal stores will be optimised during detailed design to increase system efficiency.

Air source heat pumps

It is expected that the GSHP system will be able to meet all of the heating and cooling demands of the proposed building. Ground source heat pumps are generally more efficient than air source heat pumps so would be preferred in terms of operational carbon performance. In addition, the project team are aware of potential sensitivities to noise from external plant from neighbours and equipment which can utilise indoor plant is therefore preferred.

For the above reasons, AECOM judged that no further investigation of air source heat pumps was warranted.

Heat pump carbon savings

Adding the GSHP system as described above into the energy modelling for the site, the energy and carbon savings were calculated using the BER calculated before and after the incorporation of the heat pumps. The calculated carbon savings from heat pumps for the proposed development is shown in Table 11.

Parameter	Value
CO₂ savings from heat pumps (tCO₂/year)	0.2
CO₂ savings from heat pumps (%)	5%

Table 11 Heat pump carbon savings

AECOM found that using a GSHP system to meet the heating and cooling demand for the development could save approximately 0.2 tCO₂/year.

Biomass heating

Biomass heating is expected to have unacceptable local air quality impacts. In addition, the site does not have sufficient space for storage of the required fuel and deliveries to the site would generate unnecessary vehicle journeys onto already congested central London roads. Based on the above, AECOM judged that no further investigation of biomass heating was warranted.

Wind turbines

A rule of thumb is that to make operational and financial sense micro-wind systems need to be sited in locations with an annual average wind speed of at least 5 m/s. This condition is rarely met in urban areas. In any case, it is likely that a wind turbine would have unacceptable visual impacts. For these reasons, AECOM judged that no further investigation of wind turbines was warranted.

6.2 Carbon emissions – ‘Be Green’

Ground source heat pumps and photovoltaic panels are proposed for the site. The carbon savings from the inclusion of renewable technologies (for the ‘Be Green’ stage of the energy hierarchy) are summarised in this section.

Incorporating the heat pump and PV technology described above, the calculated regulated carbon emissions for the proposed development are 3.1 tCO₂/year, as shown in Table 12.

As summarised in Table 13 below, this represents a saving of 2.3 tCO₂/year or 43% of baseline regulated emissions achieved by installing renewable technologies on site.

	Carbon emissions for new buildings (tCO ₂ /year)	
	Regulated	Unregulated
Baseline: Part L 2021 of the Building Regulations Compliant Development	5.4	7.9
After energy demand reduction	5.4	7.9
After heat network/CHP	5.4	7.9
After renewable energy	3.1	7.9

Table 12 Carbon emissions after renewable energy

	Regulated non-domestic carbon savings	
	(tCO ₂ /year)	(%)
Savings from energy demand reduction	0.0	0%
Savings from heat network/CHP	0.0	0%
Savings from renewable energy	2.3	43%

Table 13 Regulated carbon savings from renewable energy

6.3 Energy monitoring – ‘Be Seen’

A separate Be Seen report has been produced by AECOM and should be referred to for compliance with the GLA Be Seen guidance.

7. Flexibility and peak energy demand

The London Plan 2021 policies SI 2 and SI 3 encourage developments to minimise both annual and peak energy demand. This section outlines the measures taken to reduce peak energy demand and increase energy flexibility in the proposed development.

Table 14 outlines the site-wide peak demand, capacity, and flexibility potential for the proposed development.

	Electrical	Heat	Enabled through...
Estimate peak demand (MW)	0.165	Note 2	Realistic estimates of demand profiles and peak demand. ^{Note 1}
Available capacity (MW)	TBC	N/A	Early engagement with the DNO or IDNO to establish available capacity. ^{Note 3}
Flexibility potential (MW)	0.008	N/A	Modelling of flexibility using demand profiles. ^{Note 4}
Revised peak demand (MW)	0.157	N/A	Revision to peak demand considering available capacity, engagement with third parties and flexibility potential. ^{Note 5}
Percentage flexibility predicted (%)	4.8%	N/A	Calculations from flexibility potential as a proportion of peak demand.
<i>Notes:</i> 1. Estimated from current MEP design at this stage. Calculated peak loads accounts for measures already included in design, including reduced demands due to heat pumps, DHW storage and improved building fabric performance. 2. As the proposed development is designed to produce heat from electricity, the heating figures are not relevant and heat demand is included in the electrical demand column – in line with the GLA guidance document. 3. Discussions with the DNO have not taken place at this stage. Discussions will take place with the DNO at an appropriate stage of design once the building energy demands can be more reliably predicted. 4. Flexibility potential has been calculated including 50% of peak PV generation. 5. The current peak demand estimate already accounts for reduced peak demands from building fabric and services efficiency, use of GSHPs and DHW stores. Additional flexibility is estimated through an estimation of the PV contribution.			

Table 14 Summary of site-wide peak demand, capacity and flexibility potential

A number of measures are included in the building to reduce peak energy demand. Passive design measures as outlined in previous sections reduce overall energy demands, in turn reducing peak demand. In addition, a number of additional measures have been included. These are summarised in Table 15.

Flexibility achieved through	Yes/No	Details
Electrical energy storage (kW h) capacity	No	No electrical energy storage is proposed.
Heat energy storage (kW h) capacity	Yes	DHW storage is included allowing hot water to be generated gradually, further contributing to reducing peak demands. Thermal stores will be optimised during detailed design to reduce peak demands.
Renewable energy generation (load matching)	Yes	Photovoltaic (PV) panels on the roof help meet the peak electrical demand of the building, reducing the draw from the network. Use of heat pumps over direct electrical systems reduce the peak demands for electricity to provide heating. Efficiencies of heating and cooling systems will be maximised to reduce annual and peak energy demand.
Gateway to enable automated demand response	No	Not included – the building demands are relatively small and there is not scope in the proposed systems to include this.
Smart systems integration (e.g. smart charge points for EV, gateway etc.)	No	Not included.

Table 15 Summary of peak demand flexibility interventions

8. Conclusion

8.1 Baseline

The proposed development was modelled to establish baseline regulated carbon emissions. The building was modelled using Building Regulations Part L 2021 compliant software.

An estimate of unregulated electricity use and the associated carbon emissions was also made.

The regulated baseline carbon emissions were calculated to be 5.4 tCO₂/year. The site-wide unregulated emissions were calculated to be 7.9 tCO₂/year.

8.2 'Be Lean' – Energy demand reduction

The passive design measures included in the proposed building are outlined in the Design and Access Statement which is submitted in support of the planning application and summarised in Section 3.1.

The approach taken to energy efficiency is to aim for a consistent incremental improvement across the majority of energy efficiency parameters, avoiding reliance on exceptionally demanding specifications for particular fabric or services elements, and retaining flexibility and scope for optimisation during detailed design. Consideration was also given to achieving a balance between reducing energy demands and the avoidance of overheating.

Based on the proposed fabric and energy efficiency measures, the regulated carbon emissions were calculated to be 5.4 tCO₂/year. The building matches the baseline building carbon performance through energy efficiency alone. The limitations on energy efficiency savings despite the good building fabric and services specifications are outlined in Section 3.2.1.

8.3 'Be Clean' – District heating

A review of the London Heat Map indicates that there are no existing district heat networks near to the site.

Consideration was given to connecting to the wider school site, but it was judged that this was not suitable due to plant space requirements and the introduction of additional heat losses in addition to there being no buildings nearby undergoing redevelopment at this stage.

The design of the proposed development plant will allow for connection to a district heat network in future if one is developed and plant space for plate heat exchangers could be accommodated if required.

On-site CHP is no longer a low carbon option and was not considered suitable for the site.

As no connection to a district heating network or on-site CHP system is proposed, no carbon savings are reported from the 'Be Clean' stage of the energy hierarchy.

8.4 'Be Green' - Renewable energy generation

A feasibility assessment of low and zero carbon technology options for the site found GSHP and PV panels to be suitable for the site. Other technologies were ruled out due to site constraints, air quality, noise and access issues or incompatibility with the preferred options.

Ground source heat pumps are proposed to provide heating, cooling and some hot water to the building. Detailed design will ensure that the ground temperature is not excessively lowered and that good efficiency can be maintained. Hot water demand to changing and shower areas will be met with air source heat pumps. Other smaller hot water demands (in WC and kitchenette areas) will be met by direct electric water heaters to avoid storage and distribution losses. Calculations at this stage suggest that the proposed heat pump systems could save approximately 0.2 tCO₂/year, which is 5% of regulated baseline emissions.

An area of roof suitable for approximately 136 m² of thin film PV cells was identified on the proposed building. It was calculated that a PV array on this roof area could supply approximately 16,357 kW h of electricity per year, with a carbon saving of 2.0 tCO₂/year, which is 38% of baseline regulated emissions.

The regulated carbon emissions after the 'Be Green' stage of the energy hierarchy were calculated to be 3.1 tCO₂/year.

The above emissions represent a saving against the baseline of 43% from the 'Be Green' stage of the energy hierarchy.

8.5 Energy monitoring – 'Be Seen'

A separate Be Seen report has been produced by AECOM and should be referred to for compliance with the GLA Be Seen guidance.

8.6 Carbon offsetting

In order to meet the GLA carbon reduction target of 100% of baseline regulated emissions for non-residential developments, it will be necessary to offset the residual regulated carbon emissions. Over a 30-year period it is estimated that the cumulative shortfall would be 93 tCO₂. This would result in an estimated payment of approximately £8,801 at the GLA carbon offset price of £95/tonne. This is subject to agreement with LBH.

8.7 Proposed energy strategy

The proposed energy strategy for the proposed development is:

1. Energy efficient fabric and buildings services design;
2. A GSHP system to provide space heating and cooling to the building and hot water to changing room areas;
3. A PV array on the roof of the building.

The carbon emissions at each stage in the energy hierarchy are summarised below.

Figure 5 shows the carbon baseline, and emissions and savings with the proposed energy strategy, at each step in the energy hierarchy. Calculations at this stage suggest this strategy would save 2.3 tCO₂/year, which is 43% of the baseline emissions of 5.4 tCO₂/year. This is also summarised in Table 16 and Table 17.

	Carbon emissions for new buildings (tCO ₂ /year)	
	Regulated	Unregulated
Baseline: Part L 2021 of the Building Regulations Compliant Development	5.4	7.9
After energy demand reduction	5.4	7.9
After heat network/CHP	5.4	7.9
After renewable energy	3.1	7.9

Table 16 Carbon emissions after each stage of the energy hierarchy

Regulated new-building carbon savings		
	(tCO ₂ /year)	(%)
Savings from energy demand reduction	0.0	0%
Savings from heat network/CHP	0.0	0%
Savings from renewable energy	2.3	43%
Total cumulative savings	2.3	43%

Table 17 Regulated carbon savings from each stage of the energy hierarchy

The shortfall in savings relative to the 'zero carbon' 100% regulated emission saving target is 3.1 tCO₂/year, which is a cumulative total over 30 years of 93 tCO₂ that is expected to be addressed through offsetting. Using a carbon offsetting price of £95/tCO₂/year, this results in an estimated carbon offset payment of approximately £8,801, subject to agreement with LBH. This is summarised in Table 18 and Figure 5.

	Annual (tCO ₂)	Cumulative shortfall (tCO ₂)
Total Target Savings	5.4	-
Shortfall	3.1	93
Cash in-lieu contribution (£)	-	£8,801

Table 18 Carbon savings shortfall and offset payment

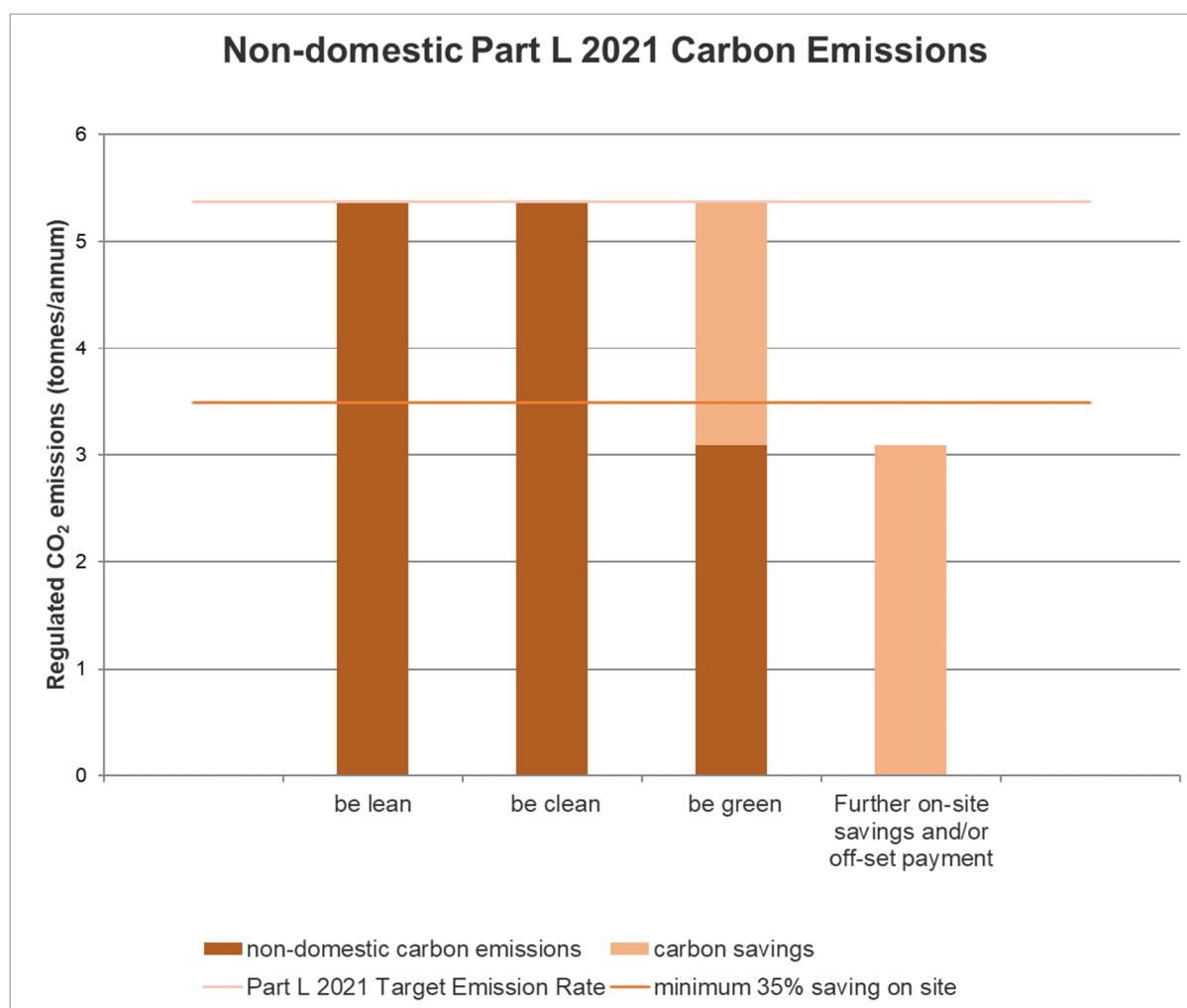


Figure 5 Proposed energy strategy: Energy Hierarchy CO₂ baseline, emissions and savings

8.7.1 Comparison with carbon saving targets

8.7.1.1 'Be Lean' target

GLA planning policy encourages on-site regulated carbon savings of 15% against the baseline from energy efficiency measures alone (the 'Be Lean' stage). The proposed development does not achieve carbon savings over the Part L 2021, but does match the notional building through energy efficiency alone. This is despite the proposed building having efficient building fabric and services. The main reason for this is the updates to the notional building in Part L 2021, which have been made to improve the overall performance of all buildings. In particular, the following changes to the Part L notional building have impacted the ability of the proposed building to meet Building Regulations through energy efficiency alone:

Lighting in the notional building is now LED lighting, which matches the performance of efficient lighting options available. Lighting savings compared to the notional building are now more difficult to achieve than under Part L 2013. The proposed building has efficient lighting and controls including daylight dimming and PIR controls.

General building fabric and services efficiencies are now much improved for the notional building. This makes savings from efficiency alone much harder to achieve with available products.

In addition, hot water provision for buildings which incorporate heat pumps assumes that heat pumps provide water heating in the notional building. At the be lean stage, there are no opportunities to make improvements to the hot water efficiency (as efficiency improvements are made at the be green stage in line with GLA Energy Assessment Guidance). In this building, which has proportionally large changing room areas, hot water represents a large proportion of the energy use. This limits the potential for overall savings. Further, there is limited potential for savings from the be green stage as the notional building already includes heat pumps.

The 2021 update to building regulations are aimed to improve efficiency across all new buildings in England. This important improvement has lowered the scope available for buildings to achieve improvements relative to the notional building and makes it difficult to meet building regulations through energy efficiency alone, or meet the GLA 15% “be lean” savings target. The GLA *Note to accompany GLA Energy Assessment Guidance 2022* acknowledges that non-domestic developments may find meeting the be lean targets difficult, but advises that applicants should follow the energy hierarchy to ensure that carbon savings are maximised. The proposed development provides efficient building fabric, in line with the energy hierarchy, to maximise available operational carbon savings.

Appendix A GLA Carbon Reporting Spreadsheets

Part L 2021 Performance

Residential

Table 1: Carbon Dioxide Emissions after each stage of the Energy Hierarchy for residential buildings

	Carbon Dioxide Emissions for residential buildings (Tonnes CO ₂ per annum)	
	Regulated	Unregulated
Baseline: Part L 2021 of the Building Regulations Compliant Development	0.0	
After energy demand reduction (be lean)	0.0	
After heat network connection (be clean)	0.0	
After renewable energy (be green)	0.0	

Table 2: Regulated Carbon Dioxide savings from each stage of the Energy Hierarchy for residential buildings

	Regulated residential carbon dioxide savings	
	(Tonnes CO ₂ per annum)	(%)
Be lean: savings from energy demand reduction	0.0	0%
Be clean: savings from heat network	0.0	0%
Be green: savings from renewable energy	0.0	0%
Cumulative on site savings	0.0	0%
Annual savings from off-set payment	0.0	-
(Tonnes CO ₂)		
Cumulative savings for off-set payment	0	-
Cash in-lieu contribution (£)	0	

*carbon price is based on GLA recommended price of £95 per tonne of carbon dioxide unless Local Planning Authority price is inputted in the 'Development'

Non-residential

Table 3: Carbon Dioxide Emissions after each stage of the Energy Hierarchy for non-residential buildings

	Carbon Dioxide Emissions for non-residential buildings (Tonnes CO ₂ per annum)	
	Regulated	Unregulated
Baseline: Part L 2021 of the Building Regulations Compliant Development	5.4	7.9
After energy demand reduction (be lean)	5.4	7.9
After heat network connection (be clean)	5.4	7.9
After renewable energy (be green)	3.1	7.9

Table 4: Regulated Carbon Dioxide savings from each stage of the Energy Hierarchy for non-residential buildings

	Regulated non-residential carbon dioxide savings	
	(Tonnes CO ₂ per annum)	(%)
Be lean: savings from energy demand reduction	0.0	0%
Be clean: savings from heat network	0.0	0%
Be green: savings from renewable energy	2.3	43%
Total Cumulative Savings	2.3	43%
Annual savings from off-set payment	3.1	-
(Tonnes CO ₂)		
Cumulative savings for off-set payment	93	-
Cash in-lieu contribution (£)	8,801	

*carbon price is based on GLA recommended price of £95 per tonne of carbon dioxide unless Local Planning Authority price is inputted in the 'Development'

Appendix B BRUKL output documents

Appendix C Part L2A report

Appendix D Correspondence with heat pump manufacturer

Appendix E Overheating Risk Analysis

Appendix F – Planning Policy Review

Policy Review

National Legislation and Policy Drivers

UK Climate Change Act

The Climate Change Act (2008) sets a legally binding target to reduce UK carbon emissions by 100% by 2050, against a 1990 baseline. The Committee on Climate Change advises the Government on the setting of binding 5-year carbon budgets on a pathway to achieving the 2050 target. The first six carbon budgets covering the period up to 2037 have been set in law. The current (third) budget requires a 37% emissions reduction by 2022, while future budgets require reductions of 51% by 2025, 57% by 2030 and 78% by 2035.

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

National Planning Policy Framework

The National Planning Policy Framework (NPPF) prescribes government planning policy and outlines the way in which this is to be applied. The document sets out a framework for local plan development and illustrates national-scale policy aims. The NPPF includes requirements for new development which assist in supporting the transition to a low carbon future.

Building Regulations and Future Buildings Standard

Part L of the Building Regulations in England is the key mechanism that prescribes standards for the energy performance of new and the refurbishment of existing buildings in the UK, based on metrics such as the estimated level of primary energy demand and CO₂ emissions. Approved Documents set out the measures required to comply with Building Regulations.

In October 2019, UK Government consulted on the introduction of a Future Buildings Standard and on an interim update to Part L of Building Regulations for non-domestic, originally planned for 2020 but later proposed for 2021.

In January 2021 the Government published its response to the consultation, including its proposals for an interim update to Part L of the Building Regulations in 2021 ahead of the introduction of the Future Buildings Standard in 2025.

The final version of the new Part L 2021 Approved Documents was published in December 2021 and was adopted in June 2022.

The Approved Documents set out the performance of the notional building against which the 2021 targets are to be set. For new buildings this is estimated to deliver a 31% carbon saving on average compared to the previous 2013 standards.

A transitional arrangement period for Part L 2013 applies only where both:

- a) The developer has submitted a building/initial notice or deposited plans by June 2022; and
- b) Commenced work on each individual building by June 2023.

Development on RMC is outside the window for transitional arrangements for Part L 2013. Therefore, the development will be required to be built in line with Part L 2021 standards and as such these standards are an important consideration in developing the energy strategy for the proposed development.

The building is required to meet the Part L 2021 standards, and has been modelled using the new Part L 2021 compliant software.

The Government's consultation response also sets out initial timescales for the adoption of the Future Buildings Standard. The consultation for this will commence in 2023 to allow the introduction of necessary legislation in 2024, ahead of implementation in 2025.

Regional Policy Drivers

Greater London Authority (GLA)

Local planning policy is set within the context of London-wide policy and guidance. The following are identified as potentially relevant to the application:

- The London Plan, March 2021.
- Sustainable Design and Construction Supplementary Planning Guidance, April 2014.
- GLA Energy Assessment Guidance, June 2022.

For energy purposes, the regional policy requires that developments reduce their CO₂ emissions in accordance with the Energy Hierarchy and make the fullest contribution to London's adaptation to climate change. In order to meet the 'zero-carbon target', a minimum on-site reduction in regulated CO₂ emissions of at least 35% beyond Building Regulations is required for a major development. Residential developments should achieve a 10% reduction through energy efficiency measures, and non-residential a 15% reduction. Where the zero-carbon target cannot be met, the remaining carbon emissions should be offset to the 100% target.

The regional policy also seeks:

- Minimisation of the overheating risk and the demand for cooling;
- On-site renewable energy generation;
- Commitment to site wide networks with a single energy centre, where feasible; and
- Allowance for connection to existing or planned district heating networks identified in the area.

This energy statement aims to follow GLA guidance on preparing energy assessments, which sets out "how to prepare an energy assessment to accompany strategic planning applications... [and] demonstrate that climate change mitigation measures comply with London Plan energy policies". The 2022 guidance on preparing energy statements is focussed on responding to the updates to Building Regulations.

The following excerpts and summaries provide an outline of planning policy expectations with regard to energy and CO₂ emissions from the building development.

London Plan (2021) 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 in accordance with the following energy hierarchy:

- 1. Be lean: use less energy and manage demand during operation*
- 2. Be clean: exploit local energy resources (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*

Part C of Policy SI 2 adds to the "be lean" stage of the energy hierarchy a goal for residential buildings to achieve an improvement of 10% and non-residential developments to achieve an improvement of 15% in carbon emissions over the Building Regulations baseline through energy efficiency measures alone. This target is included in the GLA Energy Assessment Guidance (April 2020), which expects applicants to increase the reductions from the "be lean" stage.

Any shortfall in on-site carbon savings relative to the 35% target should be made up through offsetting, in agreement with the borough. Arrangements for offsetting are the responsibility of the Local Planning Authority. GLA Energy Planning Guidance states that Boroughs should use a carbon offset price of £95/tonne or set their own price based on local viability evidence.

GLA Energy Assessment Guidance (June 2022) states that developments should use Part L 2021 of the Building Regulations when calculating emissions and demonstrating compliance with GLA energy planning policies.

Part E of Policy SI 2 details that major developments should calculate and minimise unregulated carbon emissions.

London Plan (2021) Policy SI 3 Energy Infrastructure

Part A of Policy SI 3 states that development plans should:

- 1) identify the need for, and suitable sites for, any necessary energy infrastructure requirements including energy centres, energy storage and upgrades to existing infrastructure*
- 2) identify existing heating and cooling networks, identify proposed locations for future heating and cooling networks and identify opportunities for expanding and inter-connecting existing networks as well as establishing new networks.*

Part D specifies that communal low-temperature heating systems should be used in major development proposals within the Heat Network Priority Areas. It proposes the following heating hierarchy for selection of the heat source of the communal heating system:

- a) connect to local existing or planned heat networks*
- b) use zero-emission or local secondary heat sources (in conjunction with heat pump, if required)*
- c) use low-emission combined heat and power (CHP) (only where there is a case for CHP to enable the delivery of an area-wide heat network, meet the development's electricity demand and provide demand response to the local electricity network)*
- d) use ultra-low NOx gas boilers.*

Additionally, where CHP and ultra-low NOx gas boiler communal or district heating systems are included in a design, they should meet the air quality requirements of Policy SI 1 Part B. Developments should be designed to allow for later connection to a planned heat network that is not yet in existence.

London Plan (2021) Policy SI 4 Managing Heat Risk

Part A: *Development proposals should minimise adverse impacts on the urban heat island through design, layout, orientation, materials and the incorporation of green infrastructure.*

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

- 1) reduce the amount of heat entering a building through orientation, shading, high albedo materials, fenestration, insulation and the provision of green infrastructure*
- 2) minimise internal heat generation through energy efficient design*
- 3) manage the heat within the building through exposed internal thermal mass and high ceilings*
- 4) provide passive ventilation*
- 5) provide mechanical ventilation*
- 6) provide active cooling systems.*

GLA Energy Assessment Guidance (April 2020) provides further guidance regarding the cooling hierarchy in line with Policy SI 4.

Energy Assessment Guidance (June 2022)

An updated guidance document for the production of Energy Assessments was published by GLA in June 2022⁴ to reflect the national policy updates and how these relate to the London Plan. The document includes updates to guidance, including:

- How London Plan policies apply now that Part L 2021 has taken effect;
- How to demonstrate carbon improvements from the 'be lean' stage of the hierarchy; and
- Requirement to report the Energy Use Intensity (EUI) and space heating demand of the development and explains how to report them;

The most significant elements of this update is the confirmation that the GLA expects developments to achieve the overall 35% onsite reduction and the 'be lean' reductions of 10% for residential and 15% for non-residential uses, against the new Part L 2021, which includes more stringent fabric standards, and as such an overall greater savings compared to previous guidance.

Be Seen Energy Monitoring Guidance (September 2021)

The GLA has published 'Be Seen' energy monitoring guidance document⁵ which sets out the requirements of London Plan Policy SI 2, including the expectations on planning applicants throughout the monitoring period. The final version was published for adoption in September 2021.

The Be Seen policy requires energy monitoring information to be reported to the GLA through the 'Be Seen' spreadsheet and webform.

Whole Life-Cycle Carbon Assessments Guidance (March 2022)

The GLA has published a Whole Life-Cycle Carbon Assessments guidance document⁶ which sets out the requirements of London Plan Policy SI 2, including the calculation methodology for whole-life cycle emissions and the information which is required to be submitted by the planning applicant for compliance.

The Whole Life-Cycle Carbon Assessment guidance requires a separate report to be submitted to the GLA which considers both the embodied carbon and operational carbon expected to arise as a result of the Proposed Development.

The London Plan March 2021 Improving Air Quality

The London Plan requires proposals to address air quality risks as per Policy SI 1 Improving air quality. Alternatively, where an air quality assessment has been undertaken, this can be referenced.

Policy SI 1 outlines plans to seek opportunities to deliver improvements to air quality and ensure developments do not reduce air quality benefits that result from the Mayor's or boroughs' activities to improve air quality (Part A).

Part B details that development proposals must be Air Quality Neutral, address air pollution and air quality within the design rather than post-design or with retro-fitted mitigation measures, major developments must be submitted with an Air Quality Assessment, and developments in Air Quality Focus Areas or those intended for use by people vulnerable to air quality should demonstrate that design measured minimise exposure.

Large-scale development proposals should consider how local air quality can be improved across the area as part of an air quality positive approach. Additionally, development proposals must comply with the Non-Road Mobile Machinery Low Emissions Zone and follow best practice guidance on reducing emissions from demolition and construction of buildings.

Where emissions cannot be reduced to the required level through on-site measures, offsite measures to improve local air quality may be acceptable.

⁴ GLA, June 2022; Energy Assessment Guidance. Available at: https://www.london.gov.uk/sites/default/files/gla_energy_assessment_guidance_june_2022_0.pdf

⁵ GLA, September 2021; 'Be Seen' energy monitoring guidance. Available at: ['Be seen' energy monitoring guidance | London City Hall](#)

⁶ GLA, March 2022; Whole Life-Cycle Carbon Assessments. Available at: [Whole Life-Cycle Carbon Assessments guidance | London City Hall](#)

Local policy drivers

London Borough of Haringey (LBH) Strategic Policies

The Haringey Strategic Policies 2013 – 2016 document (March 2013, consolidated with alterations since 2017) policies in terms of energy largely refer to the London Plan.

Policy SP4 Working towards a low carbon Haringey requires that all new residential developments should be zero carbon from 2016 onwards and all non-residential developments should be zero carbon from 2019. It also states:

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

5. *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;*
6. *Establishing local networks of decentralised heat and energy facilities by requiring developers to prioritise connection to existing or planned networks where feasible;*
7. *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*
8. *All new developments are required, where viable, to achieve a reduction in predicted carbon dioxide emissions of 20% from on site renewable energy regeneration, which can include connections to local sources of decentralised renewable energy.*

LBH Development Management DPD

The Development Management DPD (adopted July 2017) policy DM22 covers decentralised energy. It confirms that *subject to other policy requirements, proposals that contribute to the provision and use of Decentralised Energy network infrastructure will be supported*. In addition, the policy states that:

- 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, which is 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.*

In addition, policy DM21 outlines that new developments are expected to take measures to reduce carbon emissions and overheating in line with the energy and overheating hierarchies. It also confirms that where emissions targets cannot be fully met on site, offset payments may be considered.

Highgate School SPD

The Highgate School Supplementary Planning Document (March 2021) was developed “to help give more certainty to the local community about future development in the School’s estate”.

Paragraph 4.27 acknowledges that the mechanical and electrical systems of the school are in need of modernisation to make them more sustainable and energy efficient. It states that “*Whilst it would be desirable to establish a school-wide decentralised heat and energy facility, including the potential link into a wider network should one come forward, the fragmented nature of the School’s estate makes this unviable. The Council will assess the approach to energy and carbon conservation against policy on a site-by-site basis in the detailed planning application stage looking to make each building as energy efficient as possible.*”

Paragraph 5.26 confirms that the Council will support development which reduces energy demand and carbon emissions.

