# Energy Assessment

## Prepared by Scotch Partners

Submitted on behalf of Lab Selkirk House Ltd

Selkirk House, 166 High Holborn and 1 Museum Street, 10-12 Museum Street, 35-41 New Oxford Street and 16A-18 West Central Street, London, WC1A 1JR

## April 2021

Rev 00

ScotchPartners
Building Services Engineering | Sustainability | Acoustics

# Selkirk House, 1 Museum Street, 10-12 Museum Street, 35-41 New Oxford Street and 16A-18 West Central Street, London, WC1A 1JR

Labs Selkirk House Ltd.

## Energy Statement

Revision 02
April 2021

Scotch Partners LLP
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## Revision History

| Revision | Description | Date | Prepared By | Checked By |
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# 1 Executive Summary

## 1.1 Development Description

This Energy Statement has been prepared in accordance with the GLA's Energy Assessment Guidance[1] in support of the detailed planning application being submitted by Labs Selkirk House Ltd ('the Applicant') to the London Borough of Camden ('the Council') for the redevelopment of the land at Selkirk House, 1 Museum Street, 10-12 Museum Street, 35-41 New Oxford Street and 16A-18 West Central Street, London, WC1A 1JR ('the site').

The detailed planning application seeks planning permission for the following description of development:

> *"Redevelopment of Selkirk House, 166 High Holborn and 1 Museum Street following the substantial demolition of the existing NCP car park and former Travelodge Hotel to provide a mixed-use scheme, providing office, residential, and town centre uses at ground floor level. Works of demolition, remodelling and extension to 10-12 Museum Street, 35-41 New Oxford Street, and 16A-18 West Central Street to provide further town centre ground floor uses and residential floorspace, including affordable housing provision. Provision of new public realm including a new pedestrian route through the site to link West Central Street with High Holborn. Relocation of cycle hire docking stations on High Holborn."*

The proposed development falls within a one red line area and comprises of the following components:

- Museum Street - a single new building rising to 21 storeys, providing office (Class E(g)(i)) accommodation on upper levels and a range of flexible town centre uses (Class E) at ground level.
- High Holborn - a single new building rising to 6 storeys, providing residential (Class C3) accommodation on upper levels and a flexible town centre use (Class E) at ground level.
- Vine Lane - a single new building rising to 5 storeys, providing office (Class E(g)(i)) accommodation with a flexible town centre use (Class E) at ground level. The office (Class E(g)(i)) floorspace within this building will be operated by LABS as a co-working offer.
- West Central Street ¬- a series of new and refurbished buildings rising to 6 storeys, providing residential accommodation on upper levels (Class C3) and flexible town centre uses (Class E) at ground level.

Specifically, the proposed development will comprise:

- A series of new buildings across the site, ranging in height from 4 storeys to 21 storeys.
- The provision of 29 residentials units, totalling 2,906 sqm (GIA). This includes 11 affordable homes equating to 40% affordable housing on a floorspace basis.
- The provision of 24,817 sqm (GIA) for non-residential uses:
  - 23,359 sqm (GIA) of office floorspace (Class E(g)(i)).
  - 1,458 sqm (GIA) of flexible town centre uses floorspace (Class E), specifically comprising:
    - 321 sqm (GIA) of open Class E floorspace.
    - 1,137 sqm (GIA) of restricted Class E floorspace (allowing all Class E uses except for office (E(g)(i)) and research and development (E(g)(ii)).

## 1.2 Energy Reduction Targets

Based on current planning policy requirements (refer to section 2.2) the regulated $CO_2$ emissions reduction targets against Part L for the proposed development are as follows:

| | 'Lean' target | Minimum total target | Zero Carbon |
|---|---|---|---|
| Domestic Refurbishment<br>(West Central Street) | Best endeavours (10% has been adopted) | Best endeavours<br>(35% has been adopted) | ✓ |
| Domestic New Build<br>(High Holborn and West Central Street) | 10% | 35% | |
| Non-Domestic New Build<br>(Museum Street, Vine Lane, and Class E uses) | 15% | 35% | |

[1] Energy Assessment Guidance - Greater London Authority guidance on preparing energy assessments as part of planning applications, Greater London Authority, April 2020

The carbon emission factors used in this report are as per SAP10 :

- 0.210 kg$CO_2$/kWh with regards to the natural gas; and
- 0.233 kg$CO_2$/kWh for the grid electricity.

The GLA SAP10 Carbon Reporting Spreadsheet (v1.2) has been used to convert SAP2012 results to SAP10, in lieu of SAP10 software being published.

## 1.3 Energy Reduction Measures

The Applicant is committed to reducing energy demand and $CO_2$ emissions related to the proposed development. The following measures are proposed to that effect.

### 1.3.1 Be Lean – Reduce Energy Demand

Whilst the measures differ slightly across the 4 site components, in general the following key demand reduction measures and principles have been adopted:

- Best practice building fabric performance, improving upon Part L notional building u-values and air permeability rate.
- Consideration for appropriate glazing to solid ratio, balanced with requirements for daylighting, views out, and commercial marketing requirements.
- Provision of a means of natural ventilation where external conditions allow
- Mechanical ventilation with high efficiency heat recovery.
- Low energy lighting with occupancy sensing and daylight dimming controls.

### 1.3.2 Be Clean – Supply Energy Efficiency

There are no existing heat networks within 1km of the Site.

Museum Street, Vine Lane and the associated Class E units will be served by an onsite single communal energy centre with heating plant that will distribute heat to these components via heat network. The energy centre has been designed to facilitate connection to a future heat network, should one become available.

After investigation, it has been determined that greater benefits will be provided by the West Central Street and High Holborn apartments and Class E units having their own individual ASHPs, rather than connecting to a centralised system or the Museum Street energy centre. This approach has been confirmed by email as acceptable by Camden Council.

### 1.3.3 Be Green – Use Renewable Energy

The Development will be fossil fuel free for heating and hot water.

An appraisal of available renewable energy solutions has been carried out, which has identified Air Source Heat Pumps as the most appropriate technology for the Development. PV has been discounted due to the lack of suitable available roof space.

## 1.4 LETI Net Zero Carbon

The Applicant is keen for Museum Street, as the largest building on the proposed site, to target Net Zero Carbon through achieving a Net Zero Carbon balance between on and offsite measures, prioritising the former. Appropriate offsite methods are currently being explored.

A review has been carried out by the project team of the design measures and indicators which should be considered in order for Museum Street to aim towards Net Zero Carbon. The review is based on the measures set out in London Energy Transformation Initiative (LETI) Climate Emergency Design Guide (for office buildings) which was published in January 2020. The Guide's definition of Net Zero Carbon relates to whole life carbon i.e. both operational carbon and embodied carbon. At this stage, Museum Street is focusing on operational carbon, as per LETI's definition:

**Operational Carbon**

A new building with net zero operational carbon does not burn fossil fuels, is 100% powered by renewable energy, and achieves a level of energy performance in-use in line with national climate change targets.

The NZC review was started at RIBA Stage 2 and has been updated at Stage 3. The proposed energy strategy includes applicable and appropriate measures and indicators from the LETI Design Guide; however, it is acknowledged that the Guide will evolve over time through feedback and contributions from the industry.

Due to the efforts being made by the Applicant in this area, Museum Street is registered as LETI 'Pioneer Project' and is part of the network of other projects aspiring for Net Zero Carbon.

## 1.5 Performance Against Reduction Targets

The performance against policy targets has been calculated using SAP10 carbon emissions factors using the GLA's *Carbon Emissions Reporting Spreadsheet (version1.21)*. Due to the size and format of the Excel workbook it is not appropriate to append the completed document to this energy statement. It has instead been provided under separate cover to GLA and to the local authority to review in parallel with the information presented in this report.

The regulated $CO_2$ savings from each stage of the energy hierarchy and total cumulative performance is shown on the following pages.

#### 1.5.1 Domestic Refurbishment

Both the block on New Oxford Street and the block in 10-12 Museum Street (within the West Central Street part of the development) are refurbished. Whilst the targets aren't applicable to domestic refurbishments, the 10% lean target has been adopted and exceeded and the overall performance exceeds the minimum 35% level.

*Table 1.1 – Regulated carbon dioxide savings from each stage of the energy hierarchy for the Domestic Refurbishment Development*

| | Regulated domestic carbon dioxide savings | |
|---|---|---|
| | (Tonnes $CO_2$ per annum) | (%) |
| Be lean | 2.8 | 19% |
| Be clean | 0.0 | 0% |
| Be green | 4.4 | 29% |
| Cumulative on site savings | **7.2** | **48%** |
| Annual savings from off-set payment | 7.8 | |
| | (Tonnes $CO_2$) | |
| Cumulative savings for off-set payment | 234 | |
| Cash in-lie contribution (£)** | **22,193** | |

**Figures are rounded up/down in the GLA spreadsheet*

***price is based on GLA recommended rate of £95 per tonne of Carbon Dioxide over 30 years*

#### 1.5.2 Domestic New Build

The 10% lean target for both West Central Street and High Holborn has been exceeded and the overall performance exceeds the minimum 35% level.

*Table 1.2 - Regulated carbon dioxide savings from each stage of the energy hierarchy for the Domestic New Build Development*

| | Regulated domestic carbon dioxide savings | |
|---|---|---|
| | (Tonnes $CO_2$ per annum) | (%) |
| Be lean | 3.8 | 16% |
| Be clean | 0.0 | 0% |
| Be green | 5.8 | 24% |
| Cumulative on site savings | **9.6** | **40%** |
| Annual savings from off-set payment | 14.6 | |
| | (Tonnes $CO_2$) | |
| Cumulative savings for off-set payment | 438 | |
| Cash in-lie contribution (£)** | **41,614** | |

**Figures are rounded up/down in the GLA spreadsheet*

***price is based on GLA recommended rate of £95 per tonne of Carbon Dioxide over 30 years*

#### 1.5.3 Non-Domestic New Build

On a site-wide scale, the 15% lean target saving has been exceeded and the overall performance exceeds the minimum 35% target saving.

*Table 1.3 – Regulated carbon dioxide savings from each stage of the energy hierarchy for the Non-Domestic Development*

| | Regulated domestic carbon dioxide savings | |
|---|---|---|
| | (Tonnes $CO_2$ per annum) | (%) |
| Be lean | 30.1 | 15% |
| Be clean | 0.0 | 0% |
| Be green | 54.4 | 28% |
| Cumulative on site savings | **84.4** | **43%** |
| Annual savings from off-set payment | 111.9 | |
| | (Tonnes $CO_2$) | |
| Cumulative savings for off-set payment | 3,357 | |
| Cash in-lie contribution (£)** | **318,907** | |

**Figures are rounded up/down in the GLA spreadsheet*

***price is based on GLA recommended rate of £95 per tonne of Carbon Dioxide over 30 years*

#### 1.5.4 Total Development

The lean targets have been exceeded across the site and the overall Development performance exceeds the minimum 35% level.

*Table 1.4 – Regulated carbon dioxide savings from each stage of the energy hierarchy for the whole development*

| | Total regulated emissions (Tonnes $CO_2$ /year) | $CO_2$ savings (Tonnes $CO_2$ /year) | Percentage savings (%) |
|---|---|---|---|
| Part L 2013 baseline | 239.0 | | |
| Be lean | 199.4 | 39.6 | **17%** |
| Be clean | 199.4 | 0.0 | 0% |
| Be green | 133.4 | 66.0 | 28% |
| Total savings | - | 105.6 | **44%** |
| | | $CO_2$ savings off-set (Tonnes $CO_2$) | |
| Cumulative savings for offset payment | - | 4,003 | - |
| Cash-in-lieu contribution** | - | £380,247 | - |

**Figures are rounded up/down in the GLA spreadsheet*

***price is based on GLA recommended rate of £95 per tonne of Carbon Dioxide over 30 years*

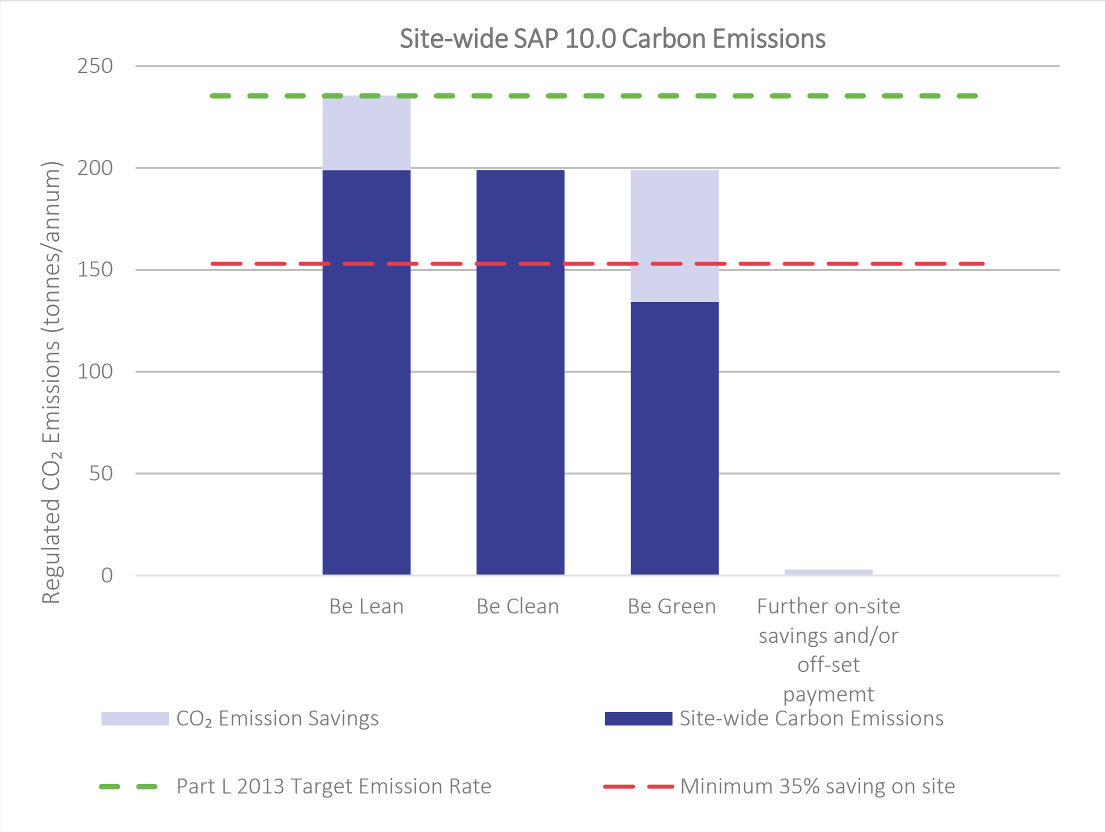


*Figure 1.1 - Regulated carbon dioxide savings from each stage of the energy hierarchy for the Total Development*

## 1.6 Carbon Offsetting

The Council's preferred mechanism for carbon offsetting is payment into the Camden Climate Fund (https://www.camden.gov.uk/camden-climate-fund). A cash in lieu contribution of £382,713 will be made to this fund, secured through the S106 agreement.

## 1.7 Whole Life-Cycle Carbon Emissions

The New London Plan Policy SI 2 requires development proposals to calculate whole life-cycle carbon emissions through a nationally recognised Whole Life-Cycle Carbon Assessment (WLCA) and to demonstrate actions taken to reduce life-cycle carbon emissions.

A Whole Life-Cycle Carbon Assessment was carried out following the GLA Whole Life-Cycle Carbon Assessments Guidance (April 2015) in accordance with BS EN 1578, with additional guidance from RICS Professional Statement. This assessment was completed using the GLA approved eTool software. The results are presented within the WLCA report which is submitted with this application.

# 2 Introduction

## 2.1 Development Description

This Energy Statement has been prepared in accordance with the GLA's Energy Assessment Guidance[2] in support of the detailed planning application being submitted by Labs Selkirk House Ltd ('the Applicant') to the London Borough of Camden ('the Council') for the redevelopment of the land at Selkirk House, 1 Museum Street, 10-12 Museum Street, 35-41 New Oxford Street and 16A-18 West Central Street, London, WC1A 1JR ('the site').

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The proposed development falls within a one red line area and comprises of the following components:

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– High Holborn - a single new building rising to 6 storeys, providing residential (Class C3) accommodation on upper levels and a flexible town centre use (Class E) at ground level.
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– West Central Street ¬- a series of new and refurbished buildings rising to 6 storeys, providing residential accommodation on upper levels (Class C3) and flexible town centre uses (Class E) at ground level.

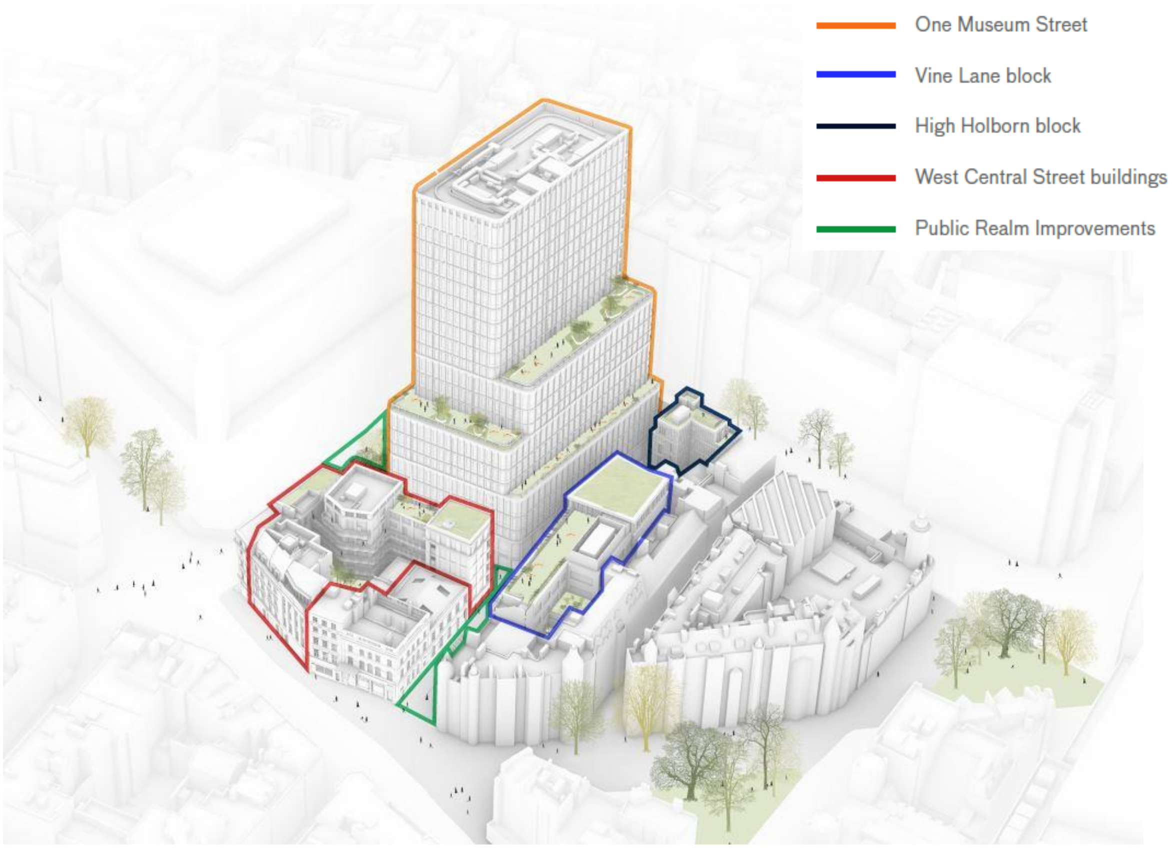


*Figure 2.1 – Proposed Scheme Overview*

Specifically, the proposed development will comprise:

– A series of new buildings across the site, ranging in height from 4 storeys to 21 storeys.
– The provision of 29 residentials units, totalling 2,906 sqm (GIA). This includes 11 affordable homes equating to 40% affordable housing on a floorspace basis.
– The provision of 24,817 sqm (GIA) for non-residential uses:
    - 23,359 sqm (GIA) of office floorspace (Class E(g)(i)).
    - 1,458 sqm (GIA) of flexible town centre uses floorspace (Class E), specifically comprising:
        - 321 sqm (GIA) of open Class E floorspace.

[2] Energy Assessment Guidance - Greater London Authority guidance on preparing energy assessments as part of planning applications, Greater London Authority, April 2020

- 1,137 sqm (GIA) of restricted Class E floorspace (allowing all Class E uses except for office (E(g)(i)) and research and development (E(g)(ii)).

## 2.2 Planning Policy

This section provides a summary of the Greater London Authority (GLA) and the London Borough of Camden's key planning policy requirements relating to energy and carbon that have been taken into consideration by the design proposals.

### 2.2.1 Key Policies and Requirements

Camden Council and the Mayor of London have declared a 'Climate Emergency', with Camden's declaration including an 'Ecological Emergency'.

Both have an aspiration to achieve a Net Zero Carbon borough and city by 2030, 20 years ahead of the national target. It is expected that both new development and refurbishments will actively contribute to this.

In June 2020, Camden approved a 5-year 'Climate Action Plan' which creates a framework for action across all aspects of the borough with the aim of achieving zero carbon by 2030.

The Development proposals have been designed with consideration for these aspirations and for the following key policies relating to energy and carbon.

| Policy | Summary of Requirements |
|---|---|
| **Publication London Plan Policy GG 6** Increasing efficiency and resilience<br>**Camden Local Plan Policy CC2** Adapting to climate change | – Seek to improve energy efficiency and support the move towards a low carbon circular economy.<br>– Ensure buildings are designed to adapt to climate change and its impacts.<br>– Create a safe and secure environment that is resilient to the impact of emergencies. |
| **Publication London Plan Policy SI 2** Minimising Greenhouse Gas Emissions<br>**Publication London Plan Policy SI3** Energy infrastructure<br>Camden Local Plan **Policy CC1** Climate change mitigation | – Major development should be net zero carbon in accordance with the energy hierarchy: be lean, be clean, be green.<br>– Target a 20% reduction in CO2 from onsite renewables<br>– Where substantial demolition is proposed, demonstrate it is not possible to retain and improve.<br>– Achieve a minimum onsite reduction of at least 35% beyond Building Regulations Part L. Any shortfall should be provided through either a carbon offset payment or an alternative offsite proposal if available. |
| **Camden CPG** Energy efficiency & adaptation | – Developments should calculate whole life-cycle carbon emissions through a nationally recognised assessment method and take action to reduce emissions.<br>– Developments should prioritise connection to an offsite heat network, where available.<br>– Major development proposals within Heat Network Priority Areas should have a communal low temperature heating system.<br>– Maximise opportunities for renewable energy by producing, storing and using renewable energy on site. |
| **Publication London Plan Policy SI 4** Managing heat risk<br>**Camden Local Plan Policy CC2** Adapting to climate change | – Development proposals should minimise adverse impacts on the urban heat island through design, layout, orientation, materials and the incorporation of green infrastructure.<br>– Major developments should demonstrate through modelling (CIBSE TM guidance) how they will reduce the potential for internal overheating and reliance on air conditioning systems in accordance with the cooling hierarchy. |
| **Publication London Plan Policy GG 3** Creating a healthy city<br>**Publication London Plan Policy SI 1** Improving air quality<br>**Camden CPG** Planning for health and wellbeing | – Seek to improve London's air quality, reduce public exposure to poor air quality and minimise inequalities in levels of exposure to air pollution.<br>– Should not create unacceptable risk of high levels of exposure to poor air quality.<br>– Development must meet the 'Air Quality Neutral' standard.<br>– Measures that will help contribute to healthier communities and reduce health inequalities should be incorporated in developments.<br>– Measures that will help contribute to healthier communities and reduce health inequalities should be incorporated in developments. |

*Table 2.1 – Energy policy summary*

### 2.2.2 GLA Energy Assessment Guidance (April 2020)

This guidance document explains how to prepare an energy assessment to accompany major planning applications and sets out what information should be included within the energy statement. This energy statement has been prepared in accordance with that guidance.

## 2.3 Target Development $CO_2$ Emissions Reduction

Based on current planning policy requirements listed under 2.2.1 the regulated $CO_2$ emissions reduction targets against Part L for the proposed development are as follows:

| | 'Lean' target | Minimum total target | Zero Carbon |
|---|---|---|---|
| **Domestic Refurbishment** (West Central Street) | Best endeavours (10% has been adopted) | Best endeavours (35% has been adopted) | |
| **Domestic New Build** (High Holborn and West Central Street) | 10% | 35% | ✓ |
| **Non-Domestic New Build** (Museum Street, Vine Lane, and Class E uses) | 15% | 35% | |

## 2.4 LETI Net Zero Carbon

The Applicant is keen for Museum Street, as the largest building on the proposed site, to target Net Zero Carbon through achieving a Net Zero Carbon balance between on and offsite measures, prioritising the former. Appropriate offsite methods are currently being explored.

A review has been carried out by the project team of the design measures and indicators which should be considered in order for Museum Street to aim towards Net Zero Carbon. The review is based on the measures set out in London Energy Transformation Initiative (LETI) Climate Emergency Design Guide (for office buildings) which was published in January 2020. The Guide's definition of Net Zero Carbon relates to whole life carbon i.e. both operational carbon and embodied carbon. At this stage, Museum Street is focusing on operational carbon, as per LETI's definition:

**Operational Carbon**

A new building with net zero operational carbon does not burn fossil fuels, is 100% powered by renewable energy, and achieves a level of energy performance in-use in line with national climate change targets.

The NZC review was started at RIBA Stage 2 and has been updated at Stage 3. The proposed energy strategy includes applicable and appropriate measures and indicators from the LETI Design Guide; however, it is acknowledged that the Guide will evolve over time through feedback and contributions from the industry.

Due to the efforts being made by the Applicant in this area, Museum Street is registered as LETI 'Pioneer Project' and is part of the network of other projects aspiring for Net Zero Carbon.

## 2.5 Supporting Information

This energy statement should be read in conjunction with the following reports submitted with this application:

- Design & Access Statement
- Air Quality Assessment
- Noise Impact Assessment
- Sustainability Statement

# 3 Establishing $CO_2$ Emissions

## 3.1 Energy Hierarchy

The energy strategy for the Development follows the energy hierarchy of, 'Be Lean', 'Be Clean', and 'Be Green' as set out within the London Plan. At each stage of the hierarchy the proposed development's $CO_2$ emissions are evaluated and the percentage reduction achieved for the measures applied are reported.

## 3.2 Methodology

Regulated energy use and the associated $CO_2$ emissions have been calculated using the Dynamic Simulation Model methodology with IES Virtual Environment Version 2019.3.1.0 software for the non-domestic areas and SAP 2012 Calculator (Design System) version 4.14r16 for the domestic dwellings (all dwellings have been assessed). The $CO_2$ emissions have been evaluated at each stage of the energy hierarchy.

The total residential (new build) development, total non-domestic development, and the total whole development $CO_2$ emissions reported are based on the outputs from the BRUKL reports and the SAP output reports. Total figures are calculated on an area weighted average basis.

**Note**: the areas given in the results tables are as per the DSM and SAP models and as reported in the BRUKL and SAP reports (which accompany this statement) as opposed to the proposed development GIA quoted elsewhere. The DSM model has been constructed in compliance with the 'National Calculation Methodology', and therefore includes minor geometric simplifications resulting in a slight variance in floor area.

### 3.2.1 Carbon Dioxide Emission Factors

The BRUKL report is generated using software that uses the SAP Guidance 2012[3] carbon emission factors for gas and electricity. Since these factors were published, grid supplied electricity has significantly decarbonised. The Government is due to update Part L and publish revised carbon emission factors to reflect this, and subsequently the assessment software will also be updated. Since the SAP 2012 factors are no longer considered appropriate, this energy assessment has converted the BRUKL results to SAP10 carbon emissions factors using the GLA's Carbon Emission Reporting Spreadsheet v1.2.

Due to the size and format of the Excel workbook it is not appropriate to append the completed document to this energy statement. It has instead been provided under separate cover to GLA and to Camden to review in parallel with the information presented in this report.

*Table 3.1- $CO_2$ Emission Factors*

| Fuel | Emission Factor ($kgCO_2/kWh$) | |
|---|---|---|
| | SAP 2012 | SAP10 |
| Natural Gas | 0.216 | 0.210 |
| Grid Supplied (or Displaced) Electricity | 0.519 | 0.233 |

## 3.3 Development Baseline Emissions

In accordance with the GLA Energy Assessment Guidance the proposed development baseline emissions have been calculated assuming that the heating would be provided by gas boilers (notional building performance) and that any active cooling would be provided by electrically powered equipment. Table 3.2 shows the calculated carbon emissions for the baseline of the proposed development.

*Table 3.2 – Regulated carbon dioxide emissions - Baseline*

| | Total Regulated Emissions ($tCO_2/yr$) | $CO_2$ savings ($tCO_2/yr$) | Percentage saving (%) |
|---|---|---|---|
| Part L 2013 baseline | 235.6 | | |
| Be Lean | - | - | - |
| Be Clean | - | - | - |
| Be Green | - | - | - |
| Total Cumulative Savings | - | - | - |

## 3.4 Unregulated Emissions

As stated in the GLA Energy Assessment Guidance April 2020, the calculation of unregulated carbon emissions has been carried out to comply with the 'be seen' policy and associated guidance.

Refer to Appendix I for the partially completed Be Seen Checklist. The results of the TM54 modelling will be provided within 4 weeks of obtaining planning consent, as required by the Be Seen Consultation Guidance September 2020.

[3] Government's Standard Assessment Procedure (SAP) Guidance 2012

# 4 Demand Reduction (Be Lean)

The Mayor has set efficiency targets through the Publication London Plan. It is expected that non-domestic developments should achieve at least a 15% improvement on Building Regulations, and domestic developments should achieve at least 10%, energy efficiency (i.e. lean) measures alone.

Passive and active design measures are proposed to reduce energy demand at source as far as possible. Where appropriate and applicable, these measures have been informed by LETI Net Zero Carbon guidance.

## 4.1 Passive Design Measures

Enhanced fabric elements have been considered for the proposed development with consideration for compatibility with the façade design and geometry, construction type and method. RIBA Stage 3 fabric performance values have been provided by the architect and façade consultant, as specified in the tables below.

*Table 4.1 - Glazing Percentage throughout the site*

| | Solar control glazing | Daylighting maximised | Opportunity for natural ventilation | Thermal mass |
|---|---|---|---|---|
| Museum Street | 0.35 g-value | ✓ | ✓ | Medium |
| Vine Lane | 0.35 g-value | ✓ | | Medium |
| West Central Street | 0.63 g-value | ✓ | ✓ | Medium |
| High Holborn | 0.63 g-value | ✓ | ✓ | Medium |

### 4.1.1 Domestic Refurbishment

Within the West Central Street development, both blocks known as 10-12 Museum Street and New Oxford Street are to be refurbished, with the top floor being considered as new build.

The fabric performance of the refurbished blocks has been enhanced compared to the building Regulation Part L requirements, as shown in Table 4.2. Refer to the façade consultant's report for the detailed build-up of the various elements.

Natural ventilation is also considered for purge ventilation purposes, both on the Museum street side and towards the internal courtyard.

*Table 4.2 - Comparison of U-values of Actual Dwelling against Building Regulations Notional Dwelling*

| | West Central Street | |
|---|---|---|
| Element | Actual Dwelling U-value (W/m²K) | Part L1B threshold U-value (W/m²K) |
| Wall | 0.21 | 0.3 |
| Floor | 0.25 | 0.25 |
| Roof | 0.18 | 0.18 |
| Windows | 1.6 | 1.6 |

### 4.1.2 Domestic New Build

*Table 4.3 - Comparison of Infiltration of Actual Dwelling against Notional Dwelling*

| Building | Actual Dwelling m³/m²/hour @50 Pa | Notional Dwelling m³/m²/hour @50 Pa |
|---|---|---|
| West Central Street | 3.0 | 5.0 |
| High Holborn | 3.0 | 5.0 |

*Table 4.4 - Comparison of U-values of Actual Dwelling against Building Regulations Notional Dwelling*

| | West Central Street | |
|---|---|---|
| Element | Actual Dwelling U-value (W/m²K) | Part L1A threshold U-value (W/m²K) |
| Wall | 0.15 | 0.3 |
| Floor | 0.12 | 0.25 |
| Roof | 0.12 | 0.2 |
| Windows | 1.3 | 2 |

#### 4.1.3 Non-Domestic New Build

*Table 4.5 - Comparison of Infiltration of Actual Building against Notional Building*

| Building | Actual Building m³/m²/hour @50 Pa | Notional Building m³/m²/hour @50 Pa |
|---|---|---|
| Museum Street | 3.0 | 3.0 |
| Vine Lane | 3.5 | 3.0 |

*Table 4.6 - Comparison of U-values of Actual Building against Building Regulations Notional Building*

| | Museum Street | | Vine Lane | |
|---|---|---|---|---|
| Element | Actual Building U-value (W/m²K) | Notional Building U-value (W/m²K) | Actual Building U-value (W/m²K) | Notional Building U-value (W/m²K) |
| Wall | 0.2 | 0.26 | 0.16 – 0.26 | 0.26 |
| Ground Floor | 0.22 | 0.22 | 0.22 - 0.25 | 0.22 |
| Roof | 0.12 | 0.18 | 0.12 | 0.18 |
| Windows | 1.6 | 1.6 | 1.3 | 1.6 |

### 4.2 Active Design Measures

The following active energy efficiency measures have been considered and incorporated into the building services design:

- Low energy LED lighting is proposed throughout the proposed development, both internally and externally to minimise associated electrical demand. See table below for details.
- Efficient mechanical ventilation with heat recovery with minimised specific fan power and optimised heat exchanger efficiency. See table below for details.
- Energy metering, including smart meters for the tenants and energy meters on the electrical supply to the air source heat pumps to monitor the consumption.
- Demand-side response through intelligent controls is being considered and will be detailed at RIBA Stage 4 onwards

*Table 4.7 - Summary of Lean Measures*

| Building | LED Lighting | Mechanical Ventilation | |
|---|---|---|---|
| | Lamp Efficacy | AHU SFP | Heat Recovery Efficiency |
| Museum Street | 140 lm/W has been used for the offices with Photoelectric dimming and a parasitic power of 0.02W/m². Areas other than the office are all reduced to 110 lm/W. | 2.0 W/l/s | 80% (seasonal) |
| Vine Lane | 140 lm/W has been used for the offices with Photoelectric dimming and a parasitic power of 0.02W/m². Areas other than the office are all reduced to 110 lm/W. | 1.5 W/l/s | 80% (seasonal) |
| West Central Street | 140 lm/W has been used for retail and landlord areas with 40 lm/W for display lighting. | 1.2 W/l/s | 90% |
| High Holborn | 140 lm/W has been used for retail and landlord areas with 65 lm/W for display lighting. | 1.2 W/l/s | 90% |

### 4.3 Part L 2013 Building Regulations

The proposed development has been designed to comply with Building Regulations Part L1A, Part L1B and L2A and to exceed the notional dwelling/building (target emission rate) through the use of demand reduction measures alone i.e. before the inclusion of clean and green measures.

*Table 4.8 – Summary of domestic (refurbishment) lean performance against the baseline performance*

| Total $CO_2$ Emissions Baseline ($kgCO_2/m^2/year$) | Total $CO_2$ Emissions Lean ($kgCO_2/m^2/year$) | Percentage improvement |
|---|---|---|
| 25.3 | 20.5 | 19% |

*Table 4.9 – Summary of domestic (new build) lean performance against the notional dwelling*

| Target $CO_2$ Emissions Rate (TER) ($kgCO_2/m^2/year$) | Dwelling $CO_2$ Emissions Rate (DER) ($kgCO_2/m^2/year$) | Percentage improvement |
|---|---|---|
| 17.3 | 14.6 | 16% |

*Table 4.10 – Summary of non-domestic lean performance against the notional building*

| Target $CO_2$ Emissions Rate (TER) ($kgCO_2/m^2/year$) | Building $CO_2$ Emissions Rate (BER) ($kgCO_2/m^2/year$) | Percentage improvement |
|---|---|---|
| 8.2 | 6.9 | 16% |

#### 4.3.1 Demand Side Response Plans

The demand side response plans for the development are based primarily on the principles of:

- Peak reduction
- Active demand response measures

Peak reduction across the site is achieved by the passive and active energy efficiency measures set out above, which aim to minimise the peak heating and cooling demands of each plot. In particular, the provision of openable windows or ventilation panels throughout the development to be used for mixed-mode free cooling (where environmental noise and air quality permits) has been demonstrated to significantly reduce the daily peak and annual cooling requirements.

Figure 4.1.2.2 is an excerpt from a study carried out by Scotch Partners on the benefits of adopting a mixed-mode ventilation strategy for the 1 Museum Street and Vine Lane blocks. The graph indicates the cooling load for a typical floor of 1 Museum Street throughout a typical summers day both with (indicated in blue) and without (indicated in green) the free cooling natural ventilation strategy applied, compared to the Building Regulations Notional Building values for the same space.

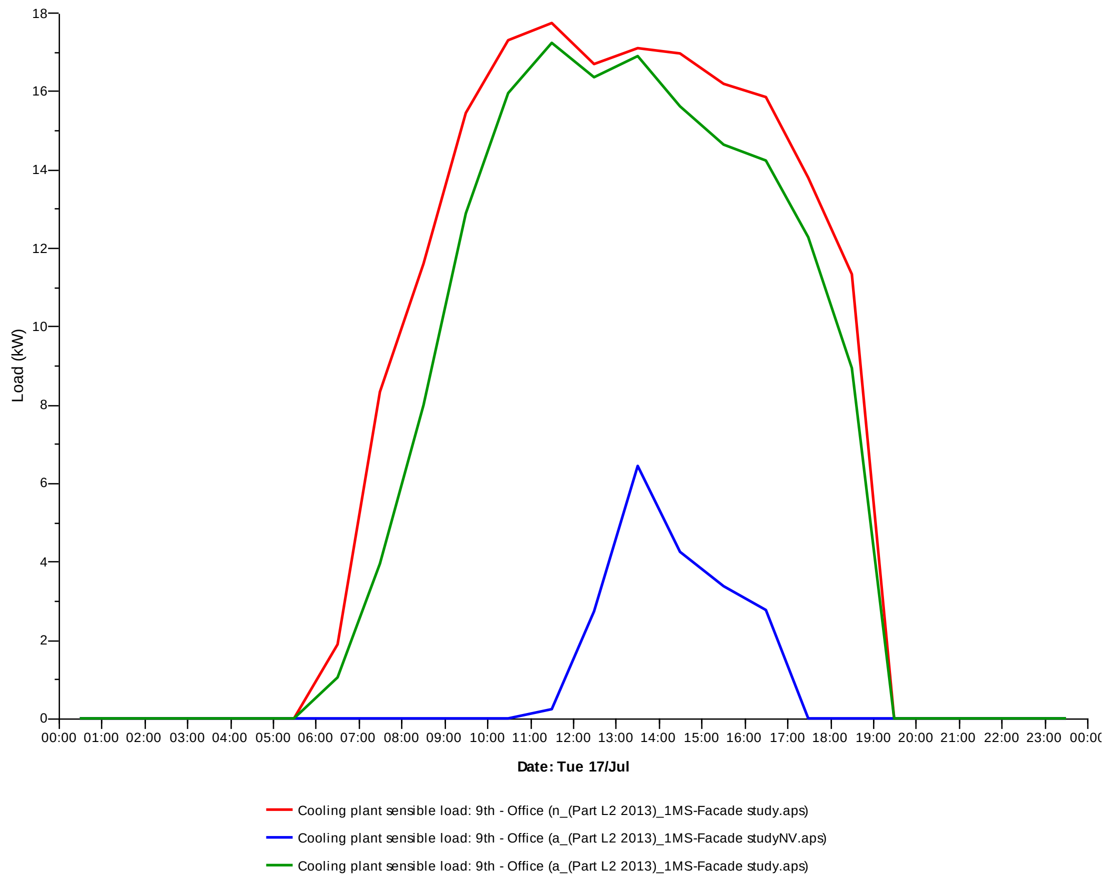


*Figure 4.1.2.2 - Comparison of cooling demand on a typical summer day for building with (blue line) and without (green line) mixed-mode free cooling strategy compared to the Building Regulations Notional Building (red)*

It can be seen from the graph that in this case the use of the operable panels for free cooling

1. Reduces the peak load on the cooling plant
2. Significantly reduces the overall cooling consumption for this 24 hour period.
3. Shortens the peak cooling period & moves the peak relative to the fully comfort cooled scenario

Peak reduction for domestic hot water is achieved through the provision of water storage throughout the development where appropriate. The domestic hot for the shower areas of 1 Museum Street and Vine Lane, which is expected to be one of the largest peak consumers of domestic hot water on site, is generated via a water source heat pump connected to the condenser loop system, and stored in a 2000L thermal store. The water source heat pump allows the hot water to be generated utilising waste heat from other parts of 1 Museum Street and Vine Lane where available, and the thermal storage allows domestic hot water to be generated at times where surplus heat is available and/or grid demand is low.

Heating and cooling setpoints throughout the commercial properties are intended to be adaptive with increased comfort bands. Heating and cooling setpoints and comfort bands will respond to occupant usage of the mixed mode natural ventilation system with the comfort bands being broadened and/or heating & cooling operation being inhibited whilst the panels are opened.

## 4.4 $CO_2$ Savings from Lean Measures

The regulated carbon dioxide savings at the 'lean' stage of the energy hierarchy are provided in the tables below and demonstrates that the proposed development is compliant with Publication London Plan and Camden policy requirements.

### 4.4.1 Domestic Fabric Performance

The total Part L Fabric Energy Efficiency Standard (FEES) for the domestic new build is provided in the table below:

| | Target Fabric Energy Efficiency (MWh/year) | Design Energy Efficiency (MWh/year) | Improvement (%) |
|---|---|---|---|
| Development total | 54.71 | 53.57 | 2% |

### 4.4.2 Domestic Refurbishment

*Table 4.11 – Regulated carbon dioxide savings - Lean*

| | Total Regulated Emissions ($tCO_2/yr$) | $CO_2$ savings ($tCO_2/yr$) | Percentage saving (%) |
|---|---|---|---|
| Part L 2013 baseline | 15.0 | | |
| Be Lean | 12.2 | 2.8 | 19% |
| Be Clean | - | - | |
| Be Green | - | - | |
| Total Cumulative Savings | - | - | - |

### 4.4.3 Domestic New Build

*Table 4.12 – Regulated carbon dioxide savings - Lean*

| | Total Regulated Emissions ($tCO_2/yr$) | $CO_2$ savings ($tCO_2/yr$) | Percentage saving (%) |
|---|---|---|---|
| Part L 2013 baseline | 24.2 | | |
| Be Lean | 20.4 | 3.8 | 16% |
| Be Clean | - | - | |
| Be Green | - | - | |
| Total Cumulative Savings | - | - | |

### 4.4.4 Non-Domestic

*Table 4.13 – Regulated carbon dioxide savings - Lean*

| | Total Regulated Emissions ($tCO_2/yr$) | $CO_2$ savings ($tCO_2/yr$) | Percentage saving (%) |
|---|---|---|---|
| Part L 2013 baseline | 196.4 | | |
| Be Lean | 166.3 | 30.1 | 15% |
| Be Clean | - | - | |
| Be Green | - | - | |
| Total Cumulative Savings | - | - | - |

### 4.4.5 Total Development

*Table 4.14 – Regulated carbon dioxide savings - Lean*

| | Total Regulated Emissions ($tCO_2/yr$) | $CO_2$ savings ($tCO_2/yr$) | Percentage saving (%) |
|---|---|---|---|
| Part L 2013 baseline | 235.6 | | |
| Be Lean | 198.9 | 36.7 | 16% |
| Be Clean | - | - | |
| Be Green | - | - | |
| Total Cumulative Savings | - | - | - |

### 4.4.6 Summary Outputs from Modelling – Lean Case

Refer to the BRUKL and SAP Output Sheets in Appendix A and Appendix C for details of the outputs from the 'lean case' energy assessment. For reference, 'Vine Lane' has been known as 'Grape Street' by the project team throughout the design period and subsequently the BRUKL reports use this title.

# 5 Cooling and Overheating

## 5.1 The Cooling Hierarchy

The cooling hierarchy as set out within the Publication London Plan Policy SI 4 requires passive design measures to be maximised to reduce the requirement for active cooling.

**Policy SI 4 Managing heat risk**

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

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

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.

## 5.2 Minimising Internal Heat Gain

To minimise the internal heat generation, energy efficient lighting is proposed to all areas; it is anticipated that low energy appliances will be provided throughout.

Enhanced insulation will be installed to the pipework distribution and to the thermal storage to minimise heat loss. Additionally, the services distribution throughout the building has been designed to minimise pipe lengths as far as practicable.

## 5.3 Reducing Summer Heat Gain

To minimise the amount of heat entering the buildings during summer and unseasonably warm months the following measures to limit unwanted solar gains have been considered as part of the architectural design (refer to the Design & Access Statement for details).

| | G-Value | Internal blinds | External Solar shading | Natural Ventilation |
|---|---|---|---|---|
| Museum Street | 0.35 | Not provided, however fittings to be installed for tenant fit-out | Building articulation includes recessed windows and 2m deep overhangs where terraces are provided<br><br>Class E units shaded by adjacent buildings | Operable ventilation panels provided to all office floors except from ground to second floor.<br><br>Openable doors to terraces at levels where provided. |
| Vine Lane | 0.35 | Not provided, however fittings to be installed for tenant fit-out | Adjacent buildings, recessed windows<br><br>Class E units shaded by adjacent buildings | Openable windows |
| West Central Street | 0.63 | Not provided, in accordance with para. 8.6 GLA Energy Assessment Guidance April 2020 | Adjacent buildings, recessed windows<br><br>Class E units shaded by adjacent buildings | Openable windows. Dual aspect allows for cross ventilation. |
| High Holborn | 0.63 | Not provided, in accordance with para. 8.6 GLA Energy Assessment Guidance April 2020 | Adjacent buildings, recessed windows<br><br>Class E units shaded by adjacent buildings | External conditions prevent the use of openable windows except for purge purposes |

In the dynamic building simulation models, the adjacent buildings have also been included to account for the shading that these cast onto the Development.

## 5.4 Use of Thermal Mass and High Ceilings

Museum Street and Vine Lane have exposed concrete soffits and generous floor to ceiling heights providing some element of thermal mass.

## 5.5 Ventilation

The opportunities for promoting natural ventilation have been maximised as far as practicable. For Museum Street and Vine Lane this is part of a mixed mode ventilation strategy.

### 5.5.1 West Central Street and High Holborn

Each apartment will be provided with supply and extract ventilation through an independent mechanical ventilation with heat recovery (MVHR) unit. The MVHR will supply tempered (via heat recovery only) and filtered, fresh air to the living areas and bedrooms and will extract vitiated air from the kitchens, bathrooms, and WCs. The MVHR units will incorporate a summer bypass operation mode.

As recommended by Arup (the air quality consultants), the New Oxford Street block (new build residential) elevation that faces New Oxford Street should be provided with non-operable windows at ground, first and second floors due to air quality issues. For this reason, the intake connection for the MVHRs serving these apartments will be on the internal courtyard side, which will guarantee enough distance from the main street and avoid the requirement of NOx filtration.

A series of high-level louvres at ground floor will provide allowance for future dedicated ventilation plant in the ground floor retail units.

Arup have advised that the High Holborn apartments should not rely on operable windows due to the proximity of the main road. NOx filters will be fitted to the air intakes for the MVHR.

### 5.5.2 Vine Lane

Vine Lane is to be provided with a decentralised mechanical ventilation system.

Intake air is taken from a louvre on the South of the roof level of Vine Lane and a riser is provided from roof level to high level ground floor. Exhaust air is taken from each of the floor plates and discharged to the North Courtyard area of the building level by level.

As part of the shell & core provision, supply and extract ductwork is to be capped off at each floor level.

Each floor will be provided with an array of high level MVHRs as part of the Cat A fit-out. These connect to the intake riser and the exhaust louvre and provide supply and extract air to each of the occupiable zones.

Demand control ventilation is to be met via the use of $CO_2$ sensing and variable speed operation of the heat recovery ventilation units.

Openable panels are provided within the façade to complement the mechanical ventilation system serving the office floor levels and provide the opportunity for "mixed-mode" free cooling when external conditions permit. A monitoring and control system including contactors on each operable panel and a roof mounted weather station will be provided to encourage users to utilise the operable panels when external environmental conditions permit, and prevent energy wastage by adapting setpoints and inhibiting the operation of the active heating & cooling systems where appropriate. The design of this system will be developed in detail at RIBA Stage 4 Technical Design.

### 5.5.3 Museum Street

A centralised ventilation system is proposed to serve all office areas with air handling units located at both basement level (B2) and roof level. Basement air handling units will serve office floors 01 to 08 and connect to atmosphere via an intake air shaft within the Grape St block and exhaust air shafts discharging at ground floor level within 1MS and at 1st floor level within the Grape Street block. Roof level air handling units will serve office floors 09 to 20 and connect to atmosphere via separated intake and exhaust points.

All air handling units will incorporate high efficiency heat recovery, with thermal wheel heat recovery preferred where possible due to the higher heat recovery efficiencies that can be achieved with this technology. Run-around coil type heat recovery is proposed for the air handling units located at roof level due to the limitations on overall unit height at roof level.

Particulate filters will be provided within each air handling unit to meet the internal air quality requirements set out under the WELL Building standard. The requirement for gas filters (carbon filters for scrubbing of oxides of nitrogen) is to be confirmed once the results of the detailed air quality analysis are available. *Note: Arup have advised that the height of the air intakes above street level should result in NOx levels being sufficiently low so as to mitigate the requirement for gas filters, and therefore no allowance for gas filtration has been made in the Stage 3 design proposals.*

The system is intended to operate as a "demand control ventilation" system, with fresh air rates to each tenancy automatically varied to maintain a constant $CO_2$ level within the space. Fresh air rates are to be varied through variable air volume (VAV) dampers located within each tenancy, with the supply volumes of the main air handling units modulated through variable speed drives fitted to all fans.

Openable panels are provided within the façade to compliment the mechanical ventilation system serving the office floor levels and provide the opportunity for "mixed-mode" free cooling when external conditions permit. A monitoring and control system including contactors on each operable panel and a roof mounted weather station will be provided to encourage users to utilise the operable panels when external environmental conditions permit, and prevent energy wastage by adapting setpoints and inhibiting the operation of the active heating & cooling systems where appropriate

## 5.6 Overheating Risk Analysis

Building Regulations requires the overheating risk analysis to comply with Criterion 3 of Part L1A and L2A, as summarised in the BRUKL and SAP output reports provided as appendices to this document. This relates to limiting the effects of heat gains in summer.

In addition, the Publication London Plan requires new developments to assess its overheating risk against TM52 and TM59 guidance produced by The Chartered Institution of Building Services Engineers (CIBSE).

CIBSE TM59 and TM52 have been used for the analysis of the domestic and non-domestic developments respectively. In addition, TM49 guidance and datasets have also been used to ensure that consideration has been given for designing for the climate it will experience over its design life.

Assumptions used in the dynamic building thermal model are provided in Table 5.1. Screenshots from the models are provided on the following page.

*Table 5.1 – Overheating Assessment Assumptions*

| Type of Assumption | Reported Information Domestic | Reported Information Non-Domestic |
|---|---|---|
| Dynamic overheating analysis software used | IES Virtual Environment Version 2019.1.0.0 | IES Virtual Environment Version 2019.1.0.0 |
| Site location | London Weather Centre | London Weather Centre |
| Site orientation | As per existing building orientations | As per existing building orientations |
| Weather file used | DSY1 (London, year 1989, 50 percentile), DSY2 (London, year 2003, 50 percentile), DSY3 (London, year 1976, 50 percentile) | SY1 (London, year 1989, 50 percentile), DSY2 (London, year 2003, 50 percentile), DSY3 (London, year 1976, 50 percentile) |
| Internal gains | Refer to raw data results provided separately, in accordance with TM59 | Refer to raw data results provided separately, in accordance with TM592 |
| Occupancy profiles | Refer to raw data results provided separately, in accordance with TM59 | Refer to raw data results provided separately, in accordance with TM52 |
| Thermal elements performance (U-values and glazing g-values) | As per Section 4 | As per Section 4 |
| Shading features (i.e. blinds, overhangs etc.) | Solar control glazing, Recessed windows, surrounding buildings shading lower levels | Low g-value, recessed windows, surrounding buildings shading lower levels |
| Thermal mass details | Lightweight | Lightweight |
| Ventilation strategy* | Decentralised mechanical systems refer to Section 5.5 | Centralised and Decentralised mechanical systems refer to Section 5.5 |
| Cooling | Via Air Source Heat Pumps (where applicable) | Via Air Source Heat Pumps |

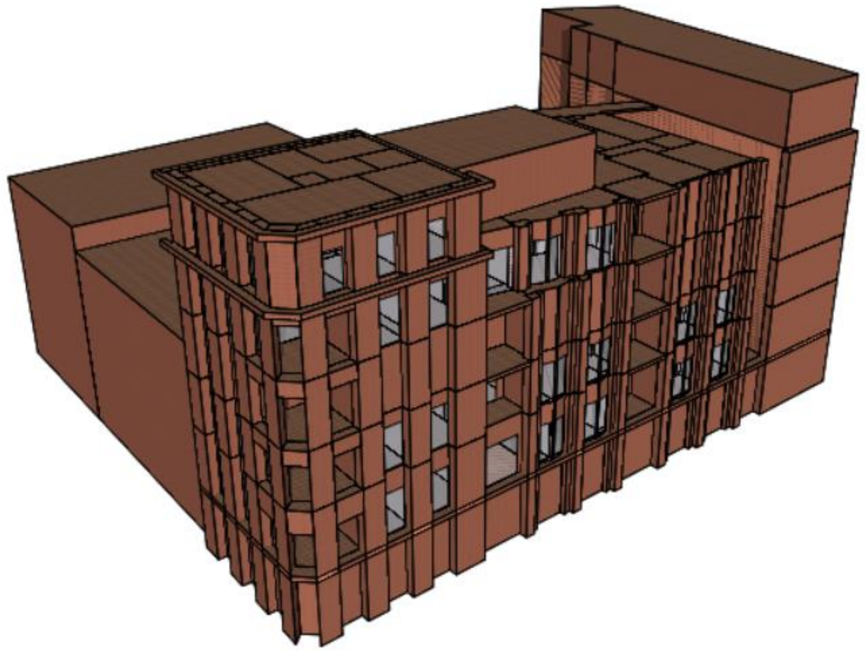

*Figure 5.1- 3D model view of New Oxford Street block (West Central Street).*

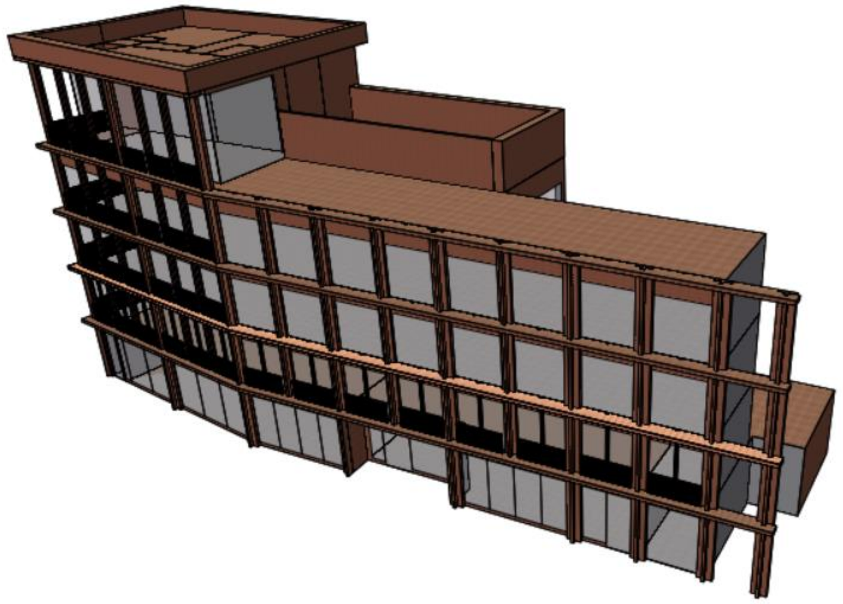

*Figure 5.3 -3D model view of Vine Lane.*

*Figure 5.2 - 3D model view of High Holborn block.*

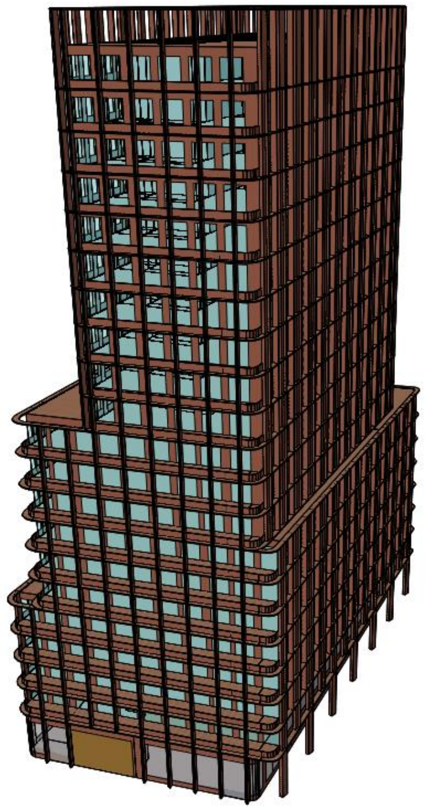

*Figure 5.4 - 3D model view of Museum Street.*

## 5.7 Risk Analysis Results

The Applicant has assessed the risk of overheating according to the CIBSE guide TM59 and TM52 via a dynamic thermal modelling. The overheating risk analysis has been assessed via a dynamic thermal model using DSY1 weather file (high emissions, 50% percentile scenario). Additional testing has been undertaken using DSY2 (very intense single warm spell) and DSY3 (prolonged period of sustained warmth).

In the following tables, the values highlighted in red show the values failing the overheating criteria. Refer to the full overheating raw data results & overheating report provided in Appendix D.

### 5.7.1 Domestic New Build

Sample flats have been modelled for the residential units.

The modelling outputs show that the apartments in West Central Street fail only Criterion 2, out of the 3 criteria (as shown in

Table 5.2). The mixed mode ventilation strategy and the dual aspect of the dwellings have contributed to reducing the overheating risk as far as possible, and subsequently the cooling demand during peak summer months.

*Table 5.2 - West Central Street - Scenario 1 - DSY 1 1989 London Weather Centre Weather File Baseline Future Projection to 2020*

| Zones | Criterion 1 - Comfort Temp Exceedance | Criterion 2 - Severity of Overheating | Criterion 3 – | Overall |
|---|---|---|---|---|
| | | | Max Temp Exceedance | Fail /Pass |
| 101 Open Plan Living/Kitchen | 1.7 | 24 | 3 | Pass |
| 101 Double Bedroom | 0.8 | 23 | 3 | Pass |
| 101 Single Bedroom | 0.8 | 23 | 3 | Pass |
| 103 Open Plan Living/Kitchen | 1.3 | 20 | 3 | Pass |
| 103 Single Bedroom | 1 | 28 | 4 | Pass |
| 103 Double Bedroom | 0.9 | 25 | 4 | Pass |
| 201 Open Plan Living/Kitchen | 1.8 | 25 | 4 | Pass |
| 201 Double Bedroom | 0.8 | 22 | 3 | Pass |
| 201 Single Bedroom | 0.8 | 24 | 4 | Pass |
| 203 Open Plan Living/Kitchen | 1.4 | 22 | 3 | Pass |
| 203 Single Bedroom | 1 | 31 | 4 | Pass |
| 203 Double Bedroom | 0.9 | 26 | 4 | Pass |
| 102 Double Bedroom | 1 | 26 | 4 | Pass |
| 102 Open Plan Living/Kitchen | 1.4 | 23 | 3 | Pass |
| 202 Double Bedroom | 0.8 | 23 | 3 | Pass |
| 202 Open Plan Living/Kitchen | 1.7 | 25 | 4 | Pass |
| 402 Double Bedroom | 1 | 29 | 4 | Pass |
| 402 Open Plan Living/Kitchen | 1.8 | 29 | 4 | Pass |
| 401 Single Bedroom | 0.9 | 26 | 4 | Pass |
| 401 Kitchen | 1.7 | 25 | 4 | Pass |
| 401 Living | 2 | 29 | 4 | Pass |
| 401 Double Bedroom | 1.6 | 29 | 4 | Pass |
| 401 Single Bedroom | 1 | 29 | 4 | Pass |
| 401 Single Bedroom | 1 | 26 | 4 | Pass |
| 401 Double Bedroom | 1.2 | 29 | 4 | Pass |

The modelling outputs show that the apartments in High Holborn fail only Criterion 2, out of the 3 criteria in 7 instances, but fail more than 2 criteria in 4 instances (Table 5.3), if considered fitted with openable windows. The same areas, modelled with non-openable windows due to noise and air pollution, would fail all three criteria, as shown in Table 5.4, therefore to ensure occupant comfort during hot weather peaks, mechanical cooling is proposed.

*Table 5.3 – High Holborn - Scenario 1 - DSY 1 - 1989 London Weather Centre Weather File Baseline Future Projection to 2020, windows open*

| Zones | Criterion 1 - Comfort Temp Exceedance | Criterion 2 - Severity of Overheating | Criterion 3 – Max Temp Exceedance | Overall Fail /Pass |
|---|---|---|---|---|
| G1 1B/2P Kitchen | 2.7 | 31 | 4 | Pass |
| G2 1B/2P Kitchen | 2.2 | 30 | 4 | Pass |
| G2 1B/2P Living | 2.4 | 29 | 4 | Pass |
| G3 1B/2P Kitchen | 2.2 | 30 | 4 | Pass |
| G3 1B/2P Living | 2.5 | 29 | 4 | Pass |
| G4 3B/5P Bedroom | 1.8 | 31 | 4 | Pass |
| G4 3B/5P Bedroom | 1.8 | 31 | 4 | Pass |
| G2 1B/2P Bedroom | 1.8 | 32 | 4 | Pass |
| G3 1B/2P Bedroom | 1.9 | 32 | 4 | Pass |
| G1 1B/2P Living | 3.4 | 34 | 5 | Fail |
| G4 3B/5P Master Bedroom | 1.9 | 34 | 5 | Fail |
| G1 1B/2P Bedroom | 2.1 | 35 | 5 | Fail |
| G5 3B/5P Kitchen/Dining/Living | 4 | 35 | 5 | Fail |

*Table 5.4 – High Holborn - Scenario 1 - DSY 1 - 1989 London Weather Centre Weather File Baseline Future Projection to 2020 High 50 percentile, windows closed*

| Zones | Criterion 1 - Comfort Temp Exceedance | Criterion 2 - Severity of Overheating | Criterion 3 – Max Temp Exceedance | Overall Fail /Pass |
|---|---|---|---|---|
| G1 1B/2P Kitchen | 90 | 182 | 17 | Fail |
| G1 1B/2P Living | 84.8 | 198 | 20 | Fail |
| G2 1B/2P Kitchen | 89.2 | 168 | 16 | Fail |
| G2 1B/2P Living | 87.3 | 183 | 18 | Fail |
| G3 1B/2P Kitchen | 92.8 | 174 | 16 | Fail |
| G3 1B/2P Living | 91.9 | 187 | 19 | Fail |
| G4 3B/5P Master Bedroom | 91.8 | 324 | 21 | Fail |
| G4 3B/5P Bedroom | 97.5 | 329 | 18 | Fail |
| G4 3B/5P Bedroom | 97.9 | 322 | 19 | Fail |
| G1 1B/2P Bedroom | 87.3 | 304 | 17 | Fail |
| G2 1B/2P Bedroom | 88.5 | 293 | 16 | Fail |
| G3 1B/2P Bedroom | 92.6 | 299 | 17 | Fail |
| G5 3B/5P Kitchen/Dining/Living | 96.4 | 230 | 25 | Fail |

### 5.7.2 Museum Street

The modelling outputs show that Museum Street has failed all 3 criteria of the overheating analysis, as shown in Table 5.5. The mixed mode ventilation strategy has contributed to reducing the overheating risk as technically possible, and subsequently the cooling demand during peak summer months. However, to ensure occupants' comfort during hot weather conditions, mechanical cooling is proposed.

*Table 5.5 - Scenario 1 - DSY 1 - 1989 London Weather Centre Weather File Baseline Future Projection to 2020*

| Zones | Criterion 1 - Comfort Temp Exceedance | Criterion 2 - Severity of Overheating | Criterion 3 – Max Temp Exceedance | Overall Fail /Pass |
|---|---|---|---|---|
| G3 Office | 20 | 29 | 4 | Fail |
| G6 Office | 23.4 | 35 | 5 | Fail |
| G9 Office | 24.1 | 42 | 6 | Fail |
| G19 Office | 43.5 | 54 | 7 | Fail |
| G20 Office | 44 | 70 | 9 | Fail |

### 5.7.3 Vine Lane

The modelling outputs show that Vine Lane sample spaces have failed 2 of the 3 criteria and 3 out 3 criteria in one instance (Table 5.6). The mixed mode ventilation strategy has contributed to reducing the overheating risk as far as possible, and subsequently the cooling demand during peak summer months. However, to ensure occupant comfort during hot weather peaks, mechanical cooling is proposed.

*Table 5.6 - Scenario 1 - DSY 1 - 1989 London Weather Centre Weather File Baseline Future Projection to 2020 High 50 percentile, windows closed*

| Zones | Criterion 1 - Comfort Temp Exceedance | Criterion 2 - Severity of Overheating | Criterion 3 – Max Temp Exceedance | Overall Fail /Pass |
|---|---|---|---|---|
| G1 Office | 11.7 | 20 | 3 | Fail |
| G2 Office | 15.5 | 27 | 3 | Fail |
| G3 Office | 18.9 | 43 | 5 | Fail |
| G0 Cafe/Bar | 20.4 | 17 | 3 | Fail |
| G0 Reception | 21.2 | 18 | 3 | Fail |

## 5.8 Active Cooling Strategy

The applicant has followed the cooling hierarchy set out in the London Plan to reduce as far as practicable the demand for active cooling through passive measures. Where it has not been possible to mitigate all overheating risks through passive design measures, or where external environmental conditions make opening windows undesirable, cooling is proposed to ensure occupant health and comfort during hot weather events.

### 5.8.1 Domestic – West Central Street and High Holborn

In both High Holborn and the New Oxford Street block it has not been possible to mitigate all overheating risks through passive design measures due to limited use of openable windows, dictated by both noise and air quality; subsequently, active cooling is proposed in these buildings to ensure occupant health and comfort when required.

The dwellings in the remaining blocks of West Central Street pass the TM59 overheating analysis through passive measures alone, aided by shading from adjacent buildings, and therefore cooling is not proposed to these units.

### 5.8.2 Non-Domestic – Museum Street & Vine Lane

Museum Street and Vine Lane will be provided with ASHP's connected to a condenser loop system providing a heat source/sink for local water cooled heat pumps located throughout. The condenser loop system will serve all areas in both Museum Street and Vine Lane.

The advantages of this system as compared to ASHP generating LTHW & CHW directly include:

- The opportunity to locally recover heat between different tenancies
- The opportunity to recover any waste heat into the scheme
- Reduced annual primary energy requirement, with associated reductions in carbon emissions and running costs
- Reduced heat losses from vertical and horizontal distribution pipework
- Reduced extent of roof plant

The disadvantages of the proposed solution as compared to ASHP generating LTHW include:

- Increased system complexity, with associated increase in capital and maintenance costs
- Larger risers required to house water cooled heat pumps

An array of modular air-to-water heat pumps are proposed to be located on the Vine Lane block roof. The heat pumps are to be mounted within a bespoke acoustic enclosure within the architectural plant screen, which will include acoustic louvres to all openings in the vertical plant screen, and a "roof" built up from intake and discharge attenuators.

It is anticipated that all heating and cooling (including cooling for comms rooms etc.) associated with the office areas of 1 Museum Street will be via the condenser loop system.

## 5.9 Cooling Demand

The cooling demand of the proposed development has also been calculated in order to provide a comparison against the notional cooling demand. The calculations show that the actual cooling demand for domestic and non-domestic properties is less than the notional cooling demand for domestic and non-domestic benchmark, as shown in Table 5.7 and Table 5.8.

*Table 5.7 –Cooling Demand – Domestic*

| | Area Weighted Average Cooling Demand (MJ/m$^2$) | Total Area Weighted Average Cooling Demand (MJ/year ) |
|---|---|---|
| Actual | 19.07 | 8798 |
| Notional | 19.71 | 9093 |

*Table 5.8 – Cooling Demand – Non-Domestic*

| | Area Weighted Average Cooling Demand (MJ/m$^2$) | Total Area Weighted Average Cooling Demand (MJ/year ) |
|---|---|---|
| Actual | 33.67 | 809,447 |
| Notional | 48.92 | 1,176,284 |

# 6 Heating Infrastructure (Be Clean)

## 6.1 Heating Hierarchy

The heating strategy has been developed following the steps of The Publication London Plan heating hierarchy, as per Table 6.1.

*Table 6.1 – Hierarchy for selecting an energy system*

| Hierarchical Element | Explanation |
|---|---|
| 1. Connection to an area wide heat networks | Where proposed developments are located near to existing or planned networks, connection must be prioritised (see paragraph 10.5 onwards). |
| 2. Communal heating system | Site-wide heat network<br>Where proposed developments are located in areas of decentralised energy potential, but no heat networks currently exist or are planned, developers should provide a site-wide heat network served by a single energy centre to future proof the development for easy connection to a wider heat network in the future. |
| | Building-level heating system<br>Appropriate for single building applications or low density developments with residential blocks, where no district heating networks are planned or feasible. |
| 3. Individual heating system | Appropriate for low density individual housing, where no district heating networks are planned or feasible, and where evidence is provided that a site-wide heat network is uneconomic.<br>Direct electric heating will not be accepted in the majority of cases as it will not provide any on-site carbon savings in line with the energy hierarchy and it is likely to result in higher energy bills. Direct electric systems are also not compatible with connection to district heating networks. |

## 6.2 Step 1: Connection to area wide heat network

According to the London Heat Map (Figure 6.1), there are currently no existing (red-orange line) District Heating Networks (DHN) identified within 1000m distance. The map does indicate that there are two proposed DHNs (orange line), however both are proposed to be further than 1000m from the site.

Should a DHN in close proximity of the site become available in the future, the Museum Street site heating plant room (i.e. energy centre) is located at basement level on the perimeter of the site and has been sized to accommodate plate heat exchangers and associated equipment (in place of the existing heating plant which would be removed), thereby facilitating connection to a heat network in the future.

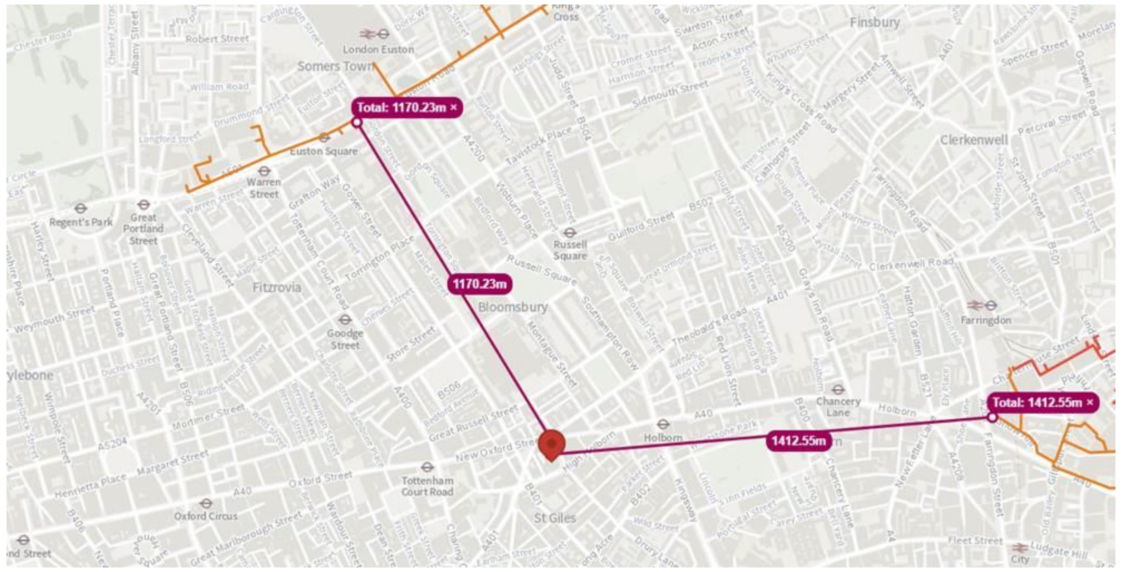


*Figure 6.1 – Proximity of the Site to a proposed heat network, as indicated by the London Heat Map*

## 6.3 Step 2: Communal Heating System - Site-Wide Heat network

It is proposed that the entire development is fossil-fuel free for all heating and hot water generation. As a result, electric heat pumps are proposed as the primary source of heat for all sites within the development.

The site location and limited extent of basement piling works mean that a ground source or water source heat pump based solution is not feasible, and therefore an air source heat pump led heating and hot water solution is proposed throughout.

A single energy centre serving the whole site has been fully investigated. However, this was deemed unfeasible and not appropriate for this development due to the reasons described in sections 6.3.1 and 6.3.2 below.

### 6.3.1 Non-Domestic – Museum Street & Vine Lane

Museum Street and Vine Lane will be provided with ASHPs connected to a condenser loop system providing a heat source/sink for local water cooled heat pumps located throughout. The condenser loop system will serve all areas in both Museum Street and Vine Lane.

The advantages of this system as compared to ASHP generating LTHW & CHW directly include:

- The opportunity to locally recover heat between different tenancies
- The opportunity to recover any waste heat into the scheme

- Reduced annual primary energy requirement, with associated reductions in carbon emissions and running costs
- Reduced heat losses from vertical and horizontal distribution pipework
- Reduced extent of roof plant

The disadvantages of the proposed solution as compared to ASHP generating LTHW include:

- Increased system complexity, with associated increase in capital and maintenance costs
- Larger risers required to house water cooled heat pumps

A dedicated heat distribution plantroom located at basement (B2) level will circulate condenser water throughout Museum Street and Vine Lane via vertical risers located in each circulation core.

As part of the CAT A future fit out, dedicated water cooled heat pumps are to be provided for each tenancy split at each floor level. Secondary distribution from the water-cooled heat pumps is proposed to be of the variable refrigerant flow (VRF) type utilising low GWP R32 refrigerant, however the system is flexible and allows for a wide range of water source heat pump technology to be used, including heat recovery VRF, hybrid VRF or reversible water-to-water. Each tenant connection will be metered with an MID approved energy meter connected to the site wide AMR system for billing purposes.

It is anticipated that all heating and cooling (including cooling for comms rooms etc.) associated with the office areas of Museum Street will be via the condenser loop system.

The Museum Street retail units will be provided with dedicated metered capped connections to the condenser loop system to allow the tenant to install their own water source heat pump system, similar to the office floors. This scenario has been modelled for the energy assessment.

Note: Due to the scale of the site extracts from the building services drawings and schematics showing how the systems and distribution will operate are provided within this Statement. The full drawings are provided in Appendix H and can be viewed as a whole.

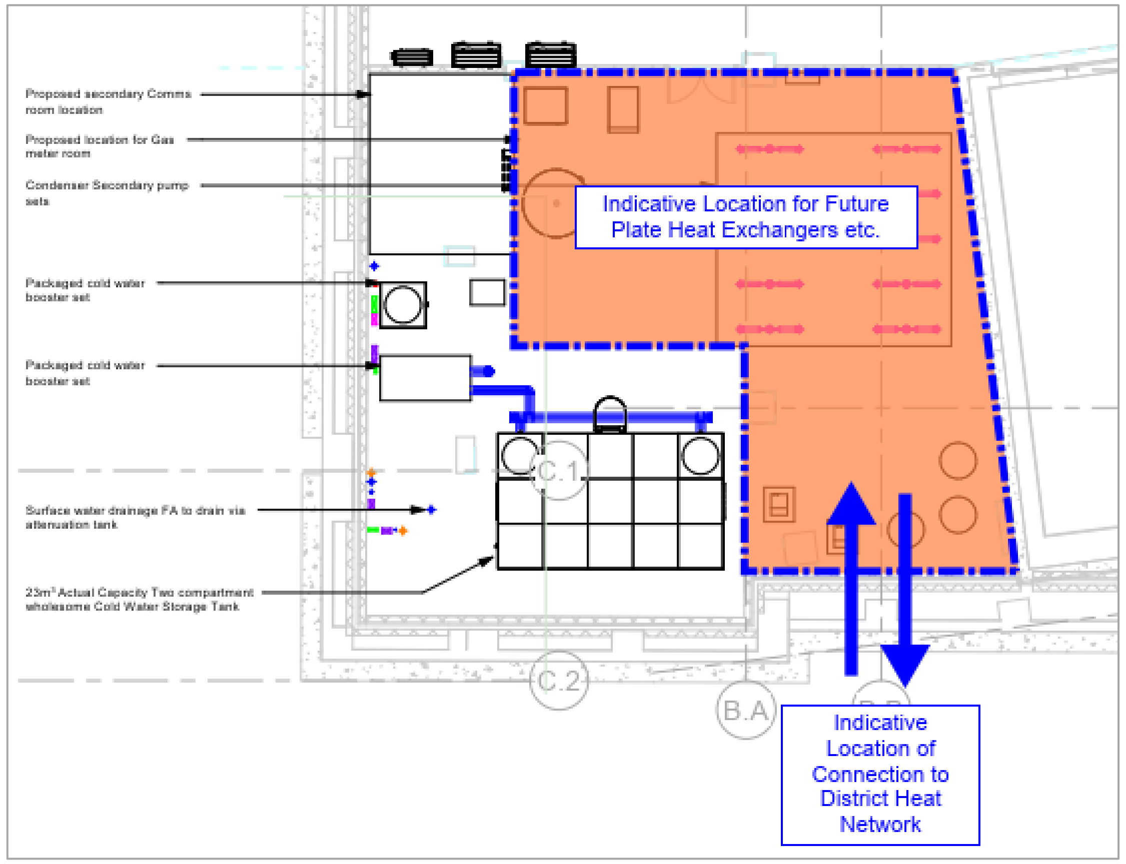


*Figure 6.2 – Museum Street Heating plant room (energy centre) location*

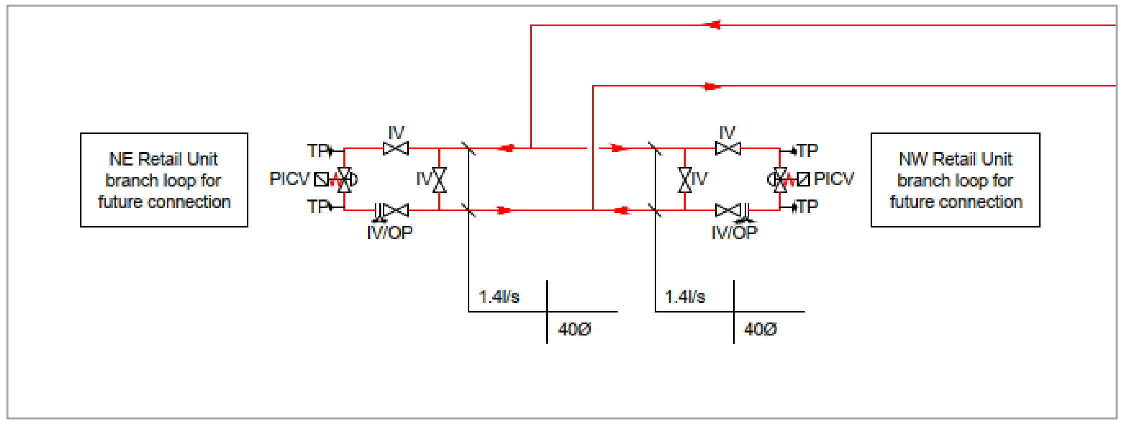


*Figure 6.3 – Onsite heat distribution network*

### 6.3.2 Domestic – West Central Street and High Holborn

An assessment has been carried out to evaluate whether it is feasible to serve West Central Street & High Holborn from the energy centre in 1 Museum Street. However, the following disadvantages have been identified:

- The two buildings have very different heating & hot water demand profiles, with the peak loads being non concurrent. This would imply running the energy centre at partial load during weekends, with a likely reduction in central system efficiencies.
- Due to the low density of the dwellings in West Central Street, the heat losses and auxiliary energy requirements would increase significantly when compared to the proposed system.
- It is also worth noting that the site lies in a heritage area. The location and layout of the condensers has been coordinated with the architects to minimise the louvres height at roof level, reducing the visual impact on the development; adopting a communal air to water heat pump would imply increasing the height of the louvres, with a more prominent impact on the elevation.

Therefore, the proposed strategy for Heating and Hot Water to West Central Street and High Holborn is to have a decentralised Air Source Heat Pump (ASHP) solution comprising a dedicated ASHP for each dwelling providing LTHW heating and domestic hot water. This system gives the following advantages:

- Reduced heat losses and auxiliary power consumption from vertical and horizontal LTHW distribution
- No centralised Landlord distribution plant or system, significantly reducing Landlord management and maintenance burden assuming plant is demised to tenants
- Heat is generated using the dwelling's metered electrical supply, meaning that the Landlord is not responsible for the sale of heat to their tenants
- Decentralised plant is smaller and can be located closer to the end user
- Energy efficiency is comparable to a centralised solution and can be better due to the lower heat losses and auxiliary power consumption

A wet underfloor heating system is proposed to deliver heat throughout all dwellings (with the exception of the market units in New Oxford Street), with electric type underfloor heating proposed to all wet rooms.

Spatial provision has also been allocated within West Central Street for a heating plant room and heating risers within each core to future proof the scheme and allow WCS to be connected to either 1MS or any other future DHN's in the area.

The WCS spatial allowance for future connections is also sized to accommodate the retail units heating/hot water loads and has been located adjacent to West Central Street to provide a short route for the hypothetical future connection.

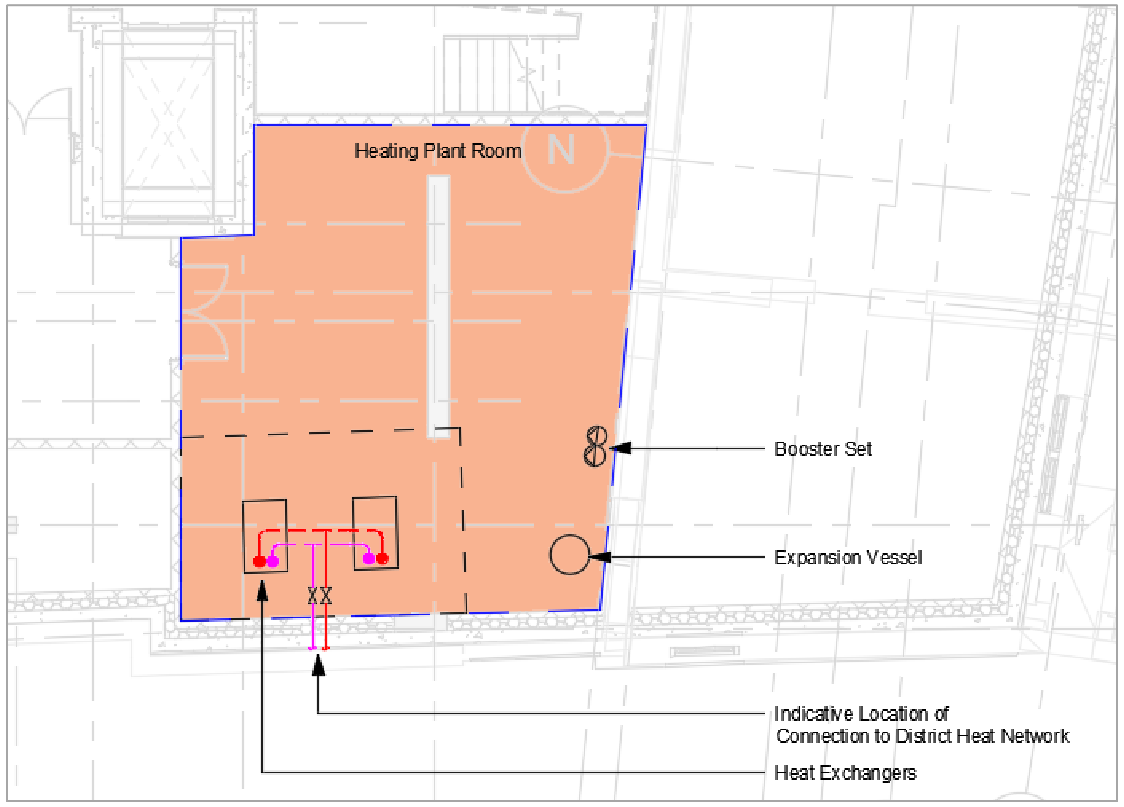


*Figure 6.4 - West Central Street Heating plant room location*


*Figure 6.5 - West Central Street heating risers*

West Central Street is a relatively small development that comprises a mixture of both existing and new buildings, with an existing communal basement (with very limited heights in certain areas); existing foundations are intended to be retained. Adopting a Ground Source Heat Pump solution would involve a series of additional challenges, including (and not limited to) the correct location to the boreholes, allowing for a suitable distance among them and their coordination with the existing buildings. Furthermore, the size of the GSHP system that could be installed on site would not be sufficient to cover the energy requirements for the whole development. It is therefore envisaged that the adoption of a GSHP is not technically and commercially feasible.

### 6.3.3 Heat Network Infrastructure

The heat distribution infrastructure has been designed to accord with relevant CIBSE and Heat Pump Association (HPA) guidance, with reference to relevant aspects of the CIBSE *Heat Networks: Code of Practice for the UK*. The system and infrastructure will be managed, together with other building services, by a dedicated facilities management team who will be based in the building.

### 6.3.4 Air Quality Impact

As the proposed development is fossil fuel free in terms of heating and hot water and will be served by air source heat pumps, the impact on the local air quality has been minimised. An air quality neutral assessment has been carried out by Arup and the results show that predicted emissions from the Proposed development are within the limits set by GLA. Table 6.2 shows the total fuel consumptions as calculated by Scotch Partners. The emissions are related only to the use of the heat pumps.

*Table 6.2 – Air Quality Impacts*

| Energy Source | Total Fuel Consumption (MWh/Year) |
|---|---|
| Grid Electricity | 576.33 |
| Gas boilers (communal/individual) | n/a |
| Gas CHP | n/a |
| Connection to existing DH network | n/a |
| Other gas use | n/a |

# 7 Renewable Energy (Be Green)

## 7.1 Renewable Energy Technologies Options Appraisal

The Publication London Plan requires development to maximise opportunities for renewable energy technologies. A high-level options appraisal has been carried out to understand which technologies are viable for the proposed development, and which are not.

Certain technology options have been automatically discounted due to the lack of available resource. These are anaerobic digestion, mid and large-scale wind, and hydro. The benefits and constraints for the remaining renewable technologies are summarised in Table 7.1 below.

*Table 7.1 - Feasibility Assessment of Renewable Technologies Application to the Proposed Development*

| Technology | Benefits | Constraints |
|---|---|---|
| **Biomass**<br>Centralised biomass boilers providing heating and hot water to all areas with condensing gas boiler backup | - Biomass is considered a carbon neutral fuel.<br>- Biomass boiler efficiency is approaching that of an equivalent natural gas boiler. | - Large space requirements for fuel store and buffer tank.<br>- Access required for regular fuel deliveries and ash removal.<br>- Reliable fuel source required.<br>- Increased quantities of $NO_x$, $SO_x$ and particulates $PM_{10}$ compared to natural gas.<br>- Suitable for a centralised system only |
| **Ground Source Heat Pump (GSHP)**<br>Centralised GSHP generating warm water for heating to all areas. Hot water via warm water pre-heat and electric immersion | - GSHP system can provide both heating and cooling.<br>- Higher efficiencies than equivalent gas boiler system.<br>- Qualifies for the RHI scheme (noting that the scheme is due to end) | - Initial explorative investigation required for vertical collectors to determine heat yield with no guarantee of viability.<br>- Exploratory work complex and costly.<br>- Spatial implications for accommodating boreholes at appropriate locations across the site. |
| **Air Source Heat Pump (ASHP)**<br>Decentralised ASHP generating warm water for heating to all areas plus domestic hot water | - ASHP provide both heating and cooling, if required to tackle overheating within flats<br>- Easy to install and maintain compared to GSHPs<br>- Lower cost than GSHP | - Extensive external plant space (must be in free air), visual implications for external plant.<br>- Night time noise emissions and impact on neighbouring properties.<br>- Functionality limitations with regards to outdoor temperature |
| **Solar Hot Water**<br>Roof mounted, centralised system providing HWS pre-heat | - Can offset a proportion of the Development's heat demand<br>- Simple installation and maintenance | - Added system complexity.<br>- Reduces roof space available.<br>- Competes with other roof uses.<br>-Increases riser space requirements. |
| **Solar Photovoltaics**<br>Roof mounted / façade mounted centralised system with single inverter fed to landlord supply with provision for export of excess of instantaneous demand | - Low maintenance<br>- Easy to integrate within roof design<br>- Feed in tariff available<br>- Minimum internal plant requirement | - Increased cost with higher efficiency modules<br>- Large roof areas required to achieve notable $CO_2$ reductions.<br>- Competes with other roof uses<br>- Not suitable for installation on shaded roofs. |

## 7.2 Proposed Technologies

Based on this appraisal, and to maximise $CO_2$ savings and minimise the impact of the proposed development on local air quality, the proposed energy strategy is based on Air Source Heat Pumps (ASHP) providing heating and hot water.

### 7.2.1 ASHP Performance Details

Details of the ASHP performance are provided below for the 4 main sites within the development. Note that these are subject to change as the design develops at RIBA Stage 4 Technical Design.

#### 7.2.1.1 Domestic – West Central Street

*Table 7.2 –System details*

| Parameter | Value |
|---|---|
| Estimate of heating energy provided by the ASHP | 125.59 MWh |
| Estimate of cooling energy provided by the ASHP | 1.03 MWh |
| Electricity the heat pump would require | 72.13 MWh |
| SCOP used in the energy modelling | SCOP heating (area weighted average) 2.57<br>SCOP hot water 1.7 |
| SEER used in the energy modelling | 5.4 (NOS apartments only) |

SCOP and SEER are calculated by the SAP software (refer to Appendix E). The design is currently at Stage 3 and we expect the final SCOP / SEER values to potentially change once detailed profiling is undertaken at Stage 4 design. This approach aligns with guidance *BSRIA BG 6 (2018) Design Framework for Building Services*.

The domestic hot water generation is generated via air source heat pumps. Each apartment is provided with a dedicated hot water cylinder.

The building services design allows for extensive insulation to the distribution pipework. This will form part of the final specification and contract with the principal contractor (i.e. through Employer's Requirements). In this way, the difference between the expected heat source temperature and the heat distribution system temperature will be minimised to ensure the system runs efficiently.

The estimated $CO_2$ savings that may be realised through the use of ASHPs is 8100 $kgCO_2$/annum (based on the Stage 2 design assumptions and modelling).

#### 7.2.1.2 Domestic – High Holborn

*Table 7.3 –System details*

| Parameter | Value |
|---|---|
| Estimate of heating energy provided by the ASHP | 23.46 MWh |
| Estimate of cooling energy provided by the ASHP | 2.05 MWh |
| Electricity the heat pump would require | 10.18 MWh |
| SCOP used in the energy modelling | SCOP heating (area weighted average) 2.91<br>SCOP hot water (area weighted average) 1.83 |
| SEER used in the energy modelling | 5.4 |

SCOP and SEER are calculated by the SAP software (refer to Appendix E). The design is currently at Stage 3 and we expect the final SCOP / SEER values to potentially change once detailed profiling is undertaken at Stage 4 design. This approach aligns with guidance *BSRIA BG 6 (2018) Design Framework for Building Services*.

The domestic hot water generation is generated via air source heat pumps, supported by domestic hot water cylinders.

The building services design allows for extensive insulation to the distribution pipework. This will form part of the final specification and contract with the principal contractor (i.e. through Employer's Requirements). In this way, the difference between the expected heat source temperature and the heat distribution system temperature will be minimised to ensure the system runs efficiently.

The estimated $CO_2$ savings that may be realised through the use of ASHPs is 2,100 $kgCO_2$/annum (based on the Stage 2 design assumptions and modelling).

#### 7.2.1.3 Non-Domestic – Museum Street

*Table 7.4 –System details*

| Parameter | Value |
|---|---|
| Estimate of heating energy provided by the ASHP | 174.5 MWh* |
| Estimate of cooling energy provided by the ASHP | 162.1 MWh |
| Electricity the heat pump would require | 119.3 MWh* |
| SCOP used in the energy modelling | 3.5 |
| SEER used in the energy modelling | 3.5 (main system) and 6.7 (comms rooms) |

*DHW energy provided and consumed by ASHP is not included

SCOP and SEER are based on data provide via manufacturer's information (refer to Appendix 10.3). The design is currently at Stage 3 and we expect the final SCOP / SEER values to potentially change once detailed profiling is undertaken at Stage 4 design. This approach aligns with guidance *BSRIA BG 6 (2018) Design Framework for Building Services*.

The building services design allows for extensive insulation to the distribution pipework. This will form part of the final specification and contract with the principal contractor (i.e. through Employer's Requirements). In this way, the difference between the expected heat source temperature and the heat distribution system temperature will be minimised to ensure the system runs efficiently.

The estimated $CO_2$ savings that may be realised through the use of ASHPs is 50,400 $kgCO_2$/annum (based on the Stage 2 design assumptions and modelling).

#### 7.2.1.4 Non-Domestic – Vine Lane

*Table 7.5 –System details*

| Parameter | Value |
|---|---|
| Estimate of heating energy provided by the ASHP | 24.8 MWh |
| Estimate of cooling energy provided by the ASHP | 10.1 MWh |
| Electricity the heat pump would require | 19 MWh |
| SCOP used in the energy modelling | 3.5 |
| SEER used in the energy modelling | 3.5 (main system) and 6.7 (comms rooms) |

SCOP and SEER are based on data provided via manufacturer's information (refer to Appendix E). The design is currently at Stage 3 and we expect the final SCOP / SEER values to potentially change once detailed profiling is undertaken at Stage 4 design. This approach aligns with guidance *BSRIA BG 6 (2018) Design Framework for Building Services*.

The building services design allows for extensive insulation to the distribution pipework. This will form part of the final specification and contract with the principal contractor (i.e. through Employer's Requirements). In this way, the difference between the expected heat source temperature and the heat distribution system temperature will be minimised to ensure the system runs efficiently.

The estimated $CO_2$ savings that may be realised through the use of ASHPs is 3,000 $kgCO_2$/annum (based on the Stage 2 design assumptions and modelling).

#### 7.2.1.5 Heat Pump Selection and Costs to Users

The building services design allows for extensive insulation to the distribution pipework. This will form part of the final specification and contract with the principal contractor (i.e. through Employer's Requirements). In this way, the difference between the expected heat source temperature and the heat distribution system temperature will be minimised to ensure the system runs efficiently.

The estimated $CO_2$ savings that may be realised through the use of ASHPs is 64,700 $kgCO_2$/annum (based on the Stage 3 design assumptions and modelling). Figure accounts for all savings achieved across the whole development including retail spaces.

The Applicant confirms that that the final heat pump selection will comply with the minimum performance standards as set out in the Enhanced Capital Allowances (ECA) product criteria for the relevant ASHP technology.

The Applicant confirms that the final heat pump selection will comply with other relevant issues as outlined in the Microgeneration Certification Scheme Heat Pump Product Certification Requirements document.

The building services strategy is based on selecting the most efficient systems. This will help to ensure that costs to the end users will be minimised as far as possible. Due to the technical detail of the ASHP heating plant systems not being finalised until Stage 4 technical design, Whole Life Costing (WLC) to determine actual costs to consumers are not available at this stage. However, WLC in accordance with the GLA energy assessment guidance would be undertaken during Stage 4 design with the results provided to Camden and GLA once available, and ideally when input from an energy services operator can be obtained.

The Applicant confirms that the performance of the heat pump system will be monitored post-construction to ensure it is achieving the expected performance approved during planning. End-users will be supplied with regular information to control and operate the system via the control and monitoring system.

### 7.2.2 Solar PV

The use of PV has been investigated across the development. Due to the other essential uses of available roof space and/or overshading, it has been determined that there is no suitable space available for PV panels, as shown by the roof plans provided below. Modelling has shown that the proposed Museum Street building would shade the roofs of Vine Lane and West Central Street, whilst some roofs are allocated to other uses (i.e. terraces and mechanical equipment on Museum Street, Vine Lane and High Holborn).


*Figure 7.1 - West Central Street roofs, overshaded by 1 Museum Street*

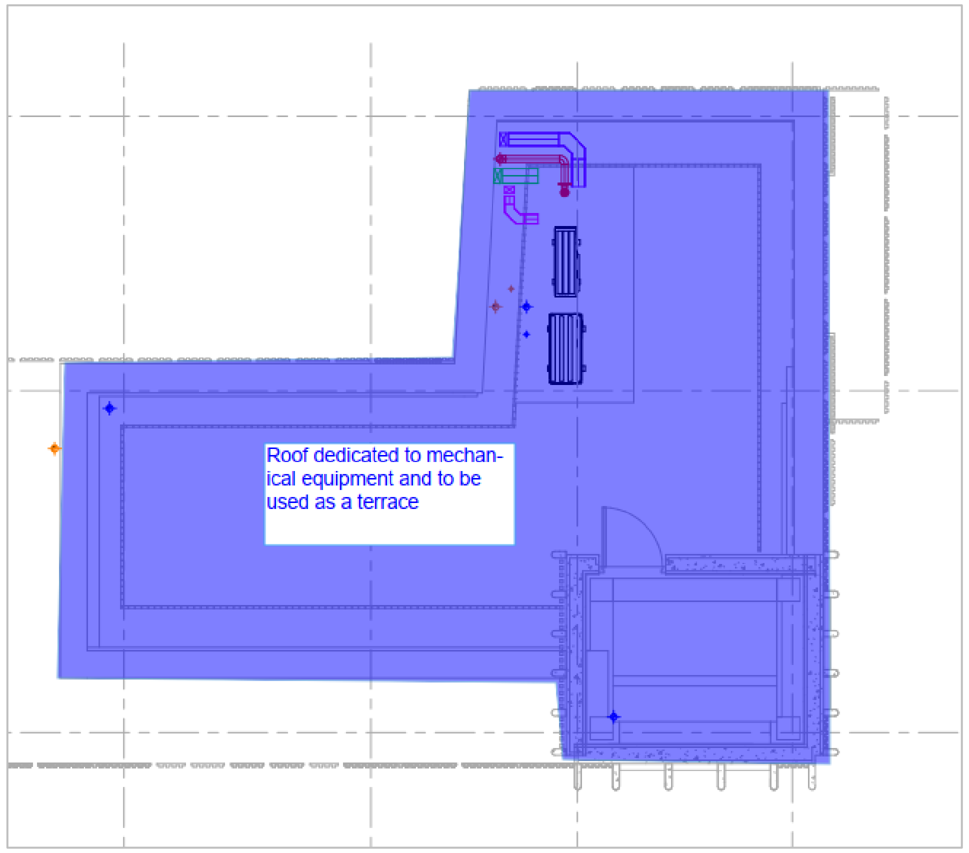


*Figure 7.2- High Holborn roof, allocated to mechanical equipment*

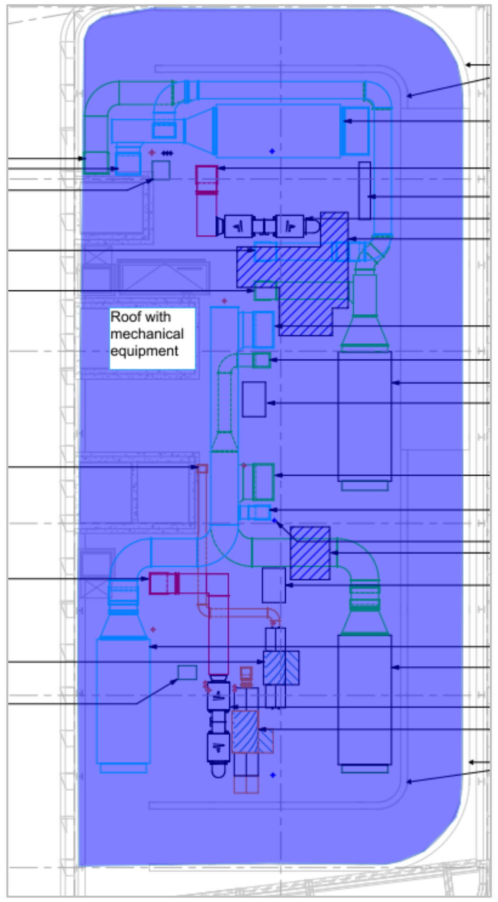


*Figure 7.3 - 1 Museum Street roof, allocated to mechanical equipment*

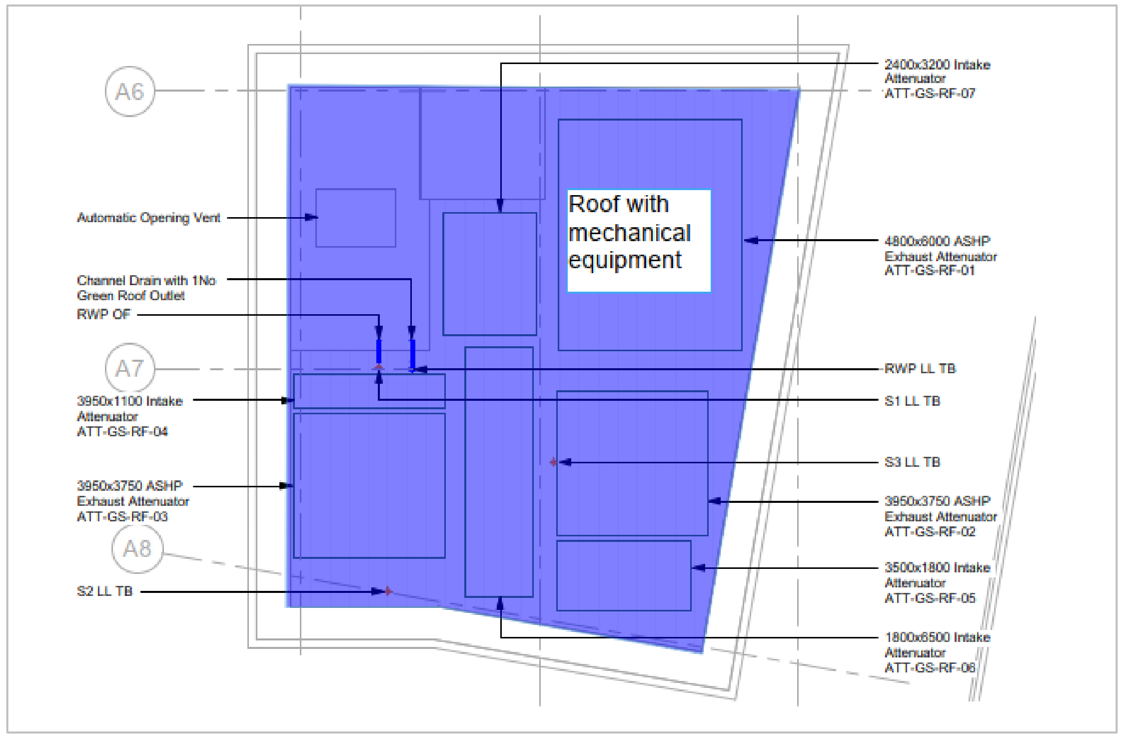


*Figure 7.4 - Vine Lane roof, allocated to both mechanical equipment and terrace, overshaded by 1 Museum Street*

## 7.3 Carbon Emission Savings from Green Measures

The regulated carbon dioxide savings at the 'green' stage of the energy hierarchy are provided in the tables below.

### 7.3.1 Domestic Refurbishment

*Table 7.6 – Regulated carbon dioxide savings - Green*

| | Total Regulated Emissions ($tCO_2$/yr) | $CO_2$ savings ($tCO_2$/yr) | Percentage saving (%) |
|---|---|---|---|
| Part L 2013 baseline | 15.0 | | |
| Be Lean | 12.2 | 2.8 | 19% |
| Be Clean | 12.2 | 0.0 | 0% |
| Be Green | 7.8 | 4.4 | 29% |
| Total Cumulative Savings | - | - | - |

### 7.3.2 Domestic New Build

*Table 7.7 – Regulated carbon dioxide savings - Green*

| | Total Regulated Emissions ($tCO_2$/yr) | $CO_2$ savings ($tCO_2$/yr) | Percentage saving (%) |
|---|---|---|---|
| Part L 2013 baseline | 24.2 | | |
| Be Lean | 20.4 | 3.8 | 16% |
| Be Clean | 20.4 | 0.0 | 0% |
| Be Green | 14.6 | 5.8 | 24% |
| Total Cumulative Savings | - | - | - |

### 7.3.3 Non-Domestic

*Table 7.8 – Regulated carbon dioxide savings - Green*

| | Total Regulated Emissions ($tCO_2$/yr) | $CO_2$ savings ($tCO_2$/yr) | Percentage saving (%) |
|---|---|---|---|
| Part L 2013 baseline | 196.4 | | |
| Be Lean | 166.3 | 30.1 | 15% |
| Be Clean | 166.3 | 0.0 | 0% |
| Be Green | 111.9 | 54.4 | 28% |
| Total Cumulative Savings | - | - | - |

### 7.3.4 Total Development

*Table 7.9 – Regulated carbon dioxide savings - Green*

| | Total Regulated Emissions ($tCO_2$/yr) | $CO_2$ savings ($tCO_2$/yr) | Percentage saving (%) |
|---|---|---|---|
| Part L 2013 baseline | 239 | | |
| Be Lean | 199.4 | 39.6 | 17% |
| Be Clean | 199.4 | 0.0 | 0% |
| Be Green | 133.4 | 66.0 | 28% |
| Total Cumulative Savings | - | - | - |

### 7.3.5 Summary Outputs from Modelling – Green Case

Refer to the BRUKL and SAP Output Sheets provided in Appendix B and Appendix E for details of the outputs from the 'green case' energy assessments.

# 8 Total Carbon Savings and Carbon Offsetting

The total $CO_2$ savings for the domestic scheme, non-domestic scheme, and whole development are provided in the tables and charts below.

### 8.1.1 Domestic Refurbishment

*Table 8.1 – Regulated carbon dioxide savings - Green*

| | Total Regulated Emissions ($tCO_2/yr$) | $CO_2$ savings ($tCO_2/yr$) | Percentage saving (%) |
|---|---|---|---|
| Part L 2013 baseline | 15 | | |
| Be Lean | 12.2 | 2.8 | **19%** |
| Be Clean | 12.2 | 0.0 | 0% |
| Be Green | 7.8 | 4.4 | 29% |
| Total Cumulative Savings | - | 7.8 | **48%** |

### 8.1.2 Domestic New Build

*Table 8.2 – Regulated carbon dioxide savings - Green*

| | Total Regulated Emissions ($tCO_2/yr$) | $CO_2$ savings ($tCO_2/yr$) | Percentage saving (%) |
|---|---|---|---|
| Part L 2013 baseline | 24 | | |
| Be Lean | 20.4 | 3.8 | **16%** |
| Be Clean | 20.4 | 0.0 | 0% |
| Be Green | 14.6 | 5.8 | 24% |
| Total Cumulative Savings | - | 9.6 | **40%** |

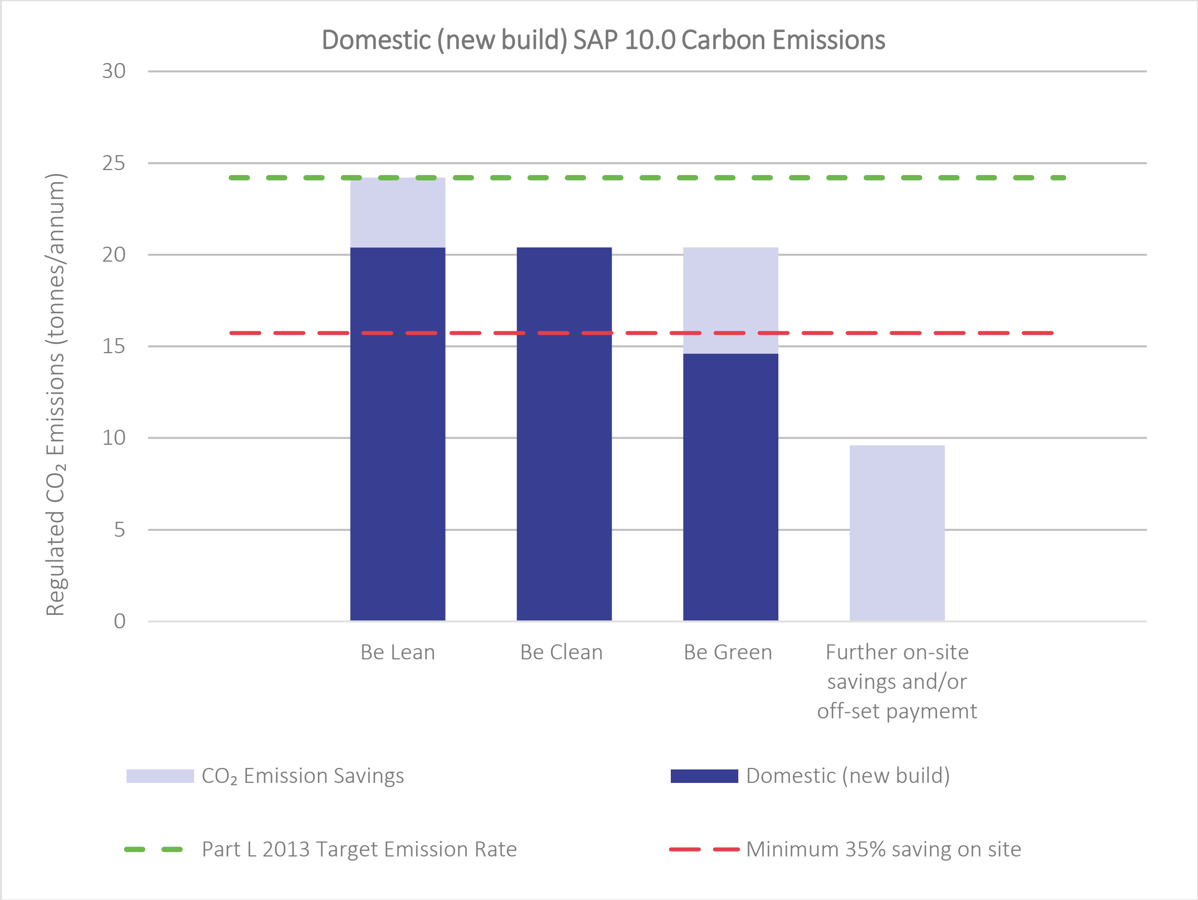


*Figure 8.1 – Proposed domestic (new build) development performance against targets*

### 8.1.3 Non-Domestic

*Table 8.3 – Regulated carbon dioxide savings - Green*

| | Total Regulated Emissions ($tCO_2/yr$) | $CO_2$ savings ($tCO_2/yr$) | Percentage saving (%) |
|---|---|---|---|
| Part L 2013 baseline | 199.9 | | |
| Be Lean | 166.8 | 33.0 | **17%** |
| Be Clean | 166.8 | 0.0 | 0% |
| Be Green | 111.0 | 55.8 | 28% |
| Total Cumulative Savings | - | 88.8 | **44%** |

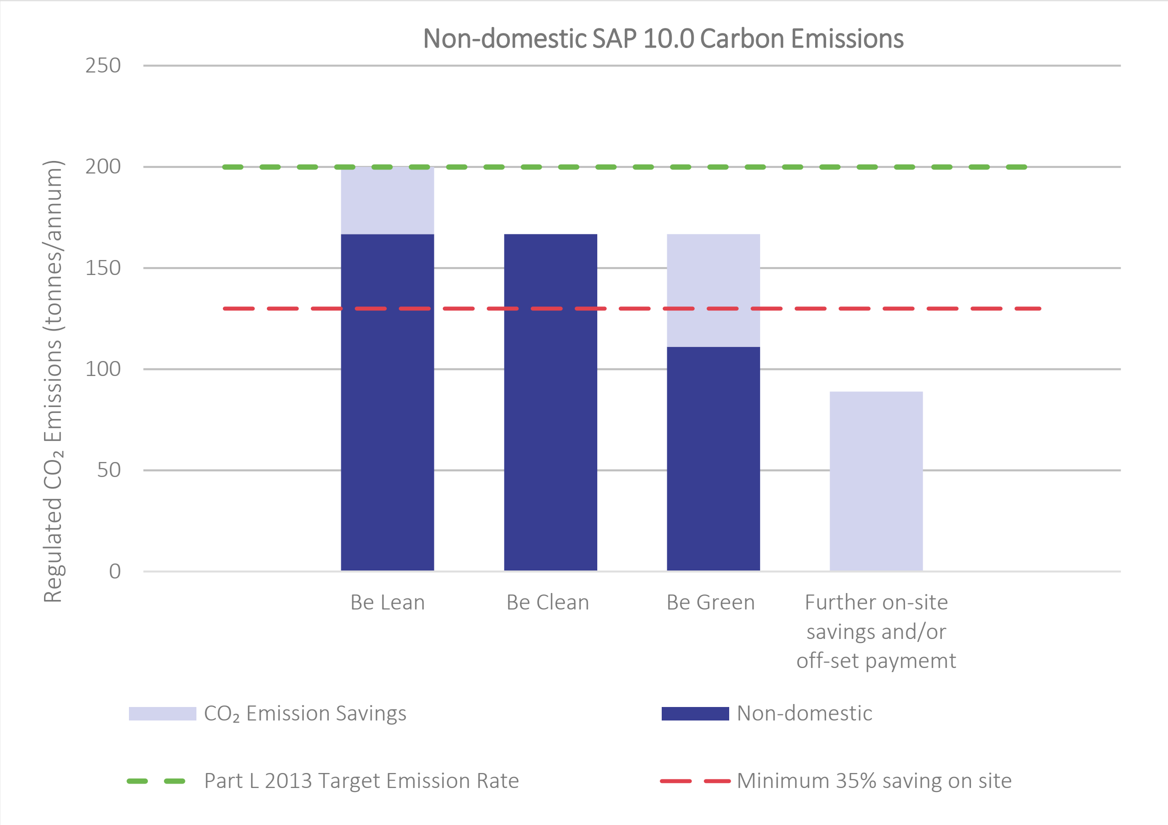


*Figure 8.2 – Proposed non-domestic development performance against targets*


*Figure 8.3 – Proposed development performance against targets*

### 8.1.4 Whole Development

*Table 8.4 – Total cumulative regulated carbon dioxide savings*

| | Total regulated emissions (Tonnes $CO_2$ /year) | $CO_2$ savings (Tonnes $CO_2$ /year) | Percentage savings (%) |
|---|---|---|---|
| Part L 2013 baseline | 239.0 | | |
| Be lean | 199.4 | 39.6 | **17%** |
| Be clean | 199.4 | 0.0 | 0% |
| Be green | 133.4 | 66.0 | 28% |
| Total savings | - | 105.6 | **44%** |
| | | $CO_2$ savings off-set (Tonnes $CO_2$) | |
| Cumulative savings for offset payment | - | 4,003 | - |
| Cash-in-lieu contribution** | - | £380,247 | - |

Carbon offsetting is required as the policy Net Zero Carbon target has not been met onsite.

The Council's preferred mechanism for carbon offsetting is payment into the Camden Climate Fund (https://www.camden.gov.uk/camden-climate-fund). A cash in lieu contribution of £382,713 will be made to this fund, secured through the S106 agreement.

# 9 Monitoring (Be Seen)

The move towards zero-carbon proposed development requires comprehensive monitoring of energy demand and carbon emissions to ensure that planning commitments are being delivered.

The Applicant commits to implementing measures to monitor and report on energy performance for at least five years via the online portal to enable the GLA to identify good practice and report on the operational performance of new development in London.

The metering strategy will be developed in full at RIBA Stage 4 and will facilitate the Be Seen criteria being met.

The GLA's 'Planning' stage Be Seen Reporting Spreadsheet will be completed and submitted within 4 weeks of obtaining planning consent, in accordance with the Be Seen Consultation Guidance, September 2020:

*Section 4.1. For major applications where planning permission has been granted (RIBA Stage 2/3), the applicant is required to provide estimates of each of the performance indicators listed in Table 2. These should be reported to the GLA using the be seen spreadsheet, which is downloadable from the be seen webpage, within four weeks of planning approval. The applicant will also be required to provide the upcoming reporting stages target dates for the submission of updated information against the performance indicators at the as-built and in-use stages.*

Target dates will also be provided by the Applicant within four weeks of planning approval.

The be seen spreadsheet will continue to be completed and provided to the GLA at the relevant stages.

# 10 Whole Life-Cycle Carbon Assessment

The New London Plan Policy SI 2 requires development proposals to calculate whole life-cycle carbon emissions through a nationally recognised Whole Life-Cycle Carbon Assessment (WLCA) and to demonstrate actions taken to reduce life-cycle carbon emissions.

A Whole Life-Cycle Carbon Assessment was carried out following the GLA Whole Life-Cycle Carbon Assessments Guidance (April 2015) in accordance with BS EN 1578, with additional guidance from RICS Professional Statement. This assessment was completed using the GLA approved eTool software.

The full WLCA report and completed GLA assessment spreadsheet tool can be found in Appendix I.

# Appendices

The following documents that append this report are provided as separate documents:

- Appendix A - BRUKL Lean reports
- Appendix B - BRUKL Green reports
- Appendix C – SAP Lean reports
- Appendix D – Overheating Results
- Appendix E – SAP Green reports
- Appendix F – GLA SAP10 Carbon Reporting Spreadsheet
- Appendix G - Manufacturer Datasheet for ASHPs
- Appendix H – Relevant Building Services Drawings
- Appendix I – Whole Life Cycle Carbon Assessment Report and Spreadsheet

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