HOARE LEA

# The Beehive Redevelopment. Cambridge.
# Railway Pension Nominees Limited.

**SUSTAINABILITY**
ENERGY STRATEGY
REP-2323716A-5A-MC-20240816-ENERGY STRATEGY-REV01
REVISION 01 – 16 AUGUST 2024

## Audit sheet.

| Rev. | Date | Description of change / purpose of issue | Prepared | Reviewed | Authorised |
|---|---|---|---|---|---|
| 01 | 16/08/2024 | Planning issue | M. Cookson | W. D. M. Naismith | J. Nuttall |
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# Contents.

# Executive summary.

This energy strategy has been prepared by Hoare Lea on behalf of Railway Pension Nominees Limited ('the Applicant') for the redevelopment of the Beehive Centre (the 'Proposed Development').

### Proposed Development.

The Proposed Development is the demolition and redevelopment of the Beehive Centre, including in Outline Application form for the demolition and redevelopment for a new local centre (E (a-f), F1(b-f), F2(b,d)), open space and employment (office and laboratory) floorspace (E(g)(i)(ii) to the ground floor and employment floorspace (office and laboratory) (E(g)(i)(ii) to the upper floors; along with supporting infrastructure, including pedestrian and cycle routes, vehicular access, car and cycle parking, servicing areas, landscaping and utilities.

A representative sample of plots has utilised for Outline Application and results are reported in line with the Building Regulations 'Part L2' 2021 guidance on the regulated carbon emissions and primary energy rate.

### Applicable policy and regulations.

The energy and carbon performance has been developed with and in accordance with the following, the following policies, and regulations:

**Approved document Part L of the building regulations & grid decarbonisation**
Part L of the Building Regulations is the mechanism by which the government is driving reductions in regulated $CO_2$ emissions from new buildings. The proposed development has been assessed in accordance with the criteria set out in Part L, Volume 2 2021, which came into force on June 15th, 2022.

**Cambridge City Council energy requirements**
Cambridge City Council states in their local plan the following requirements (Policy 28 / Policy CC/3):

- New non-residential development proposals must meet BREEAM excellent standard (or recognised equivalent assessment methodology), i.e. they must achieve 4 credits for Credit 1 of Ene 01 (by achieving an Energy Performance Ratio ($EPR_{NC}$) of 0.4).
- The City Council encourages the development of city wide heat networks and connection of new developments to existing networks where present
- All developments to take the available opportunities to integrate sustainable design and construction into the design proposals.

### Strategy.

The strategy for the site has followed the energy hierarchy to ensure energy savings can be made as part of the intrinsic design for the units. As this is an outline application, a representative sample of blocks have been modelled using high level dynamic simulation modelling with indicative input parameters at this stage for elevations, building services and building fabric. The modelling demonstrates the strategy set out within this report and will be used to inform the full design for each block.

## Be lean.

| | |
|---|---|
| | Passive measures for carbon reduction<br>Layout, fabric, and form have been refined to reduce energy demand for heating, cooling, lighting, and ventilation. The buildings will be constructed to high levels of fabric performance to provide comfortable and efficient places to work. |

## Be clean.

| | |
|---|---|
| | Energy source options for carbon reduction<br>There are no existing district energy networks within feasible vicinity of the site that would enable a connection the proposed development, nor are there currently any feasible future connections planned. |

## Be green.

| | |
|---|---|
| | LZC technologies for carbon reduction<br>The proposed strategy utilises air source heat pumps for space heating, cooling and domestic hot water. The Proposed Development will incorporate a significant roof mounted PV. Options to increase PV capacity will be reviewed on a building-by-building basis. The scheme is fully electric for heating, cooling and domestic hot water, this will allow for further carbon saving as the grid decarbonises. |

## BREEAM.

| | |
|---|---|
| Target: Ene 01. | Targeting 4 credits in lab buildings and 6 credits in office buildings<br>Through completion of sample Part L assessments which are representative of building types at Project Otter, the Proposed Development is expected to comply with Part L requirements. The development is being designed to achieve 6 BREEAM credits for shell and core offices which would meet the requirements for BREEAM Outstanding. For laboratory buildings, calculations are showing that 4 BREEAM credits are achievable, equating to the requirements for BREEAM Excellent. Therefore, the Proposed Development complies with and where possible, exceeds, planning policy. |

# 1. Introduction.

This strategy has been developed on behalf of Railway Pension Nominees Limited, hereafter referred to as 'the Applicant'. The following strategy forms part of the outline planning application for the proposed redevelopment of the Beehive Centre, hereafter referred to as the 'Proposed Development'.

## 1.1 The Proposed Development

The demolition and redevelopment of the Beehive Centre, including in Outline Application form for the demolition and redevelopment for a new local centre (E (a-f), F1(b-f), F2(b,d)), open space and employment (office and laboratory) floorspace (E(g)(i)(ii) to the ground floor and employment floorspace (office and laboratory) (E(g)(i)(ii) to the upper floors; along with supporting infrastructure, including pedestrian and cycle routes, vehicular access, car and cycle parking, servicing areas, landscaping and utilities.

## 1.2 Approach to the strategy

This energy strategy proposes recommendations regarding the approach to reducing carbon dioxide ($CO_2$) emissions and optimising energy efficiency within the development.

It summarises the pertinent regulatory and planning policies applicable to the proposed development, and sets targets commensurate with these policies, which the proposed development will seek to achieve. As this is an outline application and full design of the buildings will be undertaken as applicable, this strategy has undertaken high level energy modelling for a sample of buildings that are representative of the site usages. This strategy therefore demonstrates how the route to achieving compliance in accordance with relevant policies and targets could be achieved.

Table 1 below gives a description of the blocks that have been selected for the representative energy modelling. The buildings were cross section of building forms and space usages.

Table 1: Space uses for the assessed blocks.

| Block | Space type | Space use |
|---|---|---|
| 4 | Non-domestic | Workplace (Office) |
| | Non-domestic | Retail |
| 5 | Non-domestic | Workplace (Office and Lab) |
| | Non-domestic | Retail |
| 7 | Non-domestic | Workplace (Office) |
| | Non-domestic | Retail |

The Energy Strategy has been developed using a 'fabric first' approach through the 'be lean', 'be clean', 'be green', 'be seen' energy hierarchy.


## 1.3 National policy.

Building Regulations: Approved Document Part L

Approved Document Part L (2021, England edition), here forward referred to as ADL 2021, is the Building Regulation relating to the conservation of fuel and power in buildings. ADL 2021 has two parts, Part L1 relates to dwellings and Part L2 relates to buildings other than dwellings. Part L of the Building Regulations is the mechanism by which government is driving reductions in the regulated $CO_2$ emissions from refurbished, change of use and new buildings. For new buildings ADL 2021 has four performance metrics as follows:

- Primary energy target
- $CO_2$ emissions target
- Fabric Energy Efficiency (FEE) target
- Minimum standards for fabric and fixed building services

## 1.4 Local policy.

Cambridge Local Plan

Policy 28 of the Cambridge Local Plan requires:

- All developments to take the available opportunities to integrate sustainable design and construction into the design proposals.
- On-site carbon reduction at a sufficient level to meet the BREEAM 'Excellent' standard (4 credits, $EPR_{NC} \geq 0.4$).
- Promoters of major development, including redevelopment of existing floor space, should prepare a Sustainability Statement as part of the Design and Access Statement submitted with their planning application, outlining their approach to the following issues:
  - adaptation to climate change
  - carbon reduction
  - water management
  - site waste management
  - use of materials
- Water efficiency: Proposals are to meet a minimum of five credits under the BREEAM assessment.
- Unless it affects viability of the proposals, major developments within this area should where possible connect to existing heat networks or networks under construction.

Greater Cambridge Sustainable Design and Construction Supplementary Planning Document

Planning applications in Cambridge are required to complete satisfactorily complete all the items in the Sustainability Checklist for the relevant authority in this document. The items relevant to this energy strategy are as follows:

Cambridge:

- For non-residential development, have you carried out a BREEAM pre-assessment and met the mandatory energy requirements for BREEAM 'excellent' within Ene 01?
- Have you integrated measures to design out the risk of overheating, giving priority to architectural approaches in line with the cooling hierarchy? Have you undertaken overheating analysis following the CIBSE methodology and utilising future climate scenarios
- At least one slow EV Charge Point for every two parking spaces in non-residential developments
- All new non-residential development to achieve BREEAM 'Excellent'

## 1.5 Definitions and limitations.

### Definitions

The following definitions should be understood throughout this statement:

- **Energy demand:** the 'room-side' amount of energy which must be input into a space to achieve comfortable conditions. In the context of space heating, this is the amount of heat which is emitted by a radiator, or other heat delivery mechanism.
- **Energy requirement:** the 'system-side' requirement for energy (fuel). In the context of a space heating system using a gas boiler, this is the amount of energy combusted (e.g. gas) to generate useful heat (i.e. the energy demand).
- **Regulated $CO_2$ emissions:** the $CO_2$ emissions emitted as a result of the combustion of fuel, or 'consumption' of electricity from the grid, associated with regulated sources (those controlled by Part L of the Building Regulations).
- **Base case**: The base case against which the proposed development will be compared is the notional building. The notional building utilises the National Calculation Methodology (NCM) to provide a comparative building which applies a common servicing strategy against which improvements to building fabric, system efficiency, and deployment of renewable technologies to generate a Target Emission Rate (TER).

### Limitations

The appraisals within this statement are based on Part L calculation methodology and should not be understood as a predictive assessment of likely future energy requirements or otherwise. Occupants may operate their systems differently, and / or the weather may be different from the assumptions made by Part L approved calculation methods, leading to differing energy requirements.

### Modelling disclaimer

It should be noted that the data generated by this work is obtained using computer simulations. These simulations are the best means of predicting the performance of the building at this stage.

Full certainty can only be achieved by measuring the performance of the building and associated systems/technologies after a period of use.

The actual performant and/or energy usage for the building once occupied may vary from the calculated values contained in this report.

These differences will occur due to a number of variable parameters between the modelled building and the actual building. Such differences will include the hours, levels of occupancy, how the plant is used how the technologies perform and the design criteria with regards to how the rooms are environmentally controlled.

Whilst the simulations/calculations within this assessment have been undertaken in good faith using reasonable skill and care, Hoare Lea can take no responsibility for differences between the computer simulations and the actual performance of the completed building/technologies due to the inherent complexity and variability of the physics in a building and its environment.

### Sample buildings for the outline application

It should be noted that the Proposed Development is Outline Application stage. The Illustrative Plans, Parameter Plan and Design Code have been used to provide an indicative approach to the energy and carbon emission reduction of the development, in order to show policy compliance and set general overall emissions reduction targets and predictive performance under certifications. The referenced architectural designs, fabric performance specification, mechanical and electrical systems are illustrative at this stage.

A representative sample of plots has utilised for Outline Application and results are reported in line with the Building Regulations 'Part L2' 2021 guidance on the regulated carbon emissions and primary energy rate.

## 2. Cooling and overheating.

A thermal comfort study will be undertaken for each building as the design progresses. At this stage of the outline planning application, the below cooling hierarchy has been adopted within the strategy for the site. The impact of the below will aim to minimise the cooling demand within the space and in-tern mitigate the risk of overheating. The thermal comfort study will be undertaken in accordance with the Hea 04 BREEAM criteria, this will cover future climate change scenarios as part of the study.

### 2.1 Cooling hierarchy.

The following cooling hierarchy will be followed to limit the effects of heat gains in summer:

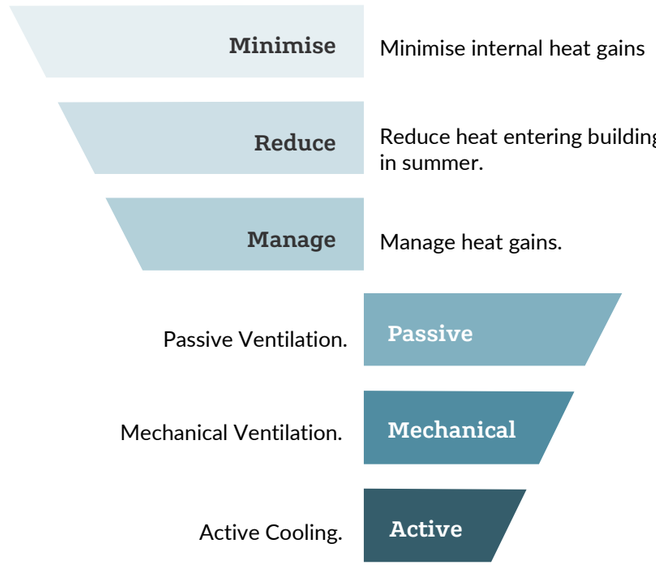



Figure 1: Cooling hierarchy.

### 2.2 Mitigation strategy.

**Minimising internal heat gains**
The following mitigation methods will be implemented to minimise the internal heat generation through energy efficient design at the proposed development:

- Energy efficient lighting (i.e. LED) with low heat output.
- Insulation to heating and hot water pipework and minimisation of dead-legs to avoid standing heat loss.
- Energy efficient equipment with low heat output to reduce unnecessary heat gain.

**Reducing the amount of heat entering the building in summer**
The following mitigation methods will be implemented to reduce the amount of heat entering the building in summer within the proposed development:

- Facades have been developed with suitable glazing-to-solid ratios, with particular focus on south facing orientations. Glazing ratios for the development are provided in Appendix A.
- Suitable g-values will be specified to further control solar heat gains as required; and
- Buildings will have the capability for internal blinds to be installed to improve occupant comfort.

**Manage heat gains**
Opportunities to expose thermal mass to help to further regulate internal temperatures will be explored where possible.

**Passive Ventilation**
Currently the design has allowed for mechanical ventilation; this is down to the intended usage types of the building requiring a mechanical ventilation strategy.

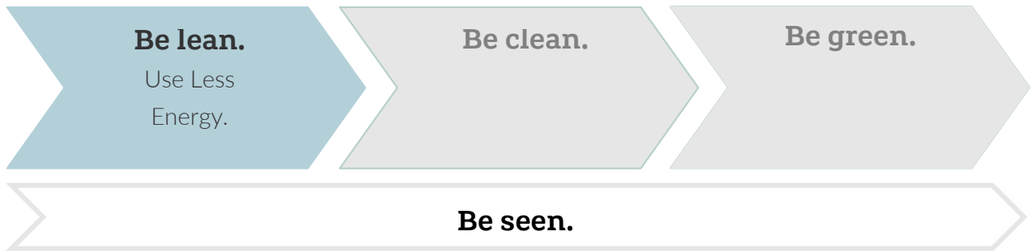
**Mechanical ventilation**
Mechanical ventilation is an important element of building services, to maintain good indoor air quality throughout the day by providing fresh air and extracting vitiated air. Providing fresh air minimises the risk of stale and stagnant air and limits the risk of condensation and mould growth as well as benefitting the occupants' physical and mental wellbeing. Heat recovery mechanisms will be provided to save heating energy.

Mechanical ventilation plant will be located away from pollution sources, typically at roof level. It is anticipated that the design flow rates specified will aid the regulation of internal temperatures in summer months.

**Active cooling**
As the final step active cooling is specified, to keep internal temperatures within acceptable limits, heat pump technology can be used to provide cooling.

## 3. Be lean.

Passive design and energy efficiency measures form the basis for the reduction in overall energy demand and carbon emissions for the proposed development. This energy strategy aims reduce the energy demand initially by optimising the envelope and building services within the development.




### 3.1 Passive design and energy efficiency features.

Passive design measures are those which reduce the demand for energy within buildings, without consuming energy in the process.

These are the most robust and effective measures for reducing $CO_2$ emissions as the performance of the solutions, wall insulation, is unlikely to deteriorate significantly with time, or be subject to change by future property owners. In this sense, it is possible to have confidence that the benefits these measures will continue at a similar level for the duration of their installation. The table below shows the targeted fabric performances. The variation in glazing g-value is for the variation in façade in order to balance daylight with overheating risk.

Table 2: Proposed fabric performance

| Building element | Target performance | Limiting Values (Building Regulations Part L2 2021) |
|---|---|---|
| Air permeability ($m^3/h.m^2$ at (50Pa)) | 3.00 | 8.00 |
| External wall u-value ($W/m^2$. K) | 0.15 | 0.26 |
| Spandrel Panels/ Louvres | 1.00 | 1.60 |
| Windows ($W/m^2$. K) | 1.30 | 1.60 |
| Roof u-value ($W/m^2K$) | 0.10 | 0.16 |
| Exposed floor u-value ($W/m^2K$) | 0.10 | 0.18 |
| Basement walls ($W/m^2K$) | 0.15 | 0.18 |
| Basement floor ($W/m^2K$) | 0.10 | 0.18 |
| Rooflight u-value ($W/m^2$. K) | 1.50 | 2.20 |
| Glazing performance | | |
| Vision Glazing g-value (Light Transmittance) | 0.30-0.40* | - |
| Rooflight g-value (Light Transmittance) | 0.50 | - |

Table 3: Proposed system parameters.

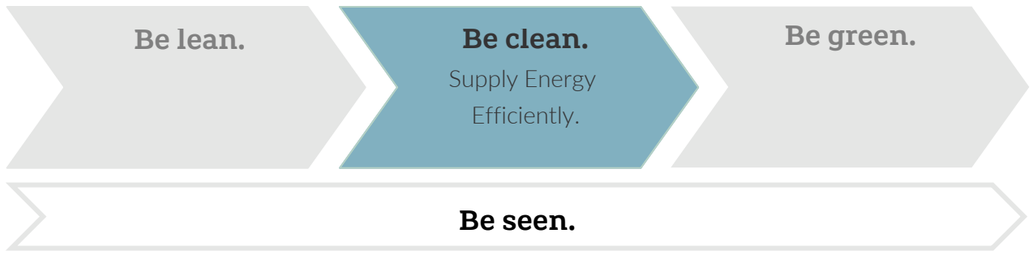
| System parameters | |
|---|---|
| Ventilation | Mechanical ventilation with heat recovery<br>Heat recovery efficiency: 80%<br>System specific fan power: 1.6 W/(l/s) |
| Lighting | 95lm/W as a minimum with the tenant targeting greater than 110 lm/W<br>Automatic lighting control optimised where possible. |

## Be lean summary.

**Passive measures for carbon reduction**
Layout, fabric, and form have been refined to reduce energy demand for heating, cooling, lighting, and ventilation. The buildings will be constructed to high levels of fabric performance to provide comfortable and efficient places to work.

## 4. Be clean.

This stage of the energy hierarchy includes consideration of connection to available district heat networks, or the use of on-site heat networks and decentralised energy production such as Combined Heat and Power (CHP) to provide energy and reducing consumption from the national grid and gas networks, through the generation of electricity, heating and cooling on-site.




### 4.1 Be clean: network and technologies.

The following sections detail considerations of the infrastructure and low-carbon energy supply measures that have been considered.

**Combined heat and power (CHP)**

Changes to the carbon factor of grid electricity have meant that previously favoured systems such as Combined Heat and Power (CHP) are becoming much less carbon efficient. In fact, CHP systems are now expected to lead to greater carbon emissions than conventional gas-fired boilers due to their lower efficiency.

Due to the decarbonisation of the electricity grid, alongside air quality concerns, CHP is not proposed.

**Decentralised heat networks**

Cambridge City Council encourage the development of city-wide heat networks. Unless evidence can demonstrate justifiable reasoning not to, it is expected to connect to a network if one exists in close proximity. As shown in Figure 2, there is not currently an existing network in close proximately to the site.

Heating and cooling networks can demonstrate benefits where heat is generated centrally with highly efficient plant and distributed to buildings within the vicinity however, distribution losses in these systems are typically very high and often entirely outweigh any benefit that would be realised from generating heat centrally. Similarly, as the plant becomes older and newer more efficient technologies are released onto the market efficiency gains become more marginal.

For these reasons, there are no plans to establish a heat network in the vicinity of the site, nor is there one existing. Therefore, the development will not utilise a connection to an onsite or an offsite network.

## Be clean summary.

| | |
|---|---|
| | Energy source options for carbon reduction<br>There are no existing or planned district energy networks within feasible vicinity of the site that would enable a connection the Proposed Development, nor are there currently any feasible future connections planned (Figure 2). |

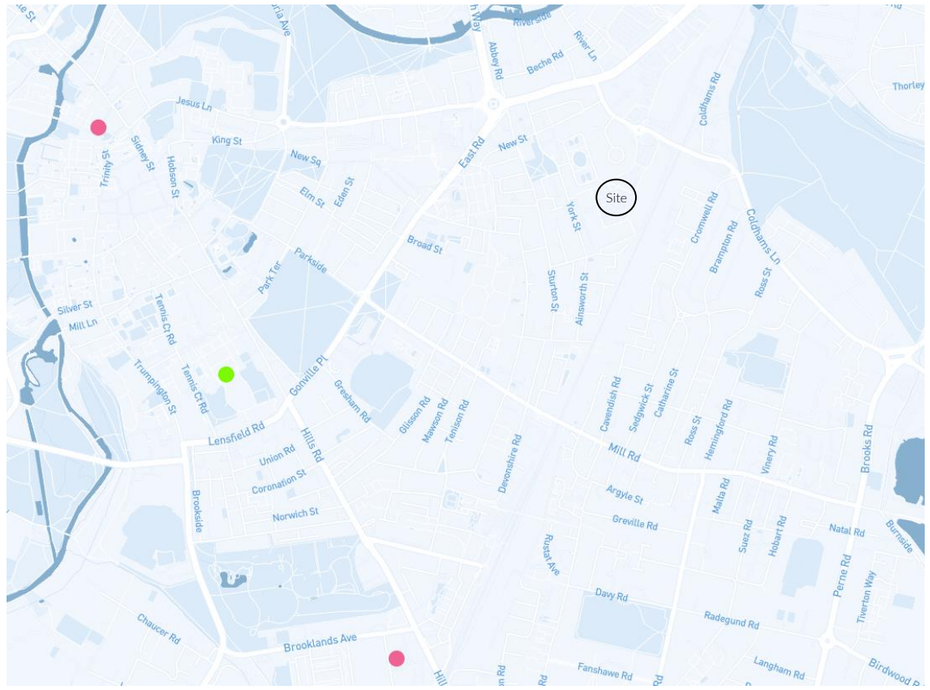
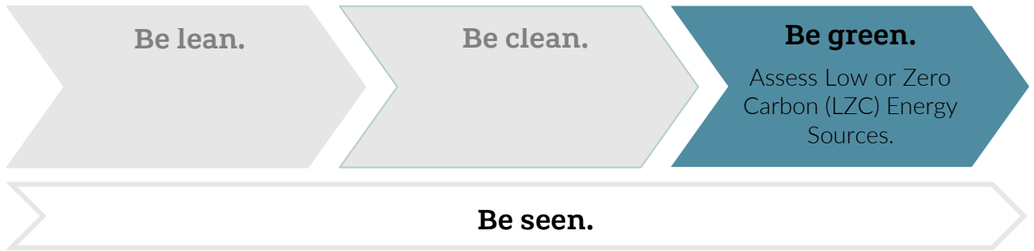



Figure 2: A map showing there are no heat networks for the development in close proximity to connect to in local area (Source: Heat Networks Planning Database | BEIS & Barbour ABI (barbour-abi.com))

## 5. Be green.

The final step of the energy hierarchy explores the feasibility of Low and Zero Carbon (LZC) technologies to allow for the production of renewable energy onsite in order to deliver further reduction in carbon emissions.




### 5.1 Low and zero carbon (LZC) technology assessment.

Renewable or zero carbon technologies harness energy from the environment and convert this to a useful form. Many renewable technologies are available, however, not all of these are commercially viable or suitable for city centre locations.

**Discounted technologies**

**Ground source heat pumps**
Ground Source systems would require extensive below ground works to bury and install the system on site and are not considered a feasible option, and are not proposed,

**Solar thermal**
Available roof area is to prioritise solar PVs, since the electrical output from PV panels will be more suitable for implementation with the heat-pump led energy strategy and building energy usage.

**Biomass boilers**
Large fuel storage volumes are required to maintain continuous operation during the winter months and potential increases in NOx emissions would adversely affect local air quality.

**Wind turbines**
The urban location of the site would limit the availability of suitable wind conditions for the installation of a wind turbine. Furthermore, wind turbines in such locations are often acoustically and aesthetically inappropriate.

**Proposed Technologies**

Air source heat pumps (ASHPs) and rooftop photovoltaic (PV) panels are considered the most suitable technology for the proposed development and have subsequently been evaluated further.

**Photovoltaics**
Solar irradiance analysis on the site has shown a good opportunity for the deployment of solar photovoltaic technologies for onsite electricity generation.

The amount of PV required for each building varies. The areas and predicted annual outputs were calculated in coordination with the MEP team. PV will be maximised where possible in coordination with MEP team. Indicative generation has been estimated for this Outline Application. The details can be found in the table below.

Table 4: Solar PV.

| Block | | Rooftop PV system |
|---|---|---|
| Building 4 | Panel Area | ~540 $m^2$ |
| | Predicted Annual output | ~91,500 kWh |
| Building 5 | Panel Area | ~1680 $m^2$ |
| | Predicted Annual output | ~28,200 kWh |
| Building 7 | Panel Area | ~850 $m^2$ |
| | Predicted Annual output | ~154,600 kWh |

**Air source heat pumps**
ASHP plant can be located at roof level of each unit and integrated into space heating and hot water system. Implementing heat-pump technology brings the additional benefit of a shift towards combustion-free development, with the associated benefit to local air quality. The table below shows the modelled efficiencies which can be targeted for the development.

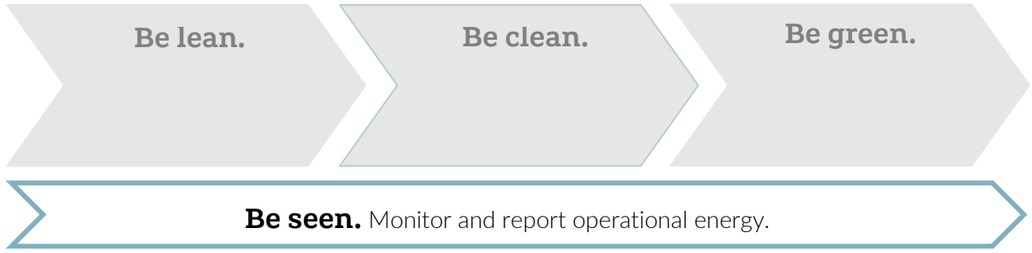
Table 5: Air source heat pump.

| | Air source heat pump |
|---|---|
| SCOP | 3.88 |
| SEER | 4.60 |
| PSEER | 4.50 |

## Be green summary.

Air source heat pumps will provide space heating, cooling, and hot water for the tenant areas, and solar photovoltaic array is proposed at roof level for the blocks.

## 6. Be seen.




### 6.1 Monitoring and reporting.

Effective energy metering will be enabled by the provision of suitable infrastructure within the building's services systems.

The developed strategy will allow for an exhaustive metering of all the various energy usage in the facility. This will enable Energy Intensity and Carbon Emissions to be reported.

Electrical meters will be provided on the main Air Source Heat Pump(s), providing data on plant energy consumption throughout the year.

Each area of high energy load will be sub-metered to monitor energy consumption in greater granularity and facilitate reporting. All the main sub-systems (i.e. small power, lighting etc) will be separately monitored and their energy usage separately accounted. Energy intensity and carbon emissions will be monitored and reported annually. This will be undertaken in accordance with BREEAM requirements for Ene 02.

### 6.2 Operational cost.

Operational costs for end users are an important consideration when appraising Energy Strategy options. Focussing solely on carbon emissions can lead to unintended consequences in the form of higher than expected occupant energy.

The following measures have been implemented or followed to protect occupants from rising energy costs:

- Quality standards to ensure optimum design such as CIBSE Code of Practice
- Where appropriate for the BREEAM certification the BREEAM Man 05 Aftercare credit to ensure all systems are correctly commissioned and training undertaken for occupant.
- Inclusion of solar PV to reduce dependence in grid electricity.

**Unregulated energy**

Unregulated energy includes small power electricity use (computers, plug in devices, washing machines, refrigeration) and catering energy consumption.

It is anticipated that the proportion of unregulated energy would gain in significance when compared to regulated energy as each revision of Building Regulations Part L comes into force and regulated energy is reduced.

It is therefore foreseeable that energy efficiency and the rising cost of energy would play an increasing role when future building users are deciding which appliances to purchase and the frequency of their use. However, it is not possible at present to quantify the extent of this potential reduction.

Given the uncertainty, measures to educate the future building users on how they can reduce their equipment energy use would be encouraged. This can be provided in the form of building user guides fit-out guides. The guidance measures detailed within these types of documents would consider:

- Energy star rated computers and flat screen monitors, and voltage optimization and power factor correction.

CIBSE TM54 Prediction of Operational Energy analysis will be undertaken on each building as part of their full design. This will allow an understanding of how they will perform, by usage type.


Figure 3: Regulated energy and unregulated emissions summary.

## Be seen summary.

| | |
|---|---|
| Target: disclosure of the development's energy use | The development will include the necessary metering, energy monitoring and data processes to facilitate the annual reporting. |

# 7. Part L results.

### 7.1 Energy and $CO_2$ emissions.

Table 6 below presents a summary of the sample units modelled the anticipated performance against the Building Regulations Part L2A 2021 based on the parameters outlined in this report. These are also demonstrated in Appendix B which contains extracts from the full BRUKL reports.

Table 6: Summary of results based on separate BRUKL files.

| Building | Part L Target Emission Rate (TER) – $kgCO_2/m^2$ | Part L Building Emission Rate (BER) – $kgCO_2/m^2$ | Part L Compliance | BREEAM Credits |
|---|---|---|---|---|
| Building 4 | 3.41 | 2.31 | PASS | 6 |
| Building 5 | 4.45 | 2.88 | PASS | 5 |
| Building 7 | 3.45 | 2.01 | PASS | 6 |

The energy requirements are driven by hot water, auxiliary and lighting demands. It should however be noted that Part L is not the most accurate methodology to represent the actual consumption of energy. Part L uses the NCM profiles based on the type of space associated with the rooms.

**Building Regulations Part L 2021 Criterion 3**

In tandem with the $CO_2$ emission calculations, a compliance check with criterion three (limiting solar gains) has been undertaken. It is anticipated that criterion three can be achieved for the majority of spaces. Where criterion three has not been achieved, these spaces will be reviewed as the design progresses to ensure overheating risk is mitigated. Investigation into overheating analysis via Hea 04 will be undertaken.

# 8. Sustainability checklist.

The sustainability checklists provided in Appendix 1 of the Greater Cambridge Sustainable Design and Construction Supplementary Planning Document define items that must be completed or responded to for any application within either the Cambridge or South Cambridgeshire areas. The checklist must be complete separately, but some of the required items have been met by the contents of this energy statement.

### 8.1 "BREEAM Excellent" requirements (En. 2).

Under the Cambridge City Council planning requirements, non-residential developments must carry out a BREEAM pre-assessment and achieve the minimum requirements to meet the standard for 'BREEAM Excellent'. This means the development must achieve at least 4 credits under Ene 01, i.e. must achieve an Energy Performance Ratio for new construction (EPRNC) value of at least 0.4.

Through completion of sample Part L assessments which are representative of block types on the proposed site, the proposed development can comply with Part L requirements. The development is being designed to achieve a 6 BREEAM credits for shell and core offices which would meet the requirements for BREEAM Outstanding. For laboratory buildings, calculations are showing that 4 BREEAM credits are achievable, equating to the requirements for BREEAM Excellent. Therefore the Proposed Development complies with and where possible exceeds planning policy.

### 8.2 Renewables and LZC feasibility (En. 3).

Cambridge requires that renewable/low carbon technologies are to be included in the approach to meeting the above carbon reduction requirements, and that these will be successfully integrated into the design of the development.

Section 5 of this document includes the Low and zero carbon (LZC) technology assessment utilised for this Proposed Development. The assessment highlights how LZC technology in the form of air source heat pumps (ASHPs) and rooftop photovoltaic (PV) panels are considered the most suitable technology for the proposed development.

### 8.3 Overheating analysis (Ca. 1).

It is required in Cambridge that integrated measures to design out the risk of overheating with priority to architectural approaches in line with the cooling hierarchy is undertaken.

Section 3 of this document outlines the fabric first approach in response to minimising overheating within the proposed development. Table 2 details the proposed developments fabric and glazing performance.

### 8.4 Overheating analysis (Ca. 2).

The checklist also states that an overheating analysis must be conducted following the CIBSE methodology and including future climate scenarios. Measures should be integrated to design out the risk of overheating by following the cooling hierarchy, giving priority to architectural approaches.

As of this an outline application an overheating assessment in line with CIBSE methodology has not yet been undertaken. However, Section 2 of this document confirms how an overheating assessment can be undertaken for each building as the design progresses and that a Hea 04 study will also be required for the units in accordance with the BREEAM criteria, this will cover future climate change scenarios as part of the study.

# Appendix A: Modelling inputs.

### Architectural information.

Building geometry has been modelled in accordance with the information provided by Leonard Design on 09/07/2024.

### Tenanted spaces in Block 5.

Block 5 is intended to support laboratory and office spaces in the shell and core design. In line with the current intention and for the purposes of Part L modelling, the tenant spaces have been assumed to be split 60:40 between laboratories and offices respectively. To more accurately reflect the likely tenant use of the space, the laboratories have been modelled as the C2: University or College type.

### Modelling methodology.

A dynamic simulation model was created to assess the design. Integrated Environmental Solutions Virtual Environment (IESve) is a Dynamic Simulations Modelling (DSM) software package that has the capabilities of enabling the user to create a virtual representation of a building.

The results presented in this report were calculated using the approved compliance software IESve 2022 (v2022.4.0.0).

### Weather data

A building's thermal performance is its response to external environmental conditions. The more dependent a building is on passive features to achieve acceptable internal comfort, the more important the use of external weather information becomes.

CIBSE weather files are available for 14 locations in the United Kingdom: Belfast, Birmingham, Cardiff, Edinburgh, Glasgow, Leeds, London, Manchester, Newcastle, Norwich, Nottingham, Plymouth, Southampton and Swindon.

The Norwich TRY has been used for the analysis.

### Model geometry

The model has been based on Revit models provided on June 9th 2024 by Leonard Design. Indicative glazing was placed on the model and the systems were input from the MEP information from the project team. The glazing was suggested by the architects from mark ups which suggested a basis of 20-30% glazing on the NW, N and NE facades and 30-40% glazing on the E, S and W facades. Horizontal window banding was decided to be most representative of the building ambitions. The PV generation was based on indicative drawings and plans by the MEP team.

### Proposed Design

Table 7: System parameters by space type.

| HVAC systems | |
|---|---|
| Tenant labs & office areas | |
| Space Heating & Cooling | Fan coil units<br>– Heating SCOP: 3.88<br>– Cooling SEER: 4.6<br>– Terminal unit SFP: 0.2 W/l/s<br>– Pump Type Variable speed with multiple pressure sensors |
| Ventilation | Air handling unit<br>– SFP: 1.60 W/(l/s))<br>– Heat recovery efficiency: 80% (plate heat exchanger)<br>– Ductwork leakage testing: CEN class B<br>– AHU leakage testing: CEN class L2<br>– DCV with gas sensors and speed control |
| Tenant retail areas, | |
| Space Heating & Cooling | Fan coil units<br>– Heating SCOP: 3.88<br>– Cooling SEER: 4.6<br>– Terminal unit SFP: 0.2 W/l/s<br>– Pump Type Variable speed with multiple pressure sensors |
| Ventilation | Air handling unit<br>– SFP: 1.60 W/(l/s))<br>– Heat recovery efficiency: 80% (thermal wheel)<br>– Ductwork leakage testing: CEN class B<br>– AHU leakage testing: CEN class L2<br>– DCV with gas sensors and speed control |
| Core WCs & WC lobby, Changing areas/showers, Circulation, Back of house | |
| Space Heating | Air handling unit<br>– Heating SCOP: 3.88<br>– Pump Type Variable speed with multiple pressure sensors |
| Ventilation | Air handling unit<br>– SFP: 1.60 W/(l/s))<br>– Heat recovery efficiency: 80%<br>– Ductwork leakage testing: CEN class B<br>– AHU leakage testing: CEN class L2 |
| Reception, Comms room | |
| Space Heating & Cooling | Fan coil units<br>– Heating SCOP: 3.88<br>– Cooling SEER: 4.6<br>– Terminal unit SFP: 0.2 W/l/s<br>– Pump Type Variable speed with multiple pressure sensors |
| Ventilation | Air handling unit<br>– SFP: 1.60 W/(l/s))<br>– Heat recovery efficiency: 80% (thermal wheel)<br>– Ductwork leakage testing: CEN class B<br>– AHU leakage testing: CEN class L2<br>DCV with gas sensors and speed control |

Table 8: Proposed system parameters.

| System Parameters | |
|---|---|
| Central DHW | $CO_2$ ASHP and hot water storage<br>– SCOP: 4<br>– Storage: 3000 litres<br>– Storage losses: 0.00260 kWh/(l.day)<br>– Circulation loop length: 425 m<br>– Circulation losses: 8 W/m |
| Retail Tenant DHW | Instantaneous point of use<br>– SCOP: 1<br>– No storage<br>– No loop length |

Table 9: Lighting details

| Lighting | |
|---|---|
| Lighting power density | – Tenant lighting power density: 120 lm/W<br>– Circulation and other landlord area lighting power density: 110 lm/W<br>– Display lighting:95lm/W |
| Lighting controls | Tenant areas:<br>– Presence detection (Auto on dimmed)<br>Circulation, WCs:<br>– Presence detection (Auto-On/Off)<br>Cleaner cupboards<br>– Manual switching<br>Reception<br>– Manual switching (Man On/Off)<br><br>Lighting controls parasitic power: 0.10 W/$m^2$ |
| Daylight controls | Tenant areas:<br>– Daylight dimming (addressable)<br>– Photoelectric parasitic power: 0.10 W/$m^2$<br>– Dimming |

Table 10: PV information.

| Renewables | |
|---|---|
| Solar PV | Refer to Section 5 |

Table 11: Miscellaneous information.

| Miscellaneous | |
|---|---|
| Power Factor | >0.95 |

| Miscellaneous | |
|---|---|
| Metering provision | Metering with “Out-of-Range” control system linked to BEMS, including:<br>– Lighting<br>– HVAC systems |

## Appendix B: BRUKL results.

**Block 4.**

# BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2021

**Project name**

**Project Otter - Building 4 Part L** — As designed

**Date:** Fri Aug 02 12:28:12 2024

**Administrative information**

**Building Details**
**Address:** Beehive Centre Retail Park, Cambridge, CB1 3ET

**Certifier details**
**Name:** Name
**Telephone number:** Phone
**Address:** Street Address, City, Postcode

**Certification tool**
**Calculation engine:** Apache
**Calculation engine version:** 7.0.20
**Interface to calculation engine:** IES Virtual Environment
**Interface to calculation engine version:** 7.0.20
**BRUKL compliance module version:** v6.1.e.1

**Foundation area [m²]:** 1795.8

**The $CO_2$ emission and primary energy rates of the building must not exceed the targets**

| | | |
|---|---|---|
| Target $CO_2$ emission rate (TER), $kgCO_2/m^2.annum$ | 3.41 | |
| Building $CO_2$ emission rate (BER), $kgCO_2/m^2.annum$ | 2.31 | |
| Target primary energy rate (TPER), $kWh_{PE}/m^2.annum$ | 37.5 | |
| Building primary energy rate (BPER), $kWh_{PE}/m^2.annum$ | 25.26 | |
| Do the building's emission and primary energy rates exceed the targets? | BER =< TER | BPER =< TPER |

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

| Fabric element | $U_{p\text{-}Limit}$ | $U_{p\text{-}Calc}$ | $U_{i\text{-}Calc}$ | First surface with maximum value |
|---|---|---|---|---|
| Walls* | 0.26 | 0.15 | 0.15 | L000000D:Surf[2] |
| Floors | 0.18 | 0.1 | 0.1 | L000000B:Surf[0] |
| Pitched roofs | 0.16 | - | - | No pitched roofs in building |
| Flat roofs | 0.18 | 0.1 | 0.1 | L0000024:Surf[0] |
| Windows** and roof windows | 1.6 | 1.3 | 1.6 | L0000001:Surf[0] |
| Rooflights*** | 2.2 | - | - | No roof lights in building |
| Personnel doors^ | 1.6 | 1.27 | 1.6 | L0000001:Surf[0] |
| Vehicle access & similar large doors | 1.3 | - | - | No vehicle access doors in building |
| High usage entrance doors | 3 | - | - | No high usage entrance doors in building |

$U_{p\text{-}Limit}$ = Limiting area-weighted average U-values [W/(m²K)] — $U_{i\text{-}Calc}$ = Calculated maximum individual element U-values [W/(m²K)]
$U_{p\text{-}Calc}$ = Calculated area-weighted average U-values [W/(m²K)]
* Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.
** Display windows and similar glazing are excluded from the U-value check. *** Values for rooflights refer to the horizontal position.
^ For fire doors, limiting U-value is 1.8 W/m²K
NB: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

| Air permeability | Limiting standard | This building |
|---|---|---|
| $m^3/(h.m^2)$ at 50 Pa | 8 | 3 |

**Block 5.**

# BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2021

**Project name**

**Project Otter - Building 5 Part L** — As designed

**Date:** Fri Aug 02 12:16:07 2024

**Administrative information**

**Building Details**
**Address:** Beehive Centre Retail Park, Cambridge, CB1 3ET

**Certifier details**
**Name:** Name
**Telephone number:** Phone
**Address:** Street Address, City, Postcode

**Certification tool**
**Calculation engine:** Apache
**Calculation engine version:** 7.0.20
**Interface to calculation engine:** IES Virtual Environment
**Interface to calculation engine version:** 7.0.20
**BRUKL compliance module version:** v6.1.e.1

**Foundation area [m²]:** 3533.99

**The $CO_2$ emission and primary energy rates of the building must not exceed the targets**

| | | |
|---|---|---|
| Target $CO_2$ emission rate (TER), $kgCO_2/m^2.annum$ | 4.45 | |
| Building $CO_2$ emission rate (BER), $kgCO_2/m^2.annum$ | 2.88 | |
| Target primary energy rate (TPER), $kWh_{PE}/m^2.annum$ | 48.9 | |
| Building primary energy rate (BPER), $kWh_{PE}/m^2.annum$ | 31.38 | |
| Do the building's emission and primary energy rates exceed the targets? | BER =< TER | BPER =< TPER |

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

| Fabric element | $U_{p\text{-}Limit}$ | $U_{p\text{-}Calc}$ | $U_{i\text{-}Calc}$ | First surface with maximum value |
|---|---|---|---|---|
| Walls* | 0.26 | 0.15 | 0.15 | B100005C:Surf[0] |
| Floors | 0.18 | 0.1 | 0.1 | B1000060:Surf[0] |
| Pitched roofs | 0.16 | - | - | No pitched roofs in building |
| Flat roofs | 0.18 | 0.1 | 0.1 | B1000008:Surf[2] |
| Windows** and roof windows | 1.6 | 1.3 | 1.6 | L0000010:Surf[0] |
| Rooflights*** | 2.2 | - | - | No roof lights in building |
| Personnel doors^ | 1.6 | 1.24 | 1.6 | L0000010:Surf[0] |
| Vehicle access & similar large doors | 1.3 | - | - | No vehicle access doors in building |
| High usage entrance doors | 3 | - | - | No high usage entrance doors in building |

$U_{p\text{-}Limit}$ = Limiting area-weighted average U-values [W/(m²K)] — $U_{i\text{-}Calc}$ = Calculated maximum individual element U-values [W/(m²K)]
$U_{p\text{-}Calc}$ = Calculated area-weighted average U-values [W/(m²K)]
* Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.
** Display windows and similar glazing are excluded from the U-value check. *** Values for rooflights refer to the horizontal position.
^ For fire doors, limiting U-value is 1.8 W/m²K
NB: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

| Air permeability | Limiting standard | This building |
|---|---|---|
| $m^3/(h.m^2)$ at 50 Pa | 8 | 3 |

**Block 7.**

# BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2021

**Project name**

## Project Otter - Building 7 Part L — As designed

**Date:** Fri Aug 02 16:41:43 2024

### Administrative information

**Building Details**

**Address:** Beehive Centre Retail Park, Cambridge, CB1 3ET

**Certification tool**

**Calculation engine:** Apache
**Calculation engine version:** 7.0.20
**Interface to calculation engine:** IES Virtual Environment
**Interface to calculation engine version:** 7.0.20
**BRUKL compliance module version:** v6.1.e.1

**Certifier details**

**Name:** Name
**Telephone number:** Phone
**Address:** Street Address, City, Postcode

**Foundation area [m²]:** 2314.93

### The $CO_2$ emission and primary energy rates of the building must not exceed the targets

| | | |
|---|---|---|
| Target $CO_2$ emission rate (TER), $kgCO_2/m^2.annum$ | 3.45 | |
| Building $CO_2$ emission rate (BER), $kgCO_2/m^2.annum$ | 2.01 | |
| Target primary energy rate (TPER), $kWh_{PE}/m^2.annum$ | 37.99 | |
| Building primary energy rate (BPER), $kWh_{PE}/m^2.annum$ | 21.93 | |
| Do the building's emission and primary energy rates exceed the targets? | BER =< TER | BPER =< TPER |

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

| Fabric element | $U_{a\text{-}Limit}$ | $U_{a\text{-}Calc}$ | $U_{i\text{-}Calc}$ | First surface with maximum value |
|---|---|---|---|---|
| Walls* | 0.26 | 0.15 | 0.15 | CL00001F:Surf[0] |
| Floors | 0.18 | 0.1 | 0.1 | CL00001F:Surf[1] |
| Pitched roofs | 0.16 | - | - | No pitched roofs in building |
| Flat roofs | 0.18 | 0.1 | 0.1 | BL000092:Surf[0] |
| Windows** and roof windows | 1.6 | 1.3 | 1.6 | L0000003:Surf[0] |
| Rooflights*** | 2.2 | - | - | No roof lights in building |
| Personnel doors^ | 1.6 | 1.25 | 1.6 | L0000003:Surf[0] |
| Vehicle access & similar large doors | 1.3 | - | - | No vehicle access doors in building |
| High usage entrance doors | 3 | - | - | No high usage entrance doors in building |

$U_{a\text{-}Limit}$ = Limiting area-weighted average U-values [$W/(m^2K)$] $U_{i\text{-}Calc}$ = Calculated maximum individual element U-values [$W/(m^2K)$]
$U_{a\text{-}Calc}$ = Calculated area-weighted average U-values [$W/(m^2K)$]
* Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.
** Display windows and similar glazing are excluded from the U-value check. *** Values for rooflights refer to the horizontal position.
^ For fire doors, limiting U-value is 1.8 $W/m^2K$
NB: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

| Air permeability | Limiting standard | This building |
|---|---|---|
| $m^3/(h.m^2)$ at 50 Pa | 8 | 3 |

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