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**TRINITY INVESTMENTS**

**CARDIFF EDGE**

**CARDIFF**

**ENERGY STATEMENT**

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## EXECUTIVE SUMMARY

KJ Tait Engineers were instructed to develop the Energy Strategy for 2No proposed buildings to be built on the Science Park at Cardiff Edge. In line with Cardiff Local Development Plans policies, the installation of LZCT has been assessed to reduce the carbon emissions on site.

Each building has been modelled in IES VE 2022 to establish a baseline carbon emission from which savings associated with the installation of LZCT could be calculated. Each building will incorporate exemplary fabric measures to reduce overall demand. These are in line with LETI standards for office buildings. Lighting systems will be LED type of at least 110lm/W with occupancy sensing and daylight linkage to further reduce their energy usage in use. Any areas served by central plant will use heat recovery that will constitute the predominant means of tempering the fresh air ventilation provision for each building.

Once the demand of the building has been lowered via energy efficiency measures, low and zero carbon heating and generation technologies should be considered. We have reviewed the potential for a range of systems to be implemented to further reduce carbon emissions. It was concluded that air source heat pumps should be taken forward.

For the Hub building, there will be a significant hot water load due to the changing and showering facilities within the building. Therefore, we would suggest that this is supplied via a heat pump with associated storage. The heating provision should also be taken from heat pump technology so supply heating to all occupied spaces. With this strategy, there would be a 41.4% saving in carbon emissions from the installation of LZCT.

Similarly for Unit 1, we would advise the heating provision by supplied via heat pumps. However, there will be little hot water load in the building due to the absence of kitchens and showering facilities. The hot water load will likely be restricted to WCs for hand washing and potentially within lab areas. Therefore, we would advise that the hot water is supplied via electric point of use water heaters. This strategy would result in a 9.7% saving in carbon emissions from LZCT.

## 1.0 INTRODUCTION

This report details the Energy Strategy for the proposed development of 2No buildings at the Cardiff Edge Science Park in Cardiff. The proposed buildings are as follows:

- Hub Building – 2 storeys consisting of gym, servery, work/studio spaces
- Unit 1 – office/laboratory space.

This Energy Statement has been prepared in line with the Cardiff Local Development Plan 2006-2026 2036.

## 1.1 Site Information

Cardiff Edge is an existing life Sciences Park located north west of the city of Cardiff just off Junction 32 of the M4 motorway. Within the park, there are a number of existing buildings that are of a similar planning class.



Figure 1: Location of proposed development

## 1.2 Cardiff Local Development Plan 2006-2026

The adopted Statutory Development Plan for Cardiff Council is the Cardiff Local Development Plan 2006-2026 which was adopted by the Council in January 2016. The Local Plan shapes out the city on how it will look and feel in years to come. It guides new developments, so that they respect the past and present of Cardiff, while improving its future by supporting the city's people and their environment.

Compliance with the following policy will be required to ensure the development is sustainable.

### 1.2.1 Policy KP15 – Climate Change

To mitigate against the effects of climate change and adapt to its impacts, development

proposals should take into account the following factors:

- Reducing carbon emissions
- Protecting and increasing carbon sinks
- Adapting to the implications of climate change at both a strategic and detailed design level
- Promoting energy efficiency and increasing the supply renewable energy; and
- Avoiding areas susceptible to flood risk in the first instance in accordance with the sequential approach set out in national guidance; and
- Preventing development that increases flood risk.

### 1.2.2 Policy EN12 – Renewable Energy and Low Carbon Technology

Development proposals are required to maximise the potential for renewable energy.

The council will encourage developers of major and strategic sites to incorporate schemes which generate energy from renewable and low carbon technologies. The includes opportunities to minimise carbon emissions associated with the heating, cooling and power systems for new development. An independent energy assessment investigating the financial viability and technical feasibility of incorporating such schemes will be required to support applications.

### 1.2.3 Policy KP5 – Good Quality and Sustainable Design

To help support the development of Cardiff as a world class European capital city, all new development will be required to be of a high quality, sustainable design and make a positive contribution to the creation of distinctive communities, places and spaces by:

- Responding to the local character and context of the built and landscape setting so that layout, scale, form, massing, height, density, colour, materials, detailing and impact on the built and natural heritage are all addressed within development proposals.
- Providing legible development which is easy to get around and which ensures a sense of continuity and enclosure.
- Providing a diversity of land uses to create balanced communities and add vibrancy throughout the day.
- Creating interconnected streets, squares and spaces as distinctive places, which are safe, accessible, vibrant and secure and incorporate public art where appropriate.
- Providing a healthy and convenient environment for all users that supports the principles of community safety, encourages walking and cycling, enables employment, essential services and community facilities to be accessible by sustainable transport and maximises the contribution of networks of multi-functional and connected open spaces to encourage healthier lifestyles.
- Maximising renewable energy solutions.
- Achieve a resource efficient and climate responsive design that provides sustainable water and waste management solutions and minimise emissions from transport, homes and industry.
- Achieving an adaptable design that can respond to future social, economic, technological and environmental requirements.
- Promoting the efficient use of land, developing at highest practicable densities and where appropriate achieving the remediation of land contamination.
- Ensuring no undue effect on the amenity of neighbouring occupiers and connecting

- positively to surrounding communities.
- Fostering inclusive design, ensuring buildings, streets and spaces are accessible to all users and is adaptable to future changes in lifestyle; and
- Locating Tall buildings in locations which are highly accessible through walking and public transport and within an existing or proposed cluster of tall buildings.

## 2.0 DEMAND REDUCTION (BE LEAN)

In line with good design principles and Cardiff Council requirements both blocks will follow the energy hierarchy so that any low or zero carbon generation is not supplying energy to areas that could have been mitigated early in the design process. The relevant steps in this process are:

### Stage 1 - Maximise Passive Design

In the first instance the building design should be efficient, incorporating measures such as good fabric and glazing, control of solar heat gain whilst providing good levels of day lighting.

### Stage 2 - Minimise Active Design

Having reduced the energy demand, energy requirements will then be minimised where possible by installing energy efficient plant and systems to meet the building's energy demands. Suitable control systems should be provided to ensure system energy efficiencies can be realised. Where mechanical intervention cannot be avoided, the design should incorporate the lowest possible level of intervention and energy use.

## 2.1 Stage 1 - Maximise Passive Design

Passive design measures will be optimised across the development and in conjunction with active measures, such as efficient building services systems, will reduce demand (Be Lean). Building design should be optimised to limit heat loss, reduce cooling loads by limiting solar gain and optimise the use of natural light and ventilation.

The following elements have been considered and optimised:

1. Site orientation optimised by ensuring that the majority of the bedrooms are not on the south façade.
2. Solar gain will be limited through limiting the extent of glazing, specifying high-performance glazing system.
3. High-performance building fabric, to significantly exceed the minimum criteria set by the Building Regulations.

### Site Orientation

The site is orientated so that the largest expanse of glazing is on the east façades for the hub building. Unit 1 has significantly less glazing but has its greatest amount on the west façade.

Reducing the glazing percentage from the south facades will ensure that solar gains are

mitigated as much as possible during the most oppressive times in the day.

	North	East	South	West
The Hub	21.6%	56.9%	20.2%	15.5%
Unit 1	19.5%	7.6%	19.5%	26.1%

### Building Fabric

In order to achieve a good reduction in emissions from Part L2A from passive design measures, an exemplary standard of building fabric will be required. For both blocks, the following U-values have been recommended and used throughout the modelling.

Thermal Element	U-Value (W/m <sup>2</sup> K)
External Wall	0.12
Ground Floor	0.10
Roof	0.10
Windows	1.20; G-value = 0.35

An air tightness target of 3 m<sup>3</sup>/(h.m<sup>2</sup>) will be sought.

### Stage 2 - Minimise Active Design

#### Lighting

LEDs of at least 110lm/W will be installed throughout the development that incorporate occupancy control and will be daylight linked. This will significantly reduce the lighting demand compared to a Part L 2013 compliant development.

#### Heat Recovery

All central plant will incorporate heat recovery to reduce the reliance on the heating coils to heat the fresh air provision for ventilation purposes.

### 3.0 HEATING INFRASTRUCTURE INCLUDING CHP (BE CLEAN)

Due to the reducing carbon factor and absence of a significant year-round heating or hot water demand, we would be against gas CHP for each building.

With respect to an existing district heat network, we are unaware of any networks that each building could connect onto in the area.

### 4.0 RENEWABLE ENERGY (BE GREEN)

The incorporation of low and zero carbon technologies (LZCT) can reduce demand on finite natural energy sources, benefit the environment and reduce running costs. LZCT will be

required to comply with the Oxford Local Plan policy for at least a 40% reduction in carbon emissions on site from Part L2A Building Regulations.

### Potential Sources of Energy

The following LZCT have been considered for the proposed building:

Technology	Comments	Feasible for Site
Solar Thermal	<ul style="list-style-type: none"> <li>- Low maintenance; little/no ongoing costs</li> <li>- Would only provide a small proportion of yearly DHW demand but would use a large proportion of the roof</li> <li>- May be preferable to use roof space for PV which has the potential to offset a greater amount of carbon.</li> </ul>	No
Photovoltaics	<ul style="list-style-type: none"> <li>- Low maintenance; little/no ongoing costs</li> <li>- Potential to generate large amounts of energy</li> <li>- Carbon reduction potential reduced by changing carbon factors.</li> </ul>	Yes
Wind	<ul style="list-style-type: none"> <li>- Would be unlikely to be granted planning permission</li> <li>- Would create noise and strobing which would be unacceptable to the occupants in the buildings.</li> </ul>	No
Biomass	<ul style="list-style-type: none"> <li>- May require a backup source of heating as biomass boilers are normally used for baseload operation</li> <li>- Issues around sizing system which may leave boilers running below optimum levels</li> <li>- Not compatible with Air Quality targets and restrictions.</li> </ul>	Yes
ASHP	<ul style="list-style-type: none"> <li>- Separate heat pumps could supply all the buildings' heating and hot water load</li> <li>- Would ensure a significant reduction in carbon emissions compared to a gas boiler baseline particularly after changing carbon factors</li> <li>- Planning implications for installing the outdoor plant.</li> </ul>	Yes
Horizontal Ground Source Heat Pumps	<ul style="list-style-type: none"> <li>- Could provide all the buildings' heating and hot water loads</li> <li>- Uplift in capital costs need to be assessed against the energy saved from using the more stable ground temperatures.</li> </ul>	Yes

<b>Vertical Ground Source Heat Pumps</b>	<ul style="list-style-type: none"> <li>- Could provide all the buildings heating and hot water loads</li> <li>- Capital costs of boreholes would be significant compared to ASHP.</li> </ul>	Yes
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### Proposed LZCT

There is an ambition for the building to be fully electric and therefore Net Zero Carbon ready. We would propose that ASHPs be installed to supply all the heating and hot water requirements for the Hub building and the heating requirements of Unit 1. Due to the small hot water loads within unit 1, this could be supplied via point of use water heaters.

## 5.0 RESULTS

Both blocks were modelled using IES VE 2022, this is a dynamic simulation modelling package. For the modelling, carbon factors were changed from SAP 2012 to SAP 10 in line with industry best practice. SAP10 carbon factors better represent the carbon emissions associated with grid electricity and are detailed below:

	Electricity	Gas
SAP 2012	0.519	0.216
SAP 10	0.233	0.210

Changing the carbon factors results in buildings that are heated via electricity, particularly those heated via heat pumps, will significantly reduce their carbon emissions compared to a gas fired boiler scheme.

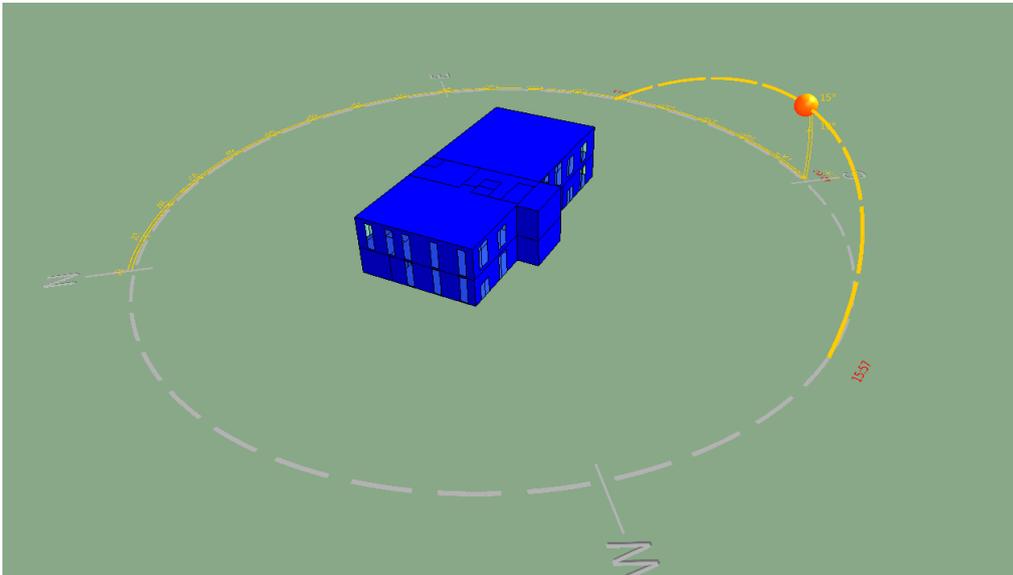
### 5.1 Modelling Steps

We have modelled the building in line with industry best practice to demonstrate compliance with the Cardiff Local Development Plan

- Baseline model (Buildings Emissions Rate) – The baseline model assumes the fabric U-values, air permeability and lighting/controls of the Actual Building but with gas fired boilers supplying all of the buildings heating and hot water loads.
- Be Green (Buildings Emissions Rate) – The Be Green model changes the heating and hot water provision for The Hub to heat pumps and the heating provision to heat pumps for Unit 1.

## 5.2 The Hub

For Block A, the modelling shows that a significant reduction in carbon emissions can be achieved by designing both the heating and hot water systems to be run off an ASHP.



	kgCO <sub>2</sub>
Baseline Emissions	62,525
Be Green	36,625
Saving (%)	41.4%

The cost of incorporating ASHPs into the scheme for the hub building is likely to be circa £30,000. The installation would not payback compared to a gas boiler over its 20 year lifetime. This is due to the cost of electricity being significantly higher than gas.

## 5.3 Unit 1

There is a significantly smaller hot water load in Unit 1 due to the absence of showering facilities, therefore hot water generation should be achieved via electric point of use water heaters. The heating provision should be generated via an air source heat pump.

	kgCO <sub>2</sub>
Baseline Emissions	81,681
Be Green	73,722
Saving (%)	9.7%

This strategy would result in a 9.7% reduction in carbon emissions compared to the baseline scheme.

The cost of incorporating ASHPs into the scheme for unit 1 is likely to be circa £190,000. The installation would not payback compared to a gas boiler over its 20 year lifetime. This is due to the cost of electricity being significantly higher than gas.