CONSULTING ENGINEERS

OUTLINE ENERGY AND SUSTAINABILITY STRATEGY

AUTHOR:
W. HINSON

FOR:
PROSPERITY PARC

STATUS:
FOR OUTLINE PLANNING

A PROJECT FOR:
ANGLESEAY LAND HOLDINGS LTD

REVISION:
P3

01908 320 099 | WWW.MBA-CONSULTANTS.CO.UK | ENQUIRIES@MBA-CONSULTANTS.CO.UK

MAPLE HOUSE | WOODLANDS BUSINESS PARK | LINFORD WOOD WEST | MILTON KEYNES | MK14 6FG

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P2	Revised to suit Planning comments	WH	KS	17.07.2024
P3	Development description updated	WH	KS	11.11.2024

EXECUTIVE SUMMARY

1. MBA Consulting Engineers Ltd. has been commissioned by Anglesey Land Holdings Ltd to produce an outline energy and sustainability strategy report in support of the Outline Planning Application for the proposed development known as Prosperity Park.

2. The planning application proposes:

   "Outline permission for the redevelopment to include demolition of structures and buildings to allow construction of new employment floorspace including, data centres (use class B8), offices and research and development space (use class B1), and battery energy storage (Unique use). Development to include drainage arrangements, retained and new landscaping, gatehouses, and other associated buildings, infrastructure and engineering works. All matters reserved except for (retained) site accesses from the A5."

3. This report provides a review of the sustainability and key efficiency features and strategies for the development and sets out targets in terms of both sustainability and energy performance. An overview of different sustainability and energy-efficiency technologies that are likely to be appropriate for the development are also included in this statement.

4. As the design progresses, the strategies outlined in this report will be further developed and subjected to detailed designs. The environmental strategies and options outlined in this report are based on the current information available and are likely to evolve with the design.

5. To comply with planning policy and client requirements, the following targets have been established for the development:

   - To install low carbon technologies in new buildings (Planning Policy Wales Edition 12 – February 2024)
   - A reduction in CO_2 emissions (after lean, clean and green measures are incorporated - Planning Policy Wales Edition 12 – February 2024)

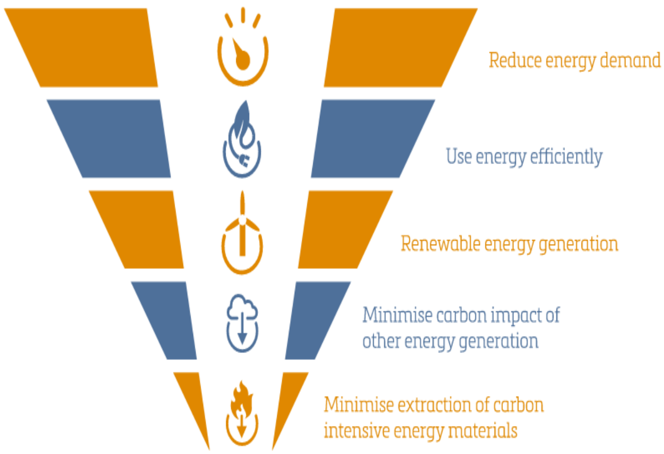

Figure 1 – Energy Hierarchy for Planning

   - Aspire to achieve EPC A
   - BREEAM "Very Good" with the aspiration for achieve "Excellent"

6. The principal objectives are to reduce the site contribution to the causes of climate change by reducing the developments energy demand and by providing a portion of the demand through clean, renewable sources. The recommendations within this report are based on the proposed Stage 2 Design, however it is understood that the design will continue to evolve as the project progresses. The detailed design of the scheme will be secured through reserved matters applications in due course.

7. All units within the development will operate 24hours a day, 7 days a week, 365 days a year

8. The development shall be reviewed to achieve the minimum 4no. credits required for a BREEAM (New Construction V6.1) Excellent rating under the Ene 01 credit issue. Please refer to Appendix E for BREEAM calculation results.

9. A BREEAM pre-assessment has been carried out for the development in line with policy requirements. The scheme is targeting an 'Very Good' rating as a minimum but will aspire to achieve BREEAM Excellent.

CONTENTS

1.0 INTRODUCTION

1. MBA Consulting Engineers Ltd. has been commissioned by Anglesey Land Holdings Ltd to produce an outline energy and sustainability strategy report in support of the Outline Planning Application for the proposed development known as Prosperity Park.

2. The proposed development is described as:

"Outline permission for the redevelopment to include demolition of structures and buildings to allow construction of new employment floorspace including, data centres (use class B8), offices and research and development space (use class B1), and battery energy storage (Unique use). Development to include drainage arrangements, retained and new landscaping, gatehouses, and other associated buildings, infrastructure and engineering works. All matters reserved except for (retained) site accesses from the A5."

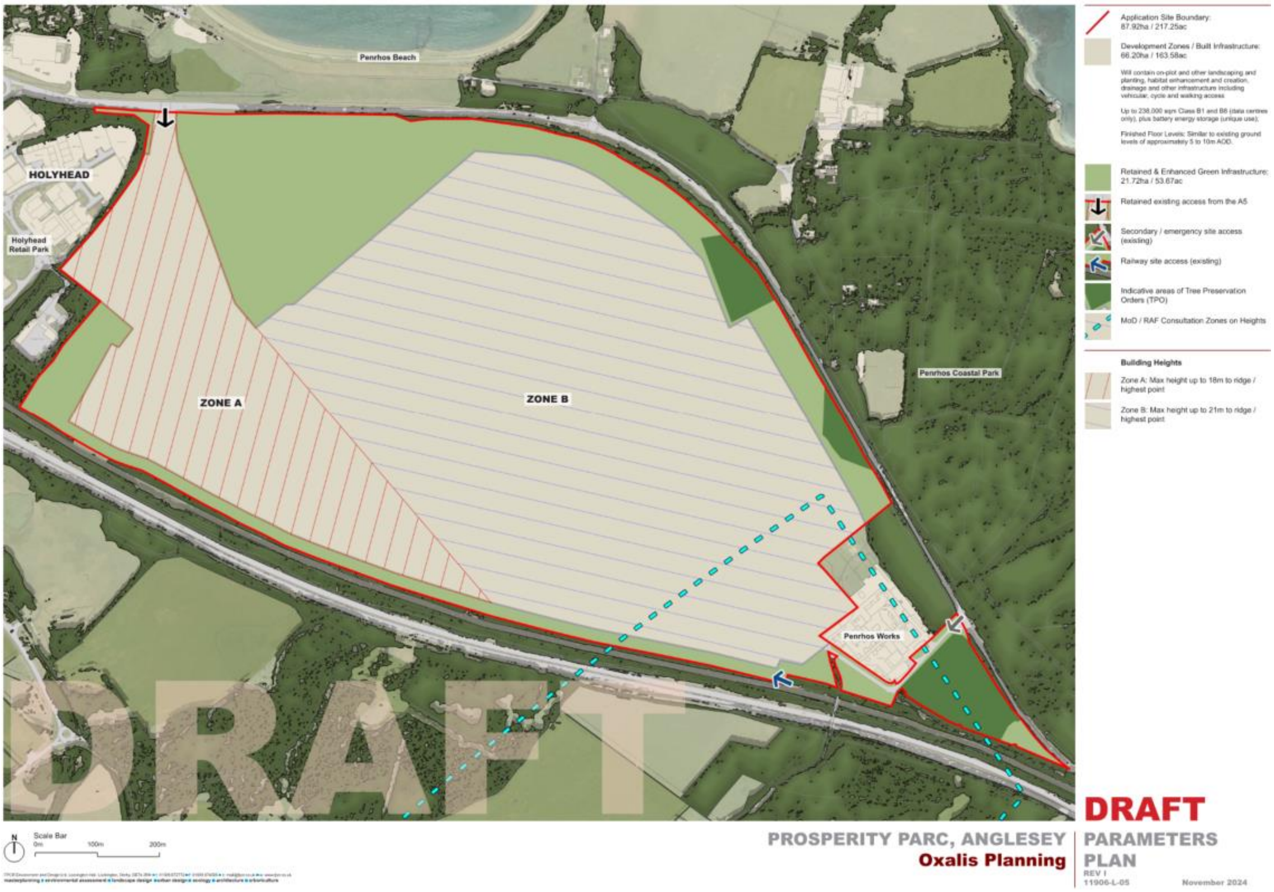

Figure 2 – Parameters Plan

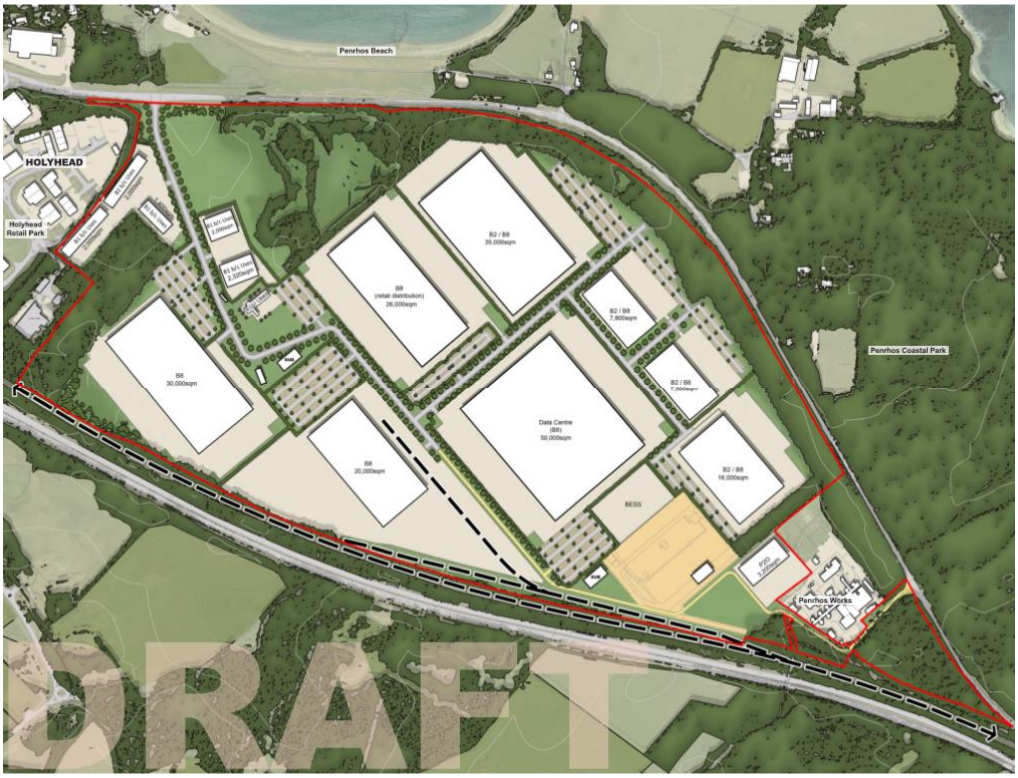

Figure 3 – Site Layout Parameters Plan

3. Figure 3 is an indication of how the development will be brought forward in accordance with the parameters plan – Figure 2.

4. The energy strategy report outlines the key measures to be incorporated within the design in regard to sustainability, carbon emissions, renewable energy and the environmental impact of the development, in accordance with the relevant national regulations, regional and local policy.

5. The proposed Outline Energy Strategy has been developed in accordance with the following complimentary local Borough planning policies:

- Anglesey and Gwynedd Joint Local Development Plan 2017 (2022-2026)
  - Policy PS 5: Sustainable Development
  - Policy PCYFF 5: Carbon Management
  - Policy PS 6: Alleviating and adapting to the effects of Climate Change

6. The principal objectives are to reduce the site contribution to the causes of climate change by reducing energy demand and by providing a portion of the demand through clean, renewable sources. The recommendations within this report are based on the proposed Stage 2 Design, however it is understood that the design will continue to evolve as the project progresses.

7. All units within the development shall aspire to achieve an EPC rating of A. The EPC rating at this stage is indicative and subject to the parameters outlined within this report. The detailed design of the scheme will be secured through reserved matters applications in due course.

2.0 PLANNING POLICY AND LEGISLATION

1. Planning Policy Wales (Edition 12), updated on February 2024, sets out government's planning policies for Wales and how these should be applied.

2. PPW supports the transition to a low carbon future in a changing climate, accounting for flood risk, coastal change. It helps shape places in ways that contribute to radical reductions in greenhouse gas emissions, encourages the reuse of existing resources, including conversion of existing buildings, and supports the use of renewable resources and low carbon energy and associated infrastructure.

3. Section 5 states that new developments should be planned for in ways that:

- Embrace the challenge of decarbonising the energy and transport sectors including phasing out of fossil fuels and moving towards local, decentralised renewable energy systems, the increased use of energy storage to balance supply and demand and the challenge this creates on our distribution networks
- To encourage polices and proposals which will promote low carbon developments and site for renewable energy, manufacturing, research and development close to areas of deployment of renewable energy.

4. Paragraph 5.8.2 states: The Welsh Government's policy is to secure zero carbon buildings while continuing to promote a range of low and zero carbon technologies as a means to achieve this.

5. Paragraph 5.8.3 states the Sustainable building design principles should be integral to the design of new development. Development proposals should:

> *Mitigate the causes of climate change, by minimising carbon and other greenhouse gas emissions associated with the development's location, design, construction, use and eventual demolition; and include features that provide effective adaptation to, and resilience against, the current and predicted future effects of climate change.*

6. Paragraph 5.8.4 states: In order to further promote energy efficiency and energy conservation, planning authorities should consider including development plan policies requiring applications for major development to be accompanied by an Energy Report. This independent report should include recommendations to the developer relating to energy efficiency and appropriate renewable energy technologies that could be incorporated into the development. A response to that report from the developer should also accompany the application.

7. Paragraph 5.8.5 states Planning authorities should assess strategic sites to identify opportunities to require higher sustainable building standards, including zero carbon, in their development plan. In bringing forward standards higher than the national minimum, which is set out in Building Regulations, planning authorities should ensure the proposed approach is based on robust evidence and has taken into account the economic viability of the scheme.

8. The key focus of the PPW is to support local and regional planning authorities.

2.1 Building Regulations Part L Vol 2 (Vol 2 2022)

1. Whilst is not a planning policy, the Building Regulations set out the requirements for energy and carbon performance. Periodic updates to these national regulations will drive the energy efficiency and carbon reduction improvements.

2. To comply with Wales building regulations, all buildings on the site must show compliance at design stage with the following criteria from Approved Document L, Conservation of fuel and power, Volume 2: Buildings other than dwellings (2022):

   - The Building Primary Energy Rate (BPER) must not exceed the Target Primary Energy Rate (TPER), i.e. BPER ≤ TPER.
   - The Building Emission Rate (BER) must not exceed the Target Emission Rate (TER), i.e. BER ≤ TER.
   - Building fabric, airtightness and HVAC systems have a minimum specified performance
   - Limits to Solar Gain: any zone in the actual building that is an occupied space is subject to further analysis to mitigate the risk of overheating

3. Reasonable provision shall be made for the conservation of fuel and power in buildings by:

   - Limiting heat gains and losses through thermal elements and other parts of the building fabric; and from pipes, ducts and vessels used for space heating, space cooling and hot water services.
   - Providing fixed building services which are energy efficient to a reasonable standard; have effective controls; and are commissioned by testing and adjusting as necessary to ensure they use no more fuel and power than is reasonable in the circumstances.

4. For each space in the building that is occupied or mechanically cooled, the solar gains through the glazing should be no greater than would occur through the relevant reference glazing systems with a defined total solar energy transmittance (g-value) calculated according to BS EN 410. In this context, an occupied space means a space that is intended to be occupied by the same person for a substantial part of the day. This excludes circulation spaces and other areas of transient occupancy, such as toilets.

2.2 Energy Performance Certificates (EPCs)

1. EPCs are an asset rating and a measure of building quality: the higher the rating the worse the building is, and the greater the opportunity to reduce carbon emissions and improve the building itself. However, the asset rating provides no information about how the building is operated in practice. An asset rating models the theoretical, as-designed energy efficiency of a particular building, based on the performance potential of the building itself (the fabric) and its services (such as heating, ventilation and lighting). The building quality (provided by the asset rating) has a large impact on the total emissions but does not explain all emissions. Other factors such as unregulated loads (e.g. IT, plug-in appliances) or building user behaviour also create emissions, which are reflected in the operational energy usage. The asset rating is intended to inform people on first occupancy, i.e. at the point of construction, sale or rent, in order to help purchasers or occupiers in selecting the right building. EPCs are for compliance and as a result have “standard driving conditions”, such as occupancy patterns and densities; set points etc., to allow them to be compared.

2. It is proposed that each building within the development aspire to achieve an EPC rating of A. The EPC rating at this stage is indicative and subject to the parameters outlined within this report. Any changes as the design progresses and at fit-out could impact the potential EPC rating.

2.3 Anglesey and Gwyneed Joint Local Development Plan 2017

1. The Anglesey and Gwyneed Joint and Local Development Plan 2017, forms the basis for planning policy on this project. The relevant policies that cover and address energy requirements, and those that touch on the wider sustainability objectives are provided below.

2. Anglesey Energy Island Programme
    - The Plan should incorporate the principles included in the Programme and facilitate low carbon development across the Plan area (including energy saving methods and carbon footprint reduction).

3. Policy PS 5 – Sustainable Development
    - Reduce the effect on local resources, avoiding pollution and incorporating sustainable building principles in order to contribute to energy conservation and efficiency; using renewable energy; reducing / recycling waste; using materials from sustainable sources; and protecting soil quality.

4. Policy PCUFF5 – Carbon Management

    - Proposals will need to demonstrate how the energy hierarchy set out in Policy PS 6 has been applied and how the contribution from renewable or low carbon energy to satisfy the proposals need for energy and waste and been maximised.

5. Policy PS 6 - Alleviating and adapting to the effects of Climate Change

    - In order to alleviate the effects of climate change, proposals will only be permitted where it is demonstrated that they have fully taken account of and responded to the following:
        - Reducing energy demand
        - Energy efficiency
        - Using low or zero carbon energy technologies wherever practical
    - Reducing greenhouse gas emissions.

3.0 ENERGY STRATEGY SCOPE

1. In accordance with best practice, the energy strategy has been developed through the application of an energy hierarchy approach. In doing so, the energy strategy demonstrates how the proposed development can meet the planning requirements and Building Regulations Part L Vol 2 (2022 Wales Edition).

2. To comply with planning policy and client requirements, the following targets have been established for the development:

    - To install low carbon technologies in new buildings (Planning Policy Wales Edition 12 – February 2024)
    - A reduction in CO_2 emissions (after lean, clean and green measures are incorporated - Planning Policy Wales Edition 12 – February 2024)

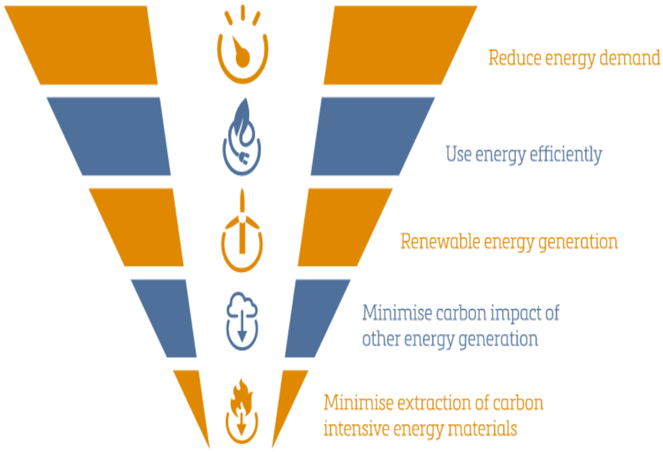

Figure 4 – Energy Hierarchy for Planning

- Aspire to achieve EPC A
- BREEAM "Very Good" with the aspiration for achieve "Excellent"

3. The energy hierarchy describes a set of principles to guide design development and decisions regarding energy, balanced with the need to optimise environmental and economic benefits. The energy hierarchy for Wales is:

   - Reducing energy demand (Be Green)
   - Energy Efficiency (Be Lean)
   - Using low or zero carbon energy technologies wherever practicable (Be Clean)

4. These guiding principles can be summarised as follows:

   - Using less energy, in particular by adopting sustainable design and construction measures; and
   - Utilise low and zero carbon energy.

5. Key features affecting sustainability that will be applied to the development include:

   - High thermal performance building fabric: low U-values and air permeability to ensure heating and cooling demand and resulting energy costs are controlled for end users
   - The use of air source heat pumps to generate thermal energy efficiently
   - Use of both natural and mechanical ventilation to provide the most efficient means of providing fresh air suitably for the conditions
   - An array of photovoltaic panels on the roof, to generate clean electricity for the development and help to reduce its carbon footprint

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   - The use of air source heat pumps to generate thermal energy efficiently
   - Use of both natural and mechanical ventilation to provide the most efficient means of providing fresh air

suitably for the conditions
- An array of photovoltaic panels on the roof, to generate clean electricity for the development and help to reduce its carbon footprint

7. Dynamic simulation models will be constructed to calculate the regulated energy use associated with the proposed development, and the energy hierarchy steps will be applied sequentially to demonstrate the carbon reductions achievable at each stage.

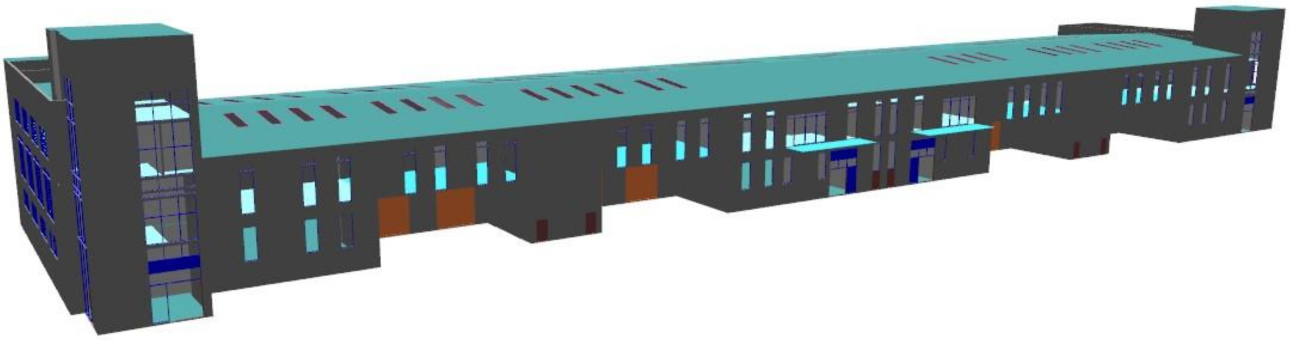

Figure 5 – TAS model of site – Example

8. Each stage of the energy hierarchy will be addressed in the proceeding sections of this report. The associated energy strategy calculation/output is included in the following Appendices for reference:

- Appendix B - Part L Vol 2 (2022 Wales Edition) BRUKL reports for each relevant stage of the energy hierarchy.
- Appendix C – Part L Vol 2 (2022 Wales Edition) draft EPC report for Be Green stage of the energy hierarchy.

9. All total development CO_2 emissions reported are based on the outputs from the BRUKL report. Total development figures are then calculated on an area weighted average basis.

10. Once the development has been modelled, the areas are as per the DSM model and as reported in the BRUKL reports appended as opposed to the Development GIA quoted elsewhere. The DSM model will be constructed in compliance with the National Calculation Methodology, and therefore includes minor geometric simplifications that may result in a slight variance in floor area.

3.1 Passive Design Measures

1. The proposed development will be designed to reduce CO_2 emissions at Be Lean Stage, as far as practicable, through utilising passive and active design measures within the design. The active and passive design measures that are proposed to be incorporated in the design are detailed below.

- Efficient building envelope with enhanced U-values beyond the Part L2 (2022 Wales edition)
- Enhanced air permeability to reduce heating demand in the winter months, and reduce heat losses through infiltration further
- Consideration for the extent of glazed area, balanced between factors such as thermal efficiency, overheating and daylighting.
- Glazed façades throughout to provide natural daylighting and reduce reliance on artificial lighting.
- Solar control glazing
- Balanced g-value for translucent elements to ensure optimised internal conditions in the winter and

summer months.
- Solar shading to be incorporated wherever possible

3.2 Active Design Measures (Energy Efficient Services)

1. To ensure that planning targets and Building Regulations are met and exceeded, the proposed development will be designed and constructed to operate with a very high level of energy efficiency, and consequently a low level of carbon emissions. The design and installation of the mechanical and electrical services will make a significant contribution towards this.

2. Approved Document Part F (Ventilation, 2021, English edition) has introduced a minimum fresh air rate per m^2, and the requirement to ventilate common parts such as corridors and lobbies in commercial buildings.

3. The following active design measures will be incorporated into the design:

    - High efficiency LED lighting to reduce electrical consumption and heat gains from lighting.
    - Passive Infra-Red (PIR) presence detection and daylight dimming control for lighting within the office core and warehouse space.
    - Energy sub-metering to BREEAM standards to enable monitoring of energy usage.
    - High efficiency hybrid ventilation with heat recovery and free cooling to office accommodation
    - Variable speed pumps and fans to be used to promote lower operating costs and help match energy usage with the operating profile and occupancy of the building.
    - Zoning of the mechanical ventilation systems.

4. In terms of mechanical services to be included within the design, the below will be proposed:

    - Ventilation: Dedicated high efficiency Mechanical Ventilation Heat Recovery (MVHR) systems in the office areas. Zonal or Local Extract system for toilet areas.
    - Space Heating and Cooling: ASHP with reverse cycle to provide heating/cooling (VRF) in the office, circulation and toilets areas
    - Domestic Hot Water: via Air Source Heat Pump

5. It is highlighted that the warehouse shall be offered to the market as a shell. There are reasonable expectations for the warehouse to be unheated and to have a high energy efficient lighting system with photoelectric controls to take advantage of the daylight entering the space via rooflights and/or the side windows. Therefore, the calculation of the energy demand and carbon emissions includes for the associated usage.

4.0 COOLING HIERARCHY AND OVERHEATING RISK

1. Dynamic overheating modelling using CIBSE guidance (TM52 in this case) is required as part of the submission of the energy strategy and should account for the limits that Approved Document Part O (2021, English edition) places on the choices available when undertaking a CIBSE assessment. Part O applies to new residential buildings only and so is not applicable in this case.

    The following interactions with Part L will be considered:

    - Solar gains in winter can reduce the amount of space heating required to be delivered by the heating system. Reducing summer overheating by limiting glazing areas will impact winter solar gains and therefore increase the need for space heating.

- Poorly insulated pipework, particularly in community heating schemes, can be a major contributor to overheating. Control of heat losses from pipework is dealt with under Part L of the Building Regulations and the guidance in Approved Document L should be followed.

2. Approved Document Part F (Ventilation, 2021, English edition) has introduced a minimum fresh air rate per m^2, and the requirement to ventilate common parts such as corridors and lobbies in commercial buildings.

3. To reduce the risk of overheating the following measures will be considered as part of the design.

- For mechanically ventilated areas (primarily main office accommodation), ensure that the ventilation system allows for a bypass function to mitigate the impact of excess heat recirculation in warmer periods.
- The glazing will have solar control to ward off excess sunlight, glare and heat from the sun.
- Internal blinds might need to be provided to the office areas.
- Solar shading to be incorporated wherever necessary.
- Within warehouse areas, a combination of roof lights and wall lights might be utilised to achieve a balance between limiting overheating potential and maximising the benefit of natural daylighting.

4. With major developments, to reduce potential overheating and reliance on comfort cooling systems. The efforts to reduce overheating should follow the priority order of the cooling hierarchy:

- Reduce the amount of heat entering a building in summer through orientation, shading, high albedo materials, fenestration, insulation, and the provision of green roofs.
- Minimise internal heat generation through energy-efficient design.
- Manage the heat within the building through exposed internal thermal mass and high ceilings
- Passive ventilation
- Mechanical ventilation
- Active cooling

5.0 HEATING INFRASTRUCTURE (BE CLEAN)

5. Dynamic overheating modelling using CIBSE guidance (TM52 in this case) is required as part of the submission of the energy strategy and should account for the limits that Approved Document Part O (2021, English edition) places on the choices available when undertaking a CIBSE assessment. Part O applies to new residential buildings only and so is not applicable in this case.

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7. To reduce the risk of overheating the following measures will be considered as part of the design.

- For mechanically ventilated areas (primarily main office accommodation), ensure that the ventilation system allows for a bypass function to mitigate the impact of excess heat recirculation in warmer periods.
- It is assumed that the glazing will have solar control to ward off excess sunlight, glare and heat from the sun.
- Solar shading will be incorporated where appropriate
- Balancing between limiting overheating potential and maximising the benefit of natural daylighting shall be considered for the development.

8. The hybrid mechanical ventilation system will automatically control the natural ventilation input, according to internal and external conditions, where possible reducing the use of mechanical HVAC and reducing energy consumption.

9. For good practice, the main office accommodation will be assessed for overheating risk in accordance with CIBSE TM52 criteria to ensure thermally comfortable conditions are achieved for spaces where activities may be more sedentary (i.e. office-based work). The resulting analysis indicates that active cooling will be required as passive measures alone are not sufficient to mitigate the risk of overheating.

6.0 USING LOW OR ZERO CARBON ENERGY (BE GREEN) - RENEWABLE ENERGY

1. This Stage of the energy hierarchy relates to the generation of on-site low carbon renewable energy to further reduce carbon emissions.

2. A reduction in carbon emissions through the use of on-site renewable energy may be achieved through several technologies to generate heat or power. In determining the most suitable technology consideration will be given to:

- Carbon reduction effectiveness.
- Cost feasibility.
- Practicality.
- Planning restrictions.
- Site related constraints and
- User desirability.

3. A feasibility assessment of the Low and Zero Carbon (LZC) technologies will be conducted to determine the suitability and feasibility for use within the development. This can be found in Appendix A of this report.

4. The assessment provided gives an indication of the technologies that would be feasible for the site. The assessment includes consideration for wind turbines, solar thermal collectors, biomass heating and ground source heat pumps.

5. The most suitable technologies for the site were found to be photovoltaic panels and air source heat pumps. These technologies are described below.

6. Consideration will be given to the site electrical infrastructure and the feasibility to facilitate battery storage of surplus power generated by PV will be explored.

6.1.1 Technology Description

1. Solar Photovoltaics (PVs) are solar panels, which generate electricity through photon-to-electron energy transfer, which takes place in the dielectric materials that make up the cells. The cells are made up from layers of semi-conducting silicon material which, when illuminated by the sun, produces an electrical field which generates an electrical current.

2. PVs can generate electricity even on overcast days, requiring daylight, rather than direct sunlight. This makes them viable even in the UK, although peak output is obtained at midday on a sunny summer's day. PVs offer a simple, proven solution to generating renewable electricity.

3. The main types of commercially available PV panels on offer in the UK are constructed from crystalline cells as described below.

   - Crystalline silicon cells are the most efficient of the PV technologies with a conversion efficiency of between 18-20% (available solar energy to electricity produced). They are cut from single ingots of silicon, have an unbroken crystal lattice and are the most expensive of PV systems.
   - Thin film cells have a conversion efficiency of between 5-10%. These are less efficient than silicone derived cells. Thin films can be mounted on folded or curved surfaces and are used extensively in Building Integrated PV products.

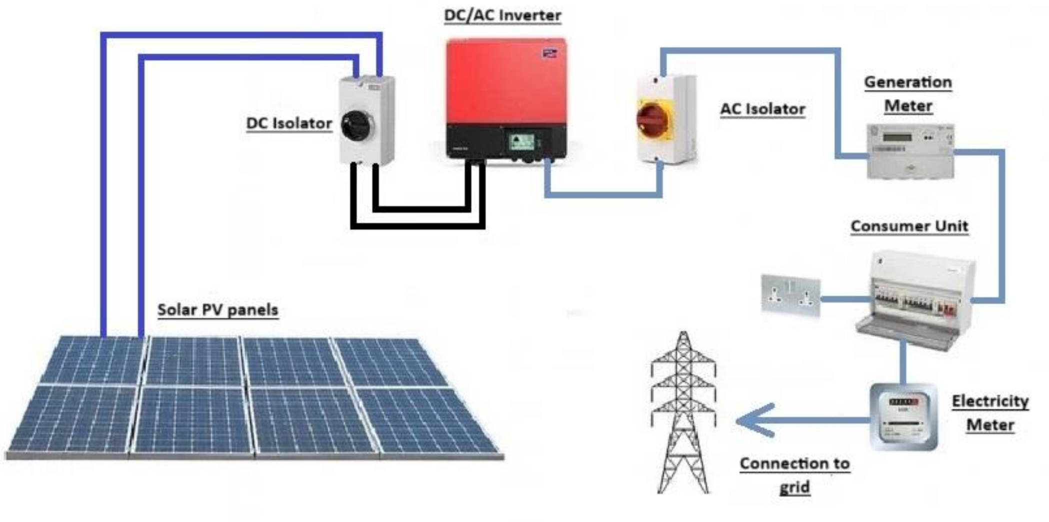

Figure 6 – Photovoltaic Panels – Typical Diagram

6.1.2 Feasibility for Site

1. The proposed development has unshaded roof areas which are suitable for mounting solar PV panels. Photovoltaic arrays are proposed for the development for generation of partial power of the buildings. This would be to typically offset the energy used in the operation of equipment and lighting.

2. There are no foreseen land use issues attributed to the system, and it is anticipated that there will be no local planning issues which will impact the feasibility of the implementation of this technology. There is also no noise impact associated with this technology.

3. A solar PV system could be proposed to meet a proportion of the energy requirements of the development. It is not anticipated that there will be a restriction on PV system generation or export back to the grid.

4. The estimated minimum annual output of the PV arrays proposed for the development, subject to detailed design, will be presented within table 5 below, in terms of estimated kWp output, area and the specific required target annual generation output in kWh in order to meet the targets for the site. The final PV arrays

required to meet the generation targets are dependent upon a number of factors, including types of panels selected, panel efficiency and orientation. The estimated system capacity and area are shown for guidance only.

5. The final specification of PV arrays would therefore be confirmed at a detailed design stage and verified by subsequent BRUKL calculations.

6. A life-cycle cost exercise will be carried out based upon the results from the initial energy modelling.

7. In terms of glint and glare, any potential issues are anticipated to be limited, since Solar PV panels are designed to absorb, not reflect, irradiation. At the detailed design PV panels, frames and supports with suitable anti-reflective finishes can be specified to reduce any impacts.

6.2 Air Source Heat Pumps

6.2.1 Technology Description

1. Air Source Heat Pumps (ASHP) work on the same principle as Ground Source Heat Pumps (GSHP). The difference is the medium in which the heat is extracted is the external air rather than the ground. An ASHP can be used for both heating and cooling and can also be used to provide simultaneous heating and cooling to different rooms as required.

2. A typical light industrial building would have a layout that would support the use of air-to-air heat pumps instead of a more typical boiler plant and an air conditioning system. The calculation below demonstrates that an electric ASHP system becomes more efficient than a 90% gas boiler system when the Co-efficient Of Performance (COP) is above 0.595.

$$\frac{CO2\ Emissions\ from\ Electricity\ x\ Boiler\ Efficiency}{CO2\ Emissions\ from\ Gas\ per\ unit} = \text{Break Even COP}$$

$$\frac{0.1388kgCO2\ x\ 0.9\%}{0.21kgCO2} = 0.595$$

3. Air Source Heat Pumps (ASHPs) are considered an alternative to Ground Source Heat Pumps despite the latter having a COP of around 4 as GSHPs have a significantly high installation cost making them unattractive for this development.

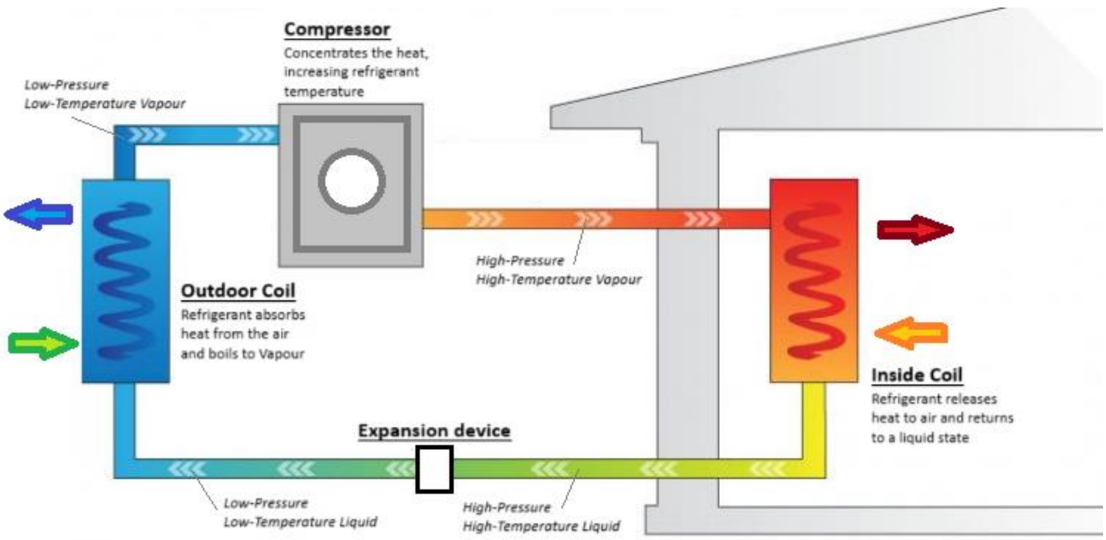

Figure 7 – Air Source Heat Pump – Typical Diagram

6.2.2 Feasibility for Site

1. Air Source Heat Pumps are proposed to provide heating and cooling to the office areas of the proposed units.

2. The system will be sized suitably to meet the demand for the site therefore exporting of energy would not be appropriate.

3. An ASHP system with a reasonable COP has a medium-term time payback period.

4. ASHP can be installed either at the roof or ground level depending on the design for the site.

5. To mitigate any potential noise impact, mitigation measures can be taken to reduce the noise levels associated with an external ASHP system such as suitable enclosures if required. Systems are typically circa 85dB at 1.0m.

6. As the system will be designed to include for cooling, it is considered that this would not be suitable for the RHI or grants available for LZC technologies.

7. A typical payback for this system is typically greater than 25 years when compared to a gas boiler system for heating only. As the design progresses and a specific system is identified costs can be accurately calculated and shall be detailed after the modelling has been undertaken.

8. The renewable proportion of energy from the ASHP considered as renewable will be calculated using the equation outlined in ANNEX VII of Directive 2009/28/EC.

9. The estimated capital cost will be based on the sized unit from assumptions from published guidance at this stage, and it's meant as an approximate cost to calculate payback years and shouldn't be used as a predicted cost for fitting out the building.

10. Annual and peak heating loads from the Part L assessment may not be accurate for the actual running of the building.

7.0 CONCLUSION

1. The energy strategy outlines the key measures to be incorporated within the design in regard to sustainability, carbon emissions, renewable energy and the environmental impact of the development, in accordance with the relevant national regulations, regional and local policy.

2. The principal objectives are to reduce the site contribution to the causes of climate change by reducing the developments energy demand and by providing a portion of the demand through clean, renewable sources.

3. To comply with planning policy and client requirements, the following targets have been established for the development:

- To install low carbon technologies in new buildings (Planning Policy Wales Edition 12 – February 2024)
- A reduction in CO_2 emissions (after lean, clean and green measures are incorporated - Planning Policy Wales Edition 12 – February 2024)
- Aspire to achieve EPC A
- BREEAM "Very Good" with the aspiration for achieve "Excellent"

4. The results that will be produced by the draft energy modelling will demonstrate that the proposed development complies with all the relevant policies addressed within this document and will be able to achieve carbon and energy reductions through the inclusion of energy efficient measures and Low and Zero Carbon (LZC) technologies.

5. A feasibility assessment of the Low and Zero Carbon (LZC) technologies will be conducted to determine the suitability and feasibility for use within the development.

6. To further quantify the positive impact of the proposed sustainability measures the development is currently aiming to achieve a BREEAM rating of “Excellent”.

APPENDIX A – LOW AND ZERO CARBON FEASIBILTY ASSESSMENT SUMMARY

1.0 Low And Zero Carbon Technologies

1.1 Wind Generation

1.1.1 Technology Description

1. Wind turbines are an established means of capturing wind energy and converting it into usable electricity. Wind turbines come in various sizes depending on requirements. A wind turbine usually consists of a nacelle containing a generator connected, sometimes via a gearbox, to a rotor consisting of three blades.

2. The two main types of commercially available wind turbines on offer in the UK are described below:

   - Horizontal Axis Wind Turbines (HAWT) are traditionally the most common form of wind turbines installed in the UK. They are usually formed of three blades and work best when provided with a constant laminar air flow; and
   - Vertical Axis Wind Turbines (VAWT) are less efficient compared to HAWTs but have the advantage that they can cope with variable wind flows as they do not have to 'face' the wind.

3. Wind turbines can also be classified according to their size:

   - Micro-wind: under 15kW rated capacity;
   - Small-scale wind: between 15kW to 100kW rated capacity;
   - Medium-scale wind: between 100kW to 500kW rated capacity; and
   - Large-scale wind: greater than 500kW rated capacity.

1.1.2 Feasibility for Site

1. Referring to the NOABL (Numerical Objective Analysis of Boundary Layer) wind speed database as adopted by the Business, Energy, and Industrial Strategy (BEIS), the site experiences an average wind speed of 5.6 m/s assuming a rotor height at around 10m above ground level, but it is unlikely that average speeds will meet this estimate.

Average Wind Speeds (estimates from NOABL - https://www.rensmart.com/Maps)

- At 10m above ground level 5.6 m/s
- At 25m above ground level 6.4 m/s.
- At 45m above ground level 7.0 m/s.

Figure 1 – Average Wind Speeds (source: NOABL)

2. As demonstrated in Figure 1 above, taking a turbine with a rotor at 45m above ground level may increase wind speeds to 7.0 m/s, but given the local environment, it is unlikely that average speeds will meet this estimate.

3. Irrespective of wind speeds, freestanding horizontal axis wind turbines require a large area of land, which would have a detrimental effect on the viability of the site.

4. Smaller freestanding vertical axis wind turbines have smaller operational footprints. However, anticipated wind turbulence at low level rules out their application. However, anticipated wind turbulence at low level also rules out their application. Although these turbines can also be installed at roof level, this can have a significant effect on the total height of the building, and is not considered appropriate for this development.

5. Roof mounted wind turbines can generate small but valuable amounts of electricity. Turbines specifically designed to make best use of the wind flows around a building and mounted on the roof edge can often be appropriate for urban environments.

6. However, wind turbines place additional forces on structures and the effect of potential noise, vibration and visual intrusion would all need careful analysis before deployment. A roof mounted system would have a significant effect on the total height of the building, and is not considered appropriate for this development.

7. Due to the above and the wind speed available, this technology has not been considered further.

1.2 Solar Thermal Evacuated Tube Panels

1.2.1 Technology Description

1. Solar thermal panels are used to produce hot water and consist of roof mounted collector panels that make use of heat energy from the sun and use it to heat water circulating in a closed loop. Usually, this heat is transferred via a heat exchanger into a hot water storage tank that is also heated by a gas or other boiler.

Figure 2 – Evacuated Tube Solar Collector

2. Two main types of solar water heating system are used in the UK:

- Flat plate collectors circulate water around a black coloured receiver plate that is heated by direct sunlight and to some extent by indirect light; heat being retained by a thermally glazed panel above.
- Evacuated glass heat tubes are more efficient, particularly in the UK, as they can work more effectively at low solar radiation levels. However, they are more expensive than flat plate collectors. They consist of rows of parallel transparent glass tubes, each containing an absorber tube which converts the sunlight into heat energy

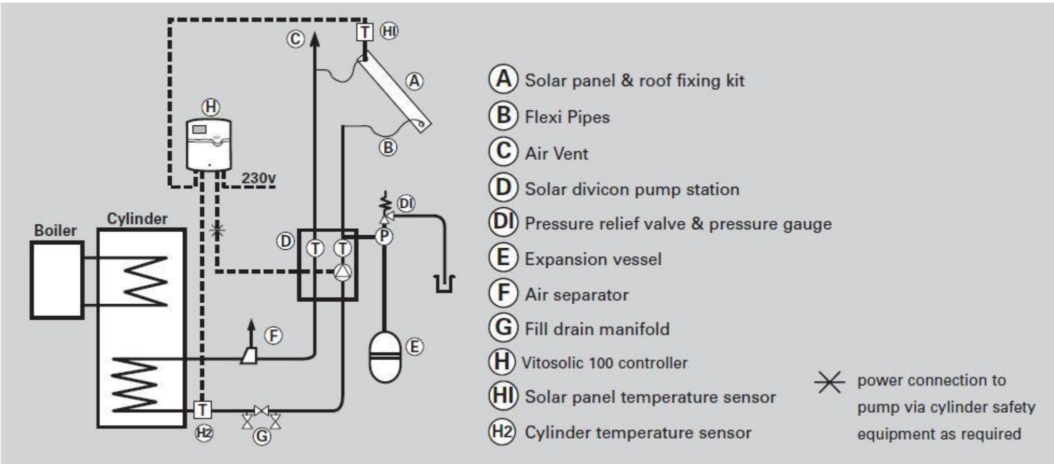

Figure 3 – Evacuated Tube Solar Collector Typical Schematic Diagram

1.2.2 Feasibility for Site

1. It is assumed that site will have a low anticipated requirement for hot water except for hand wash sinks in toilets and tea-making areas and occasional shower usage.

2. The BRUKL calculations shall be undertaken without the use of solar thermal installations. It is proposed that domestic hot water is produced using highly energy efficient electric water heaters.

3. Priority on the roof will be given to providing photovoltaic panels and roof lights.

4. Solar thermal water heating has not been considered further for this assessment.

1.3 Geothermal Heat Pump

1.3.1 Technology Description

1. Ground Source Heat Pumps (GSHP) extract heat from the ground. GSHPs work on the principle that the below ground temperature is more constant compared to above ground. In the winter months, the below-ground temperature is warmer than above ground and the heat carrier fluid circulating within the absorber pipes absorbs the heat. This heat energy is then raised by a compressor (using the compression cycle) and through a heat exchanger, distributed via a low temperature distribution system such as under floor heating, to satisfy a proportion of space heating requirements.

2. In the summer months, the below-ground temperature is colder than above ground and the heat carrier fluid circulating within the absorber pipes rejects building's heat. This heat rejecting capacity is then raised by a compressor (using the compression cycle) and through a heat exchanger, distributed via a chilled water distribution system to satisfy a proportion of space cooling requirements. GSHP systems are not suitable for satisfying high temperature hot water demands.

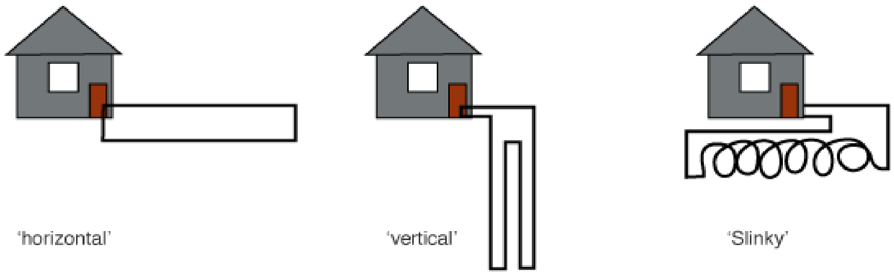

Figure 4 – Ground Source Heat Pump Loop Arrangements

3. In the summer months, the below-ground temperature is colder than above ground and the heat carrier fluid circulating within the absorber pipes rejects building's heat. This heat rejecting capacity is then raised by a compressor (using the compression cycle) and through a heat exchanger, distributed via a chilled water distribution system to satisfy a proportion of space cooling requirements.

4. As Figure 4 above indicates, there are a number of configurations for GSHP systems. A vertical collector system is considered the most appropriate in the context of the proposed development given the scale of the system and limited area available for horizontal collectors. Vertical collectors can be between 15–180m deep with minimum spacing between adjacent boreholes should be maintained at 5-15m to prevent thermal interference.

5. A key component of this technology is the heat exchanger. Larger heat exchangers deliver greater heat transfer and are, therefore, more efficient but they have a higher capital cost.

1.3.2 Feasibility for Site

1. As outlined above, a typical class B2 - B8 building has little requirement for heat as much of the building is likely to be maintained at ambient temperature or refrigerated. This technology will therefore not be suitable.

2. For a commercial or industrial development, it is common that heating is installed to the office and core areas only.

3. Within the majority of logistics and industrial there is no space conditioning, and the requirement is completely dependent on end user operation which is not known at this stage.

4. The estimated heating loads for the speculative units are unknown and cannot be determined at this time.

5. With regard to the areas served by ASHP, this is provided to all office areas. No direct electric heating is proposed.

6. The costs involved in installing a GSHP, particularly the drilling of boreholes will make it economically unviable for the development. Ground source heat pumps are therefore not considered further as part of this assessment.

1.4 Energy Storage

1.4.1 Technology Description

1. Energy storage works by capturing energy produced by both renewable and non-renewable resources and storing it for discharge when required. The solution allows users to come off the grid and switch to stored energy, at a time most beneficial, giving greater flexibility and control of electrical usage.

2. At times of low demand, when there is excess supply energy it can be stored for use at times of high demand, with low supply, thus adjusting to provide the required balance between supply and demand. This approach is especially effective with renewable generation, which is intermittent by its nature. Solar and wind, for example, generate little amounts of power in the absence of sunshine or wind. Energy storage is able to smooth out the supply from these sources to provide a more reliable supply that matches demand.

3. Energy storage systems provide a wide array of technological approaches to managing power supplies in order to create a more resilient energy infrastructure and bring cost savings to utilities and consumers. The diverse approaches currently being deployed around the world can be divided into six main categories:

   - Solid State Batteries - a range of electrochemical storage solutions, including advanced chemistry batteries and capacitors
   - Flow Batteries - batteries where the energy is stored directly in the electrolyte solution for longer cycle life, and quick response times
   - Flywheels - mechanical devices that harness rotational energy to deliver instantaneous electricity
   - Compressed Air Energy Storage - utilising compressed air to create an energy reserve
   - Thermal - capturing heat and cold to create energy on demand
   - Pumped Hydro-Power - creating large-scale reservoirs of energy with water

1.4.2 Feasibility for Site

1. Energy storage is not included as part of the current design, the PV system is suitably sized for the development, and it is anticipated there would be limited requirement for storage. However, this could be considered by the future Tennant depending on their energy requirement.

2. The viability for energy storage will be dependent on the final building operational profile which is unknown at this stage. The electrical infrastructure on site will be designed to facilitate installation of energy storage in the form of solid-state batteries in future.

1.5 Low Zero Carbon Recommendations

1. In line with the above findings, it is recommended that the proposed development includes the incorporation of solar PV and ASHP to serve heating and cooling demand within the office accommodation areas.

2. The recommended LZC technologies collectively would provide a significant reduction in terms of both energy and carbon. The following percentage savings from LZC technologies are achievable compared to building regulated energy and carbon baseline.

APPENDIX B – BRUKL REPORTS (FOR EACH ENERGY HIERARCHY STAGE)

APPENDIX C – DRAFT INDICATIVE EPC CERTIFICATE (BE GREEN STAGE)

APPENDIX D – ARCHITECTURAL DRAWINGS USED FOR DYNAMIC MODELLING

DRAWING	DATE RECEIVED
XX	XX

Table 1 – Architectural Drawings used to produce the draft thermal model

APPENDIX E – BREEAM DRAFT ENE 01 CALCULATIONS OUTPUTS – EXAMPLE ONLY

Energy performance - Building score	
Heating and cooling demand energy performance ratio (EPRdem)	0.326
Primary energy consumption performance ratio (EPRpe)	0.042
CO_2-eq energy performance ratio (EPRco2-eq)	0.238
Overall building energy performance ratio (EPRnc)	0.607
Total BREEAM credits achieved	6.0
Is the primary energy consumption the same or lower than that of the notional building?	Yes
Is the primary energy consumption at least 10% lower than that of or higher than that of the notional building?	Yes