

Intermodal Logistics Park North Ltd

INTERMODAL LOGISTICS PARK NORTH (ILPN)

Intermodal Logistics Park North (ILPN) Strategic Rail Freight Interchange (SRFI)

Project reference TR510001

Appendix 17.5: Outline Energy Strategy Report

October 2025

Planning Act 2008

The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017

This document forms a part of a Preliminary Environmental Information Report (PEIR) for the Intermodal Logistics Park North (ILPN) project.

A PEIR presents environmental information to assist consultees to form an informed view of the likely significant environmental effects of a proposed development and provide feedback.

This PEIR has been prepared by the project promoter, Intermodal Logistics Park North Ltd. The Proposed Development is described in Chapter 3 of the PEIR and is the subject of a public consultation.

Details of how to respond to the public consultation are provided at the end of Chapter 1 of the PEIR and on the project website:

<https://www.tritaxbigbox.co.uk/our-spaces/intermodal-logistics-park-north/>

This feedback will be taken into account by Intermodal Logistics Park North Ltd in the preparation of its application for a Development Consent Order for the project.

DOCUMENT MANAGEMENT

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Appendix 17.5 ◆ Outline Energy Strategy Report

EXECUTIVE SUMMARY

- 1.1 MBA Consulting Engineers Ltd. has been commissioned by Intermodal Logistics Park North Ltd to produce an Outline Energy Strategy report in support of the Development Consent Order (DCO) application for the proposed development known as Intermodal Logistics Park North, Parkside East, Newton-le-Willows (ILP North).
- 1.2 An estimate of operational energy demand has been made based on experience of similar developments and mix of building use. Further detailed energy modelling will be undertaken for the detailed application for each unit.
- 1.3 The DCO application proposes:

‘Development of a Strategic Rail Freight Interchange (SRFI) with connections to the West Coast Main Line and Chat Moss (Liverpool-Manchester) Line, including container storage, Heavy Goods Vehicle (HGV) parking, rail control building and staff facilities; rail served warehousing and ancillary service buildings; new road infrastructure and works to existing road infrastructure; demolition and alterations to existing structures and earthworks to create development plots and landscape zones; strategic landscaping and open space, including alterations to public rights of way and the creation of new ecological enhancement areas’.

Figure 1.1 Proposed Masterplan

- 1.4 This energy strategy has been developed in accordance with relevant national and local legislation and policy.
- 1.5 In addition to meeting the relevant policy objectives, additional active and passive measures to improve building efficiency will be employed across the proposed development, including works to facilitate an on-site micro grid which will primarily be energised by a roof mounted photovoltaic array. Various scenarios have been modelled to determine the percentage of demand being met on site with minimal import of additional energy.
- 1.6 Table 1.1 demonstrates the expected PV output versus the development's expected total energy demand. Using an estimated energy use for each building considering occupancy, heating and provision for electric vehicle charging, it is expected that a large percentage of the site's energy demand could be met by renewable energy generated on-site. Further dynamic simulation modelling will be undertaken at detailed design stage to further verify the below figures.

Table 1.1 Projected energy demand met by on-site renewable source

Expected PV Provision vs Annual Demand - By Scenario				
	Occupancy	Occupancy + Heating	Occupancy + Heating + eV	Occupancy + Heating + eV +eHGV
PV annualised yield (MWh)	67,880	67,880	67,880	67,880
Typical annualised demand (MWh)	27,140	36,110	48,890	176,610
100% PV yield as % of annual demand	250%	188%	139%	38%

- 1.7 Where there is a shortfall in terms of PV energy output, each building occupier will have the option to add a battery storage system, before import from the main electricity grid supply.

INTRODUCTION

- 1.8 MBA Consulting Engineers Ltd. has been commissioned by Intermodal Logistics Park North Ltd to produce an Outline Energy Strategy report in support of the Development Consent Order (DCO) application for the proposed development known as Intermodal Logistics Park North, Parkside East, Newton-le-Willows (ILP North).

- 1.9 This energy strategy has been developed in accordance with national and local policy.

Department for Transport's National Networks National Policy Statement March 2024

- 1.10 The National Policy Statement (NPS) sets out Government policy on climate change mitigation and adaptation, and in particular how applicants should take climate change effects into account when developing infrastructure.
- 1.11 The NPS states that *'The Secretary of State should be satisfied that applications for new national networks infrastructure have taken into account the potential direct and indirect impacts of climate change ... with a high level of climate resilience built-in from the outset.'* (Paragraph 4.40)

- 1.12 The NPS specifies the following to ensure a robust approach to climate change adaptation:

‘Any adaptation measures should be based on the latest set of UK Climate Projections, the government’s latest UK Climate Change Risk Assessment, when available and in consultation with the Environment Agency’s Climate Change Allowances for Flood Risk Assessments. Any adaptation measures must themselves also be assessed as part of any environmental assessment, which should set out how and where such measures are proposed to be secured.’ (Paragraph 4.42)

- 1.13 The NPS also states that climate change adaptation measures should not cause ‘an adverse effect on other aspects of the project and/or surrounding environment’ (Paragraph 4.43).

Department for Energy Security and Net Zero (DESNZ) Overarching National Policy Statement for Energy (EN-1) and National Policy Statement for Renewable Energy Infrastructure (EN-3)

- 1.14 The Proposed Development will not be an Energy NSIP due to the thresholds changing at the end of 2025 before the DCO Application is due to be submitted. However, the energy infrastructure forming part of the Proposed Development are considered to be in line with the Government’s energy policy because this infrastructure includes the provision of roof-mounted photovoltaic arrays with a generation capacity of up to 77 megawatts peak (MWp) providing direct electricity supply to the building or exporting power to battery storage, if installed by the building occupier. The emerging draft suite of Energy NPSs which have been reviewed by the Government as a result of the Clean Power 2030 Action Plan are also relevant. These draft Energy NPS’s aim to reflect the policies and broader strategic approach set out in the Clean Power mission and ensure that we continue to have a planning policy framework which can support the infrastructure required for the transition to net zero and are a material policy consideration.
- 1.15 The existing and emerging draft NPS’s set out the critical need and strong policy support for decarbonising energy generation, including the need for renewable generation such as solar PV, the benefits of energy generating efficiency through Good Quality Combined Heat and Power (CHP) and an indication of the likely increasingly significant role that hydrogen will play in the energy supply mix in future.

National Planning Policy Framework (NPPF)

- 1.16 The National Planning Policy Framework (NPPF) (December 2024, as amended February 2025) sets out government’s planning policies for England and how these should be applied.
- 1.17 The NPPF 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.
- 1.18 Paragraph 164 states that ‘new development should be planned for in ways that:

‘(a) avoid increased vulnerability to the range of impacts arising from climate change. When new development is brought forward in areas which are vulnerable, care should be taken to

ensure that risks can be managed through suitable adaptation measures, including through incorporating green infrastructure and sustainable drainage systems; and

(b) help to reduce greenhouse gas emissions, such as through its location, orientation and design. Any local requirements for the sustainability of buildings should reflect the Government's policy for national technical standards.'

1.19 Paragraph 166 states that in determining planning applications, local planning authorities should expect new development to:

- comply with any development plan policies on local requirements for decentralised energy supply unless it can be demonstrated by the applicant, having regard to the type of development involved and its design, that this is not feasible or viable; and
- take account of landform, layout, building orientation, massing and landscaping to minimise energy consumption.

1.20 Paragraph 168 states that when determining planning applications for renewable and low carbon development, local planning authorities should:

- Not require applicants to demonstrate the overall need for renewable or low carbon energy, and give significant weight to the benefits associated with renewable and low carbon energy generation and the proposal's contribution to a net zero future;
- Recognise that small-scale and community-led projects provide a valuable contribution to cutting greenhouse gas emissions;
- in the case of applications for the repowering and life-extension of existing renewable sites, give significant weight to the benefits of utilising an established site.

Greater Manchester Combined Authority (GMCA) Places for Everyone Joint Development Plan, adopted March 2024

1.21 Policy JP-S1: Sustainable Development states that '*by 2020, all 10 districts and the Greater Manchester Combined Authority have declared a climate emergency*' and sets out targets to address climate change and be carbon neutral by 2038.

1.22 Key areas to achieve this are through the following:

- Upscaling solar photovoltaic energy
- Reducing heating and cooling demand

1.23 Policy JP-S2: Carbon and Energy sets out that new developments will achieve net zero operational carbon, improving to also include emissions from construction from 2028.

1.24 Development proposals should use the energy hierarchy to achieve this, which in order of importance seeks to:

- minimise energy demand;
- maximise energy efficiency;
- use renewable energy;
- use low carbon energy; and
- utilise other energy sources.

1.25 Policy JP-S3: Heat and Energy Networks states the *‘the provision of decentralised energy infrastructure is critical to the delivery of our objectives for low carbon growth, carbon reductions and an increase in local energy generation.’*

St Helens Borough Council Local Plan up to 2037 adopted July 2022

1.26 Policy LPA02: Development Principles requires new development to *‘lower St Helens Borough’s carbon footprint and adapt to the effects of climate change’*

1.27 Policy LPC13: Renewable and Low Carbon Energy Development requires new developments to:

‘meet high standards of sustainable design and construction and minimise carbon emissions equivalent to CSH level 4, i.e. 19% carbon reduction against Part L 2013 unless proven unviable. To this end they should use energy efficiently and where feasible incorporate decentralised energy systems that would use or generate renewable or other forms of low carbon energy.’

1.28 And to: *‘ensure that at least 10% of their energy needs can be met from renewable and / or other low carbon energy source(s).’*

Wigan Council Core Strategy, adopted September 2013 remaining policies March 2024

1.29 Wigan Council’s Core Strategy declares that *‘Our current patterns of energy use are not sustainable’* and has set Objective E1 *‘to strengthen our energy infrastructure and minimise emissions of greenhouse gases’*

Wigan Council emerging Local Plan 2025-2040

1.30 Objective 7: Ensuring that development mitigates and adapts to climate change by:

- taking a positive approach to securing low carbon and renewable energy opportunities;
- managing flood risk through the use of integrated water management and the provision of multi-functional green infrastructure; and
- promoting the efficient use of water resources and water quality.

1.31 Policy J7 proposes to require all developments for businesses to achieve EPC rating B or better.

ENERGY STRATEGY SCOPE

- 1.32 In accordance with best practice, this energy strategy has been developed through the application of an energy hierarchy approach. In doing so, the energy strategy will demonstrate how the proposed development can meet national and local policy requirements and Building Regulations Part L2 (2021 Edition incorporating 2023 amendments).
- 1.33 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 England is:
- Be lean: use less energy
 - Be clean: supply energy efficiently
 - Be green: use renewable energy
 - Offset
- 1.34 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
- 1.35 The calculations in this document are indicative of system size and are based on guidance documents, approved software and practical experience. They are not design calculations but establish the viability and feasibility of various technologies for the proposed development suited to B2 / B8 building use types.

Energy Efficiency Measures

- 1.36 In accordance with the energy hierarchy a range of energy efficiency measures will be implemented at Be Lean Stage, which encompasses the adoption of a fabric first approach (passive design measures) and energy efficient building servicing (active design measures).
- 1.37 The passive and active design measures incorporated in the energy strategy are detailed below.

PASSIVE MEASURES

- 1.38 The proposed development will be designed to reduce CO2 emissions at Be Lean Stage, as far as practicable, through utilising passive and active design measures within the design. The 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 (2021 England

incorporating 2023 amendments) limiting values (as shown in Table 1.2);

- reduced 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 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 both the winter and summer months; and
- solar shading to be incorporated wherever possible.

1.39 The current Building Regulations Part L2 (2021 edition incorporating 2023 amendments) for England specify that all non-domestic developments must have U-Values limited to the levels included within table below. The proposed development will have enhanced building envelope, wherever possible, as shown in Table 1.2 below.

Table 1.2 Limiting and Proposed U-values as per Building Regulations Part L2 (2021 edition incorporating 2023 amendments)

ELEMENT	PROPOSED U-VALUE FOR THE DEVELOPMENT (W/M ² .K)	NOTES
Walls (external)	0.17	With metal cladding, to match part L limiting values
Ground floors	0.18	To match part L limiting values
Roof	0.18	With metal cladding, to match part L limiting values
Windows	1.6	To improve upon part L limiting values
Roof-lights	2.2	To improve upon part L limiting values

ELEMENT	PROPOSED U-VALUE FOR THE DEVELOPMENT (W/M ² .K)	NOTES
Personnel Doors	1.5	To improve upon part L limiting values
Vehicle access & similar large doors	1.3	To match part L limiting values

AIR PERMEABILITY

- 1.40 Generally, all buildings on the proposed development will have an improved air permeability to a maximum of 2.0 m³/h.m² @50Pa, which is an improvement upon the standard Building Regulations Part L (2021) value of 8.0 m³/h.m² @50Pa.

ACTIVE DESIGN MEASURES (ENERGY EFFICIENT SERVICES)

- 1.41 To ensure that planning standards 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.
- 1.42 The following active design measures are incorporated into the design:
- LED Lighting Systems and Smart Controls.
 - Rooftop Solar PV Systems.
 - Electrical infrastructure designed to facilitate future Battery Energy Storage.
 - High-Efficiency HVAC & Air Handling.
 - Variable Speed Drives on all mechanical plant and equipment.
 - Energy Recovery Ventilation (ERV/HRV) — recover energy from exhaust air.
 - Smart & Connected Systems.
 - Building Energy Management System (BEMS/BMS) — monitor and optimise energy use in real-time.

- Sub-Metering — track energy use by zone/process to identify inefficiencies.
- Rainwater Harvesting — for non-potable uses.
- Low-Flow Fixtures — reduce water consumption in restrooms or wash stations.
- On-Site Microgrid/Backup Generation — combine with renewables for energy resilience.

Low And Zero Carbon Technologies

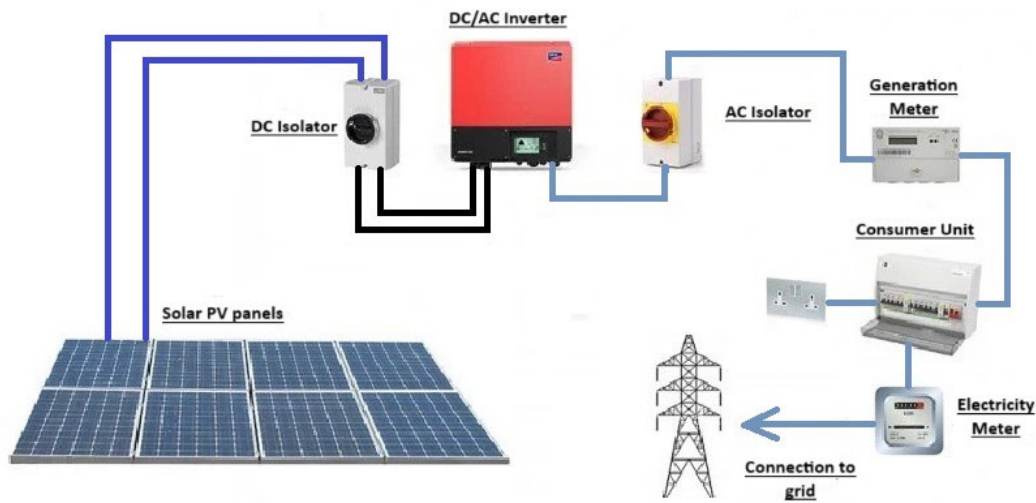
- 1.43 A feasibility assessment of low and zero carbon (LZC) technologies can be found in Appendix A of this report.
- 1.44 The assessment provided gives an indication of whether technologies would be feasible at the site. The assessment includes consideration for wind turbines, solar thermal collectors, biomass heating and ground source heat pumps.
- 1.45 The most suitable technologies for the site were found to be photovoltaic panels which have the facility to feed into a sitewide microgrid and future battery storage technology once building energy use data is understood, and air source heat pumps. These technologies are described below.

PHOTOVOLTAIC (PV) ARRAY

Technology Description

- 1.46 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.
- 1.47 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.
- 1.48 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 1.2 Photovoltaic Panels – Typical Diagram



Feasibility for Site

- 1.49 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 power for the buildings. The system will be designed such that once building energy use data is known, battery storage modules can be installed to increase renewable energy generated by PV being consumed on site.
- 1.50 The estimated PV arrays proposed for the development, subject to detailed design, are presented within Table 1.3 below, in terms of estimated kWp output, area and the specific required target annual generation output in MWh 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.
- 1.51 The below figures are based on preliminary calculations on energy demand. Further calculations will be undertaken using dynamic simulation modelling when building designs have been developed in further detail.

Table 1.3 Potential PV Array Outputs

Full PV Capacity				
Unit	Panel Area (m ²)	Megawatt peak	MWh/Year	MW average
TOTAL	323,000	77.5	67.9	7.75

1.52 Parameters within the above table explained:

- Panel area – The proposed electricity generation by solar photovoltaics (PV) could utilise up to the maximum available and useable roof space, excluding that needed for rooflights, maintenance walkways and plant.
- Megawatt Peak – Peak simultaneous electrical output.
- MWh/year – Electricity generated by PV installation per annum.
- MW average – Average electricity generated by PV installation.

1.53 It is proposed that the PV systems on each building will contribute to the site's energy demand.

Table 1.4 Expected Peak Site Demand

Expected Peak Site Demand (MVA) - Central Scenario				
	Occupancy	Heating	eV	eGV
Nominal	14.6	4.8	1.5	32
Diversity	85%	85%	100%	100%
Peak (MW)	12.4	4.1	1.5	32

Table 1.5 Expected Annual Site Demand

Expected Site Annual Demand (MW average) - By Scenario				
	Occupancy	Occupancy + Heating	Occupancy + Heating + eV	Occupancy + Heating + eV + eGV
Building Demand Occupancy + Heating average demand	5.3	7.0	7.0	7.0
Transportation eV + eGV average demand			2.5	25.0
Typical average demand	5.3	7.0	9.5	32.0

Table 1.6 Potential PV Provision vs Annual Site Demand

Potential PV Provision vs Annual Demand - By Scenario				
	Occupancy	Occupancy + Heating	Occupancy + Heating + eV	Occupancy + Heating + eV + eGV
PV annualised yield (MWh)	67,880	67,880	67,880	67,880
Typical annualised demand (MWh)	27,140	36,110	48,890	176,610
100% PV yield as % of annual demand	250%	188%	139%	38%

Potential PV Provision vs Annual Demand - By Scenario				
	Occupancy	Occupancy + Heating	Occupancy + Heating + eV	Occupancy + Heating + eV + eGV
% PV installation for 100% of annual demand	40%	53%	72%	260%
PV capacity installation for 100% of annual demand (MWp)	31	41	56	202

- 1.56 There are no foreseen land use issues attributed to the system. There is also no noise impact associated with this technology.

AIR SOURCE HEAT PUMPS

Technology Description

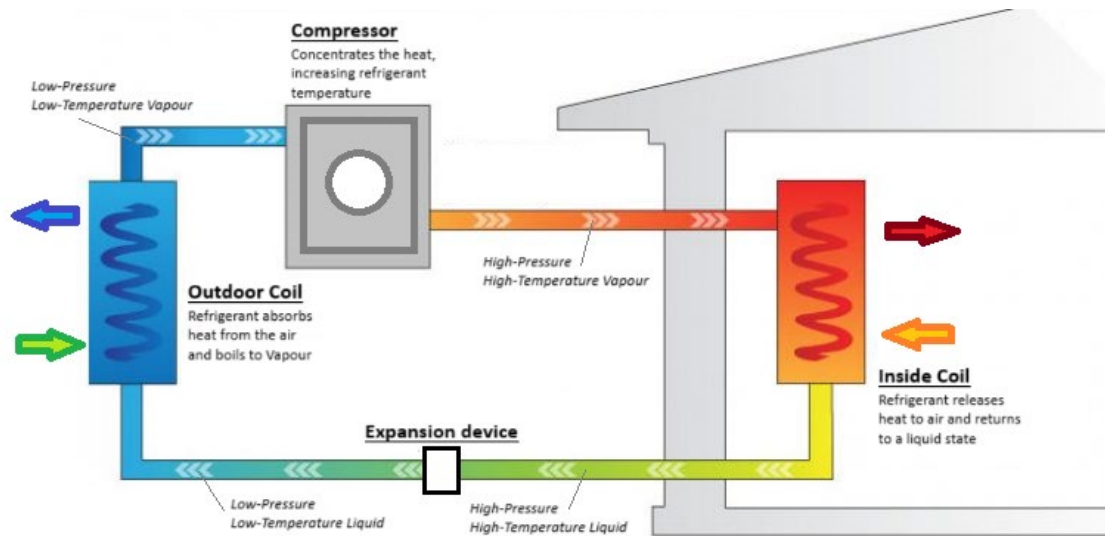
- 1.57 Air Source Heat Pumps (ASHP) work on the same principle as Ground Source Heat Pumps (GSHP). The difference is the medium in which the heat is extracted is the external air rather than the ground. An ASHP can be used for both heating and cooling and can also be used to provide simultaneous heating and cooling to different rooms as required.
- 1.58 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.

$$\frac{CO_2 \text{ Emissions from Electricity} \times \text{Boiler Efficiency}}{CO_2 \text{ Emissions from Gas per unit}} = \text{Break Even COP}$$

$$\frac{0.1388kgCO_2 \times 0.9\%}{0.21kgCO_2} = 0.595$$

- 1.59 Air Source Heat Pumps (ASHPs) are considered a more flexible alternative to Ground Source Heat Pumps which cannot be altered or expanded to suit future building occupier requirements.

Figure 1.3 Air Source Heat Pump – Typical Diagram



Feasibility for Site

- 1.60 Air source heat pumps are proposed to provide heating and cooling to the office areas of the proposed units.
- 1.61 The system will be sized suitably to meet the demand for the site therefore exporting of energy would not be appropriate.
- 1.62 ASHP can be installed either at the roof or ground level depending on the design for the site. In this case, the ASHPs would be installed within the proposed plant rooms or externally at ground level, as applicable to the layout of the particular development unit.
- 1.63 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.
- 1.64 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.
- 1.65 A typical payback for this indicative system tends to be 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.

ENERGY STORAGE (BATTERIES)

Technology Description

- 1.66 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.

- 1.67 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.
- 1.68 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.

Feasibility for Site

- 1.69 If excess power is generated by the solar PV systems on each building, energy storage in the form of batteries may be suitable for integration but would be installed in future by the building occupier to ensure they are correctly scaled to suit the specific energy use profile of each building to ensure the optimum use of resources.

CONCLUSION

- 1.70 This Energy Strategy has demonstrated how the proposed development has been designed to reduce the regulated energy usage and deliver carbon dioxide savings compared with Building Regulations Part L 2021.
- 1.71 The following site wide measures for the development will be incorporated into the design:
- improved building envelope details against Building Regulations Part L (2021);
 - enhanced air tightness better than Building Regulations Part L (2021);
 - efficient mechanical plant systems; and

- high efficiency lighting.
- 1.72 These measures have been included to reduce the energy demand of the site and in turn reduce the carbon dioxide (CO₂) emissions.
 - 1.73 The hierarchy for selecting an energy system has been adopted, the application of which has resulted in the selection of efficient building level and localised electrically powered heating systems, appropriate to the particular building specification, uses and requirements for planning policy compliance.
 - 1.74 Photovoltaic panels (PV) and air source heat pumps for domestic hot water and heating demand have been incorporated. From undertaking a feasibility assessment, these technologies were deemed the most appropriate for the site and applications. The development has been designed to incorporate low carbon and renewable technologies to follow the national and local planning requirements.
 - 1.75 The technologies proposed are highly appropriate to a final building design for the proposed development. Their incorporation into the design will ensure the development will comply with Building Regulations Part L and achieve a proportion of energy needs of the development from decentralised and renewable sources or low carbon generation technologies on site.
 - 1.76 Where possible the development will aspire to exceed the requirements of local policy with additional passive design measures and increase in renewable technologies over and above the minimum requirements.

APPENDIX A – LOW AND ZERO CARBON FEASIBILITY ASSESSMENT

WIND GENERATION

Technology Description

- 1.78 Wind turbines are an established means of capturing wind energy and converting it into usable electricity. Wind turbines come in various sizes depending on the location and electrical requirements. A wind turbine usually consists of a nacelle containing a generator connected, sometimes via a gearbox, to a rotor consisting of three blades.
- 1.79 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.
- 1.80 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.

Feasibility for Site

- 1.81 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 4.5 m/s assuming a rotor height at around 10m above ground level, but it is unlikely that average speeds will meet this estimate.

Figure 1.4 Average Monthly Wind Speeds (source: NOABL)

Wind Speeds

estimates from NOABL data

- At 10m above ground level 5 m/s
- At 25m above ground level 5.7 m/s
- At 45m above ground level 6.2 m/s

- 1.82 Taking a roof-mounted turbine with a rotor at 45m above ground level may increase wind speeds to 6.2 m/s, but given the local environment, it is unlikely that average speeds will meet this estimate.
- 1.83 Smaller freestanding vertical axis wind turbines do not need to change direction to suit wind direction and have smaller operational footprints. 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.
- 1.84 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. However, these wind turbines place additional forces on structures and the effect of potential noise, vibration and visual intrusion would all need careful analysis before deployment.
- 1.85 Due to the above and the wind speed available, this technology has not been considered further.

SOLAR THERMAL EVACUATED TUBE PANELS

Technology Description

- 1.86 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.

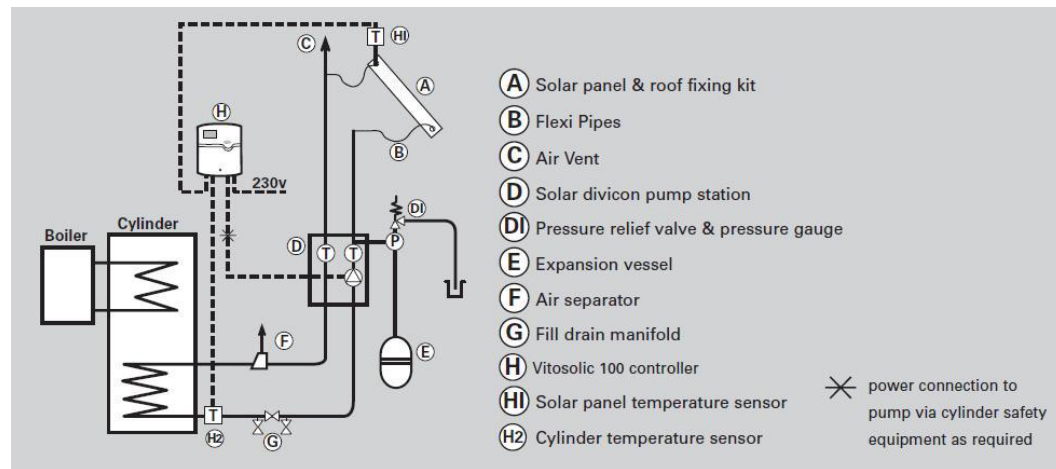
Figure 1.5 Evacuated Tube Solar Collector



- 1.87 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 1.6 Evacuated Tube Solar Collector Typical Schematic Diagram



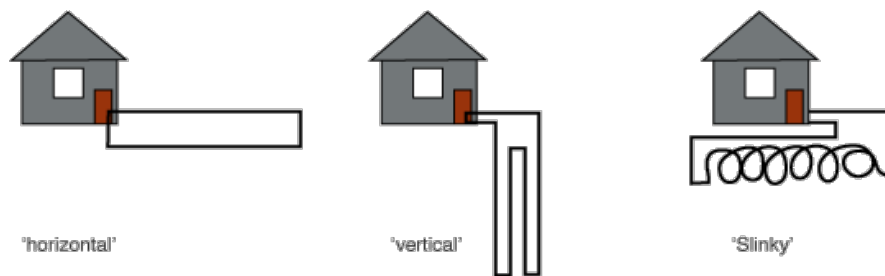
Feasibility for Site

- 1.88 The 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.
- 1.89 Priority on the roof has been given to providing photovoltaic panels and roof lights.
- 1.90 Solar thermal water heating has not been considered further for this assessment.

GEOTHERMAL HEAT PUMP

Technology Description

- 1.91 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.
- 1.92 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.

Figure 1.7 Ground Source Heat Pump Loop Arrangements

- 1.93 As figure 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.

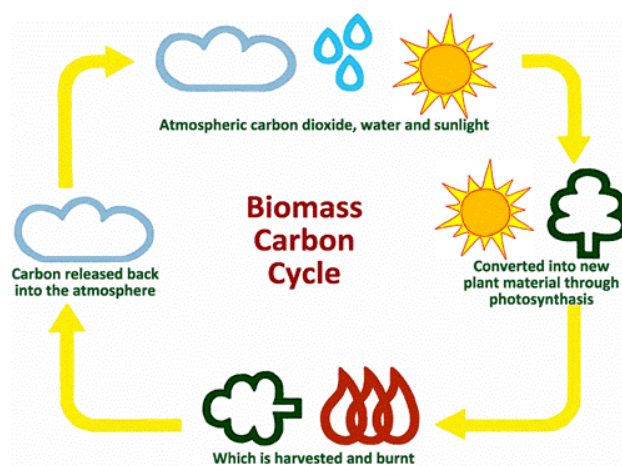
Feasibility for Site

- 1.94 The inherent inflexibility of installing a GSHP, particularly due to the drilling of a fixed number of boreholes will make it unsuitable for the an Occupier of the development to expand the system if required. Ground source heat pumps are therefore not considered further as part of this assessment.

BIOMASS BOILERS & HEATING

Technology Description

- 1.95 Biomass boilers replace conventionally powered boilers with an almost carbon neutral fuel such as wood pellets or wood chips. The fuel is classed as almost carbon neutral because the CO₂ released during the burning of biomass is balanced by that absorbed by the plants during their growth, see figure below.

Figure 1.8 Biomass Carbon Cycle

- 1.96 The proposed development could allocate space for boilers and fuel storage but fuel would likely be sourced from outside the local area.
- 1.97 Though biomass is a cleaner fuel than gas or heating oil, it should be noted that fossil fuels are utilised in the production, processing and transportation of biomass fuels. Therefore a key issue when choosing the biomass fuel supplier is the distance between the grower and the boilers as well as the method of transportation.
- 1.98 Biomass energy can be derived from a number of sources, but are principally divided into three main types: first, second and third generation:
- Traditional first-generation woody biomass, which can be a by-product of forest industries or agriculture.
 - Second generation biomass consists of residual food parts of crops (e.g. stems, leaves) as well as other crops that are not used for food purposes, and also industry waste.
 - Third generation biofuel whereby algae culture, which is farmed at low cost, produces biofuels at high yield, is and considered to be more efficient compared to the other generations.
- 1.99 First generation biomass includes raw material which is already in a suitable form for combustion [e.g. firewood], but also include energy crops; plant grown at low cost and low maintenance harvest, which is directly exploited for its energy content. However, the use of first-generation biofuels has been heavily criticised, as it is considered that there is a limit to the production of first generation biofuel without threatening food supplies and biodiversity. Much of the criticism of first-generation biofuels is due to their use of crops which are diverted from the food chain resulting in food shortages and price rises. On this basis, second generation biofuel technologies were developed to help address these limitations and ensure that biofuel can be produced sustainably.

Feasibility for Site

- 1.100 Combustion of wood biomass releases higher quantities of NO_x, SO_x and particulates (PM₁₀ and PM_{2.5}) compared to a comparable system fuelled by natural gas. This will have a negative impact upon the air quality in the vicinity of the area.
- 1.101 Biomass boilers typically have a high maintenance cost when compared to traditional gas fired boilers, which can make the technology economically unviable.
- 1.102 There are associated logistical issues associated with Biomass Boilers. The system requires significant space for both the Biomass boiler and fuel storage required. Biomass Boilers are not considered appropriate due to reasons detailed above.