Tritax Symmetry (Hinckley) Limited

HINCKLEY NATIONAL RAIL FREIGHT INTERCHANGE

The Hinckley National Rail Freight Interchange Development Consent Order

Project reference TR050007

Environmental Statement
Volume 2: Appendices

Appendix 18.1: Energy Strategy

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March 2023

Planning Act 2008

The Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009 Regulation 5(2)(a)

The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 Regulation 14

This document forms a part of the Environmental Statement for the Hinckley National Rail Freight Interchange project.

Tritax Symmetry (Hinckley) Limited (TSH) has applied to the Secretary of State for Transport for a Development Consent Order (DCO) for the Hinckley National Rail Freight Interchange (HNRFI).

To help inform the determination of the DCO application, TSH has undertaken an environmental impact assessment (EIA) of its proposals. EIA is a process that aims to improve the environmental design of a development proposal, and to provide the decision maker with sufficient information about the environmental effects of the project to make a decision.

The findings of an EIA are described in a written report known as an Environmental Statement (ES). An ES provides environmental information about the scheme, including a description of the development, its predicted environmental effects and the measures proposed to ameliorate any adverse effects.

Further details about the proposed Hinckley National Rail Freight Interchange are available on the project website:

[redacted]

The DCO application and documents relating to the examination of the proposed development can be viewed on the Planning Inspectorate's National Infrastructure Planning website:

https://infrastructure.planninginspectorate.gov.uk/projects/east-midlands/hinckley-national-rail-freight-interchange/

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Appendix 18.1 ◆ Energy Strategy

There is a shortfall in terms PV energy output, additional energy will be made up via an on- site battery storage system once building load profiles are known, before import from the Grid supply. Supplementary to this, and as a last resort such as during a grid fault, a Combined Heat and Power (CHP) energy centre will be used. There may be an opportunity to distribute excess heat around the site generated by the CHP subject to suitable demand.

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1. EXECUTIVE SUMMARY

1.1.1. MBA Consulting Engineers Ltd. have been commissioned by Tritax Symmetry (Hinckley) Limited (TSH) to produce an energy strategy in support of the Development Consent Order (DCO) application for the proposed development of Hinckley National Rail Freight Interchange (HNRFI).

1.1.2. Some assumptions with regard to energy demand in operation have been made as the final use of each building is not yet finalised. Further dynamic simulation modelling will be undertaken for the detailed design for each unit.

1.1.3. The planning application proposes the development of a rail port next to the existing Leicester to Hinckley railway, a series of B8 logistics buildings with space for lorries and car parking, a proposed link road between M69 junction 2 and the B4668 / A47 Leicester Road to the north-west, with a new bridge over the railway, and new areas of open space to the south of the A47 Link Road on both sides of the railway.

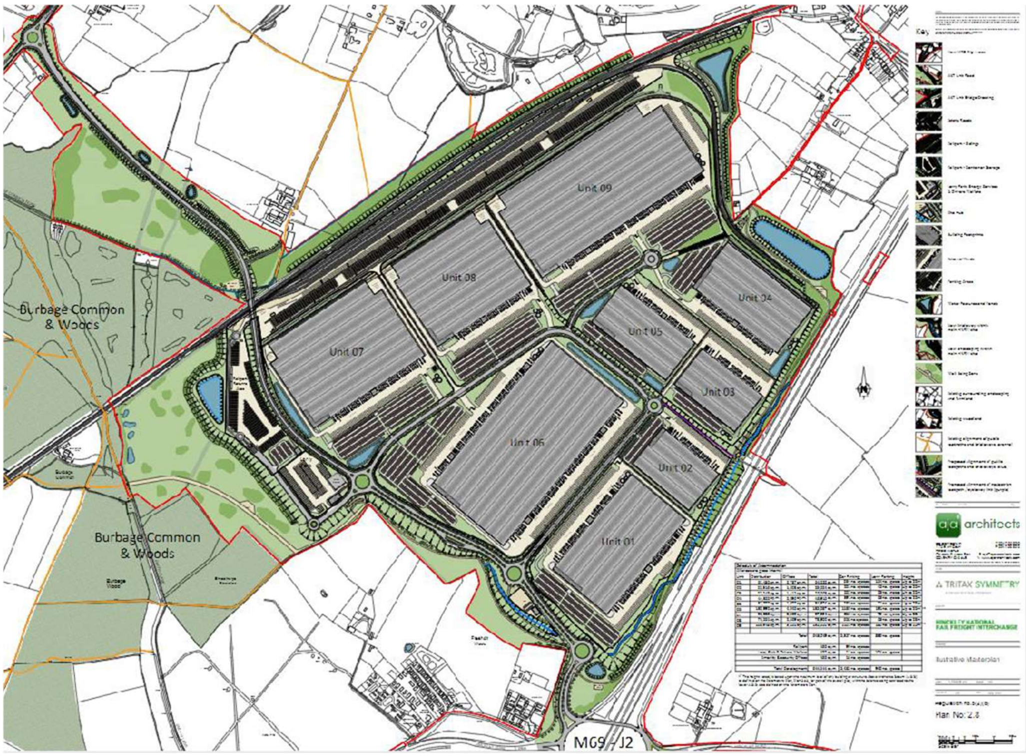

Fig.1 - Proposed masterplan

1.1.4. This energy strategy has been developed in accordance with relevant National and Local policy.

1.1.5. In addition to meeting the relevant policy objectives set out above with passive measures to improve building efficiency, the proposed development will incorporate an on-site micro grid primarily energised by a roof mounted photovoltaic array on each building. Various scenarios have been modelled to determine the percentage of demand which will be met on site with minimal import of additional energy.

1.1.6. Table 1 demonstrates the expected PV output versus the development's expected total energy demand. Using an estimated energy demand for each building considering occupancy, heating and provision for electric vehicle charging, it is expected that 83% of the 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 - Projected energy demand met by on-site renewable source and microgrid

Expected PV Provision vs Annual Demand - By Scenario				
	Occupancy	**Occupancy + Heating**	**Occupancy + Heating + eV**	**Occupancy + Heating + eV +eGV**
PV annualised yield (MWh)	47,930	47,930	47,930	47,930
Typical annualised demand (MWh)	22,284	32,169	58,088	154,943
100% PV yield as % of annual demand	215%	149%	83%	31%

1.1.7. Where there is a shortfall in terms of PV energy output, additional energy will be made up via an on- site battery storage system , before import from the Grid supply.

1.1.8. Supplementary to this, and as a last resort such as during a grid fault, a Combined Heat and Power (CHP) energy centre will be used. The CHP has capacity to generate 5 MW to the wider site if there is an unforeseen requirement. CHPs may also operate when occupier process heat and electricity demand mix is such that cogeneration is the best technology. Any CHP units would be hydrogen ready and able to operate on 100% hydrogen as grid gas is decarbonised in accordance with Government policy.

2. INTRODUCTION

2.1.1. MBA Consulting Engineers Ltd. have been commissioned by TSH Limited to produce an energy strategy in support of the DCO application for the proposed development of HNRFI. This energy strategy report has made some assumptions with regard to energy demand in operation as the final use of each building is not yet known. Further dynamic simulation modelling will be undertaken for the detailed design stage for each unit.

2.1.2. The application proposes the development of a rail port next to the existing Leicester to Hinckley railway line, a series of B8 logistics buildings with space for lorries and car parking, a proposed link road between M69 junction 2 and the B4668 / A47 Leicester Road to the north-west, with a new bridge over the railway, and new areas of open space to the south of the A47 Link Road on both sides of the railway.

2.1.3. This energy strategy has been developed in accordance with National and Local policy.

2.1.4. Department for Transport's national policy statement for national networks 2014.

2.1.5. Government policy for nationally significant infrastructure rail and road projects within England, and the need that underpins this, is set out in the National Policy Statement (NPS) for National Networks 2014.

2.1.6. The 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.

2.1.7. Because of the impacts of climate change, 'Adaptation is therefore necessary to deal with the potential impacts of these changes that are already happening. New development should be planned to avoid increased vulnerability to the range of impacts arising from climate change' (Paragraph 4.38).

2.1.8. 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 national Climate Change Risk Assessment and consultation with statutory consultation bodies. Any adaptation measures must themselves also be assessed as part of any environmental impact assessment and included in the environment statement, which should set out how and where such measures are proposed to be secured.' (Paragraph 4.44)*

2.1.9. 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 4.47).

2.2. (FORMER) DEPARTMENT FOR ENERGY AND CLIMATE CHANGE'S OVERARCHING NATIONAL POLICY STATEMENT FOR ENERGY 2011 (NPS EN-1) AND NATIONAL POLICY STATEMENT FOR RENEWABLE ENERGY INFRASTRUCTURE 2011 (EN-3)

2.2.1. Although the Proposed Development is not an Energy NSIP, a critical component of HNRFI is the development of energy infrastructure. The threshold for an Energy NSIP process is triggered if the generating station has a capacity of more than 50MW. This infrastructure includes the provision of roof-mounted photovoltaic arrays with a generation capacity of up to 42.4 megawatts peak (MWp) providing direct electricity supply to the building or exporting power to battery storage, and also includes provision of an energy centre, incorporating an energy substation connected to the local distribution network, battery storage and a gas-fired combined heat and power plant (designed to be ready for 100% hydrogen in the grid gas supply) with an electrical generation capacity of up to 5MW. With these energy facilities in mind, the suite of energy NPSs are considered to be relevant to Chapter 18. The emerging draft suite of Energy NPSs which have been reviewed by the Government as a result of the Energy White Paper9 are also relevant. These draft Energy NPSs aim to reflect the policies and broader strategic approach set out in the White Paper 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.

2.2.2. The existing and emerging draft NPSs 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, in the draft NPS EN-1, an indication of the likely increasingly significant role that hydrogen will play in the energy supply mix in future.

2.3. NATIONAL PLANNING POLICY FRAMEWORK (NPPF) 2021

2.3.1. In accordance with NPPF Chapter 14: Meeting the challenge of climate change, flooding and coastal change; 'The planning system should support the transition to a low carbon future in a changing climate, taking full account of flood risk and coastal change. It should help to:

- *shape places in ways that contribute to radical reductions in GHG emissions;*
- *minimise vulnerability and improve resilience;*
- *encourage the reuse of existing resources, including the conversion of existing buildings; and*
- *support renewable and low carbon energy and associated infrastructure" (Paragraph 152).'*

2.4. REGIONAL POLICY – LEICESTERSHIRE COUNTY COUNCIL ENVIRONMENT STRATEGY 2018 – 2030

2.4.1. Para 18.29 – LCC declared a climate emergency in 2019. Their Environment Strategy 2018 - 2030, which was revised to reflect this emergency declaration, sets out the council's commitment to carbon neutrality by 2030 and enforces LCC's commitment to 'minimising its environmental impacts, protecting and enhancing the Leicestershire environment and helping to deliver sustainable development by recognising and fostering the links between the environment, people and our economy'.

2.4.2. Para 18.30 – This Strategy will be updated every 5 years to be 'consistent with 'stock takes' as agreed in the Paris Agreement and the timeframes used for the UK Government's carbon budgets.

2.5. DISTRICT POLICY – BLABY DISTRICT LOCAL PLAN 2013 – 2029.

2.5.1. Para 18.31 – Strategic objectives set out by the plan in Policy CS21 – Climate Change include: to minimise energy use and use of valuable resources and to encourage renewable energy production in suitable locations;

2.5.2. Para 18.32 – The plan supports development which mitigates and adapts to climate change. BDC will "contribute to achieving national targets to reduce greenhouse gas emissions by:

- Focusing new development in the most sustainable locations; and
- Seeking site layout and sustainable design principles which reduce energy demand and increase efficiency.'
- Improving energy performance of buildings
- Reducing energy consumption through efficiency measures, and
- Using or producing renewable or low carbon energy from a local source with energy generated on site

2.6. LOCAL POLICY – HINCKLEY AND BOSWORTH BOROUGH COUNCIL - LOCAL DEVELOPMENT FRAMEWORK (LDF) – CORE STRATEGY 2006 - 2026

2.6.1. Para 18.34 – Thirteen spatial objectives were identified in the Hinckley and Bosworth Borough Council (HBBC) core strategy to ensure the strategy's vision is achieved. The following objective specifically relates to climate change:

- Spatial Objective 12: Climate Change and Resource Efficiency – 'To minimise the impacts of climate change by promoting the prudent use of resources through sustainable patterns of development, investment in green infrastructure (GI), minimising the use of resources and energy, increasing reuse and recycling of natural resources, increasing the use of renewable energy technologies and minimising pollution, including greenhouse gas emissions.'

2.7. HBBC CLIMATE EMERGENCY

2.7.1. Para 18.35 – HBBC declared a climate emergency in 2019. Although a Climate Change Action Plan is yet to be completed, HBBC has set 'the target of becoming carbon neutral by 2030.

2.7.2. In addition to meeting the national, regional, district and local policy objectives set out above with passive measures to improve building efficiency, the proposed development will incorporate an on-site micro grid primarily energised by a roof mounted photovoltaic array on each building. Various scenarios have been modelled to determine the percentage of demand which will be met on site without the requirement for importing additional energy.

2.7.3. Using an estimated energy demand for each building for occupation, heating and provision for electric vehicle charging, it is expected that 83% of the demand will be met by renewable energy generated on-site.

3. ENERGY STRATEGY SCOPE

3.1.1. In accordance with best practice, the energy strategy has been developed to ensure the development can demonstrate how the proposal can meet National and Local policy requirements and Building Regulations Part L (2021).

3.1.2. This energy strategy describes a set of principles to guide design development and decisions regarding energy, balanced with the need to optimise environmental and economic benefits. These guiding principles can be summarised as follows:

- Using less energy, in particular by adopting sustainable design and construction measures;
- Significant use of on-site renewable energy generation and use of an on-site micro-grid; and
- Utilise low and zero carbon energy

3.1.3. 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 B8 building use types.

3.2. ENERGY EFFICIENCY MEASURES

3.2.1. In accordance with the energy hierarchy a range of energy efficiency measures are implemented, which encompasses the adoption of a fabric first approach (passive design measures) and energy efficient building servicing (active design measures).

3.2.2. The passive and active design measures incorporated in the energy strategy are detailed below.

4. PASSIVE MEASURES

4.1.1. In order to achieve a building that complies with Building Regulations Part L 2021 (Volume 2) and improve upon the baseline Target Emission Rate (TER), the following passive design measures are incorporated into the design:

- Efficient building envelope with enhanced U-values beyond the Part L, Volume 2 (2021 edition) limiting values (as shown in Tables 2 and 3).
- Enhanced air permeability to reduce heating demand in the winter months

(Paragraph 1.29).

- Glazed façades throughout to provide natural daylighting and reduce reliance on artificial lighting.
- Balanced g-value for translucent elements to ensure optimised internal conditions in the winter and summer months but reduce the risk of overheating in the summer months.

4.1.2. The current Building Regulations Part L 2021 specify that all developments must have U-Values limited to the following levels:

Table 2 - U-Value limits as per Building Regulations Part L 2021

ELEMENT	U-VALUE (W/M².K)
Walls (external)	0.26
Ground floors	0.18
Roofs (Flat/ Pitched)	0.18/ 0.16
Windows	1.6
Rooflights	2.2
Personnel Doors	1.6
Vehicle access & similar large doors	1.3
High usage entrance doors	3.0

4.1.3. The building fabric values for the proposed development are shown in Table 3.

Table 3 – Proposed development U-Values

ELEMENT	U-VALUE (W/M².K)
External walls	0.18
Insulated wall (dividing wall between office/core & warehouse space)	0.18
Ground floors	0.15
Insulated ceiling (dividing slab between office & warehouse space)	0.15
Roof	0.18
Windows and curtain walling	1.4 (g-value 0.29) (VLT value 0.60)
Rooflights	1.3 (g-value 0.45) (VLT value 0.43)
Personnel Doors	1.6
Vehicle access & similar large doors	1.3

5. AIR PERMEABILITY

5.1.1. Generally, all buildings on the proposed development will have an improved air permeability to a maximum of 3.0 $m^3/h.m^2$ @50Pa, which is an improvement upon the standard Part L2A (2021) value of 8.0 $m^3/h.m^2$ @50Pa.

6. ACTIVE DESIGN MEASURES (ENERGY EFFICIENT SERVICES)

6.1.1. 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.

6.1.2. The following active design measures are incorporated into the design:

- Dedicated high efficiency mechanical ventilation heat recovery systems to serve office areas
- High efficiency LED lighting to reduce electrical consumption and heat gains from lighting
- Passive infrared (PIR) presence detection and daylight dimming control for lighting within the office core and warehouse space

6.1.3. Energy metering and sub-metering will be installed in all buildings to comply with Building Regulations Part L (2021) to facilitate automatic metering and targeting. The outputs of all renewable energy systems will be separately monitored.

6.2. LOW AND ZERO CARBON TECHNOLOGIES

6.2.1. A feasibility assessment of low and zero carbon (LZC) technologies can be found in Appendix A of this report.

6.2.2. 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.

6.2.3. The most suitable technologies for the site were found to be photovoltaic panels which feed into a sitewide microgrid, the facility to install battery storage technology once building energy use data is understood, CHP to provide resilience in terms of power supply and air source heat pumps. These technologies are described below.

7. PHOTOVOLTAIC ARRAY

7.1. TECHNOLOGY DESCRIPTION

7.1.1. 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.

7.1.2. 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.

7.1.3. The main types of commercially available PV panels on offer in the UK are constructed from crystalline cells or thin film 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 2 – Typical Photovoltaic Array

7.2. FEASIBILITY FOR SITE

7.2.1. 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 power for the buildings. The system will be designed such that once building energy use data is known, battery storage modules will be installed to increase renewable energy generated by PV being generated on site.

7.2.2. The estimated PV arrays proposed for the development, subject to detailed design, are presented within Table 4 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.

7.2.3. 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 4 – Proposed PV array outputs

PV Capacity				
Unit	**Panel Area (m2)**	**Megawatt peak**	**MWh/Year**	**MW average**
		150.1	169.5	
Unit 1	16,885	2.5	2,862	0.33
Unit 2	14,354	2.2	2,433	0.28
Unit 3	12,287	1.8	2,083	0.24
Unit 4	12,774	1.9	2,165	0.25
Unit 5	22,390	3.4	3,795	0.43
Unit 6	15,329	2.3	2,598	0.30
Unit 7	20,439	3.1	3,464	0.40
Unit 8	17,420	2.6	2,953	0.34
Unit 9	21,995	3.3	3,728	0.43
	282,774	42.4	47,930	5.47

7.2.4. Parameters within the above table explained:

- Panel area – 50% of total roof area occupied by PV panels
- Megawatt Peak – Peak simultaneous electrical output
- MWh/year – Electricity generated by PV installation per annum
- MW average – Average electricity generated by PV installation
- It is proposed that the PV systems on each building will contribute significantly to its energy demand.

Table 5 – Proposed PV array outputs

Expected Peak Site Demand (MVA) - By Scenario				
	Occupancy	**Occupancy + Heating**	**Occupancy + Heating + eV**	**Occupancy + Heating + eV +eGV**
Nominal	12.0	17.3	20.8	33.8
Diversity	85%	85%	85%	85%
Peak (MW)	**10.2**	**14.7**	**17.6**	**28.7**

7.2.5. In order to estimate the development's peak electrical power demand, a mix of occupation types and building operations has been assumed. These were consolidated into a representative weighted average used in the model.

The demand levels used were based on typical industry data with distinction between the office and warehouse areas of each building.

The weighted average loads used in the model are:

- Office Power Loads: 35.0W/m^2
- Warehouse Power Loads: 15.0W/m^2
- Heat Power Requirements: 9.0W/m^2
- eV (cars): 5.9W/m^2
- eGV (LGV): 23.0W/m^2

In addition, railport loads were modelled following direct enquiries of operators, and is based on the use of energy efficient regenerative equipment. The estimated railport power requirement is 2.0MW.

When assessing the supply requirements, consideration was given to diversity and to the impact of the substantial battery storage to be included in the development. The battery storage effectively smooths peak demands; the supply capacity therefore has to meet maximum average daily demand. A diversity factor of 85% was used when modelling peak demands. Average demand was assessed as 25% of peak for occupancy and heating loads, and 100% of peak for eV and eGV loads.

Table 6 – Expected Annual Site Demand

Expected Site Annual Demand (MW average) - By Scenario				
	Occupancy	**Occupancy + Heating**	**Occupancy + Heating + eV**	**Occupancy + Heating + eV +eGV**
Occupancy + Heating average demand – 25%	10.2	14.7	14.7	14.7
eV average demand – 100%	-	-	3.0	14.0
Typical average demand	**2.5**	**3.7**	**6.6**	**17.7**

Table 7 – Expected PV provision vs Annual Site Demand

Expected PV Provision vs Annual Demand - By Scenario				
	Occupancy	**Occupancy + Heating**	**Occupancy + Heating + eV**	**Occupancy + Heating + eV +eGV**
PV annualised yield (MWh)	47,930	47,930	47,930	47,930
Typical annualised demand (MWh)	22,284	32,169	58,088	154,943
100% PV yield as % of annual demand	215%	149%	83%	31%
% PV installation for 100% of annual demand	46%	67%	121%	323%
PV capacity installation for 100% of annual demand	19.7	28.5	51.4	137.2

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

8. AIR SOURCE HEAT PUMPS

8.1. TECHNOLOGY DESCRIPTION

8.1.1. Air source heat pumps (ASHP) work on the same principal as ground source heat pumps (GSHP). The difference is the medium in which the heat is extracted, heat extracted from 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 areas as required.

8.2. FEASIBILITY FOR SITE

8.2.1. A typical 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 air source heat pump system becomes more efficient than a 90% gas boiler system when the co-efficient of performance is above 2.35.

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

$$\frac{0.517kgCO2\ x\ 0.9\%}{0.198kgCO2} = 2.35$$

8.2.2. Air-to-air heat pumps are considered an alternative to ground source heat pumps despite the latter having a coefficient of performance of around 5 as Ground Source Heat Pumps have a significantly high installation cost making it unattractive for this development.

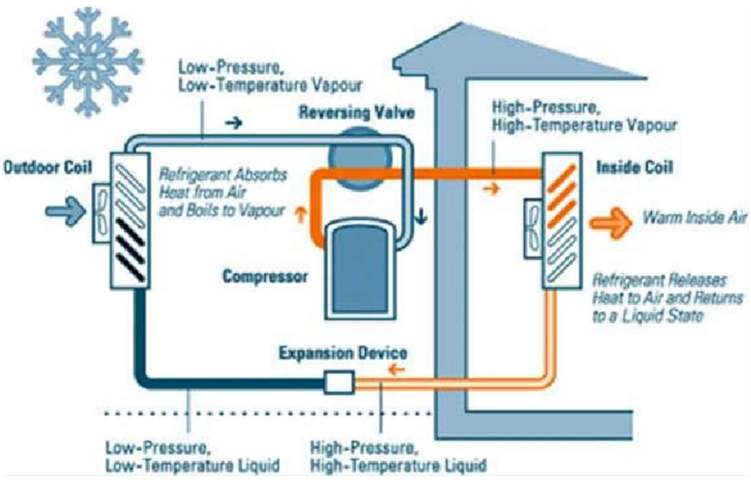

Figure 1 – Diagram of Air Source Heat Pump

8.2.3. Air source heat pumps are proposed to provide heating and cooling to the office areas of the proposed units.

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

8.2.5. 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.

8.2.6. 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.

8.2.7. 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.

8.2.8. 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.

9. ENERGY STORAGE (BATTERIES)

9.1. TECHNOLOGY DESCRIPTION

9.1.1. 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.

9.1.2. 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.

9.1.3. 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.

9.2. FEASIBILITY FOR SITE

9.2.1. Energy storage in the form of batteries are suitable for integration. These will be scaled to suit the specific energy use profile of each building to ensure the optimum use of resources.

10. COMBINED HEAT AND POWER (CHP)

10.1. TECHNOLOGY DESCRIPTION

10.1.1. CHP is a renewable source when it is powered by non-fossil fuel. Even ahead of general decarbonisation of the gas grid, when it is used in combination with fossil fuels such as gas and diesel or even refuse-derived fuels, it is still more energy efficient than obtaining energy from the National Electricity Grid.

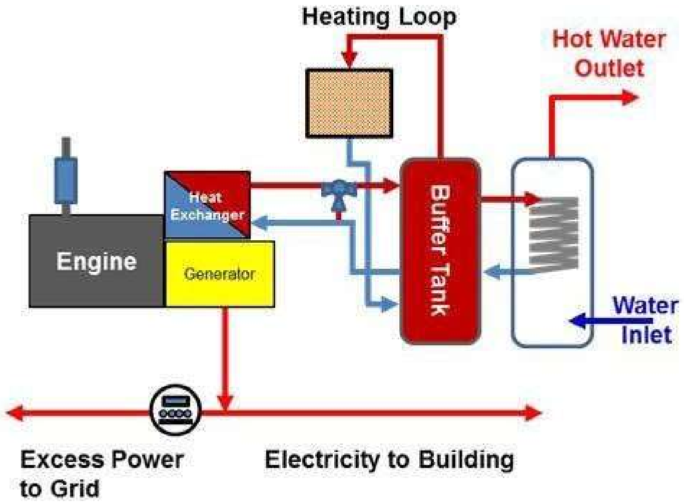

Figure 2: Combined Heat and Power Schematic [CHP]

10.1.2. It is anticipated that the majority of energy demand on site will be met by solar PV and backed up by battery storage, or imported from grid sources. As a back-up and to provide resilience to building occupiers, a CHP energy centre would be provided on site.

10.1.3. The energy centre could also be used to provide heating via a district heat network should there be a demand on site. For example, heating may be provided to the warehouse areas of a building but typically to a temperature of 16°C.

10.1.4. As buildings are occupied, Tritax will identify and assess feasibility of connection to the local heat networks and to incorporate the use of CHP heating systems if deemed viable.

11. CONCLUSION

11.1.1. The energy strategy has been developed in accordance with National and Local policy. 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.

11.1.2. The following site wide measures for the development will be incorporated into the design:

- Improving energy performance of buildings
- Improved building envelope details against Part L (2021)
- Enhanced air tightness better than Part L (2021)
- Efficient mechanical plant systems
- High efficiency lighting
- Using or producing renewable or low carbon energy from a local source

11.1.3. These measures have been included to reduce the energy demand of the site and in turn reduce the carbon dioxide (CO) emissions.

11.1.4. Photovoltaic panels (PV) have been proposed for electricity generation.

11.1.5. Where there is a shortfall in terms of PV energy output, additional energy will be made up via an on- site battery storage system, before import from the Grid supply.

11.1.6. Air source heat pumps are proposed to provide heating and cooling to the office areas of the proposed units.

11.1.7. Supplementary to this, and as a last resort such as during a grid fault, a Combined Heat and Power (CHP) energy centre will be used. The CHP has capacity to generate 5 MW to the wider site if there is an unforeseen requirement. CHPs may also operate when occupier process heat and electricity demand mix is such that cogeneration is the best technology. Any CHP units would be hydrogen ready and able to operate on 100% hydrogen as grid gas is decarbonised in accordance with Government policy.

11.1.8. 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 in line with national and local planning policy.

11.1.9. 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.

11.1.10. Where possible the development will aspire to exceed the requirements of national and 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

1. WIND GENERATION

1.1. TECHNOLOGY DESCRIPTION

1.1.1. 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.

1.1.2. 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.

1.1.3. 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.

1.2. FEASIBILITY FOR SITE

1.2.1. Referring to the NOABL (Numerical Objective Analysis of Boundary Layer) wind speed database as adopted by the Department of Energy & Climate Change (DECC), the proposed development site experiences fairly low wind speeds, averaging 5.0 m/s assuming a rotor height at around 10m above ground level.

Wind Speeds

estimates from NOABL data

- At 10m above ground level 5 m/s
- At 25m above ground level 5.8 m/s
- At 45m above ground level 6.4 m/s

Figure 1 – Average Wind Speeds (source: NOABL)

1.2.2. As demonstrated in Figure 1, taking a turbine with a rotor at 45m above ground level may increase wind speeds to 6.4 m/s, but given the local environment, it is unlikely that average speeds will meet this estimate.

1.2.3. Freestanding horizontal axis wind turbines require a large area of land, which would have a detrimental effect on the viability of the site.

1.2.4. Smaller freestanding vertical axis wind turbines have smaller operational footprints. However, anticipated wind turbulence at low level rules out their application.

1.2.5. Roof mounted wind 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, place additional forces on structures and the effect of potential noise, vibration and visual intrusion. A roof mounted system would have a significant effect on the total height of the building, and is not considered appropriate for this development.

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

2. SOLAR THERMAL EVACUATED TUBE PANELS

2.1. TECHNOLOGY DESCRIPTION

2.1.1. 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. This heat is transferred via a heat exchanger into a hot water storage tank that is also heated by a gas or other boiler.

2.1.2. 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. They are however, 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 2 – Evacuated Tube Solar Collector

2.2. FEASIBILITY FOR SITE

2.2.1. 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.

2.2.2. Priority on the roof has been given to providing photovoltaic panels and roof lights.

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

3. GEOTHERMAL HEAT PUMP

3.1. TECHNOLOGY DESCRIPTION

3.1.1. 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.

3.1.2. 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.

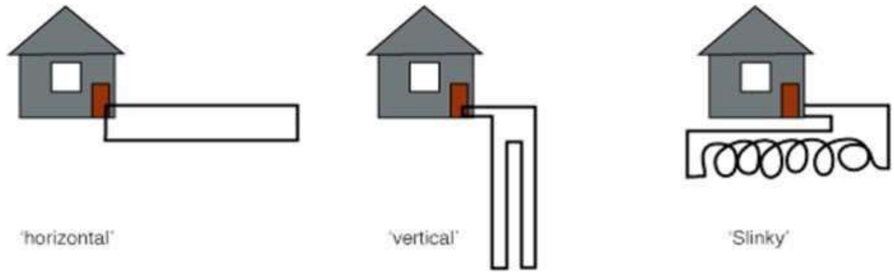

Figure 3: Ground Source Heat Pump Loop Arrangements

3.1.3. As Figure 3 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.

3.2. FEASIBILITY FOR SITE

3.2.1. 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.

4. BIOMASS BOILERS & HEATING

4.1. TECHNOLOGY DESCRIPTION

4.1.1. Biomass boilers can replace conventionally powered boilers with an almost carbon neutral fuel such as wood pellets or wood chips. The CO_2 released during the burning of biomass is balanced by that absorbed by the plants during their growth, making the technology almost carbon neutral. However, 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.

4.1.2. 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 further efficient to the other generations.

4.2. FEASIBILITY FOR SITE

4.2.1. Combustion of wood biomass releases higher quantities of NOx, SOx and particulates (PM10 and PM2.5) compared to a comparable system fuelled by natural gas. This would have a negative impact upon the air quality in the vicinity of the area.

4.2.2. Biomass boilers typically have a high maintenance cost when compared to traditional gas fired boilers, which can make the technology economically unviable.

4.2.3. 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.