

REPORT

MARCH 2023

ENERGY OPTIONS ANALYSIS FOR GREATER LINCOLNSHIRE

INTERIM REPORT
GREATER LINCOLNSHIRE

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VERSION

Version	Authorised	Date
V1	HE	27 Feb 2023
V2	HE	10 March 2023

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1.0 EXECUTIVE SUMMARY

This report is intended to support Greater Lincolnshire Local Authorities and the Greater Lincolnshire Infrastructure Group through conducting an energy option analysis of the region and to identify where investment may be required, to meet not only net zero targets but to enable economic growth.

The Key Line of Enquires (KLOE) are detailed below:

- To challenge whether the provision of energy genuinely affects viability, differentiating between the levels of National Grid, Local Distribution Network Operator (DNO) and local energy operators – and whether a decision to implement local innovative solutions could deliver necessary local requirements.
- To identify how authorities could work together to build the scale to make an alternative energy offer attractive to the private sector.
- To strengthen the connection between energy and other utility provision, notably digital infrastructure, and the internet of things.
- To provide a forum for the private and public sectors to collaborate on specific schemes, creating the environment for a strong dialogue that leads to investment in priority sites.

This paper outlines the Key Lines of Enquiries alongside analysis of the demand from growth in the immediate term, and any further energy requirements to deal with the growth over the next 20 years.

This study, managed by Lincolnshire County Council and completed by RLB, looks at current and proposed developments in the Greater Lincolnshire area to estimate what their energy demands are likely to be in terms of electricity. These demands have been mapped onto the electricity network to see where infrastructure, including sub-stations and power lines may have limited capacity in future. The local distribution network operators have been consulted on the information and various options for providing additional capacity have been investigated and outlined.

Recommendations (placeholder, to be summarised in final report)

2.0 PROJECT SCOPE

The project scope was to deliver a fully coordinated, intelligence-led and targeted report into an Energy Options Analysis for Greater Lincolnshire that incorporates the outputs below and shows any current legislation implications.

The key project objective was to develop a report that will support the Greater Lincolnshire Local Authorities and the Greater Lincolnshire Infrastructure Group through providing an energy option analysis of the area, and to identify where investment may be required, to meet not only net zero targets but to enable economic growth.

RLB have developed this study to support and address the Key Lines of Enquiries and then assess the ability of the energy approach identified to meet the demand from growth in the immediate term, and any further energy requirements to deal with the growth over the next 20 years.

2.1 PROJECT OUTPUTS

A report detailing the key lines of enquiry below;

- To challenge whether the provision of **energy genuinely affects viability**, differentiating between the levels of National Grid, Local Distribution Network Operator (DNO) and local energy operators – and whether a decision to implement local innovative solutions could deliver necessary local requirements.
- To identify how **authorities could work together** to build the scale to make an alternative energy offer attractive to the private sector.
- To strengthen **the connection between energy and other utility provision**, notably digital infrastructure, and the internet of things.
- To provide **a forum for the private and public sectors to collaborate** on specific schemes, creating the environment for a strong dialogue that leads to investment in priority sites.

Study outputs to include;

- Consideration of how vital is energy for investment?
- **Explore Opportunities within present/future energy networks** including Green Energy, Renewables, Energy from Waste, Agricultural & Forestry energy, and forward funding.
- Analyse **requirements for key employment sectors** including future impact of growth e.g. food chain carbon reduction.
- 2 x pilot **Residential Development Scheme case studies**.
- **RAG GIS Mapping overlay of DNOs** - National Grid: Energy Distribution and Northern PowerGrid.

2.2 STAKEHOLDERS

This report has been commissioned by Greater Lincolnshire authorities, with the main stakeholder for the Project being the Greater Lincolnshire Infrastructure Group (IG). Management and key decision making for this project is by the Infrastructure Reference Group (IG Reference Group).

2.3 APPROACH

This study has used projected growth plans from each local authority and developed a trajectory of energy usage, to enable analysis of requirements for energy patterns. Within this study, area wide transportation plans, such as the freeport on the Humber and other infrastructure requirements which would contribute to the overall energy demands have been considered.

It has been widely acknowledged that there is a shortfall in electrical capacity within the Greater Lincolnshire area of power capacity and this has been determined by several developments providing advice and evidence to that effect. RLB have engaged with the licenced distribution network operators (National Grid ED & Northern Powergrid) with a view of aligning the need for additional capacity and generation. As part of this study, consideration has been given to how private generating companies could assist the long-term objective of growing and investing the local areas.

3.0 ENERGY OPTIONS ANALYSIS

3.1 NATIONAL ENERGY CONTEXT

Holder, to be expanded

3.2 LOCAL CONTEXT

The Greater Lincolnshire area covers three tier one local authority areas of Lincolnshire County Council, North Lincolnshire Council and North East Lincolnshire Council. The Lincolnshire County Council area comprises the following seven tier two districts each serviced by a district or borough council: City of Lincoln, North Kesteven, South Kesteven, South Holland, Boston Borough, East Lindsey and West Lindsey. The Greater Lincolnshire Local Enterprise Partnership (LEP) covers the Greater Lincolnshire area included within this study.

Greater Lincolnshire has seen significant population growth, with the 2021 Census data showing a 10% increase in some areas, with Lincoln’s population rising to over 100,000.

Following the Covid-19 pandemic, Greater Lincolnshire has experienced significant economic impact. The Greater Lincolnshire LEP has released a strategy “Protecting, Progressing, Prospering: Greater Lincolnshire Plan for Growth”. The intent to grow the local economy will drive a different requirement for energy demand and supply

District	Population	Growth since 2011
Boston	70,500	9.1%
East Lindsey	142,300	4.3%
Lincoln	103,900	11.1%
North Kesteven	118,000	9.5%
South Holland	95,100	7.7%
South Kesteven	143,400	7.2%
West Lindsey	95,200	6.7%
North Lincolnshire	169,700	1.3%
North East Lincolnshire	156,900	-1.7%

Source: Census 2021

requirements, particularly in the context of a rising population with a key goal to improve economic equality across the wider region.

RLB note: expand on economic drivers and goals



Figure 1 Greater Lincolnshire Map, GLLEP Revival Plan

3.3 ENERGY STAKEHOLDERS

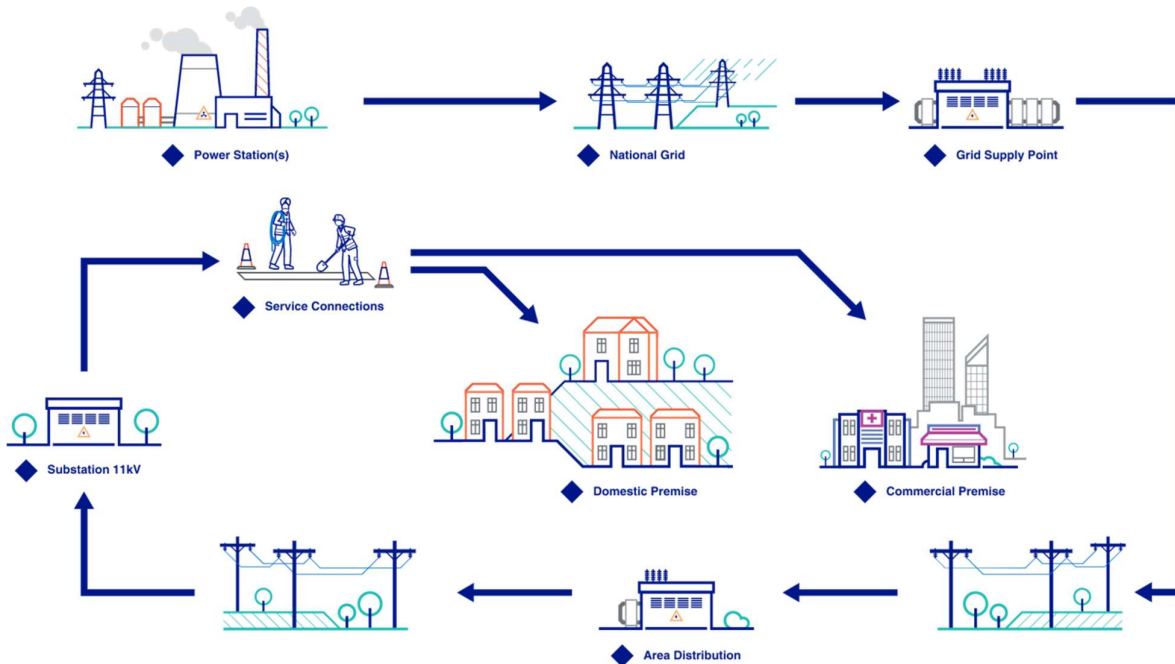


Figure 2 Energy provision structure, National Grid

NATIONAL GRID

The National Grid is the system operator of UK electricity and gas supply. It is the company that manages the network and transmission of electricity and gas to properties nationally. The National Grid network is made of high-voltage power lines, gas pipelines, interconnectors and storage facilities that together enable the transmission of electricity. The grid ensures that all areas of the UK have power supply. Within the network, there are many electricity distribution companies called Distribution Network Operators (DNO).

LOCAL DISTRIBUTION NETWORK OPERATOR (DNO)

Distribution Network Operators manage the electric power distribution system which delivers electricity to end users. There are 14 licensed DNOs owned by six different groups that cover specific geographically defined regions across the UK all regulated by Ofgem, and the two covering Greater Lincolnshire are Northern Powergrid and National Grid ED (previously Western Power Distribution). All DNOs are licensed companies that own and operate the network of towers, transformers, cables and meters that carry electricity from the national transmission system and distribute it throughout Britain.

DNOs manage distribution networks from 240V to 400 kV through underground and overhead power lines, this covers commercial, industrial and residential properties.

Northern Powergrid (NPg) – Transports electricity across the North East, Yorkshire and northern Lincolnshire to provide electricity supply to 3.9million homes and businesses across the regions. NPg are part of Berkshire Hathaway Energy. NPg business plan for 2023-2028 states;

“Our plan positions us to take a leading role in enabling decarbonisation in our region and support future uptake in low carbon technologies such as electric vehicles and heat pumps. Our network will be instrumental in efficiently facilitating this transition, sitting at the heart of a decentralised, low carbon energy system that enables customers to be increasingly flexible with their energy use.”

National Grid Electricity Distribution (NGED) (previously Western Power Distribution) – Transports electricity across Midlands, South West and Wales. NGED business plan (RIIO-ED2) for 2023 – 2028 is under consultation, but states that investment proposals are circa £6billion (increase of £1bn compared to present) with a goal towards net zero.

RLB note: transition of DNOs to DSOs. Map of NPg and NGED split across Greater Lincs to be included

INDEPENDENT DISTRIBUTION NETWORK OPERATORS (IDNOS)

IDNOs provide an alternative route for businesses that want to connect to the electricity grid in the UK. Both distributors have many similarities, starting from the main concept - they own, run and maintain electrical infrastructure. The main difference is that IDNOs operate nationwide, without regional restrictions, to manage local networks. They are also regulated by Ofgem.

DNOs distribute electricity from the transmission grid for a large geographical area, whereas IDNOs distribute electricity from either DNOs, or the transmission network, to smaller local areas. Both DNOs and IDNOs are responsible for connection line faults and maintenance.

RLB note: Summary of importance and engagement to be included

SUBSTATIONS

A substation is a part of an electrical generation, transmission, and distribution system. Substations transform voltage from high to low, or the reverse. Substations contain equipment that help keep our electricity transmission and distribution systems running as smoothly as possible, without repeated failure or downtime. Specialist equipment within the substation site can help prevent local network failures or power cuts.

There are two main types of substation; transmission and distribution. Transmission substations are where the electricity enters the power grid and convert it to a level that can be transmitted. Increasing or decreasing the voltage as it is transmitted ensures it meets the local distribution networks safely whilst minimising energy loss. Distribution substations then lower the voltage so it can be used in buildings safely.

National Grid owns more than 300 large substations, where 275kV and 400kV overhead power lines or underground cables are switched and where electricity is transformed for distribution to

surrounding areas. Smaller substations are owned and maintained by local distribution networks such as NGED and NPg.

3.4 SECTOR FOCUS

Within Greater Lincolnshire there are significant sectors where energy demand and supply is critical to development. Greater Lincolnshire LEP (GLLEP) have identified key sectors which are Agri-Food, Manufacturing, Visitor Economy, Energy, Health and Care, Ports and Logistics. Additionally, residential sector has been deemed as a sector where energy is critical to ensure ongoing investment.

Each of the above have been engaged with to understand the current situation and gain an insight into predicted development and significant changes.

3.4.1 RESIDENTIAL

The residential sector is influenced by existing demand, predicted growth through direct population growth and through attracting those from other regions. Housing and the economy in Greater Lincolnshire are inextricably linked, contributing significantly to the local economy by creating two jobs for every house built¹.

Greater Lincolnshire is committed to housing growth, with Local Plans working towards the delivery of 100,000 new dwellings by 2031¹. The right mix of housing helps to attract and retain the workforce needed to enable growth, whilst new development generates employment opportunities and encourages spending in the local economy. Planned new developments will provide major growth opportunities along nationally important investment corridors. Our study has tracked all developments given to us by local authorities and planning portals.

All residential housing developments have been categorised into the following planning priorities;

- Short term, 1-3 years
- Medium term, 3-10 years
- Long term, 11+ year

Further engagement with key developers across the region required

Outcomes and recommendations

To be developed further by final report issue

RESIDENTIAL DEVELOPMENT CASE STUDY SELECTION

An outcome required from this study was the identification of opportunities in Greater Lincolnshire where a more collaborative energy approach can deliver commercially viable net zero carbon development and achieve the wider objectives of this energy options analysis.

In order to establish the two housing sites a short list of twelve housing sites was formed based on the following criteria:

- Greater than 50 units by 2025

- The development has planning permission
- Construction has not begun and will begin in the next two years.

Following review between RLB and the IG it was confirmed that the two development schemes to be used as case studies for wider application of learned issues across the Greater Lincolnshire area are the **Lincoln Western Growth Corridor** and **Boston Toot Lane**.

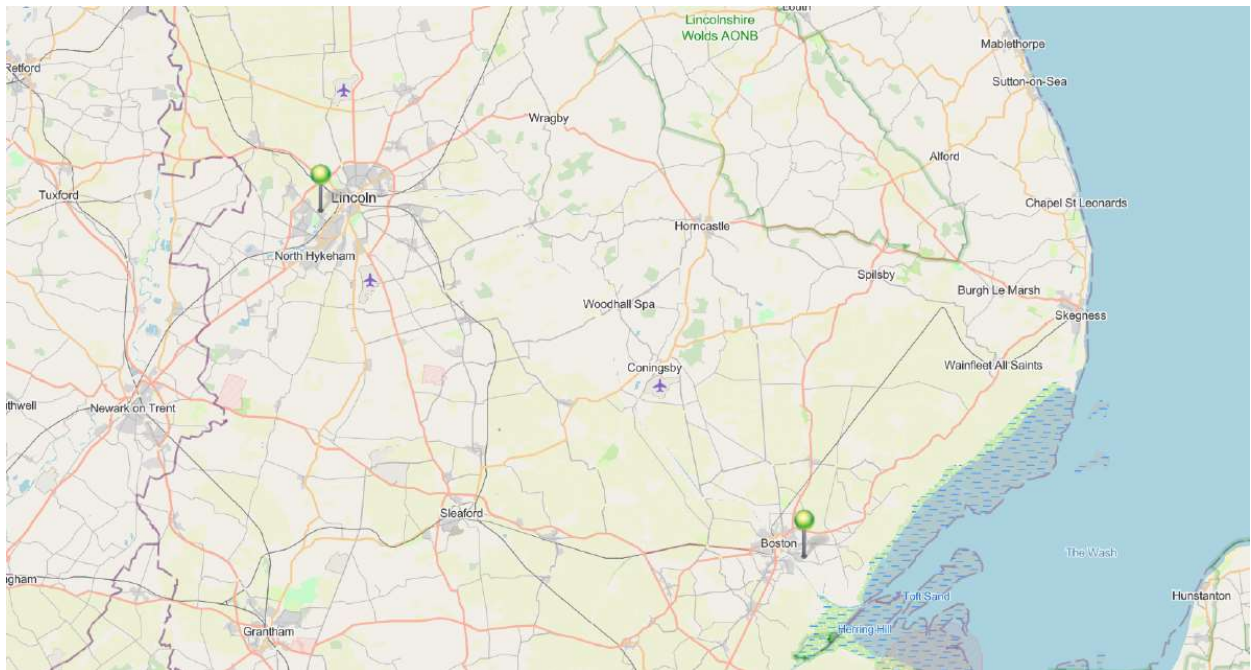


Figure 3 Location of chosen housing sites

These sites were selected based on the following factors:

- Ability for learning from the sites to add value to the overall commission / study
- Ability for this learning to be replicated through Greater Lincolnshire
- One Brownfield and one Greenfield site
- One Sustainable Urban Extension and one edge of town / semi-rural site
- Predicted housing values close to the Lincolnshire average
- Substation availability
- Scale and nature of development

Although the two sites do not reflect the full range of housing units, the combination of both provides a large site with great diversity and a smaller less diverse development. The main driver for the two sites selected is to capture as many aspects of housing developments as possible to have the greatest breadth of potential learning that can be applied to all new developments across the whole of Greater Lincolnshire – including future developments that are not yet scheduled, confirmed, or granted planning consent. This is intended to provide Greater Lincolnshire with the necessary tools and institutional capacity for future actions without the same level of need for external assistance. This has necessarily required some optimisation, being restricted to two case studies.

Further rationale is provided below for the site selections;

Boston Toot Lane - 200 units

- Low sub-station availability
- The development consists of greater than 50 units built by 2025
- Obtained full planning permission
- Construction has not yet commenced
- The area is representative of the average Lincolnshire housing price.
- The development is located in an area that can provide access to affordable housing

Beaver Street (Lincoln Western Growth Corridor) 3,200 units

- 4.679 MVA estimated demand, 5.2kW/unit
- Residential and commercial demand, challenges and constraints
- Planning consent granted
- Brownfield city site
- A Sustainable Urban Extension site, the findings/opportunities from the study could be replicated across GL, including at 7 SUEs in Central Lincs
- Outline planning permission awarded with start on site for phase 1 and infrastructure (spine road and new rail bridge) expected before 2025
- The largest site on the shortlist, 3200 homes
- An urban brownfield and greenfield site with a range of infrastructure challenges/opportunities.
- Utility strategy report available to provide energy requirement for the site
- Substation demand headroom 7.14 MVA and residential site will require 27MVA. Additional demand from surrounding commercial, residential and leisure developments threaten to stagnate development in this area in the medium/long term phases
- An agreed commitment between the 2 major landowners (City Council and Lindum) to deliver a commercially viable net zero carbon development.
- Large areas of land that is not suitable for housing has the potential for renewable energy generation/heat network

3.4.2 INDUSTRIAL

RLB held engagement workshops with a range of commercial / industrial organisations across the region. The key outcomes are detailed below.

ABLE HUMBER PORT

Able Logistics Park has now changed to Able Energy Park (AEP), with Able Marine Energy Park



being Able Humber Port (AHP). It is situated on the south bank of the Humber Estuary, which has been described as the Energy Estuary and in recent years it has been one of the UK's fastest growing port and logistics centres. AHP is potentially Europe's largest new port development as part of the growing marine renewable energy sector; this includes [Able Energy Park²](#) (AEP) providing an additional c. 1,000 acres of hinterland development to support a wide variety of port centric logistics functions.

The UK Government has identified AHP as a strategic location in the National Renewable Infrastructure Plan and HMG UK Treasury has confirmed AHP as the UK's largest Enterprise Zone, attracting 100% enhanced capital allowances.

ABLE ENERGY PARK

Able Energy Park (AEP) is located at the top of the Humber Low Carbon Pipeline (as shown in Figure 3) close to the nearby Humber Ports.

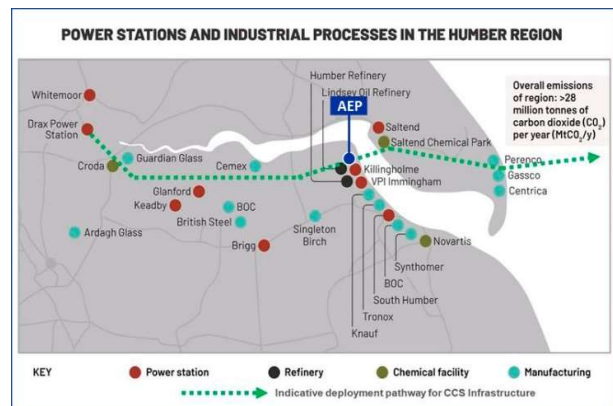


Figure 4 Able Humber Port / Humber Region

The site has local sources of electricity, including power supplied from renewable sources, most notably the Hornsea offshore wind farms, with a potential of a new carbon capture pipeline adjacent to the site. AEP states; “the Energy Estuary is pursuing the option to deliver the UK's first zero carbon cluster and help position the North of England at the heart of the global energy revolution”³.

AEP has a significant predicted demand with an investigative exercise being undertaken to determine if the local converter station can provide green supply from the substation or if there is an existing agreement to feed green energy back to the grid. There is an intent that green hydrogen will be produced; this is dependent on there being sufficient renewable energy supply. If there is not, then blue or grey hydrogen would be produced. Blue or grey hydrogen will not align with net zero aspirations as well as green hydrogen, however it will provide energy supply to the region. Additionally, there are numerous solar proposals surrounding both sites, many of which are seeking battery storage sites.

At present, the quoted dates required will be at the earliest 2.5 years before demand kicks in, with AEP clients requiring energy from 2026 of c. 200MW with the remaining anticipated energy demand within the next 5 years.

There are challenges not only for energy supply to the site, but water supply too on a clean, industrial scale. As Greater Lincolnshire moves towards attracting industry, it is likely that resource intensive industrial developments will require linked utility management supply and demand.

From the engagement with Able, there is potential for both significant energy demand and energy supply. However, until the developments progress further it is difficult to accurately predict either

demand or supply. A key item from engagement is that Able have been in discussions with IDNO management companies for both energy and water supply rather than the DNOs (NGED and NPg).

BRITISH STEEL

British Steel’s headquarters are in Scunthorpe, Lincolnshire employing the majority of their 4,000 employees within North Lincolnshire. There is a period of significant investment ahead, aligned to their overarching decarbonisation strategy; committing British Steel to deliver net zero steel by 2050 and significantly reduce CO2 intensity by 2030 – 2035. This includes a £14.6million investment to enhance energy operations including projects to improve electricity and process gas usage. Due to soaring energy prices, the steel manufacturing industry has been hit hard.

The Scunthorpe manufacturing site imports 500M kWh of gas per year. The site has 2 CHP and a central power station to generate steam for the site which produces 19MW baseload, with 35MW generated internally. British Steel confirmed that grid connection is key to maintain the manufacturing plant, with a key risk being any issues with grid transmission connection. Relocation of the British Steel plant would need to be considered in respect of energy supply and energy cost, alongside their decarbonisation strategy. At present, they are reliant on market prices for low carbon energy. It is likely that hydrogen technologies will be adopted early for steel manufacturing.

Electrical requirements - 3 incomers from local network supply, not transmission connected - 220MW has been calculated to be the new upgraded supply requirements, with a need to upgrade the connections, this will likely be a transmission connection via National Grid.

National Grid Electricity Transmission (NGET) and British Steel have held informal discussions for the last five years. National Grid engagement is intended to restart after further feasibility studies for equipment requirements and private wire network assessments.

To note, at the time of interim report issue, British Steel have warned of potential reductions in workforce. It is unknown whether there will be government support to avoid this, and additionally unknown as to whether this will impact their energy requirements going forward.

RLB note: IG to provide further contacts for commercial sector

3.4.3 HEALTH AND CARE

Engagement with NHS attempted, to be actioned prior to final report

EDUCATION

Engagement with universities attempted, to be actioned prior to final report

3.4.4 AGRI-FOOD

As part of the Greater Lincolnshire LEP Growth Strategy, agrifood/agriculture is a key sector for economic growth with an ambition to deliver sustainable, healthy food from land and sea by championing supply chain efficiency, the delivery of a Net Zero food chain and food which is naturally

healthy. This is intended to reinforce the position as the UK Food Valley and an internationally competitive food cluster.

Greater Lincolnshire is responsible for growing 30% of the nation's vegetables and producing 18% of the poultry, with a total agricultural output of over £2bn in 2019, representing 12% of England's total production. In total the food chain provides 24% of jobs throughout Greater Lincolnshire (as compared with just 13% nationally) and 21% of its economic output (7% nationally). The future of the food chain is therefore absolutely vital to Lincolnshire and its population, with the region being strategically important to national food security⁴.

The food supply chain accounts for circa 75,000 jobs within the region, therefore a significant sector for both employment and energy consumption. This sector is experiencing growth, with high levels of predicted investment. There are three key factors behind the sectors growth;

1. Brexit: increased costs to import food results in preference for local
2. Covid: global food supply chain impacted by disrupted labour supply
3. Low carbon supply chain: local food reduces carbon miles, reducing food wastage.

As part of the growth and investment in the agricultural sector, new facilities such as large scale greenhouses will be required. This can be to the scale of 150hectacre greenhouse, which would consume 150 MW.

As the transport sector looks to decarbonise, this will result in increased demand for EV facilities and hydrogen fuelled transportation. This will therefore increase energy demand. This will not be a wholesale switch to EV, as it is deemed inefficient in larger trucks due to weight and recharge times; with EV preferred option for small vehicles and machinery.

As there is more Grade 1 agricultural land than in any other LEP area in England, the Greater Lincolnshire agri-food sector is anticipated to double its contribution to the economy by 2030 through an ambitious programme of investment in productive capacity. This increase in productive capacity will have an impact on energy requirements, as technology investment grows.

The strategy for the sector includes building an economic case for investment in the strategic transport infrastructure to support agri-food sector growth, with a particular focus on road freight.

Outcomes and recommendations

To be developed further by final report issue

A recommendation from this study is to integrate energy demand from the sector into Agricultural sectors strategy and collaborating on transport strategies where there is anticipated increase in EV demand.

Alternative technologies for energy generation such as Energy from Waste and Biofuels could be of significant benefit to the region; reducing grid energy demands for producers and allowing income through exporting back to the grid.

3.4.5 PORTS AND LOGISTICS

Greater Lincolnshire is expected to experience projected population growth, alongside economic growth across key sectors. To facilitate this, transport infrastructure requires investment. This impacts energy in two ways;

- Switching to lower carbon transport resulting in increased demand for EV charge points, particularly for strategic transport hubs
- Economic growth particularly across low carbon energy generation / carbon capture which requires operations and maintenance, and across agriculture, chemicals, ports and logistics increasing transport demand and improvements.

From analysis of Transport for North and Local Authority transport strategies, it is clear that the move towards sustainability and enhancing active travel in urban areas are key for the next decade. Increasing the opportunities for sustainable modes of transport such as public transport, cycling and walking for commuting, leisure and recreation is intended to reduce private car demand.

When considering road networks and private transportation, there are developments both current and scheduled for EV charging networks across the wider region. An example of this is the rapid charging fund (RCF), which is a £950 million fund to future-proof electrical capacity at motorway and major road service areas to prepare the network for 100% zero emissions vehicles (ZEV) uptake. A local case study is the LEVI scheme (Local EV Infrastructure) pilot – Lincolnshire County Council advised that as part of this successful bid 109 EV charging points will be installed across the Lincolnshire area, site locations are being reviewed, subject to approval. Locations have been selected primarily due to their proximity to areas highly reliant on on-street parking and with a lack of current charge point provision. The charge points themselves will include slow and fast charging. The project will go out for tender in January 2023, and it is anticipated that Charge Point operators will be talking to DNOs from January - March to discuss the best way forward.

It is worth considering that the additional wider infrastructure for EV is likely to increase the attractiveness of private EV ownership, which can then result in additional demand both at a local residential unit level and across the wider infrastructure network.

Outcomes and recommendations

To be included in final report issue

3.4.6 ENERGY

Greater Lincolnshire has significant ambitions in the energy sector, aligning to the Humber Estuary Plan; the acceleration of clean growth and the potential to be a global leader in the transition to net zero carbon emissions in line with the ambition of the Green Industrial Revolution presents a significant opportunity. In more rural parts of Greater Lincolnshire there remains huge potential to provide an innovation test bed for clean energy and whole system technologies.

This study has considered the below energy initiatives; these have the potential to significantly impact the energy landscape across Greater Lincolnshire over the next decade. A note of caution should be

applied to predicted growth of energy industry where there is non-confirmed funding, planning or agreements in place.

It is clear to see that the region has the potential for huge growth, but is not maximising partnerships across the region to the fullest possible extent.

EAST COAST CLUSTER

The East Coast Cluster (ECC) is a collaboration between Zero Carbon Humber, Net Zero Teesside and Northern Endurance Partnership.

The ECC is enabled by the Northern Endurance Partnership (NEP) comprising BP, Equinor, National Grid Ventures, Shell and TotalEnergies. Together the partnership will develop the infrastructure needed to transport CO₂ from across the Humber and Teesside to the Endurance Carbon Store, located 145km offshore in the Southern North Sea.

Survey works have commenced, which will inform engineering plans for pipelines connecting the onshore CO₂ transportation and storage network with the offshore Endurance Carbon Store. The ECC is intending to deliver the following which will impact Greater Lincolnshire;

- Decarbonise industry: potential to tackle almost 50% of the UK’s total industrial cluster CO₂ emissions – *significant area of North Lincolnshire*
- Support levelling-up: creating and supporting an average of 25,000 jobs per year to 2050 and underpinning new low carbon industries in the north of England – *significant area of job creation in Greater Lincolnshire*
- Kick-start a hydrogen economy: supporting the creation of low-carbon hydrogen projects to deliver 70% of the UK’s hydrogen target for 2030 – *job creation and energy generation across the region*

ZERO CARBON HUMBER

Zero Carbon Humber is a collection of international energy producers, major regional industries, leading infrastructure and logistics operators, global engineering firms and academic institutions. The group are working to deliver low carbon hydrogen production facilities and essential carbon capture usage and storage (CCUS), together with region-wide infrastructure that will enable large-scale decarbonisation across the country’s most carbon intensive region.

Hydrogen to Humber (H₂H) Saltend is intended to be the worlds largest hydrogen production plant with carbon capture at Saltend Chemicals park. It will be the starting point for a carbon dioxide (CO₂) and hydrogen pipeline network developed by National Grid Ventures, connecting energy-intensive industrial sites throughout the region, offering businesses options to directly capture emissions or fuel switch to hydrogen.

All captured CO₂ will be compressed at Centrica Storage’s Easington site and stored under the southern North Sea using offshore infrastructure shared with the East Coast Cluster. It is expected that this will be available to organisations in Greater Lincolnshire. Hydrogen production requires significant energy supply to produce either blue or green hydrogen – the wider benefits of energy supply and economic generation will be particularly relevant to this study.

HUMBER LOW CARBON PIPELINES

Nearby to and of significance to Greater Lincolnshire, is the UK’s largest industrial cluster, the Humber which is responsible for producing 12.4 million tonnes of CO₂ emissions per year. It’s home to a high concentration of fossil-fuel power stations and large industrial plants that release millions of tonnes of carbon dioxide (CO₂) every year. This makes it an ideal and important location for clean growth projects using carbon capture, usage and storage (CCUS) and hydrogen. The intent from this project is to play a crucial part in helping the UK to transition to a low-carbon economy and reach its ambitious net zero targets by 2050.

The Humber Low Carbon Pipelines project is a significant part of the Zero Carbon Humber vision, to become the UK’s first net zero carbon cluster by 2040. The project aims to deliver new onshore pipeline infrastructure to transport the captured carbon emissions from the regions industrial emitters for safe storage in the North Sea, and enable industries to fuel-switch from fossil fuels to low-carbon hydrogen.

KEADBY 3 CARBON CAPTURE POWER STATION – SSE THERMAL

Carbon capture and storage (CCS) is a technology that has the potential to capture at least 90% of the carbon dioxide emissions produced from the use of fossil fuels in electricity generation and industrial processes, preventing the carbon dioxide from entering the atmosphere.

The CCS chain consists of three parts; capturing the carbon dioxide, transporting the carbon dioxide, and securely storing the carbon dioxide emissions underground, in depleted oil and gas fields or deep saline aquifer formations.

Keadby 3 will connect to the shared infrastructure being developed by the East Coast Cluster to transport the captured CO₂ and store it safely offshore. The installation of CCS into a power station utilises a significant amount of energy to run therefore has the potential to significantly reduce the efficiency of the power station.

Whilst CCS does not generate energy, it is a key part of this study as it will enable decarbonisation of energy across the region; which has been a theme throughout all stakeholders engaged with. It is likely that CCS will be required to decarbonise the energy consumed by heavy industry such as steel within the region, where demand is consistently high and renewables will not provide sufficient supply and continuity in the short term.

ALTERNATIVE TECHNOLOGIES

RLB: further expansion of this sector including engagement summaries to be included in final report

- Geothermal - Geothermal projects are occurring across Greater Lincolnshire, ranging from geothermal heat pump drilling of boreholes in Lincolnshire to Scunthorpe General becoming the first NHS Hospital in England to use renewable geothermal power for heating and hot water.
- [Biomass](#)
- [Energy From Waste](#)
- [Hydrogen](#)

- Solar PV
- Anaerobic digestion (AD)
- Nuclear
- Onshore wind
- Offshore Wind - Offshore wind has been excluded from this study, as it connects at National Grid level above the DNOs 132 kVA level.

4.0 KEY LINES OF ENQUIRY

The sources of information from various stakeholders are ever changing as the developments are constantly in a state of flux. Regarding energy networks, the main challenge has been to provide a robust and up to date analysis of the capacity in the networks. As network operators are constantly under scrutiny by the regulator, they are tasked with exploring innovation to provide a flexible network and alleviate, where possible, reinforcements. However, this is not always possible especially where networks have been underfunded and not maintained due to license constraints.

RLB have reviewed local energy networks alongside how national transmission could benefit the county and local areas, with the intent of understanding how new opportunities for generation and distribution could promote private investment.

RLB note – final report will focus on expansion of KLOE, playing back initial findings to stakeholders (public and private) and summarising research concluding during this period.

- **To challenge whether the provision of energy genuinely affects viability, differentiating between the levels of National Grid, Local Distribution Network Operator (DNO) and local energy operators – and whether a decision to implement local innovative solutions could deliver necessary local requirements.**

Engagement with key energy stakeholders

Developed an analysis of current energy supply, future strategies for increasing

Blockers, constraints and risks included in the report

It has been acknowledged that there is a shortfall in electrical capacity within the Greater Lincolnshire area of power capacity and this has been determined by several developments providing advice and evidence to that effect. RLB have engaged with NGED and NPg, with a view of aligning the need for additional capacity and generation. As part of this study, consideration has been given to how private generating companies could assist the long-term objective of growing and investing the local areas.

NGED and NPg both have future growth strategies in place, which are currently out for consultation.

There are methods of managing energy demand which are driven by monitoring limits on networks and allocating maximum capacity to customers in that area, typically based on connection application dates. This method is called Active Network Management (ANM). This Last In, First Out (LIFO)

hierarchy prioritises the oldest connections when issuing capacity, but is scalable so that new entrants will get access to the capacity when it becomes available.

Where constraints are driven by DNO limits they may be referred to as Distribution Active Network Management (DANM) and for National Grid constraints Transmission Active Network Management (TANM). Both DANM and TANM constraints are handled by the same ANM systems per zone.

- **To identify how authorities could work together to build the scale to make an alternative energy offer attractive to the private sector, and to provide a forum for the private and public sectors to collaborate on specific schemes, creating the environment for a strong dialogue that leads to investment in priority sites.**

Sector analysis carried out to understand current risks and constraints that may be preventing private / public sector development

Next stages will include detailed suggestions for energy offers based on local position and opportunities

The opportunity for alternative energy supply at scale within the region is significant – from a review of economic activity across the region, the energy sector has held steady during the recent turbulence caused by the pandemic. This bodes well, particularly paired with the investment (private and publicly funded) into the Humber region to generate energy supply and industrial economic market increase; this will not only impact the regions energy supply and demand, but the wider economy through employment, infrastructure requirements and innovation.

To progress the energy analysis of the region, it is suggested that utilising local authority leadership and central government relationships to drive insight, funnel investment and create an attractive, local centric environment for energy generation and investment would be of benefit. This could be driven through Greater Lincolnshire LEP, ensuring links to central government are integrated to create insight into funding, future strategies and policy. This streamlined approach of generating a forum of collaborative, shared knowledge can facilitate a centre of excellence and innovation, to attract private investment into the region and strengthen the robustness of energy supply in the future.

Prior to deregulation of the utility market, developers and investors could only engage with the monopolistic incumbent statutory utility providers. These organisations still exist today but are all now in private ownership. However, the obligation to provide a connection to a customer remains. It is suggested that any forum/committee reviewing the energy market going forward should appraise different models available since de-regularisation, to include but not limited to Asset leasing, Asset SPV, Asset sale, adoption, and concession arrangements. All of these have the potential to attract private investment and innovation; this has been demonstrated by commercial organisations reaching out for information beyond DNOs to explore other options.

Existing groups and forums do not currently have consistent structured engagement with NPg and NGED. A key recommendation from this study is to integrate all DNOs into energy forums and committees to improve information sharing, collaboration and continuous improvement. There are NGED Local Investment Workshops, one of which covers Lincolnshire. At present, this appears to be

the main opportunity to provide feedback on local investment. It is clear that a coordinated approach between Greater Lincolnshire and local DNOs would be of significant benefit.

- **To strengthen the connection between energy and other utility provision, notably digital infrastructure, and the internet of things.**

All sectors are predominantly focused on energy supply rather than other utility provision

Significant investment into digital accessibility for energy providers

Key focus area for next stage of the report

Through this study, it is clear that two main focus points have been shown by the stakeholders engaged with – residential demand through the region, and industrial development across the north. Considering strategic districts like Boston and the wider agricultural areas where alternative energy production could be utilised should be prioritised (RLB will progress this area of focus throughout the next stage of the report). These could be Energy from Waste and biomethane; both options can be linked to the thriving agrifood industry. The growth in agrifood presents a challenge of finding net zero/carbon negative networks by providing a secure, reliable, and affordable energy systems. Creating an attractive environment for innovation and investment in this area will address this challenge and further, the ability to export energy (heat and/or power).

There are many options for alternative energy generation. Through a focused, strategic approach per sector options can be considered within the remit of current policies and charters; sustainability long term; with opportunities to work collaboratively to provide a holistic approach to energy generation and distribution; and offering opportunities for end-user cost savings as well as income generation.

Water supply has been noticeably less concerning for developments across most sectors. However, with the increasing investment in industrial hubs across Greater Lincolnshire and the Humber, the focus of water supply to industry is becoming critical. Engagement held during this study have shown developers reaching out to independent DNOs for both energy and water supply.

The National Grid is commencing with the next stage of a new Government-backed project to explore how satellite imagery and data analytics can improve the resiliency of the UK’s gas and electricity infrastructure, potentially helping to reduce blackouts while cutting emissions.

- **To provide a forum for the private and public sectors to collaborate on specific schemes, creating the environment for a strong dialogue that leads to investment in priority sites.**

Engagement held with public and private stakeholders

Existing forums are not providing an environment for specific scheme collaboration

Focus to be on investment specific to region opportunities e.g. clean energy generation

ToR and detailed forum guidance to be provided in next stage

5.0 FUTURE DEMAND ANALYSIS

A large quantity of data on the future developments was obtained from the seven district and two unitary authorities in the Greater Lincolnshire area. The intent behind the GIS mapping exercise is to enable the ability to develop key/targeted decisions based on the need to secure significant inward investment, where this is needed from National Grid/DNOs based on what we know as the regions growth areas.

The data collected was via documents submitted from the seven district and two unitary authorities as well as further investigation by the RLB team. Circa 250 documents were gathered in the data analysis phase. On top of the analysis of documents, research, engagement via email and virtual meetings was undertaken in search of further information that was not contained in the submitted documents.

The bulk of the information was gathered from the Local Plans adopted by the various councils and each district into each council. The local plans contained planning data on residential, commercial and industrial developments. There was also information on projected future energy demand. Based on this information, further research was carried out by the RLB team into obtaining further details on the developments contained in the plans and also other developments that were relevant. Further consultation was sought with each district on any developments that considered would be relevant to the project.

There were consultations with third party stakeholders that were considered large energy users in the council areas about the projects for their future energy use. This type of data was not available to the districts councils and required a direct approach.

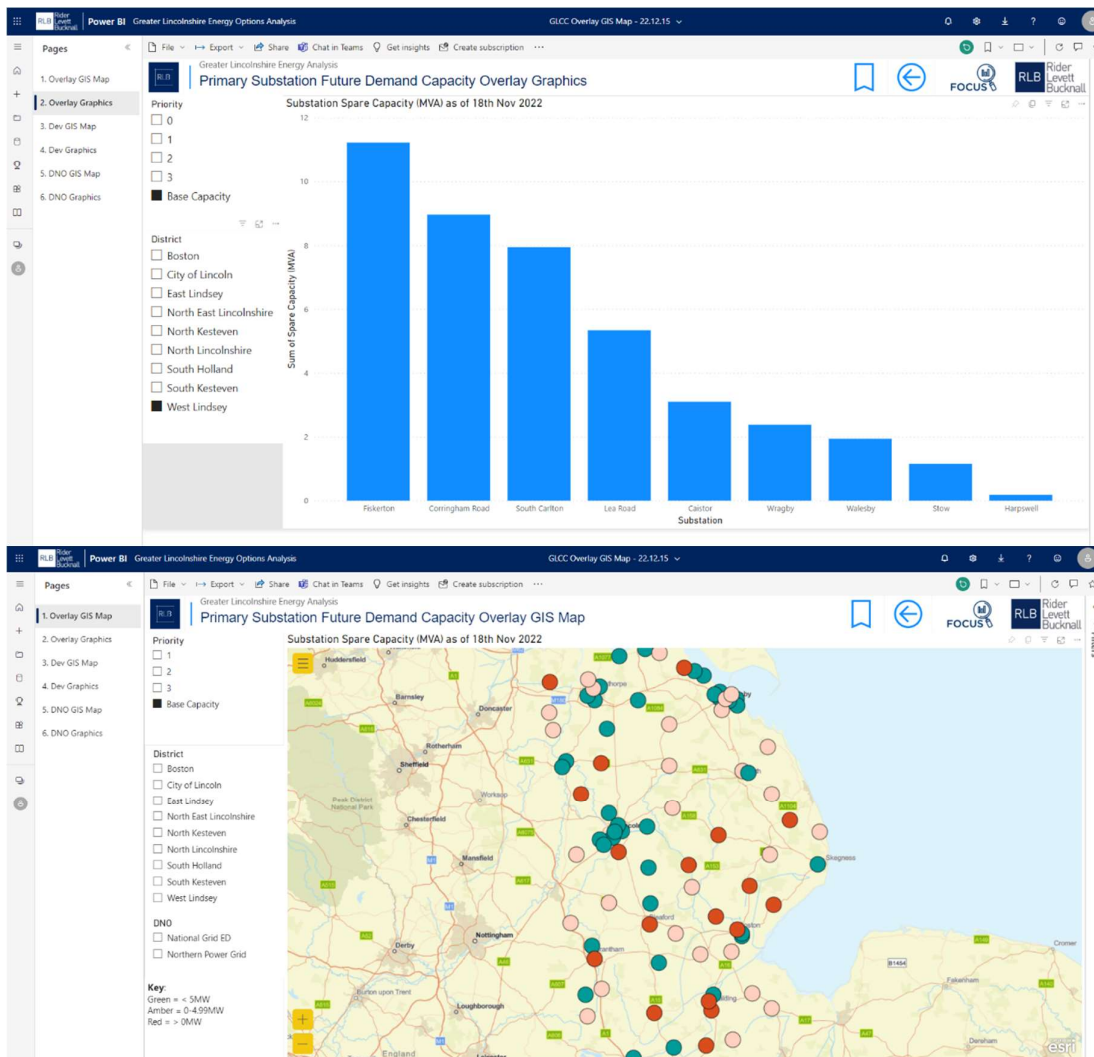
The data was compiled into a spreadsheet and the total energy load was calculated based on the number of residential units or area of development. This information was then used to gather a picture of the future energy demand for the region.

This data was analysed for relevant information relating to energy demand from future developments. The data was inputted into a detailed spreadsheet that calculated the electrical demand in load and over a predetermined timeframe. Concurrently, data was gathered from the two Distribution Network Operators (DNOs), Northern PowerGrid and National Grid ED.

Each primary substation in the Greater Lincolnshire area was assessed to determine the demand headroom availability for each. This information was inputted into a spreadsheet to allow for the analysis of the demand availability in the Greater Lincolnshire area. Both sets of data were overlaid on top of each other to determine the amount of demand headroom that would be available in each primary substation with the introduction of the future developments. This information can be found here;

- Greater Lincolnshire Priority demand: [LCC Energy Demand - Priority 1 – Google My Maps](#)
- Northern PowerGrid demand availability: [Demand Availability Map | Northern Powergrid](#)
- National Grid: Energy Distribution network capacity: [National Grid - Network Capacity Map Application](#)

To provide a visual representation of the data, Microsoft Power BI was used to create a GIS map with a red, amber, green representation that allowed the client a clear image of where there will be a shortage of demand in the future.



An analysis of the information gathered gives a picture of the energy demand and availability in the Greater Lincolnshire regions over the next twenty years.

There are a number of areas that will require significant investment in the electrical infrastructure while other areas have adequate supply for the future. In North Lincolnshire and North East Lincolnshire there will be a large investment in industrial developments that will require a similar investment in the electrical infrastructure. Similarly in the City of Lincoln, there will be a significant increase in the number of residential dwellings that will impact on the electrical infrastructure. Other large towns in the region will see similar growth while rural areas of Greater Lincolnshire will see less of an increase in demand.

General rules of thumb and industry standards have been used to calculate the anticipated power demand for each area. It was explained that large power users in the area e.g., British Steel and the NHS had also been engaged with.

The mapping has been based on worst case scenario and maximum demand, based on 5.4 kVA per house (considering low carbon technologies).

The housing sites have been grouped in terms of priority based on the below:

Priority number	Justification
1	High priority - LCC Partner with live requirement - 1 - 3 years
2	High priority - confirmed 3rd party demand, LCC sites requiring future proofing, 4 - 10 Years
3	Consented development - status unknown, Unconsented but highly likely to come forward, 11+ years
4	Potential future demand

RLB note: final report to include analysis of the following;

Project Energy Demands

Project capacity short falls

Infrastructure investment

6.0 SUMMARY & RECOMMENDATIONS

6.1 KEY FINDINGS

Clear shift towards innovation and alternative energy sources across the region

Net zero is a common theme across all sectors, echoed by the shift in energy providers and increase in private investment

Inconsistent collaboration across the region

RLB note: findings and recommendations to be developed and enhanced throughout next stage. Please note: this will include local specifics for Greater Lincolnshire.

Greater Lincolnshire

Outcomes and recommendations

RECOMMENDATION A – FUTURE ENERGY FORUM

Facilitation of a private and public future energy forum / committee, focused on demand vs supply. Throughout the data analysis it was found that significant developments often hadn't engaged with the local DNOs. This impacts the viability of future development, the robustness of predicted future demand, and slows down the process of enabling new developments through lack of early engagement.

As part of this forum, it is recommended that beyond energy demand and supply, consideration of energy intensity reduction initiatives are included alongside efficient resource management. The management of resources such as electricity will benefit society and reduce costs as well. The more energy efficiency and resource management that is undertaken the greater benefit that will transpire. Reducing of existing demand and improving efficiencies whilst identifying new energy infrastructure requirements to promote growth will be critical to robust, resilience energy for the region.

Energy supply is critical to commercial developments, therefore engagement with Greater Lincolnshire energy stakeholders (private and public) will be key to enabling development. Organisations such as British Steel are engaged with UK government, as UK wide policy driving decarbonisation is integral to achieving targets. Smaller scale organisations will also require not only access to support, but a forum to understand capacity across all levels of energy infrastructure in the area, and are less likely to have existing relationships.

Organisations such as British Steel are engaged with UK government, as UK wide policy driving decarbonisation is integral to achieving targets. Smaller scale organisations will also require not only access to support, but a forum to understand capacity across all levels of energy infrastructure in the area, and are less likely to have existing relationships.

It is recommended that a Greater Lincolnshire Energy Committee/Forum is created. Our recommendation is to consider the following to participate;

- Key relevant and influential members of each local authority
- Representatives of each DNO
- Representatives of significant future demand / development
 - Able Energy Park
 - Humber

Benefits analysis to be included

RECOMMENDATION B – ENERGY PUBLIC / PRIVATE PARTNERSHIP

Whilst public-private partnerships (PPPs) can be challenging to deliver and not without controversy, robust and well-coordinated partnerships present opportunities to bring together the resources, expertise, and powers available in ways that cannot be achieved by either sector in isolation. As such, councils are now rightly exploring how this investment could unlock a range of social, environmental, and economic benefits aligned to local and national priorities.

When considering PPPs from a collaborative angle, there are two impacts that the energy sector can have. These are net zero and energy security/fuel poverty. “The cost of achieving net zero is calculated to be at least £200 billion. If we can find the right financing models we can turn this cost into an investment opportunity, and a ‘skills and jobs dividend’. Local and national government need to work together with the investment community to realise this massive dividend.”

An example of this is Energetik, an energy company that was established by Enfield Council and has wide ambitions to service residents across the borough with low carbon energy, with surpluses reinvested into infrastructure and education programmes. Energetik highlighted that councils are well placed to deliver more affordable energy solutions for residents. Where the private sector would seek to return a margin, the public sector can elect to reinvest surpluses to deliver low and transparent tariffs.

Recommendation to be developed with further details.

RECOMMENDATION C - DRIVING FORWARD CLEAN ENERGY

Shifting focus from energy supply to integrate sustainable energy as a fundamental shift. Previously focused on cost and risk, sustainability is viewed as investment and opportunity.

The emphasis is now on Energy capacity generation innovation, differential and growth.



**APPENDIX A:
REFERENCES**

Figure references

Figure 1 Greater Lincolnshire LEP

https://www.greaterlincolnshirelep.co.uk/assets/documents/2875_GL_LEP_Revival_Plan_ART_-_No_logos_page.pdf

Figure 2 Energy provision structure, National Grid [National Grid - About us](#)

Text references

1. Greater Lincolnshire LEP <https://www.greaterlincolnshirelep.co.uk/priorities-and-plans/priorities/priority-2/>
2. Able Energy Park <https://www.ableuk.com/sites/port-sites/humber-port/able-logistics-park/>
3. Able Energy Park <https://www.ableuk.com/sites/land-sites/able-energy-park/>
4. Greater Lincolnshire LEP <https://www.greaterlincolnshirelep.co.uk/priorities-and-plans/sectors/agri-food-sector/>



**APPENDIX B:
REGIONAL DEMAND AND SUPPLY ANALYSIS DATA**

Development demand and supply data to follow

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